

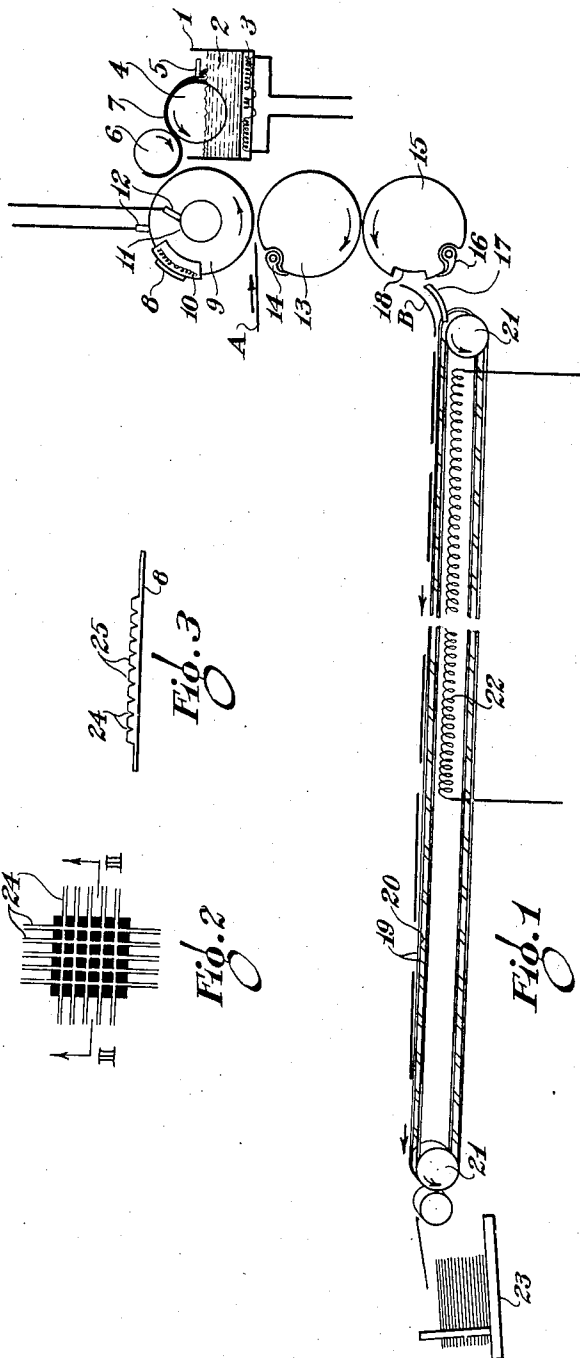
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TREATMENT OF SHEET MATERIAL

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TREATMENT OF SHEET MATERIAL

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This invention relates to the treatment of paper and more particularly to a treatment by which it may be rendered transparent.

Such transparent paper is especially useful in window envelopes and similar articles where it is desired to provide a single integral piece of material having definite transparent portions and the remainder of the article opaque.

Heretofore window envelopes of two types have been produced, in the first of which an opening is cut from the paper forming the envelope and this opening sometimes covered with a separate piece of transparent material.

In the other type, a predetermined area of the envelope has been rendered transparent by the application of a varnish-like material to this area.

With such varnish like materials, after application to the paper, it has been necessary to dry the envelope to remove the solvent present in the varnish, and in many cases to oxidize oils likewise present in the varnish.

Many variations of this process have been proposed, but none of them have entirely eliminated the several serious practical limitations and difficulties which have existed in "transparentizing" or rendering transparent normally opaque paper or similar materials.

One of these difficulties is uncertainty of obtaining a uniform degree of transparency, which apparently arises from difficulty in maintaining a uniform composition of the transparentizing material, particularly in regard to its solvent concentration.

Another difficulty arises from the relatively long period of time required to dry the transparentizing material after application, which has led to the devising of elaborate and expensive equipment in attempts to maintain the high rate of production which is essential in such low priced articles as envelopes.

