July 12, 1932. I. GURWICK 1,867,314

METHOD FOR MULTICOLOR PRINTING ON TRANSPARENT CELLULOSE PAPER AND PRODUCT RESULTING FROM THE SAME

Filed June 4, 1931

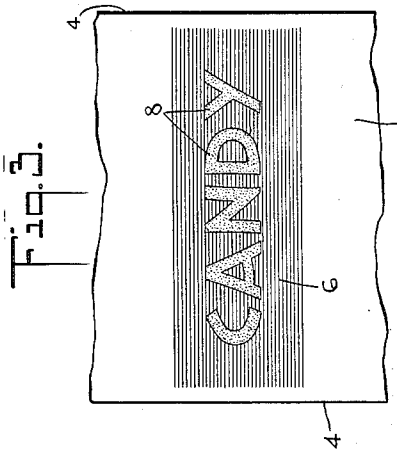

Fig. 3.

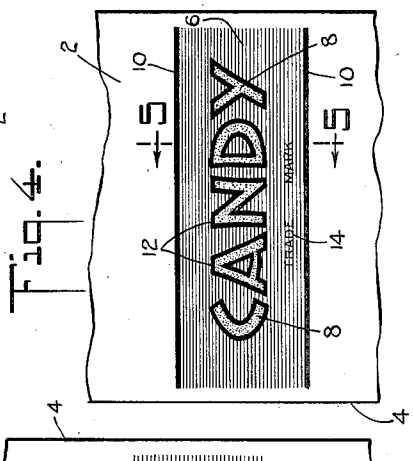

Fig. 4.

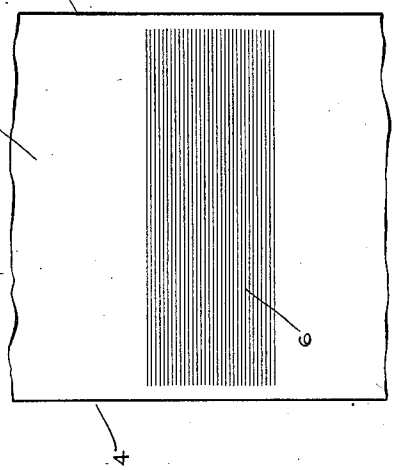

Fig. 2.

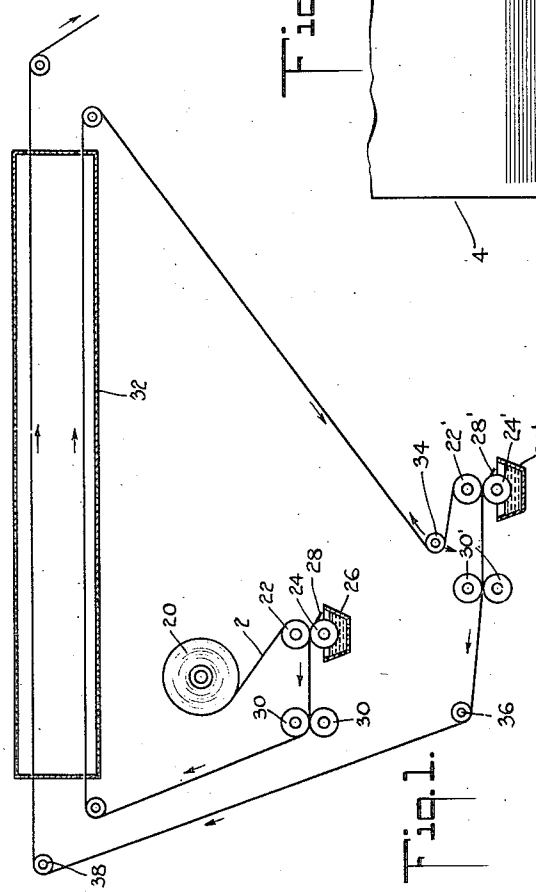

Fig. 1.

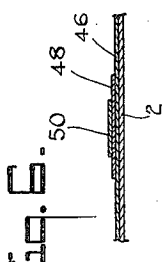

Fig. 6.

