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TRACING MEDIUM

Walker M. Hinman, Winnetka, Ill., assignor to
The Frederick Post Company, Chicago, Ill., a
corporation of Illinois

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The present invention relates to tracing sheets for drawing and offers a transparentized paper base with strength approaching that of tracing cloth, with high translucency, high uniformity of translucency, and smoothness exceeding that of tracing cloth.

The invention replaces so-called "vellum" tracing sheets, which are of oil-transparentized paper. The deficiencies of the process of making vellums limit the products to use of thin papers, to limited translucency, to cloudy or mottled translucency, and to sheets of low strength.

The present invention offers tracing mediums at low cost which may be substituted for most common uses of tracing cloth available only at much higher cost.

It is the general object of the invention to make an improved tracing sheet for drafting uses.

It is a particular object of the invention to transparentize a cellulosic sheet by improved methods and materials.

It is a particular object to provide a paper-base tracing sheet having the conventional utilities of tracing cloth and in addition thereto having water-resistance.

Various other and ancillary objects and advantages of the invention will appear from the following description and explanation.

The present invention is essentially an improvement in and an extension of the process of making vellums. Heretofore vellum papers have been made by dipping a sheet of paper into a solution of an oil in a volatile solvent distender, and drying out the solvent. Drying and non-drying oils have been used with preference for the non-drying oils such as the saturated petroleum hydrocarbon heavy oils. To minimize oiliness of the sheet and transfer of oil to adsorbent material in contact therewith, a secondary substance in the nature of natural or synthetic resins has been employed. Rosin, and its derivatives are examples. The incorporation of resin limits the translucency. Also, the process requires very thin papers to secure the desired degree of translucency. The irregularities of formation of paper or of sizing of the paper become visible as a mottled or cloudy effect when the sheet is so treated to secure translucency. To reduce these effects, sizing is used to a limited extent, and as a result the papers are not so strong as they would be if heavier sized papers were used.

According to the present invention the "vellum" process may be modified and is extended to overcome these defects, whereby greater translucency results, and irregularities of formation and of

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sizing become ineffective to produce a mottled effect. Thereby, thicker paper and heavier-sized paper may be employed, producing sheets of greater translucency, uniformity, and strength than is found in vellums.

In modifying the process for producing vellums, the use of an oil and resin are retained, and these need not, but may be, applied in solution in or distended by a volatile organic solvent.

Both thin sheets, as used for vellums, and sheets thicker than for vellums, may be used with a solution consisting of a resin and an oil. Said thicker sheets are more quickly penetrated by slightly distending the oil-resin compound by a volatile solvent to lower the viscosity of the liquid.

The paper is subjected to contact, preferably by submergence, in a warm homogeneous liquid of oil and resin, with or without solvent distender. The resulting wet sheet is placed against itself, or a like sheet, preferably by winding a long web of it into a roll, and allowed to stand for a period of time to advance the absorption, or to complete it, as occurs in several days.

In the case of heavier sheets, such as a 24-pound paper sheet, which may be heavily sized and therefore resistant to penetration, the oiling process may be repeated, with the rolling and standing as in the first instance.

The extension of the process consists of friction calendering the sheet under heavy pressure, using at least one hot roll which is highly polished, as provided by steel, rotating faster than the other roll, with enormous pressure between the rolls. The calendering also creates heat. The heat softens the composition to a more fluid one, expands the air in the sheet, and the pressure squeezes the air out, compresses the paper, produces uniformity in thickness, and wipes off excess of the composition. If the paper passes through the calendering so fast that it is not dry to the touch, it is again passed through calenders. In the second pass, the frictioning effect of a faster roll is not required, and simple compression rolls may be used with a high pressure between them, at the same elevated temperature or at a lower one. In practice, the same pair of rolls has been employed with the speed-change gear removed to provide simple non-frictioning compression rolls. The exact temperature is not important, but for the purpose of control and uniformity of procedure, it is kept at a more or less constant temperature, for example $400^{\circ} \pm 10^{\circ} \text{F.}$ As heat is generated from the friction the supplied heat is reduced, for example by turning down a gas supply to the

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interior of the roll. Where a second pass is used, a temperature of 200° F. is chosen for control.