The nature of such equipment has required high labor charges for its operation and maintenance.

A third disadvantage has been the tendency of solvent-thinned, varnish-like material to creep and spread during the relatively long period required for drying the same, extending the edges of the transparent area into irregular outlines, which have, in the past, necessitated the masking of these edges by the printing of a relatively wide border about the window area of the envelope.

An object of my invention is to provide an improved means for rendering paper transparent

in any desired locality which will eliminate the above mentioned disadvantages.

Another object is to provide an improved method for transparentizing paper.

Another object is to provide an improved material for this purpose.

Another object is to provide an improved and more attractive envelope than has heretofore been available.

Other objects will hereinafter appear.

The invention will be better understood from the description of one practical manner in which it may be employed, of various combinations of material and the like which may enter into its application, and of one type of apparatus which constitutes, in part, an embodiment thereof and, in part, illustrates the manner of its performance.

This apparatus is illustrated in the accompanying drawing, in which:

Figure 1 is a somewhat diagrammatic side elevational view, parts being shown in section, of a mechanism for use in transparentizing of window envelopes;

Figure 2 is a fragmentary enlarged plan view of a material transferring or printing pad shown in Figure 1; and

Figure 3 is a sectional view taken on the line III—III of Figure 2.

As a transparentizing material, I prefer to employ a normally solid amorphous or semi-amorphous transparentizing material, rendering the same molten by application of heat instead of dissolving the transparentizing material into a solvent. "Semi-amorphous", as used herein, refers to a material which, while it may have some crystalline particles, has these particles of such minute size or so separated or both that its effect, insofar as may be judged by the unaided eye, is the equivalent of a material having no crystalline structure.

This amorphous or semi-amorphous transparentizing material is applied to that area or portion of the paper which it is desired shall be rendered transparent.

It is maintained above its melting point for a sufficient period to permit its complete penetration into the paper to render the latter transparent, and is finally cooled below its melting point, thus rendering it solid and permitting immediate stacking of the articles.

The manner in which these steps are performed will be pointed out with reference to the accompanying drawing. In Figure 1, a tank is illustrated at 1, which is used to contain a trans-

parentizing material 2. This material is maintained in a molten condition within the tank by means of an electrical heating element 3 positioned within the bottom of the latter.

5 A roll 4 is mounted upon a horizontal axis and positioned to extend into the molten transparentizing material and adjacent this roll is provided a knife-like scraper 5 positioned immediately above the surface of the molten liquid and
10 arranged to scrape such liquid from the roll, leaving only a film of predetermined thickness adhering to the latter.

A second or distributing roll 6 is mounted to rotate about a horizontal axis substantially tangent to the roll 4 and to which is transferred the film 7 of transparentizing material. This
15 film, after having been removed from the tank and by the time it is applied to the paper, has probably cooled to a plastic or semi-fluid and somewhat tacky or sticky condition.

The distributing roll is arranged to roll upon a pad 8 carried upon a printing roll 9 and arranged to be heated by an electrical heating
20 element 10, also carried by the printing roll, and supplied with electricity through collector rings 11 and brushes 12 from any suitable source of power.

It will be noted that the printing pad projects substantially beyond the surface of the printing
30 roll, so that the pad is the only portion of this roll which comes in contact with the distributing roll 6.

Below the printing roll is a "tympan" roll 13 provided with paper engaging members or grippers 14 by which an envelope or other blank may
35 be picked up from a suitable feeding mechanism, not shown, and which will carry the blank between the printing roll and the tympan roll, and thence around the latter to a reversing or transferring roll 15 therebeneath.

Of course, as the blank passes between the printing roll and the tympan roll, the pad is
40 impressed upon the surface of the blank, moving in synchronism therewith, and so delivers to the surface of the blank the transparentizing material which it has brought from the distributing roll 6.

The transferring roll, like the tympan roll, has blank engaging elements or grippers 16 which
50 take the blank from the tympan roll and carry it to the left, over the transferring roll, to a slide 17 which passes the blank down upon a horizontal conveyor.