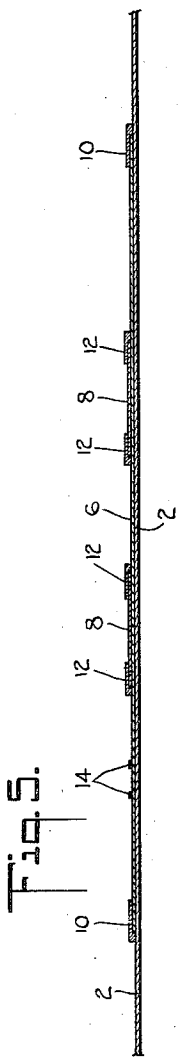

Fig. 5.

INVENTOR
Irving Gurwick
BY
Cushman Darby & Cushman
ATTORNEYS

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UNITED STATES PATENT OFFICE

IRVING GURWICK, OF NEW YORK, N. Y., ASSIGNOR TO TRANSPARENT PACKAGING & PRINTING CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

METHOD FOR MULTICOLOR PRINTING ON TRANSPARENT CELLULOSE PAPER AND PRODUCT RESULTING FROM THE SAME

Application filed June 4, 1931. Serial No. 541,974.

This invention relates to a method for printing multi-color designs on transparent cellulose paper, such as the products known commercially under the names "Cellophane" and "Sylphwrap", and to the multi-color printed blank resulting from the process.

A type of wrapper for packaging goods for sale which has proved to be exceedingly popular in recent years is made of a transparent cellulose paper, made, for example, of regenerated cellulose. This paper is lustrous and perfectly transparent, and is non-absorbent with respect to oil or grease. It also is moisture-proof, although the paper itself is somewhat hygroscopic. Typical examples of this paper are the products known commercially as Cellophane and Sylphwrap.

The printing of multi-color designs on this kind of paper has presented particular difficulty. The paper is non-absorbent with respect to the colors or inks used and therefore difficult to dry thoroughly. To produce the desired wrappers at a commercially useful price, it is necessary to print the same continuously on a rapidly moving continuous web. This, in the case of a multi-color design, necessitates exact registration of the different colored portions of the design, for these portions have heretofore been printed in juxtaposition and not in superposition, that is, color has been placed alongside of color instead of color on top of color. The printing was done by printing cylinders the impression on which is formed in relief, so that complete drying of one color was not essential before applying another color.

It will be evident that this process requires exact registration of the different printing impressions. In the case of many designs such as those using exceedingly fine lettering on a different colored background, or those utilizing half-tone or charcoal effects, the design of itself presents extraordinary difficulty in obtaining the necessary precise registration. Regardless of the kind of design being printed, further difficulty is caused by the nature of the transparent cellulose paper which varies with temperature and humidity conditions and which initially is frequently characterized by differences in thickness, all of which lead to changes in the tensile strength and stretch of the continuous web, as well as irregularities and waves in the web as it is being run through the printing units.

The primary object of the present invention is to overcome the foregoing difficulty and to make possible and apparently perfect registration of the various colored portions of a multi-color design without, however, necessitating undue accuracy of the printing impressions, and in spite of variations in the stretch of the web. To this end the method of my invention includes printing on a continuously moving web of the transparent paper a first body of color, drying the same, and thereafter printing on top of a portion of the first body of color another body of different color, and so on, thereby obtaining a design in a plurality of colors which are arranged in superposition or color on color. With this process when lettering is printed on a background the lettering may be as fine as desired, and exact registration is of no importance because the lettering is printed on the background and may appear at any point thereon. At the same time additional advantage is obtained because the finished printed material is relatively dense and opaque, and this is important when printing on a transparent medium which reveals any deficiency in this regard.

A corollary object of the foregoing process is to dry the successive colors before applying the next succeeding color. It is evident that each color should preferably be bone dry before it is attempted to print another in different color on top of the same. This thorough drying of the color possesses additional advantages because it obviates the necessity for providing a backing web or slip sheeting as has heretofore proved necessary. The slip sheeting is a relatively absorbent paper which prevents the printing of one sheet from soiling the back of the next sheet when the sheets are stacked after being cut from the web. The use of a slip sheet is costly and inconvenient. It further dulls the natural brilliance of the coloring employed, so that the product of my improved

process is characterized by a luster and brilliance which contrasts with the ordinary printing obtained on transparent cellulose paper.