Where the non-slipping calendering roll is one of fiber or matt surface and the slipping one is of polished metal, the sheet is glossy from the metal roll and matt from the other roll. A second passage of such a sheet between two simple polished compression rolls does not destroy the glossy or the matt surface. The matt surface is essential for providing tooth for drawing, where no further treatment of the sheet is employed. Where a coating providing tooth is applied afterwards, both faces of the calendered sheet may be glossy. The one glossy side increases the transparency, compared to a like sheet with two matt surfaces.

The composition is preferably a clear white mineral oil to produce the finest grade. The resin is also of a clear white variety for the same reason. The preferred resins are high grade wood rosin, or abietic acid, or their derivatives such as ester gum or hydrogenated rosin, or ester gum derived from hydrogenated rosin. However, other natural or synthetic resinous material may be used which dissolves in the oil employed, or in any solution of the oil employed.

The oil is not limited to the mineral oils or to the glycerides. Synthetic products of an oily nature may be used, such as the oily plasticizers used in the coating composition field. Dibutyl phthalate is an example. These act to plasticize the resinous material in the product, as well as to disperse it in the process of applying it to paper.

The following examples illustrate the invention.

Example 1

A commercial formaldehyde-tanned glue-sized high grade rag stock paper of 16 to 24 lb. folio is employed. This may be one having a wet tensile strength of 2500 to 3000 grams, which is merely indicative of the high degree of hardening of the glue-sizing which is permitted on paper for the present invention, whereby strength is increased. The tanning or glue-sizing is not essential, but in the vellum art it is not employed because it leads to the mottled effect.

A bath is prepared having equal parts of white mineral oil and of ester gum, or of hydrogenated rosin, which bath at 50° C. is a homogeneous solution. At this temperature or at any other temperature where homogeneity prevails, the sheet is brought into contact on both sides with the oil solution. For a 24 lb. paper penetration is facilitated by adding 10% of naphtha or other solvent, the intended effect of which is to lower the viscosity.

The dipped paper, while wet is rolled and allowed to stand for 3 days at room temperature or higher. For a 24 lb. paper it is desirable to unroll, and repeat the process, in order to get into the paper a sufficient quantity of the material.

The sheet is then run through a calender stack, having a fiber roll and a faster polished steel roll heated to about 400° F., running 2 to 3 times faster than the fiber roll. From 40 to 60 tons per sq. in. gage pressure is applied on the journals of the rolls.

Where the product is not dry to the touch, as may occur with the heavier paper, the sheet is run through the same rolls, or two steel rolls, heated preferably at 200° F., running as compression rolls, with a high pressure preferably at least equal to that originally employed. Thereby, an

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excess of composition is removed and a dry-feeling product results.

It is of course to be understood that the composition is not limited to equal parts of oil and resin, as given. The choice of oil and of resin permits altering the proportion to the point where a non-oily sheet results, which does not transfer oil to an absorbent sheet in contact therewith in normal usage, as in drawing, or filing.

Other compositions may be substituted in the example above given, and some are shown by way of illustration in the following examples, in which parts are given by weight.

Example 2

	Parts
Castor oil	25
Arochlor 1254 ¹	75

¹This is a chlorinated diphenyl manufactured by Monsanto Chemical Company of St. Louis, Missouri.

Example 3

	Parts
Cocoonut oil	50
Paracumarone indene resin W ²	50

²This is a product of The Barrett Company, New York, N. Y.

Example 4

	Parts
Dibutyl phthalate	50
Santolite MHP ³	50

³This is a condensation product of formaldehyde and para toluene sulfonamide, made by Monsanto Chemical Company of St. Louis, Missouri.

The process forces the transparentizing mixture into the sheet, and the air out of the sheet. There being no air in the sheet, the local differences in content of paper stock do not permit the exhibition of mottled transparency. The process makes a sheet of uniform caliper. The sheets are from 10% to 20% more transparent than vellums made from the same paper stock. The process permits use of heavy papers, such as 24 lb. stock, which cannot produce a satisfactory vellum. The heavier sheets are comparable to tracing cloth in texture, durability, strength and translucency, and superior in the clarity of translucency by lack of evidence of the weave of the cloth. The product is much less expensive to produce than tracing cloth.

