

May 7, 1935.

J. D. MURRAY

2,000,347

COATING OF PAPER

Filed July 24, 1933

2 Sheets-Sheet 1

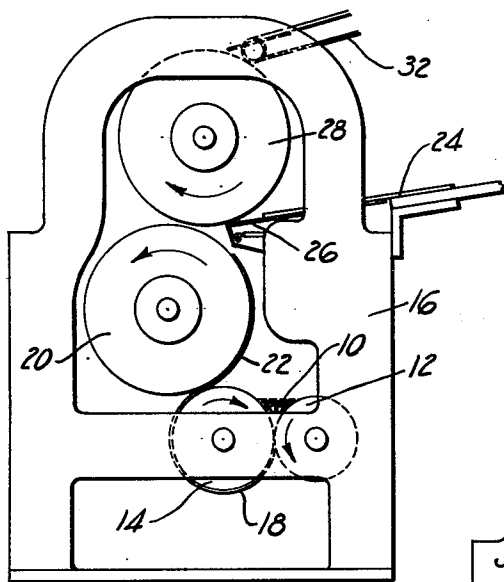


FIG. 1

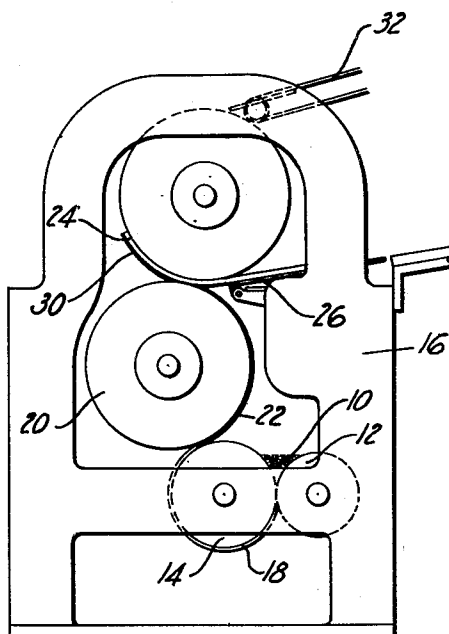


FIG. 2

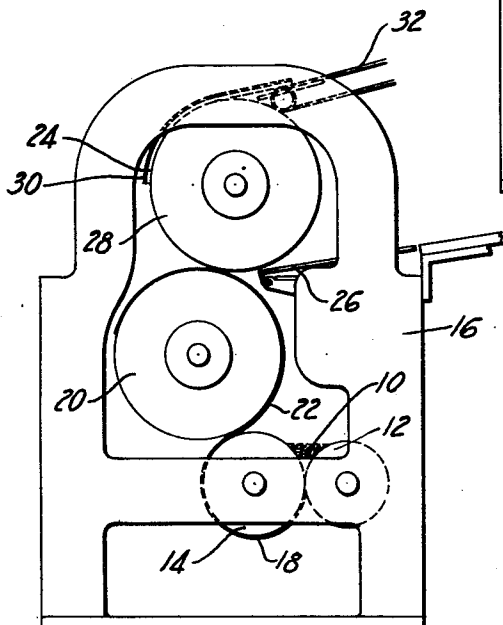


FIG. 3

INVENTOR.
JOHN D. MURRAY
BY *W. W. McConkey*
ATTORNEY

May 7, 1935.

