Oct. 26, 1965 C. S. MILLER 3,213,787

SIMULTANEOUS MULTICOLOR PRINTING

Filed Jan. 26, 1956 2 Sheets-Sheet 1

FIG. 1

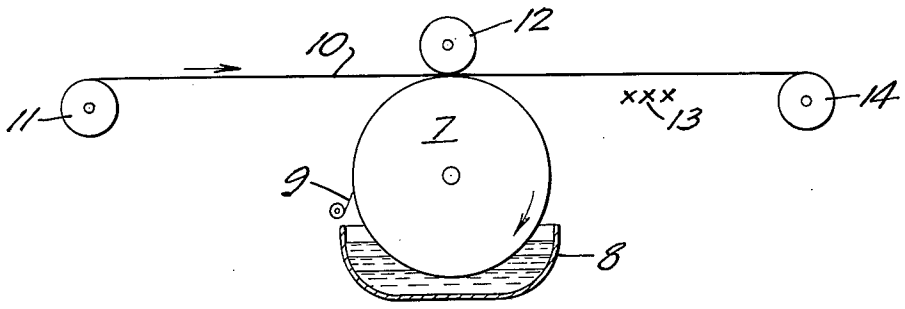


FIG. 2

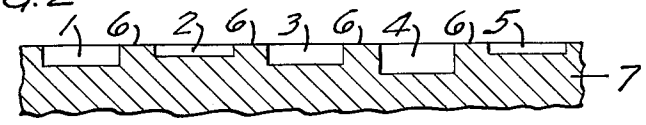


FIG. 3

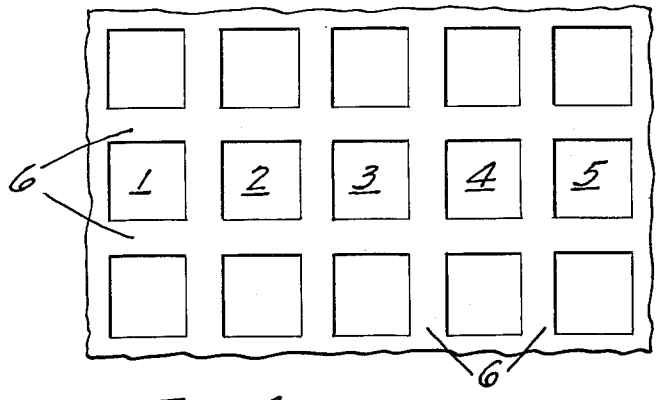
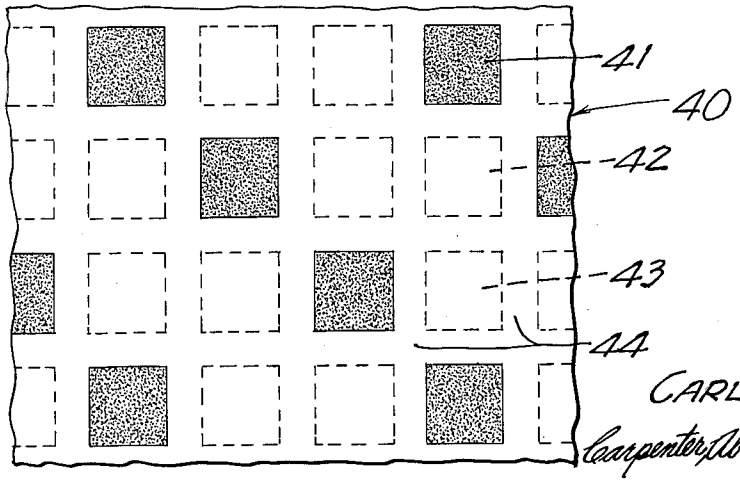


FIG. 4



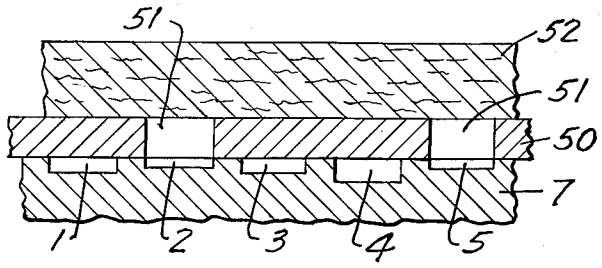
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Filed Jan. 26, 1956 2 Sheets-Sheet 2

FIG. 5



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SIMULTANEOUS MULTICOLOR PRINTING

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12 Claims. (Cl. 101—211)

This invention relates to multicolor printing, particularly as applied to intaglio or photogravure processes. The invention relates to the novel method, and to novel components employed therein.

