

UNITED STATES PATENT OFFICE

2,375,660

METHOD OF PRINTING

Wilbur L. Jones, New York, N. Y., assignor to
Interchemical Corporation, New York, N. Y.,
a corporation of Ohio

No Drawing. Application December 26, 1941,
Serial No. 424,415

4 Claims. (Cl. 101—170)

This invention relates to a method of printing with thermoplastic inks, or inks which are solid at normal room temperature and which become liquid when heated to elevated temperatures. The invention involves particularly an improved method of gravure or intaglio printing with such inks which is more economical and permits higher printing speeds than prior known methods and produces a superior printed result having less tendency to offset and smudge than prints produced by former methods.

Printing with thermoplastic or hot melt inks has certain obvious advantages over printing cold with conventional inks and has been receiving considerable attention recently. At present such inks have been printed both by the typographic and gravure methods. In printing by the latter method with inks that have laterally been developed, commercially acceptable results have been obtained, but there nevertheless have been certain limitations, due primarily to the thickness of the film laid down. I have found, for example, that while the appearance of prints produced with an ordinary gravure cylinder is acceptable in the areas of half-tone, the areas of solid color contain noticeable mounds of ink where the flow-out has been incomplete before cooling and solidification of the ink. The film is also thick enough so that there is a pronounced tendency for the prints to offset if stored in a warm room or rewound before the web and ink are entirely cool. Furthermore, due to the thickness of the film, it is somewhat difficult to obtain drying or cooling quickly enough altogether to prevent offsetting, and this obviously limits the ultimate speed at which the printing can be carried out.

I have now discovered that all of these difficulties or limitations in the gravure method of thermoplastic printing can be successfully overcome, and at the same time the process can be rendered far more economical, by (1) printing with an intaglio or gravure cylinder in which the depth of the engraved cells is approximately one third to one half of that normally used and (2) employing an ink which has sufficient pigment to hide the paper properly and with suitable color effect in film thicknesses of from 5 to 15 microns but in insufficient quantity to produce a yield value of over 100 dynes per square centimeter at temperatures at which the ink is printable. The term "yield value" as used herein refers to a tangential force (measured in dynes per square centimeter) equivalent to that acting upon an area of one square centimeter that will just produce a flow of a plastic at an infinitely slow rate relative to an area of one square centimeter parallel to the first area and spaced perpendicularly therefrom by a distance of one centimeter. Thus, the practice of my improved method of

printing first requires that the conventional gravure or intaglio cylinders be discarded. These cylinders are designed for solvent inks, which penetrate into the paper, and in addition lose approximately two-thirds of their volume by evaporation. When thermoplastic inks are discharged from such cylinders, they produce very thick films, of the order of 20 to 60 microns in thickness in the solid portions of the print, due to the fact that no solvent is lost and substantially no penetration into the paper occurs. My experience has indicated that ink films of such thickness are highly undesirable. I have, therefore, produced and used cylinders which have a cell depth of 20 to 30 microns in the areas which produce solid color, as compared with conventional intaglio cylinders which have a cell depth, in the areas which produce solid color, of from 40 to 60 microns. Cylinders etched in accordance with my invention are so shallow that solid colors cannot be deposited from them when conventional solvent intaglio inks are used.

However, it should be understood that the reduction in the depth of the cells of the intaglio cylinder alone, with consequent reduction in the thickness of the applied film, is not sufficient for the attainment of my improved results. My experiments have shown that if the depth of the cells is reduced in the areas of solid color and ordinary thermoplastic inks are employed, proper coverage and color intensity cannot be obtained. Therefore, it is necessary to increase the pigmentation of the thermoplastic inks to a point where proper coverage and color intensity can be obtained with the reduced film thicknesses. I have found that if thermoplastic inks are very highly pigmented, so as to produce satisfactory prints in films of the order of 5 microns to 15 microns in thickness, the tendency to transfer in piles is substantially reduced. This is due to the fact that the very thin film has a tendency to adhere to the paper on which it is printed, and there is insufficient film to produce an effective transfer. However, there is a critical upper limit on the amount of pigment that may be added since too high a pigmentation may introduce undesirable yield value into the ink compositions and this will produce unsatisfactory flow-out. The pigment should not be added in such amounts that the resulting yield value will exceed 100 dynes per square centimeter at printing temperatures.

The amount of pigment required to produce the desired color intensity, while avoiding undesirably high yield value, varies from pigment to pigment, but can easily be determined. From 6 to 15% of carbon black represent acceptable limits for this pigment when used alone; 10 to 25% of iron blue may be used; and the limits

rise to a range of from 30 to 50% for chrome yellow.