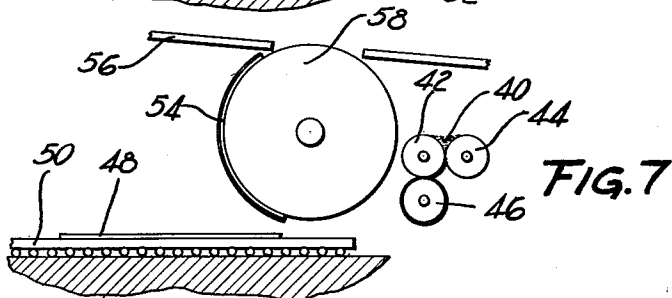
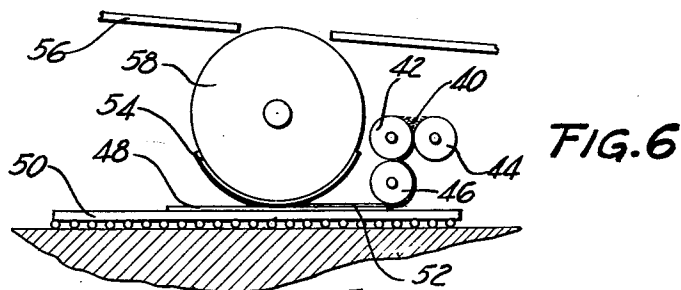
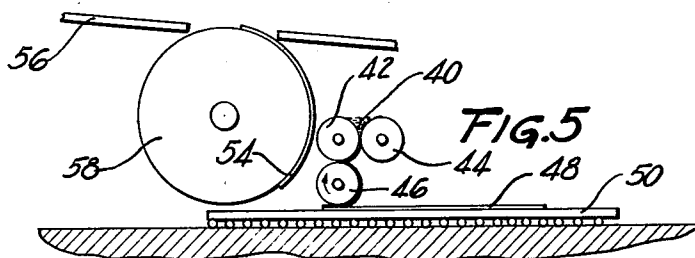
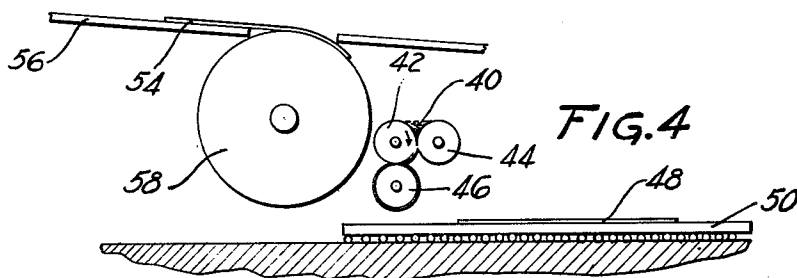
J. D. MURRAY

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COATING OF PAPER

Filed July 24, 1933

2 Sheets-Sheet 2



INVENTOR.
JOHN D. MURRAY
BY *J. W. McCarty*
ATTORNEY

UNITED STATES PATENT OFFICE

2,000,347

COATING OF PAPER

John D. Murray, Chicago, Ill., assignor to The
Murray Liquafilm Corporation, Chicago, Ill., a
corporation of Illinois

Application July 24, 1933, Serial No. 681,838

16 Claims. (Cl. 91—67.9)

This invention relates to the coating of paper with transparent protective coatings of cellulose and the like materials, and particularly to providing such coatings of improved appearance in that they overlie and are in effect bonded to the surface of the paper, instead of sinking into the structure of the paper, and which are therefore also capable of use on printed or lithographed paper without causing smudging or "bleeding" of the ink, even on very porous paper.

According to one feature of the invention, such a coating is formed by first forming a viscous mixture of a cellulose coating material with a solvent, the mixture being two to four times as concentrated as the materials heretofore used and therefore being considerably cheaper on the basis of area to be coated. This mixture is then formed into a viscous liquid film of the desired width but somewhat thicker than the final coating. This film is then treated to evaporate off a part of the solvent, to give a partly-dried film which is almost self-sustaining, and which is preferably formed on a transfer member from which it is stripped under heavy pressure onto the paper, for example by rolling the partly-dried film and the paper together under pressure between the transfer member and a paper-feed roll or the like.

This film is bonded to the surface of the paper as a substantially separate overlying lamination, under pressure as described, preferably in one of two ways: (1) if it is "spotted" on the paper by the use of electrotype plate or the like on the transfer member, the paper and the plate are rolled together under pressure at the same effective speed; but (2) if the entire surface is coated I prefer to feed the paper at a faster effective speed so that the film is stretched out lengthwise while it is being rolled under pressure against the paper to bond it thereto.