In a typical prior art continuous process for gravure printing, a cylindrical surface is provided with an engraved recessed design, which when filled with a suitable colored ink and pressed against a paper surface then produces a printed reproduction of the design. For multicolor prints, the several colors are applied from successive gravure cylinders, the paper being passed in registry and in succession over the several cylinders required. The process thus requires the preparation of a number of separate printing cylinders by processes involving color separation of the colored original, and the exact registry of the several cylinders in their contact with the paper or other surface on which the final multicolor reproduction is to be impressed.

The present invention permits the printing of multiple color impressions by a single contact with a single printing cylinder which is fed from a single source of printing ink. The problem of exact registry is eliminated. Shrinkage or expansion of the paper, or weaving of the paper web through the printing apparatus, may be tolerated. The printing apparatus is greatly simplified, and need not be subject to precision control. The time required for setting up the press and for cleaning up after the completion of the run is drastically reduced. Clear and sharply outlined copy, having accurate color rendition, is obtained.

These and other advantages are secured, in accordance with the principles of the present invention, by providing on the gravure cylinder a plurality of types of image printing cavities, each type being selective of a particularly colored printing composition, the several types of image printing cavities being located on the surface in accordance with the arrangement of color ("hue") in the graphic subject matter or other colored original of which a duplicate is desired. The thus treated cylinder is simultaneously fed with a plurality of mutually incompatible inks of suitable color, either at separate inking stations or as a mixture of the differently colored inks applied at a single station. Each ink composition is capable of selectively wetting and adhering to one of the specific types of image printing cavities. Surplus ink is removed from the surface of the cylinder by conventional means, the paper is pressed against the surface, and the separate and independent quantities of the several colored inks initially retained in the different types of image printing cavities are thus transferred to the paper to provide, in a single step, a multicolor print.

The operation as thus briefly described has been successfully applied to two-color and to three-color printing, by means of techinques and materials which will now be described in detail in connection with specific but non-limitative examples, and by reference to the attached drawing, in which:

FIGURE 1 is a cross-sectional representation showing in simplfied schematic form the apparatus and procedure employed in the process of this invention;

FIGURE 2 represents a cross-section of a portion of a recessed and treated surface of the printing cylinder;

FIGURE 3 represents a plan view of a portion of the surface of the treated cylinder of FIGURE 2;

FIGURE 4 represents a plan view of a portion of a base sheet used in preparing screen elements employed in the practice of this invention; and

FIGURE 5 is a cross-sectional representation illustrating one process for the selective activation of cavities.

Example 1

A copper printing cylinder is first provided with a recessed design, by methods which will be more fully described hereinafter, to produce a recessed surface somewhat as illustrated in FIGURES 2 and 3 in which alternate pockets represent different colors in the original article, print, picture or other subject of which a reproduction is desired. The depth of each cavity is determined by the intensity ("value") required for that particular color at the particular point. The individual cavities, which may be of any desired uniform configuration but for convenience are shown in FIGURE 3 as square-shaped, are separated by ridges, the tops of which are all in the plane of the original surface of the printing cylinder. In FIGURE 2, cavities **1** and **4** represent different values of a first color, cavities **2** and **5** represent different values of a second color, and cavity **3** represents still a third color and value. The ridges **6**, lying in the plane of the original surface of the roll **7** of FIGURE 1 (of which a portion only is illustrated in FIGURE 2) separate the several cavities from each other.

The copper surfaces of the cavities **1** and **4** are treated with a 2½ percent aqueous solution of ammonium sulfide, providing a hydrophilic surface presumably comprising copper sulfide.

The surfaces of cavities **2** and **5** are treated with a dilute solution in a volatile solvent of an organic silicone, such as Dow Corning silicone varnish No. 996 or No. 997, and which is believed to be largely polymethyl silicone in an organic solvent, to provide an organophilic surface.

Cavity **3** is treated with a three percent solution in xylene hexafluoride of polymerized dehydroperfluorooctylmethacrylate, to provide a surface which is receptive to fluorochemicals and may therefore be designated a "fluorophilic" surface.