The reversing roll has formed on its outer surface a recess or clearance 18 positioned to underlie at least the portion of the envelope carrying the transparentizing material, to prevent contact
55 with or smearing of the same.

This is particularly important, inasmuch as the side of the blank to which the transparentizing material has been applied will be that against the transferring roll.

The conveyor consists of a plurality of horizontal flexible elements, such as the chains 19
60 connected by cross-bars 20, passing over pulleys or sprockets 21, and moving to the left on its upper side as shown in the drawing.

Immediately beneath this upper side is positioned a heating device 22, conveniently an electrical heater, arranged to throw relatively intense
70 radiant heat through the conveyor. Of course, any desired or well known source of heat might be used.

75 As will be noted, the blanks, in passing along

the conveyor, have their newly coated sides down, and their uncoated sides upward.

The conveyor extends substantially beyond the heating device to provide a sufficient period for the blanks to cool before reaching its end, and a suitable rack 23 or the like is positioned adjacent the end of conveyor to which the blanks
5 may be delivered, and which may be arranged so that they will automatically stack themselves, as shown.

10 Preferably, the surface of the printing pad is not continuous, but is grooved or scored as indicated by the horizontal and vertical lines 24 of Figure 2, the grooves being shown as of generally V-shaped cross-section in Figure 3, so that the material is not printed upon the paper in a continuous film, but more in the form of closely
15 spaced parallel and perpendicular ridges, there being substantially no material delivered by the elevated portions, or plateaus 25, between the grooves of the printing pad.

In this respect, the printing of the transparentizing material resembles the application of ink in the process of engraving more closely than it does printing with raised type. By careful proportion and arrangement of the grooves of the
25 printing pad, these may deliver just sufficient quantities of transparentizing material to spread over the spaces between the grooves and properly penetrate the paper, providing a much more accurate supply of material, and obviating any substantial surplus upon the paper which would tend to spread beyond the desired imprint.

In addition to more accurate, uniform application of the transparentizing material, a higher rate of penetration of the paper is obtained than is the case when a continuous film is applied.

While the grooves of the pad are shown in Figure 3 as two mutually perpendicular series of parallel lines, it will be obvious that any type of groove which maintains proper relationship between the material carried by the grooves and the area of the spaces between them will be satisfactory, and that the elevated portions or plateaus between the grooves might be circular, lozenge shaped, hexagonal, triangular or even
45 that only one set of parallel grooves or sinusoidal grooves or the like might be used, the one essential being that the material in the grooves be properly correlated to the area of the plateaus between them.

For a common variety of paper used in envelopes, and for the first described of the transparentizing materials hereinafter mentioned, grooves spaced $\frac{3}{4}$ inch apart and $\frac{1}{4}$ inch wide
55 and deep produce very satisfactory results.

Not only does the transparentizing material penetrate the paper upon being heated, but it extends itself from each ridge across intervening spaces left by the plateaus to join the material from the adjacent ridges, and so, in the finished blank, there is a continuous transparent area, with probably but a very thin superficial and continuous excess film of transparentizing material on the coated side of the paper.

Of course, a printing pad having a continuous surface might be used, but unless its natural surface is slightly rough and capable of producing about the same effect as the grooves above mentioned, it is more difficult to produce uniform distribution of the transparentizing material on the paper, and continuous surfaces exhibit something of a tendency to roll the transparentizing material before them, causing a dif-
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ference in the thickness of the film at the two sides of an impression.

As above mentioned, the transparentizing material preferably is amorphous or at least semi-amorphous, as materials which are crystalline in character develop certain internal refractions when the crystals are formed within the paper, lessening its transparency.

Another requirement of the material is that it be fluid at a sufficiently low temperature so that it may be applied to and penetrate the surface of the commoner varieties of paper without raising the same to a temperature which will in any way impair its physical characteristics. Not only does this mean that the paper must not be raised to a temperature at which it will start to char, but it must not be permitted to become so dry as to show signs of brittleness, and the transparentizing material should therefore become fluid at not over 300° F.