This gives a novel laminated structure having the transparent coating firmly adherent to the paper but arranged in a substantially separate layer. The coating material affixed by my novel method does not substantially penetrate the structure of the paper, even if the paper is very porous, as in the case of cartons for merchandise and the like, and therefore does not cause "bleeding" or otherwise affect the inks and colors used in printing and lithographing. When the coated paper is finally dried, by driving off the remainder of the solvent, it is provided according to my method with a firmly-adherent flexible transparent layer which overlies and is bonded to the

surface of the paper, and which protects the printing without affecting the ink, and which by the proper choice of ingredients may be made moisture-proof to any desired degree.

Much of the paper coated as above described is used for labels, cigarette and other cartons and packages, and other articles which must afterwards be fed through label-affixing machines, cigarette-packaging machines, and the like. While the coated surface must not feel greasy to the touch, it is desirable that it be slippery enough to feed readily.

I find that this can be done by introducing into the coating material a small amount of a high viscosity mineral oil which is soluble or miscible with or in the solvent used in the coating. This oil being miscible or soluble with or in the solvent in our coating material does not tend to separate therefrom while the coating material is in a liquid state. This mineral oil, not being a solvent for nitrocellulose, is squeezed or exuded out of the coating and lies on top of the coated surface because of the shrinkage of film which forces the oil out of the film structure. All films shrink early because of the evaporation of adsorbed or absorbed solvents and later due to the shrinkage occasioned by chemical change. This oil, being squeezed out to the surface, keeps the coated paper slippery for a considerable period of time but without giving it a greasy feel. The oil also is used to increase the resistance to moisture vapor transfer.

The above and other objects and features of my invention, including various novel steps and desirable particular constructions and combinations, will be apparent from the following description of the apparatus illustrated in the accompanying drawings, in which:

Figures 1, 2 and 3 are side elevations of a rotary coating machine, showing successive steps in the coating of a sheet of paper; and

Figures 4, 5, 6, and 7 are diagrammatic views showing successive steps in coating a sheet of paper on a bed type machine.

Prior coating machines have been mainly of two types, one being the typical varnishing machines in which the coating material is contained in a tank or trough in which there revolves an applying roller (usually of rubber or composition) which applies coating material directly to the paper. This machine may or may not have an additional bar or roller commonly called a smoothing or "doctor" bar to scrape the surplus material off the applying roller before the applying roller contacts the paper. The

other type of coating machine is one in which the coating material is spread on an applying roller which wipes past the paper being coated, with a movement opposite to the direction of the movement of the paper, so that the coating material is wiped off onto the paper substantially without pressure and without direct contact between the applying roller and the paper.

In both these old methods a very thin solution must be used, not only greatly increasing the cost on account of the greater quantity of solvent necessary (and which must either be wasted, or recovered in some way, at considerable expense), but having the additional disadvantage that the solution penetrates deeply into the structure of the paper. If the paper is printed or lithographed, this is apt to cause "bleeding" of the ink in the pores of the paper, especially if the paper is very porous. Moreover, the appearance of a coating which has sunk into and which forms a part of the porous structure of the paper is inferior in many ways to the appearance of a coating which is bonded to the surface of the paper and overlies it as a substantially separate lamination.

Instead of the 20% to 25% of solids which can be used in the solutions employed in these old methods, I find it possible to use with my novel method a very high degree of concentration, with consequent greater economy of solvent. It is my intention to use any of the variations in ingredients fully disclosed in my prior application No. 654,887, filed January 13, 1933, of which the present application is a partial continuation.

However, for purposes of illustration in describing herein my novel method of applying the coating, the following may be considered a representative formula:

	Parts
Nitrocellulose.....	40
Diamyl phthalate.....	18
Mineral oil.....	5
Resin.....	20
Tri cresyl phosphate.....	18

Up to eight pounds of the above coating materials can be dissolved in each gallon of solvent, or about three times the concentration used in the older methods. One solvent which may be used, and which is here selected as illustrative of those disclosed in my prior application, comprises 20% butyl lactate, 20% butyl alcohol, and 60% high flash naphtha.