Thermoplastic inks of the general character disclosed in my copending application Serial No. 244,607, filed December 8, 1938, may be used in the practice of my improved method. Typical examples of such inks including the particular pigments referred to above are as follows:

EXAMPLE 1

Monotone yellow ink

	Parts by weight
Chrome yellow -----	35
Hydrogenated castor oil: (M. P. 183° F.) -----	51
Grinding varnish comprising:	
Gum rosin (W. W. grade), 50% } -----	14
Raw linseed oil, 50% }	

The pigment is introduced into the ink by dispersion into the grinding varnish. This ink has a melting point of about 180° F., and at a temperature of 210° F. has a viscosity of 0.8 poise and a yield value of about 7 dynes per square centimeter. When chilled, it is printable to about 170° F. It is an excellent ink for printing of monotone yellows.

EXAMPLE 2

Process blue

	Parts by weight
Iron blue -----	20.0
is ground in a varnish comprising	
Linseed oil -----	11.7
and	
Alkyd resin (see below) -----	11.7
and the paste is mixed with	
Hydrogenated castor oil -----	56.6

The alkyd resin in the above ink may be prepared by reacting, at 475° F., 150 parts by weight of the dibasic acid obtained by reacting molar proportions of dipentene and maleic anhydride, 150 parts of the unsaturated fatty acids obtained by the dehydration of castor oil acids, 70 parts of glycerol, 3 parts of lauryl alcohol and 292 parts of modified rosin ester gum (modified with 20 per cent. of phenol aldehyde resin in known manner) to the point where the resin has an acid value of 9 to 10, and a melting point of 165° F.

This ink has a melting point of 185° F., and is printable at 170 to 175° F. At a temperature of 195° F., the ink has a viscosity of 1.0 poise and a yield value of 4 dynes per square centimeter. This is an excellent process blue, as I have found that best results are obtained when blue process inks have melting points above 160° F., and are printable below 175° F.

EXAMPLE 3

Monotone black

	Parts by weight
Carbon black -----	6.0
Gilsonite -----	6.8
Methyl violet toner -----	1.0
Zinc resinate -----	1.7
Petroleum base ink oil -----	14.0
Hydrogenated soya bean oil -----	10.0
Candelilla wax -----	60.5

This ink has a melting point of 160° F. At

175° F., the ink has a viscosity of 0.45 poise and a yield value of 20 dynes per square centimeter.

From the foregoing description and examples, it will be understood that where the pigment has good hiding power and high tinctorial value, such as is the case with blues and blacks, the amount of pigment in the ink may vary from 6 to 25%; whereas, if the pigment has relatively poor hiding power and low tinctorial value, such as is the case with yellows and other light colors, the amount required in the thermoplastic ink may vary from 30 to 50%.

What I claim is:

1. A method of printing with thermoplastic inks which are solid at normal room temperatures and become liquid when heated to elevated temperatures between 150° and 300° F. which comprises applying to an intaglio printing cylinder, having engraved cells with a depth of from 20 to 30 microns in the areas of solid color, a thermoplastic printing ink comprising a thermoplastic vehicle and pigment in sufficient quantity completely to hide paper in film thickness of from 5 to 15 microns but in insufficient quantity to produce a yield value of over 100 dynes per square centimeter at temperatures at which the ink is printable; and transferring such ink from said engraved cells of the printing cylinder to the material being printed.

2. A method of printing with thermoplastic inks which are solid at normal room temperatures and become liquid when heated to elevated temperatures between 150° and 300° F. which comprises applying to an intaglio printing cylinder, having engraved cells with a depth of from 20 to 30 microns in the areas of solid color, a thermoplastic printing ink comprising a thermoplastic vehicle and from 8 to 50% of pigment, the ink having a yield value of less than 100 dynes per square centimeter at temperatures at which the ink is printable; and transferring such ink from said engraved cells of the printing cylinder to the material being printed.

3. A method of printing with thermoplastic inks which are solid at normal room temperatures and become liquid when heated to elevated temperatures between 150° and 300° F. which comprises applying to an intaglio printing cylinder, having engraved cells with a depth of from 20 to 30 microns in the areas of solid color, a thermoplastic printing ink comprising a thermoplastic vehicle and from 6 to 25% of a pigment having good hiding power and high tinctorial value; and transferring such ink from said engraved cells of the printing cylinder to the material being printed.

4. A method of printing with thermoplastic inks which are solid at normal room temperatures and become liquid when heated to elevated temperatures between 150° and 300° F. which comprises applying to an intaglio printing cylinder, having engraved cells with a depth of from 20 to 30 microns in the areas of solid color, a thermoplastic printing ink comprising a thermoplastic vehicle and from 30 to 50% of a pigment having poor hiding power and low tinctorial value; and transferring such ink from said engraved cells of the printing cylinder to the material being printed.

WILBUR L. JONES.