Using the preferred process above described, it is possible to produce the product with a matt drawing face and a glossy back, comparable in use to tracing cloth. As made by the preferred formulas, the sheets may be filed and used with pressure on other sheets, without transfer of the oily ingredient.

By the process about 25% is added to the original weight of the paper, and its caliper is reduced by about 25%. This is about 66% increase in density of the sheet by application of the process.

Compared to ordinary tracing cloth, the product is outstanding. Reference to "ordinary tracing cloth" signifies those sheets in common use which are filled with colloidal material such as starch, including dispersed therein a transparentizing fat or oil. Such tracing cloth has a glossy face and a matt drawing face. Both faces readily spot with water to impair the surfaces. The glossy surface will not take a pencil mark. However, the products of the present invention do not spot with water, and both sides will take a pencil mark. Although the smoothness of the product of the present invention on the drawing side exceeds that of ordinary tracing cloth, it is to be understood that the term smoothness refers to the planar

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character of the surface, rather than to its frictional character, which is greater in the present invention than in ordinary tracing cloth. It is this frictional character that is responsible for both faces of the present product taking a pencil mark.

The process may be employed on cloth, or other aggregated fiber sheets, as well as paper, but offers a better product economically when made of paper, as herein described. Numerous changes and modifications of the process particularly described are contemplated as falling within the scope of the appended claims.

I claim:

1. A tracing sheet comprising a sheet base of cellulosic fibers constituting the body of said base, and a normally fluid water-insoluble transparentizing composition of water-insoluble oil and a water-insoluble resin-like solid soluble in said oil, said composition impregnating and completely filling said sheet base and being exposed at the surfaces of said sheet, said tracing sheet being characterized by a glossy calendered surface on one face, by a lack of pocketed air, and by freedom from oiliness to the extent that the sheet is incapable in normal usage as a tracing sheet of transferring oil to an ordinary drawing sheet of paper when said glossy face is in normal tracing contact therewith.

2. A tracing sheet according to claim 1 in which one face is mat-embossed for drawing.

3. A tracing sheet comprising a sheet base of cellulosic fibers constituting the body of said base, and a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and a water-insoluble resin soluble in said oil, said composition impregnating and completely filling said sheet base and being exposed at the surfaces of said sheet, said tracing sheet being characterized by a glossy calendered surface on one face, by a lack of pocketed air, and by freedom from oiliness to the extent that the sheet is incapable in normal usage as a tracing sheet of transferring oil to an ordinary drawing sheet of paper when said glossy face is in normal tracing contact therewith.

4. A tracing sheet according to claim 3 in which one face is mat-embossed for drawing.

5. A tracing sheet comprising a sheet base of cellulosic fibers constituting the body of said base, and a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and a water-insoluble resin derived from wood rosin and soluble in said oil, said composition impregnating and completely filling said sheet base and being exposed at the surfaces of said sheet, said tracing sheet being characterized by a glossy calendered surface on one face, by a lack of pocketed air, and by freedom from oiliness to the extent that the sheet is incapable in normal usage as a tracing sheet of transferring oil to an ordinary drawing sheet of paper when said glossy face is in normal tracing contact therewith.

6. A tracing sheet according to claim 5 in which one face is mat-embossed for drawing.

7. A tracing sheet comprising a sheet base of cellulosic fibers constituting the body of said base, and a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and ester gum, said composition impregnating and completely filling said sheet base and being exposed at the surfaces of said sheet, said tracing sheet being characterized by a glossy calendered surface on one face, by a lack of pocketed air, and by freedom from oiliness to the extent that the

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sheet is incapable in normal usage as a tracing sheet of transferring oil to an ordinary drawing sheet of paper when said glossy face is in normal tracing contact therewith.

8. A tracing sheet according to claim 7 in which one face is mat-embossed for drawing.

9. A tracing sheet comprising a sheet base of paper of felted cellulose fibers, and a transparentizing composition consisting of substantially equal parts of white mineral oil and ester gum, said composition impregnating and completely filling said sheet base and being exposed at the surfaces of said sheet, said tracing sheet being characterized by a glossy calendered surface on one face, by a lack of pocketed air, and by freedom from oiliness to the extent that the sheet is incapable in normal usage as a tracing sheet of transferring oil to an ordinary drawing sheet of paper when said glossy face is in normal tracing contact therewith.