A supply of the above mixture or an equivalent, indicated at 10, is fed into the trough between two feed rollers 12 and 14 carried by end frames 16 of the coating machine shown in Figures 1, 2, and 3. The particular machine illustrated is fully described, and is claimed, in application No. 681,837 filed July 24, 1933, by myself jointly with Mortimer S. North.

The rollers 12 and 14 are driven in opposite directions, at different peripheral speeds (although the angular speeds may be the same if the rollers are of different sizes). Roller 14, which has the higher peripheral speed, draws from the supply 10 a film 18 of a thickness determined by the distance rollers 12 and 14 are apart, the film being smoothed out by the drawing or wiping action due to the greater peripheral speed of roller 14. This film is of the desired width, but is of course thicker than the desired final coating due to the solvent which is afterwards dried out

as well as to the drawing and stretching operations described below.

The film 18 is stripped from roller 14 onto a transfer member such as a roller 20 as a film 22, the transfer roller 20 being driven in the same direction as roller 14 but at a higher peripheral speed, so that it strips the film 18 therefrom with a drawing or wiping action which smooths and stretches it out on the transfer roller.

The film 22 is partly dried by evaporation of a portion of its solvent, partly by its exposure over a large area on the rollers 14 and 20, partly by the drawing action of the two rollers, and if necessary by heating it (for example by making roller 20 hollow and passing steam therethrough).

The partly-dried film is forced under heavy pressure against the surface of a sheet 24 of paper or the like, which is to be coated, and which is fed in any desired manner from a feed table 26 or the like. The paper 24 and the partly-dried film 22 are rolled together between the transfer roller 20 and a paper-feed roll 28. Roll 28 is equipped with paper-feeding grippers, etc., and moves at the same peripheral speed as the transfer roller 20, toward which it is pressed under considerable pressure.

The coating may be "spotted" on the paper by providing the transfer roller 20 with an electrotype or the like as described in the above-identified joint application on the machine. In this case the paper and the electrotype or other "spotting" plate are rolled together under pressure at the same effective speed. Where coating the entire surface of the paper, however, I prefer to give the paper feed roll 28 a higher peripheral speed than the transfer roller 20, by suitably proportioning the driving gears or by making it the larger of the two. This stretches the partly-dried film lengthwise at the same time that it is bonded under pressure to the surface of the paper by being rolled against it.

This rolling pressure action firmly affixes or bonds to the surface of the paper 24 an overlying lamination 30 of coating material having left a very small amount of solvent. However, this lamination does not penetrate deeply into the structure of the paper, so that it can be affixed even to very porous paper without substantially penetrating into it, and without affecting the ink with which it may have previously been printed or lithographed.

The coated paper is ejected onto a suitable conveyor 32, which may if desired lead to a drier in which the remainder of the solvent is evaporated.

Since many of the articles coated by my method are afterwards fed through other machines, such as label-affixing machines or cigarette-packaging machines or the like, I prefer to insure that they will at least for some time have a very slippery surface which facilitates feeding them to the other machines. At the same time the surface must not feel greasy to the touch.

I find that this can be done by introducing into the coating material a small amount of a high viscosity mineral oil which is soluble or miscible with or in the solvent used in the coating. This oil being miscible or soluble with or in the above-mentioned solvent in our coating material does not tend to separate therefrom while the coating material is in a liquid state. This mineral oil, not being a solvent for nitrocellulose, is squeezed or exuded out of the coating and lies on top of the coated surface because of the shrinkage of film which forces the oil out of the film structure. All films shrink early because of the

evaporation of adsorbed and absorbed solvents and later due to the shrinkage occasioned by chemical change. This oil, being squeezed out to the surface, keeps the coated paper slippery for a considerable period of time but without giving it a greasy feel. The oil also is used to increase the resistance to moisture vapor transfer.