Treatment of the cavity surfaces with the different solutions suggested may be accomplished, where the cavities are not too small, by careful hand application of the solution with a pointed brush or hypodermic needle, care being taken to avoid spreading of the solution across the surrounding ridges into adjacent cavities. After drying, the thus treated cylinder is thoroughly washed, for example in alternate baths of warm water and solvent naphtha, to remove all soluble salts without disturbing the treated surfaces. The cylinder **7** is then ready for the printing operation and is placed in the press, as indicated schematically in FIGURE 1.

Three different and mutually incompatible ink formulations are next provided, in the conventional three subtractive colors.

The magenta ink is compound with a water base and contains the following components in the weights indicated:

Calcium lithol toner ("Calco 20–4620")	15
Methyl cellulose ("Methocel" X–2602), 10% solution in water	50
Glycerol	5
Polyethylene glycol ("Polyglycol P–3000")	1
Water	129

The pigment is ground into the solution of binder and plasticizer, forming a smooth homogeneous liquid product having a viscosity of approximately 1.25 poise, as determined on the Gardner bubble viscosimeter.

The yellow ink is compounded with an oil base. The formula is:

Yellow oil-soluble dye ("FDC Yellow No. 4")	1
Xylol	14
VM & P naphtha	85

The dye is dissolved in the mixed solvents. The viscosity of the solution is about 0.45 poise.

The cyan ink is compounded of a fluorochemical color body and a fluorochemical vehicle, as follows:

Perfluoroheptylated copper phthalocyanine	4
Perfluoroethylcyclohexane	96

The two components are vigorously shaken together, forming a stable liquid mixture having a viscosity of about 0.35 poise.

The fluorochemical color body is appropriately produced by heating together 1.4 grams of copper phthalocyanine ("Monastral" blue, a commercial pigment) and 10.0 grams of perfluoro-n-heptyl iodide, n-$C_7F_{15}I$, in a 30 ml. glass ampoule at 330° C. for 14 hours. The reaction product is extracted with c-$C_6F_{12}O$, and the intensely blue solution is evaporated to dryness, leaving 2.7 grams of dark blue-black powder. Further extraction of the filtration residue with benzotrifluoride ($CF_3C_6H_5$) provides an additional yield of 1.7 grams of the color body. Both of the product materials are found on analysis to consist mainly of tetraperfluoroheptyl copper phthalocyanine, having the empirical formula $C_{60}F_{60}H_{12}N_8Cu$.

Each of these ink compositions is a low-viscosity liquid, whereas prior art lithographic inks are conventionally viscous or paste-like materials. For example, a typical lithographic ink such as used on a "Multilith" office printing machine has a soft buttery consistency and cannot be tested on a bubble viscosimeter. These various viscosity or consistency values are each given at room temperature.

Appropriate quantities of each of the three inks above-described are added to the inking fountain **8** of the apparatus of FIGURE 1. The three liquids arrange themselves in separate layers, the cyan ink being at the bottom, the yellow at the top, and the magenta between. The cylinder **7** contacts each of the liquid layers, and rotation of the cylinder brings each liquid into positive contact with each part of the cylinder surface. The several liquids adhere strongly to appropriately treated areas of the surface and are displaced from temporarily contacted areas of different surface characteristics. Thus, the aqueous liquid remains exclusively on the sulfide-treated surfaces, the hydrocarbon liquid remains only on the silicone-treated surfaces, and the fluorochemical liquid is retained only on the fluorochemical-treated surfaces.

Excess ink is removed from the surface of the cylinder **7** by the doctor-blade **9** and returned to the fountain **8**. The blade rides on the ridges **6** of the recessed surface of the cylinder, providing accurate control of the amount of ink retained in each cavity. Although the liquid is low in viscosity, the small size of the cavities and the nature of the treated surfaces is found to cause the liquid to be retained in the cavities while the cylinder is rotated past the doctor-blade and to the printing position.

The ink-treated surface is next contacted with a sheet or strip of paper **10**, here shown as supplied from stock roll **11**. The paper is pressed firmly against the cylinder by means of an impression cylinder **12**, and the ink is transferred to the ink-receptive surface. The printed sheet then desirably passes over a heat source **13** for removal of volatiles, and is wound up into stock roll **14** or stacked up in sheet form.