10. The method of making a tracing sheet which comprises thoroughly soaking a sheet base of cellulosic fibers in a normally fluid water-insoluble transparentizing composition of water-insoluble oil and dissolved water-insoluble resin-like solid while providing a removable excess of said composition on the surfaces of said sheet, then friction-calendering by calendering rolls the said sheet at an elevated temperature above the boiling point of water and under heavy mechanical pressure while driving out volatile material and air from said sheet, while rendering said composition more fluid than at the time of soaking said sheet and while removing by squeezing action of said rolls excess of said composition, applying the pressure of heavy squeezing rolls to said sheet at an elevated temperature while removing excess composition to provide substantially non-oily and dry when-cold surfaces to said sheet, and cooling the resulting sheet to secure said surface.

11. The process of claim 10 in which one of the rolls runs at the speed of the sheet while impressing by said roll into said hot sheet a mat surface from a mat surface on said roll, thereby providing a mat drawing surface.

12. The method of making a tracing sheet which comprises thoroughly soaking a sheet of paper of felted cellulose fibers in a normally fluid transparentizing composition of substantially equal parts of white mineral oil and ester gum, while providing a removable excess of said composition on the surfaces of said sheet, then friction-calendering by calendering rolls the said sheet at an elevated temperature above the boiling point of water and under heavy mechanical pressure while driving out volatile material and air from said sheet, while rendering said composition more fluid than at the time of soaking said sheet and while removing by squeezing action of said rolls excess of said composition, applying the pressure of heavy squeezing rolls to said sheet at an elevated temperature while removing excess composition to provide substantially non-oily and dry when-cold surfaces to said sheet, and cooling the resulting sheet to secure said surface.

13. The method of making a tracing sheet which comprises thoroughly soaking a sheet base of cellulosic fibers in a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and a water-insoluble resin dissolved in said oil while providing a removable excess of said composition on the surfaces of said sheet, then friction-calendering by calendering rolls the said sheet at an elevated temperature above the boiling point of water and under heavy

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mechanical pressure while driving out volatile material and air from said sheet, while rendering said composition more fluid than at the time of soaking said sheet and while removing by squeezing action of said rolls excess of said composition, applying the pressure of heavy squeezing rolls to said sheet at an elevated temperature while removing excess composition to provide substantially non-oily and dry when-cold surfaces to said sheet, and cooling the resulting sheet to secure said surface.

14. The method of making a tracing sheet which comprises thoroughly soaking a sheet base of cellulosic fibers in a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and a water-insoluble resin derived from wood rosin dissolved in said oil while providing a removable excess of said composition on the surfaces of said sheet, then friction-calendering by calendering rolls the said sheet at an elevated temperature above the boiling point of water and under heavy mechanical pressure while driving out volatile material and air from said sheet, while rendering said composition more fluid than at the time of soaking said sheet and while removing by squeezing action of said rolls excess of said composition, applying the

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pressure of heavy squeezing rolls to said sheet at an elevated temperature while removing excess composition to provide substantially non-oily and dry when-cold surfaces to said sheet, and cooling the resulting sheet to secure said surface.

15. The method of making a tracing sheet which comprises thoroughly soaking a sheet base of cellulosic fibers in a normally fluid water-insoluble transparentizing composition of clear saturated petroleum oil and ester gum dissolved in said oil while providing a removable excess of said composition on the surfaces of said sheet, then friction-calendering by calendering rolls the said sheet at an elevated temperature above the boiling point of water and under heavy mechanical pressure while driving out volatile material and air from said sheet, while rendering said composition more fluid than at the time of soaking said sheet and while removing by squeezing action of said rolls excess of said composition, applying the pressure of heavy squeezing rolls to said sheet at an elevated temperature while removing excess composition to provide substantially non-oily and dry when-cold surfaces to said sheet, and cooling the resulting sheet to secure said surface.

WALKER M. HINMAN.