Further objects of the present invention are to provide for the use of a color or ink which will be even more brilliant and solid or dense than the varnish colors heretofore employed, and which will facilitate the process of drying the web between successive printing stages. With this object in view, I have found it feasible and exceedingly desirable to employ lacquer colors. These colors are superior in every way to varnish colors, and are exceedingly volatile and quick-drying,—so much so, in fact, that they cannot be suitably employed with relief printing.

However, I have found it possible to use lacquer colors when the printing is performed by an intaglio printing cylinder. The intaglio printing cylinder may be employed despite the multicolor nature of the work, because of the fact that each color is completely dried before the next color is printed. The usual advantages of intaglio printing, such as the production of a solid, sharp, clean impression are all obtained, in addition to the added advantage of making possible the use of lacquer colors with their increased brilliance and speed of drying.

In accordance with a further feature and object of the present invention the successive colors are printed on the web in the order of darkness of the color, so that each color of successively darker shade stands out in clean relief on top of the previously applied relatively light color.

The present application is a continuation in part of my prior copending application Serial No. 361,584, filed May 9, 1929. The said application is directed to intaglio printing machinery particularly adapted for the printing of one or a plurality of colors on a continuous web of transparent cellulose paper. The present application is more particularly directed to the process of printing color on color on transparent cellulose paper, and to the product resulting therefrom.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention resides in the process steps, the multicolor printed article, and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing in which:

Fig. 1 is a schematic view in elevation of apparatus suitable for practicing the present method;

Fig. 2 is a fragment of a continuous web of transparent cellulose paper after the first printing stage;

Fig. 3 illustrates the same after the second printing stage;

Fig. 4 illustrates the same after the third printing stage;

Fig. 5 is an enlarged section taken in the plane of the line 5—5 in Fig. 4; and

Fig. 6 is a modified fragment of Fig. 5.

Referring to the drawing and particularly to Figs. 2 through 5 thereof, a fragmentary portion of a web of paper is indicated by the numeral 2, the said web being defined by the longitudinal side edges 4. The paper is a transparent cellulose paper, made, for example, of regenerated cellulose, such as the products known commercially under the names "Cellophane" or "Sylphwrap". This paper is perfectly transparent, and polished and lustrous in appearance. It is grease-proof and oil-proof, and substantially moisture-proof, although slightly hygroscopic. Because of unevenness in the thickness of the web as manufactured, and because of changes in tensile strength resulting from variations in temperature and humidity conditions, it is difficult to print a plurality of colors in perfect registration on a continuously moving web. Thus, referring to Fig. 4, a portion of a candy wrapper is illustrated which is printed in three colors, the background 6 being, for example, white, the lettering 8 being, for example, orange, and the lines 10 bounding the background 6, the lines 12 bounding the lettering 8, and the lettering 14, all being, for example, blue or black. It will be evident that if the colors are printed in juxtaposition, that is, color alongside of color, the various areas referred to must register perfectly, and this is particularly true when dealing with a transparent paper, because the slightest departure from registry will leave transparent spaces having no color. The printing of fine lettering, such as the words "Trade Mark" shown at 14, is exceedingly difficult because of the fine lines making up the lettering. Furthermore, if some of the area, as, for example, the lettering 8, is given a half-tone effect as though drawn lightly with crayon, the area will be composed of minute spaces, some having the color of the crayon, and some having the color of the background, and such an effect is practically impossible to produce with side by side coloring.

In accordance with the present invention the printing is accomplished by superposition of the successive colors. To produce the design shown in Fig. 4 the web 2 is first printed with a solid white background as is indicated at 6 in Fig. 2. The orange lettering 8 is next printed on the background 6, as will be evident from Fig. 3. This lettering if made in the half-tone or crayon-like effect previously referred to is no more difficult than if made solid, because the fragments of background showing through the

orange color are readily obtained from the original solid background. Registration of the lettering 8 on the background 6 is of relatively little importance, for if the position of the lettering shifts, it is nevertheless bounded by the coloring of the background without clear or transparent spaces being caused by the said shift in position of the lettering, as would be the case if the background 6 were printed with blank spaces left for receiving the lettering 8.