The inks are transferred from the treated surfaces of the cylinder to the surface of the paper in a pattern established by the arrangement of the treated cavities in the cylinder surface. The three colors are simultaneously applied. The resulting print is in full color, and the colors

are in perfect registry regardless of changes in humidity or other causes of dimensional instability in the paper.

Printing with three basic colors, viz., yellow, magenta and cyan, provides full-color reproductions and is required for most effective results. The process hereinabove described, using the combination of components indicated, now for the first time makes possible full-color printing in a single operation, with the simultaneous application of inks of all three required subtractive colors; and such processes are therefore greatly preferred. It will be apparent that the same principles may be applied also to two-color printing, employing any desired pair of mutually incompatible inks and appropriate treatments of the printing cylinder, and may also be expanded to include printing in four or more colors where suitable inks and suitable surface treatments are provided.

In conformance with recognized authority, "color" or "hue" here refers to the particular shade, either additive or subtractive, such as red, magenta, blue, green, cyan, yellow or the like; and "value" refers to the "intensity" of the color, thus covering such gradations as pink, light red, bright red, etc. It has been found that prints having a wide range of hue and value may be produced from three subtractive colors by the procedures and with the type of ink compositions hereinbefore described. While it is not desired to be limited to any particular theory of operation, it is believed that the lateral flow of ink along individual fibers or between adjacent fibers of the paper effectively provides overlapping colored areas and makes possible the subtractive transmission of light, thus providing the unique and highly desirable results attained. Effective lateral flow of color components may also be obtained with surface coatings of mixtures of suitable treated clay or other particulate materials, or in other ways.

Printing may also be accomplished on surfaces which prevent the lateral flow of ink. For example, various films and foils may be printed in multicolor in a single operation. In such cases the separate small areas of ink may remain as separate dots of color, to give an impression of uniform coloring when seen from a sufficient distance; and additive rather than subtractive colors will normally be used. It will also be apparent that colorless compositions of various kinds, such as liquids capable of selectively swelling or dissolving, or chemically reacting with, a surface to which they are to be applied, may equally well be printed in multiple and on selected areas in a single operation by methods employing the principles of this invention.

A number of other surface treatments are available which may be substituted for the specific surface-activating treatments and formulas as applied to the cavities of the copper cylinder in the above specific example. A hydrophilic surface, suitable for retaining aqueous inks, may be obtained by treating the prepared copper cylinder with dilute solutions of sodium thiosulfate, or sodium sulfide, or mixtures of sodium sulfide and sodium silicate, or mixtures of animal glue, alum, and sodium thiosulfate. An oleophilic surface may be obtained by treatment with a dilute solution of zinc strearate and ethyl cellulose in a mixture of acetone and toluene; or with any of a number of adhesive cement solutions containing mixtures of rubbery polymers and resinous tackifiers and modifiers in volatile organic solvents; or with a dilute solution of polyvinylidine chloride ("Saran F–120"), followed, after drying, by a dilute solution of paraffin or spar varnish. A fluorophilic surface is obtained by treatment with a dilute solution of fluorocarbon polymer such as polyperfluorobutylacrylate or polydihydroperfluorohexylmethacrylate; or with a dilute solution of a chromium complex of a perfluoro fatty acid, applied either directly to the copper surface or after preliminary treatment with aqueous sodium sulfide. Variations of these surface treatments may be required where cylinders having other than copper surfaces are to be treated; or the cylinder may first be given

a plating of copper if desired. Each of the compositions noted provides a surface or surface coating which is capable of selectively retaining a single type of ink while being repellent to the remaining types. Other specific surfaces or surface treatments having analogous properties are contemplated, those here presented being offered as operable and illustrative but non-limitative examples.

Similarly, a number of different ink formulations may be substituted for those described in connection with the foregoing illustrative example. For the aqueous ink there has been employed a solution of a magenta colored dye in 5 percent glue solution, as well as various commercial water-color inks and paints such as tempera paints, thinned to the required low viscosity. Liquid paraffin oils containing various oil-soluble dyes have been found useful as oleophilic ink compositions. For the fluorophilic inks, best results have thus far been obtained with perfluoroheptylated copper phthalocyanine pigment, applied in various fluorinated solvents such as perfluorotributylamine, perfluoro cyclic octyl ether (particularly containing small amounts of perfluoropolymers as viscosity-controlling agents), and perfluoroethylcyclohexane or mixtures of perfluoroethylcyclohexane and 4-perfluoroethylcyclohexene.