Figures 4-7 illustrate the coating of paper by my process in a flat-bed press of the Miehle type. In this arrangement the coating mixture 40 is fed downward between feed rollers 42 and 44, and is passed by an auxiliary feed roller 46 onto a flat transfer member or plate 48 on a reciprocating bed 50.

In the illustrated arrangement, the plate 48 may be an electrotpe or halftone plate or the like which "spots" the coating material on the paper, or it may be of such dimensions as to coat substantially the entire surface of the paper.

The film 52 on the transfer member 48 is rolled under considerable pressure, with a sheet 54 of paper fed from a feed table 56, between the transfer member 48 and the paper-feed roll 58. On the return stroke the bed 50 drops, or the rollers are lifted, so that there is no contact therebetween, as well understood in presses of this type. The plate 48 and the paper may move at the same effective speed, if the coating material is being "spotted" on the paper. Otherwise, as explained above, I prefer to move the paper faster and with a sort of dragging action on the film of coating material on the plate, so that the film is stretched out lengthwise as it is affixed and bonded to the surface of the paper. The partial evaporation of the solvent, to give a viscous partially-dried film, takes place partly on the roller 46 and partly on the plate 48, but mainly on the latter.

While my invention and its method of operation have been described in detail, it is not my intention to limit its scope by that description, or otherwise than by the terms of the appended claims.

I claim:

1. That method of providing a transparent protective coating for a sheet of ink printed paper or the like, without sufficient penetration of the paper substantially to affect the ink, which comprises forming a film of transparent coating material and solvent as a viscous liquid, evaporating part of the solvent from the film to give a partially self-sustaining film still containing a considerable proportion of solvent, affixing said partly-dried film under heavy pressure to the printed surface of the paper, and drying by evaporating substantially the remainder of the solvent.

2. That method of providing a transparent protective coating for a sheet of printed paper or the like, without substantial penetration of the structure of the paper, which comprises forming a film of transparent coating material and solvent as a viscous liquid, transferring said film to a movable transfer member, and evaporating part of the solvent from the film to give on said transfer member a partially self-sustaining film still containing a considerable proportion of solvent, affixing said partly-dried film under heavy pressure to the printed surface of the paper by forcing the transfer member against the paper thereby preventing bleeding of the printing, and drying by evaporating substantially the remainder of the solvent.

3. That method of providing a printed paper with a transparent protective coating having a slippery surface which comprises mechanically

incorporating in a viscous mixture of cellulose coating material and solvent a high viscosity mineral oil which is not affected by said material or by the solvent, forming a coating of the mixture on a sheet of printed paper or the like, and drying the coating by evaporating the solvent while leaving the mineral oil as a part of said coating, whereby the oil remains at least for a considerable time on the surface of the coating and keeps it slippery without forming a greasy film thereon.

4. An article comprising a sheet of printed paper or the like provided with a transparent coating of cellulose material having associated therewith a high-viscosity mineral oil forming on the surface thereof a slippery but non-greasy film.

5. That method of providing a transparent protective coating bonded to and overlying the surface of a sheet of paper or the like, which comprises forming on a transfer member a film of coating material and solvent as a very viscous and partly dried liquid, and affixing said partly-dried film to the surface of a sheet of paper by rolling the paper under pressure against said transfer member and at the same time stretching said film lengthwise by moving the paper faster than the transfer member, and thereafter completing the drying of the film.

6. That method of providing a transparent protective coating bonded to and overlying the surface of a sheet of paper or the like, which comprises forming a film of coating material and solvent as a very viscous and partly dried liquid, and affixing said partly-dried film to the surface of a sheet of paper by forcing the paper and said film together under pressure and at the same time stretching said film lengthwise, and thereafter completing the drying of the film.

7. That method of "spotting" on a sheet of paper having a contrasting pigment in the surface thereof to form lettering or a design, a protective coating overlying and bonded to the surface of the paper as a substantially separate lamination, which comprises forming a film of viscous transparent coating material on a "spotting" plate and partly drying it to give a very viscous and almost self-sustaining film on said plate, forcing the plate and that surface of the sheet of paper having the pigment therein together under pressure to transfer the film to the paper thereby preventing bleeding of the design, and completing the drying of the film.