The black lines 10 and 12 and the lettering 14 are next applied on top of the white background 6 and the orange lettering 8, as is evident from an inspection of Fig. 4. The position of the words "Trade Mark" instead of being a matter of critical importance is of no importance whatsoever. The position of the lines 10 and 12 should be made approximately correct, but need not be exact, for slight variations are readily accommodated by the thickness of the black lines.

The theory of the color superposition so far described may be clarified by reference to Fig. 5 which is an enlarged section taken in the plane of the line 5-5 in Fig. 4. Referring to this figure the transparent paper web 2 has applied thereto a white background 6 on top of which there is next applied the orange lettering 8. The black lines 10 and 12 and the lettering 14 are next applied to the sheet and these superimpose the background 6 and the lettering 8. The lines 10 may be superposed entirely on the background 6, but if desired a slight projection beyond the background 6 may be provided, as shown in the drawing, so as to accommodate any changes in registration which may take place during the printing operation. Similarly the lines 12 may be superimposed exactly on the lettering 8, but by permitting the same to project slightly beyond the lettering 8, variations in registration are readily accommodated.

It should be noted that the order in which the colors are printed preferably runs from the lighter colors to the darker colors. For example, in the present case involving the colors white, orange, and black, the printing is performed in that order. This is done because the darker colors stand out in bold relief on a background of lighter coloring. The darker colors superimposed on lighter colors obviously more readily conceal the lighter colors than will lighter colors superimposed on darker colors. Furthermore, a dark strip such as the line 12 around the lettering 8 conceals both the white background and the orange lettering, and therefore makes possible that ease of registration which has previously been emphasized.

By selecting colors to increase in darkness in the order of decrease of area, even greater ease in registration may be obtained. For example, if in the lettering "Candy" the middle portion 8 is made black instead of orange and the border portion 12 is made orange instead of black, the orange lettering is applied on a general white background and the black lettering is applied on a general orange background, so that exact registration becomes of but slight importance. Such an arrangement is illustrated in section in Fig. 6 which is equivalent to a fragmentary portion of the section shown in Fig. 5. In Fig. 6 the paper web is shown at 2; the white background is indicated by the numeral 46; the orange lettering is indicated by the numeral 48; and the black central portion of the lettering is indicated at the numeral 50. It will be evident that this is only a simple and typical example of the general fact that by applying the successive colors in the order of diminishing area, each color is applied on a still larger area and therefore permits of laxity in registration.

It will further be understood that the printing, although including color superimposed on color, may be produced by leaving the lettering in blank instead of by printing the same. Specifically the words "Trade Mark" might be produced in orange on a black background by printing a nearly solid strip of black, with spaces therein tracing the desired lettering, so that the orange background shows through the black strip. The effect produced, of course, is that of having printed orange lettering on a black background.

It will also be appreciated that the lettering may be produced by completely blank spaces, leaving a transparent portion in the paper, or by blank marginal portions surrounding the lettering so as to produce contrasts not only of colors but also of transparency and color.

A multiple unit printing apparatus suitable for the practice of the present method is schematically indicated in Fig. 1. The apparatus need not be described in detail, for it may take the form of that disclosed in my copending application Serial No. 361,584 previously referred to. Briefly considered, the continuous web 2 of transparent cellulose paper is taken from a roll 20 and passed between an impression roll 22 and an intaglio printing cylinder 24. The latter rotates in a bath of color 26 which is removed from the intaglio printing cylinder by a scraper or doctor blade 28. The paper then passes through thin feed wheels 30, which grip the paper at its margin only.

As is explained in my copending application, to print clearly on lustrous non-absorbent transparent paper it is necessary to deposit a solid body of color, and this is preferably done by etching the intaglio printing cylinder 24 to a considerable depth. However, the printing pressure must be relatively light, for otherwise the desired impression

will be ruined by squeeze-back of the excessive ink deposit. Accordingly, the functions of feeding and printing are preferably divorced, and the printing is accomplished between impression roller 22 and printing cylinder 24, while the feeding of the web is accomplished by feed wheels 30 which are relatively thin and which grip the unprinted margin only of the paper web with sufficient pressure to feed the web at the desired speed.