Another requirement of the material is that it shall solidify at temperatures somewhat in excess of those to which it will be subjected in storage and handling of the finished articles, to prevent the material from becoming sticky or tacky and causing adjacent blanks or envelopes to stick together during further processing, shipment, or storage, and therefore the material preferably should completely solidify at a temperature of 100° F. or above.

Numerous compositions may be used for this purpose, one of which has been found to be particularly satisfactory, consisting of, by weight:

35	Rosin.....	50
	Paraffin.....	20

This material has a melting point of about 130° F. which is well within the temperature range above indicated. The rosin is non-crystalline or amorphous in character, while the paraffin ordinarily is crystalline. However, when the two are mixed in the proportions above mentioned, the rosin in effect neutralizes the tendency to the crystallization of the paraffin, forming much smaller crystals and separating these from each other, and so eliminates any visible tendency to internal refraction.

On the other hand, rosin alone, particularly when heated, is quite sticky and adhesive and this stickiness is greatly reduced by the presence of the paraffin.

Other compositions of a similar nature may be made including a resinous element and a waxy one, and I find that the following resinous constituents give satisfactory results: burgundy pitch, gum dammar, and other similar relatively low melting varnish resins, as do also certain synthetic resins such as "amberol", and for the waxy element of the composition, stearic acid, japan wax, ceresin wax, and the like, have been found satisfactory.

Also the proportions given above may be somewhat varied and good results are obtained with 50% to 90% resin and 50% to 10% wax.

Also, a single material may be used instead of a mixture, and any of the materials above mentioned may be used in this manner, although alone they do not appear to be quite so advantageous as a mixture containing both resinous and waxy constituents.

The operation of Figure 1, when supplied with the composition of rosin and paraffin first above described, is as follows: The tank is filled with transparentizing material and maintained by

means of heating coil 3 at a temperature of between 130° and 160° F., at which temperature the transparentizing material remains in satisfactorily fluid condition.

The various rolls rotate in timed relation in the directions indicated by the arrows placed thereon. The roll 4 picks up a film of transparentizing material which is scraped to a predetermined thickness by the scraper or knife 5 and is passed from this roll to the distributing roll 6.

The printing roll 9 brings the printing pad 8 against this film, and so fills the grooves of the pad with transparentizing material.

As this is being done, a blank A is fed from the left between the printing roll 9 and tympan roll 13, its edge being engaged by the grippers 14 of the latter, and is carried between these rolls as the printing pad is brought down and impressed upon it.

The printing pad is maintained by the electrical heater 10 at a temperature of about 120° F., at which the transparentizing material is sufficiently adhesive to readily attach itself to the blank, but at which it is not sufficiently liquid to run.

The blank, after passing between the printing and tympan rolls, is carried down the right hand side of the latter, with the transparentizing material out, until its edge reaches grippers 16 of transferring roll when it is carried between the tympan and transferring rolls to the left as shown in the drawing, the imprinted side being against the transferring roll 15 with the imprint itself extending over the recess 18 in the same.

The blank is then dropped as at B upon the chute 17 and conveyor 19 with its imprinted side down, and passes to the left upon the conveyor over the heater 22. This heater raises the temperature of the blank to between 275° and 300° F. and the time in passing over the same may be between ½ and 1½ minutes.

It is important that the coated or imprinted side of the blank be downward and toward the heater, as when the blanks are passed over the heater with the transparentizing material on the remote side therefrom a frothy or bubbly condition of the transparentizing material is produced, which condition is avoided when the coated side of the blank is adjacent the heater.

Apparently, this is due to moisture contained in the paper which is free to escape from the uncoated side thereof when the coated side is closest the heating pad, which, when the position of the blank is reversed, is driven into it and then through the layer of transparentizing material.

As the top of the conveyor is exposed, the atmosphere may freely circulate to carry away such vaporized moisture.