PREPARATION OF THE PRINTING SURFACE

Procedure I

In preparing a printing surface for application of the activating solution, the following illustrative precedure is found to be effective.

A base sheet **40**, a portion of which is shown in FIGURE 4, is provided with a series of dark areas **41** in a regularly recurring pattern within a continuous grid or screen area. Alternative positions are indicated with dotted lines for convenience. The sheet is then photographed on a process photographic film and the film developed in the usual manner. The resulting negative film has a series of transparent areas corresponding to the dark areas **41** of FIGURE 4, each conveniently about 0.02 inch or somewhat smaller on each side; the remainder of the film is opaque. Such a film may be identified as a "⅓ screen."

A second process film is exposed through the ⅓ screen in each of three separate positions, to produce a developed negative film which is opaque at each of areas **41**, **42** and **43** of FIGURE 4 and which has a transparent grid **44** separating the opaque areas. This film may be identified as a "negative full screen."

A panchromatic film is then exposed to a light-image of the colored subject of which prints are desired. The light passes first through a color filter, then through the ⅓ screen, and finally to the film. Separate exposures are made through each of three suitable color filters and with the ⅓ screen in each of three appropriate positions, so that the light through each filter acts on a previously unexposed portion of the film and in a pattern as indicated in FIGURE 4. The thus exposed film is next developed and reversed. There is produced a transparency having a fully opaque grid corresponding to the grid **44** of FIGURE 4, and three groups of partially transparent areas corresponding to areas **41**, **42** and **43** of FIGURE 4 in which each group corresponds to a single complementary color of the subject and the degree of transparency of the individual areas corresponds to the relative intensity or value of that single complementary color at the particular area involved. The film thus produced may be identified as a "gray image" film.

Sensitized carbon tissue, having a light-senitive bichromated gelatin surface coating, is first strongly exposed through the negative full screen and then given a controlled exposure through the gray image film. The grid pattern of the latter during exposure is made to coincide with the position previously occupied by the grid pattern of the negative full screen.

The gelatin film is next transferred to the clean surface of the copper cylinder and the design developed by washing. Chemical etching of the copper through the gelatin layer, and removal of the latter, then completes the process and produces a cylinder having a surface similar to that indicated in FIGURES 2 and 3. The surface is then ready for activation.

While the hand-activation method previously described is effective, and has been applied over small areas with a screen pattern having color areas as small as 0.02 inch on a side, the method is tedious and time-consuming. The improved method now to be described makes possible the simultaneous activation of an entire surface area, containing a great number of individual printing areas for a single color. In this method, a photographic negative of the ⅓ screen previously described is first prepared. The previously transparent areas of the ⅓ screen, i.e., the areas corresponding to the dark areas **41** of FIGURE 4, here become opaque, the remainder of the screen being transparent. A thin, flexible, dimensionally stable foil, preferably a metal foil, coated with light-sensitive bichromated gelatin, is exposed through this negative and is then subjected to chemical etching through the gelatin mask to the degree necessary to remove alll of the metal at the areas corresponding to the opaque areas of the negative. By means of suitable micrometer controls, the cleaned perforated foil is positioned over the etched pattern of the gravure cylinder with the perforations lying above the etched cavities corresponding to a single color and with the unperforated areas of the foil covering and protecting the cavities of the other colors and the intervening grid. The desired activating solution is then applied through the perforations to the cavities, conveniently by lightly pressing a section of blotting paper, saturated with the appropriate solution, against the exposed foil surface. The process is repeated, with intermediate thorough washing and drying, for the other two sets of cavities and with activating solutions appropriate to the other two colored inks. The completely activated cylinder is then ready to be placed in the press for simultaneous three-color printing operations as hereinbefore described.

The procedure is illustrated in FIGURE 5. The perforated foil **50** having perforations **51** corresponding to the darkened areas **41** of the base sheet **40** of FIGURE 4 is placed over the etched plate **7** with the perforations **51** aligned with cavities **2** and **5** corresponds to a single color. The section of blotting paper **52**, saturated with the appropriate treating solution, is placed over the foil **50**, permitting the solution to be expelled into the cavities **2** and **5** of the plate **7** and rendering the same receptive of the appropriate colored ink.