The web next passes through a dryer generally indicated at 32 through which a blast of air is forced at exceedingly high velocity. By the time the web leaves the dryer 32, the first color printed thereon is bone dry. The web is next passed through a second printing unit which is similar to the first printing unit in including an impression roller 22′, and an intaglio printing cylinder 24′ which rotates in a color bath 26′ and which is scraped by a doctor blade 28′. The web meanwhile is fed by feed wheels 30′ corresponding to the feed wheels 30 in the first printing unit. Here again the wheels grip only the unprinted marginal edge of the web and therefore do not affect the freshly deposited ink.

It should be noted that the web passes through an adjustable idler or tensioning roller 34 between the first and second printing units. Variation of the position of this roller makes possible adjustment of the registration of the successively printed impressions. However, this adjustment of registration presupposes a uniform strength and texture of the moving web, and, as has heretofore been pointed out, this factor is not at all constant in the case of the transparent cellulose paper here being dealt with, and accordingly that advantage obtained by the present color on color printing process which reduces the importance of and necessity for perfect registration, is of extreme importance.

From the second printing unit the web next passes around appropriate guide rollers 36 and 38, and is again passed through the dryer 32. The operation may be repeated more times if more than two printing impressions are applied. The finished web is then led directly to any appropriate types of cutting and stacking machines wherein the cut sheets may be stacked in direct superposition without the use of slip sheets with attendant bother and expense.

The mode of practicing the present invention, the nature of the article obtained therefrom, and the many advantages of the process and the article, will, it is thought, be apparent from the foregoing description thereof. The process is superior to any method heretofore employed, first, because the registration obtained need not be perfect. This reduces the cost of manufacture of the printing cylinders and the necessity for constant supervision and adjustment of the printing machinery. Secondly, the process involves complete drying between colors, and therefore permits of the use of intaglio printing which is itself superior because it gives a sharp, clean impression and a solid, opaque body of color. In the third place, the use of intaglio printing in turn makes it possible to use lacquer colors instead of varnish colors such as are used in typographic or relief printing, and the lacquer colors are brilliant and attractive in appearance, and being highly volatile, dry quickly, which in turn facilitates both the use of color on color printing and the use of intaglio printing cylinders for the color on color printing. In the fourth place, printing color on color makes it possible to obtain fine impressions or fine lettering without in any way increasing the problem of registration because the said fine lettering may simply be printed on a full background. In the fifth place, color or color printing permits the obtention of various tone effects including simulation of charcoal or crayon without at the same time necessitating registration of minute areas and without danger of points of transparency showing through due to imperfect registration. In the sixth place, the present process avoids slip sheeting and the constant trouble of removing the slip sheets and the waste of paper. In prior processes it was not feasible to dry between colors in order to avoid the use of slip sheets, because the typographic or relief printing used required varnish colors, and varnish colors could not be dried quickly enough when applied to a non-absorbent web such as the transparent cellulose paper here dealt with. Of course with ordinary paper more rapid drying may be obtained because of the absorption properties of the paper and because the paper may be run over heated plates in a manner which is impossible in the case of transparent cellulose paper here involved. Even when printing on ordinary paper, the color on color printing is ordinarily resorted to only in the case of costly plates or individual sheets which are permitted to dry for several days between each of the successive printing operations. In the present process the printing is accomplished on a continuously moving web of shiny non-absorbent paper, which is run at exceedingly high speed.

The article resulting from the process is superior to the wrappers heretofore known which utilize color printed alongside of color, first, because the present blank is characterized by apparently perfect registration regardless of slight errors in actual registration; secondly, a dense, solid, opaque body of color may be obtained through which nothing can be seen, and this effect is, of course, heightened at the areas over which a plurality of colors are superimposed. In

the third place the present blank or wrapper includes exceedingly fine lettering with no blurring or indistinctness due to inaccurate registration. In the fourth place half-tone or crayon and charcoal effects are obtainable. In the fifth place the use of lacquer colors results in the printing on the blank having a brilliant attractive appearance, and the full luster of the ink is retained without injury such as is caused by slip sheeting. In the sixth place, at no point in the printed blank are there found the numerous spaces or/and hair lines of unprinted and transparent areas, such as result when registration of the colors is relied upon regardless of the care taken to obtain perfect registration.