8. A sheet of printed paper having a transparent overlying protective coating of cellulose material "spotted" on and bonded to a part of its surface as a substantially separate lamination not penetrating substantially into the pores of the paper, the coating having associated therewith a high viscosity mineral oil forming on the surface thereof a slippery but non-greasy film.

9. That method of coating paper or the like which comprises forming a very viscous and almost self-sustaining film of coating material and forcing the film and the paper together under pressure and at the same time stretching the film.

10. That method of providing a transparent protective coating for a sheet of printed or lithographed paper or the like, without sufficient penetration of the paper substantially to affect the ink, which comprises forming a film of transparent coating material and solvent as a viscous liquid, evaporating part of the solvent from the film to give a partially self-sustaining film still

containing a considerable proportion of solvent, forcing the film against the printed surface of the paper under pressure and at the same time stretching the film, and drying by evaporating substantially the remainder of the solvent.

11. That method of providing a transparent protective coating for a sheet of printed or lithographed paper or the like, without sufficient penetration of the paper substantially to affect the link, which comprises forming on a transfer member a film of transparent coating material and solvent as a viscous liquid, evaporating part of the solvent from the film to give a partially self-sustaining film still containing a considerable proportion of solvent, forcing the film against the printed surface of the paper under pressure and at the same time stretching the film by moving the paper faster relatively to the transfer member than the film is removed from the transfer member, and thereafter completing the drying of the film.

12. An article comprising a sheet of printed paper or the like provided with a transparent coating of cellulose material forming a substantially separate layer not penetrating substantially into the structure of the paper, said coating having a mineral oil mechanically incorporated therein and forming on the surface thereof a slippery but non-greasy film.

13. That method of providing a transparent protective coating for a sheet of paper or the like having a contrasting pigment in the surface thereof forming lettering or a design without substantial penetration of the structure of the paper, which comprises forming a film of transparent coating material and solvent as a viscous liquid, evaporating part of the solvent from the film to give a partially self-sustaining film still containing a considerable proportion of solvent, affixing said partly-dried film under heavy pressure to that surface of the paper having the pigment therein thereby preventing bleeding of the design, and drying by evaporating substantially the remainder of the solvent.

14. That method of providing a transparent protective coating for a sheet of paper or the like having a contrasting pigment in the surface thereof forming lettering or a design with-

out substantial penetration of the structure of the paper by said coating, which comprises forming a viscous liquid film of transparent coating material and a solvent, evaporating a portion of the solvent from said film, rolling said film and the paper together under heavy pressure to give a laminated structure with the coating as a substantially separate layer covering the pigmented surface of the paper thereby preventing bleeding of the design, and then evaporating substantially the remainder of the solvent to dry the coated paper.

15. That method of providing a printed paper with a transparent protective coating having a slippery surface which comprises mechanically incorporating in a viscous mixture of nitro-cellulose coating material and solvent a high viscosity mineral oil which is not affected by said material or by the solvent, forming a coating of the mixture on a sheet of printed paper or the like, and drying the coating by evaporating the solvent while leaving the mineral oil as a part of said coating, whereby the oil remains at least for a considerable time on the surface of the coating and keeps it slippery without forming a greasy film thereon.

16. That method of providing a transparent protective coating for a sheet of paper or the like having a contrasting pigment in the surface thereof forming lettering or a design without substantial penetration of the structure of the paper, which comprises mechanically incorporating in a viscous mixture of cellulose coating material and solvent a high viscosity mineral oil which is not affected by said material or the solvent, forming a film of said mixture, evaporating part of the solvent from the film to give a partially self-sustaining film still containing a considerable proportion of solvent, affixing said partly dried film under heavy pressure to that surface of the paper having the pigment therein, and drying the film by evaporating the solvent, whereby the oil remains for at least a considerable time on the surface of the film and keeps it slippery without forming a greasy film thereon.

JOHN D. MURRAY.