The end of the conveyor shown to the left in Figure 1 is unheated and is of sufficient length to permit a cooling period of between ½ and 1 minute as the blanks move therealong. This is sufficient for the transparentizing material to become solid, losing any tacky or fluid characteristic, that it may have possessed while passing over the heater and permitting the envelopes and blanks to be immediately delivered into a stack at the end of the conveyor.

While I have described the above procedure, apparatus and material, obviously many embodiments, variations and modifications thereof will readily occur to those skilled in the art to which this appertains, and I therefore do not limit myself to the precise details shown and described, but claim as my invention all modifications, vari-

ations and embodiments coming within the scope of the appended claims.

I claim:

1. The method of making one piece window envelopes, which comprises applying normally solid transparentizing material to one surface only of a sheet of paper, directing heat against only the surface of said sheet to which said material has been applied, subjecting the sheet to said heat until the material has been rendered fluid and caused to penetrate the paper and simultaneously permitting air to circulate along the side of the sheet of paper opposite that to which the material was applied, and thereafter permitting said sheet to cool until the transparentizing material has solidified.
2. The method of preparing paper for one piece window envelopes, which consists in heating normally solid transparentizing material to a temperature at which it becomes adhesive and lower than that at which it becomes fluid, applying said transparentizing material to one side only of a preselected area of a sheet of paper, then directing heat to the side of said sheet of paper to which the transparentizing material has been applied, continuing the application of heat to said side until the transparentizing material has been rendered fluid and caused to penetrate through the paper to the side opposite to which it was applied, and thereafter permitting the sheet to cool until the transparentizing material has solidified.
3. The method of preparing paper for one piece window envelopes, which consists in heating normally solid transparentizing material to a temperature in the vicinity of its melting point, forming a pattern of pre-determined quantity of said transparentizing material, transferring said pattern to one side only of a pre-selected area of a sheet of paper, then directing radiant heat to the side of said sheet of paper to which the transparentizing material has been applied while maintaining the paper in the open air, continuing the application of heat to said side until the transparentizing material has been rendered fluid and caused to penetrate through the paper to the side opposite to which it was applied, and thereafter permitting the sheet to cool until the transparentizing material has solidified.
4. The method of making one piece window envelopes which comprises forming a pattern of normally solid un-diluted transparentizing mate-

rial consisting of small, slightly spaced areas, the amount of material in the areas being sufficient to spread through the space between adjacent areas, upon one side of a sheet of paper, and then subjecting said sheet of paper to heat until the transparentizing material has spread over and penetrated throughout the surface between said areas, and thereafter cooling said sheet until the transparentizing material has solidified.

5. The method of making one piece window envelopes which comprises forming a pattern of slightly spaced dots of normally solid undiluted transparentizing material, the quantity of material in the dots being sufficient to spread through the space between adjacent areas, upon one side of a sheet of paper, and then subjecting said sheet of paper to heat until the transparentizing material has spread over and penetrated throughout the surface between said areas, and thereafter cooling said sheet until the transparentizing material has solidified.

6. The method of making one piece window envelopes which comprises raising normally solid undiluted transparentizing material to substantially its melting point, forming a pattern of said transparentizing material consisting of small quantities of material in slightly spaced areas, transferring said transparentizing material while in adhesive condition to a portion of one side of a sheet of paper, and then subjecting said sheet of paper to heat until the transparentizing material has spread over and penetrated throughout the surface between said areas, and thereafter cooling said sheet until the transparentizing material has solidified.

7. The method of making one piece window envelopes which comprises raising normally solid undiluted transparentizing material to substantially its melting point, forming a pattern of said transparentizing material consisting of small quantities of material in slightly spaced areas, transferring said transparentizing material while in adhesive condition to a portion of one side of a sheet of paper, and then directing heat against only the side of the sheet to which said transparentizing material has been applied until the transparentizing material has spread over and penetrated throughout the surface between said areas, and thereafter cooling said sheet until the transparentizing material has solidified.

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