It will be apparent that while I have shown and described my invention in the preferred form, many changes may be made in the method and article disclosed, without departing from the spirit of the invention, defined in the following claims.

I claim:

1. The method of printing a multi-color design on lustrous grease-proof transparent regenerated cellulose paper, which includes first printing on said sheet a solid body of color, drying the printed sheet, and thereafter printing on top of a portion of the first solid body of color another solid body of a different color, in order to obtain a design in a plurality of solid colors printed in superposition instead of in juxtaposition.

2. The method of printing a multi-color design on transparent regenerated cellulose paper which includes first printing on said sheet a solid opaque body of lacquer color of light shade, drying the printed sheet, and thereafter printing on top of a portion of the first body of color another solid opaque body of lacquer color of dark shade, in order to obtain a design in a plurality of colors.

3. The method of printing a multi-color design on a continuously moving web of lustrous grease-proof transparent cellulose paper, which includes continuously printing a body of color on the moving web by means of a printing cylinder, drying the moving web, immediately thereafter continuously printing another body of a different color on top of a portion of the first body of color by means of a second printing cylinder, drying the web, and so on, until the desired multi-color design has been obtained.

4. The method of printing a multi-color design on a continuously moving web of lustrous grease-proof transparent cellulose paper, which includes continuously printing a solid opaque body of lacquer color on the moving web by means of an intaglio printing cylinder, drying the moving web, immediately thereafter continuously printing another solid opaque body of a different lacquer color on top of a portion of the first body of color by means of a second intaglio printing cylinder, drying the web, and so on, until the desired multi-color design has been obtained.

5. The method of printing a multi-color design on a continuously moving web of lustrous grease-proof transparent cellulose paper, which includes continuously printing a solid opaque body of color of light shade on the moving web by means of an intaglio printing cylinder, drying the moving web, immediately thereafter continuously printing another solid opaque body of color of darker shade on top of a portion of the first body of color by means of a second intaglio printing cylinder, drying the web, and so on, until the desired multi-color design has been obtained.

6. The method of printing a multi-color design on a continuous web of transparent regenerated cellulose paper, which includes continuously printing a solid opaque body of lacquer color of light shade on the web by means of an intaglio printing cylinder, drying the web, immediately thereafter continuously printing another solid opaque body of lacquer color of darker shade on top of a portion of the first body of color by means of a second intaglio printing cylinder, drying the web, and so on, until the desired multi-color design has been obtained.

7. As an article of manufacture, a blank made of a lustrous grease-proof transparent regenerated cellulose sheet, a first solid body of color deposited directly thereon, and another solid body of a different color superimposed on and partially covering the first body of color, said colors forming a multi-color design.

8. As an article of manufacture, a blank made of a lustrous grease-proof transparent regenerated cellulose sheet, a solid opaque body of a relatively light color deposited directly thereon, and another solid opaque body of a relatively dark color superimposed on and partially covering the first body of color, said colors forming a multi-color design.

9. As an article of manufacture, a blank made of a lustrous grease-proof transparent cellulose sheet, a solid opaque body of lacquer color deposited directly thereon, and another solid opaque body of a different lacquer color superimposed on and partially covering the first body of color, said colors forming a multi-color design.

10. As an article of manufacture, a blank made of transparent regenerated cellulose paper, a solid opaque body of lacquer color deposited directly thereon, and another solid opaque body of a darker lacquer color superimposed on and partially covering the first body of color, said colors forming a multi-color design.

11. As an article of manufacture, a blank

made of a lustrous grease-proof transparent regenerated cellulose sheet, said sheet having thereon a multi-color design formed of a plurality of solid bodies of color, the colors being relatively located in superposition instead of in juxtaposition.

12. As an article of manufacture, a blank made of a transparent regenerated cellulose paper, said sheet having thereon a multi-color design formed of a plurality of solid opaque bodies of lacquer colors, the colors being relatively located in superposition instead of in juxtaposition, and with the lightest color on bottom and the darkest color on top.

Signed at New York, in the county of New York and State of New York, this 3rd day of June, A. D. 1931.

IRVING GURWICK.