More viscous sensitizing solutions are more conveniently applied by applying them directly to the perforated metal foil in position on the etched cylinder, e.g., by means of a rubbery squeegee as in screen-printing.

The same type of mask may be employed in intensifying the value of one or more of the colors to be printed, by permitting selective additional etching and deepening of the corresponding cavities. The mask may be protected by coating or plating with suitable polymeric, metallic, or other protective layers. Where flat plates rather than cylinders are to be masked, the mask may be held tightly in position by direct pressure or under edge tension with the plate temporarily convexly curved.

Procedure II

An alternative multicolor printing process combines the principles of this invention, as hereinbefore noted, with procedures and principles of intaglio half-tone printing, in which the ink-accepting cavities are all of substantially equal depth but vary in area inversely with the intensity of the light image. In this process, the ⅓ screen is maintained a sufficient distance from the panchromatic photographic film to act as a half-tone screen. The film is exposed to the light-image with the ⅓ screen in each of the three required positions, through the appropriate color filters, and with the appropriate lens stop as required for

half-tone procedures. Alternatively, the ⅓ screen may be used in conjunction with a suitable conventional half-tone screen or contact screen of identical spacing but more appropriate size openings. The film is developed and reversed. The copper cylinder is coated with a photosensitive resist film of bichromated gelatin or the like, exposed through the positive film, developed, and etched, all by known processes. The etched cylinder is then activated for the several required types of inks, employing the activating solutions previously described and applying them successively through the perforated metal foil mask in each of the appropriate positions. It is then ready for multiple-color printing.

In this intaglio half-tone process the effective color values in the finished print are determined by the relative areas rather than the relative depths of the ink-receptive cavities in the printing surface. However it will be noted that in both of the processes described the effective color value is a function of the volume of the printing cavities.

Procedure III

Another system for preparing the printing surface involves the use of a multiple-color mosaic screen or filter plate and thus simplifies the preparation of the gray image film from which the photosensitive resist is prepared. For three-color printing, the filter plate is provided with alternate red, green and blue filter areas corresponding to areas **41**, **42** and **43**, respectively, of FIGURE 4.

A three-color filter plate is easily prepared by separately exposing a "Kodachrome" photographic color film or plate to light of each of the three desired colors through the ⅓ screen in each of the three positions. Development of the film then provides the desired recurring pattern of groups of areas in the three desired filter colors, the areas in this instance being separated by an opaque grid. Such a plate is not entirely effective as a color filter due to inherent low color selectivity in the filter areas. A preferred type of screen or filter is made by screen-process coating of a transparent base with appropriately colored lacquer or gelatin solutions through the perforated metal foil previously described under Procedure I in connection with activation of the cavitated printing-plate. The perforated screen is placed in each of the three positions and an appropriately colored coating composition applied in each position. The resulting filter again has the desired recurring pattern of groups of unit areas in the three filter colors, but has a transparent separating grid. Effective results may also be obtained by uniformly enlarging the color areas and eliminating the transparent grid portions of the filter.

This three-color mosaic filter plate is placed in contact with a panchromatic film and the film is exposed through the filter to the light-image of the original colored article. The film is then developed and reversed, providing a recurring pattern of groups of unit areas differing in density in accordance with the color and color value of the original. Sensitized carbon tissue is exposed through this gray image film and separately through the negative full screen, the gelatin film is transferred to the printing surface, and the latter is selectively etched and activated, as described in connection with Procedure I, to provide the desired one-pass multicolor intaglio printing surface.

The procedures hereinbefore described have been discussed primarily in connection with the preparation and use of rotogravure cylinders for continuous one-pass multicolor printing. It will be apparent that the same principles are equally applicable to printing from flat plates. In place of the square rulings illustrated in FIGURES 3 and 4, triangular, hexagonal, circular, or various other rulings will likewise be found to be effective. It will be understood that the single isolated cavities of FIGURES 2 and 3 may be replaced by groups of smaller cavities. Likewise, groups of the larger cavities may be activated, either by hand or mechanically, for application of a single color in the printing of maps, comic supplements, and other large-area items. Application of several inks from a single fountain as indicated in connection with FIGURE 1 is advantageous for a number of reasons and is preferred; but separate fountains for each ink may alternatively be used, or the inks may be applied by brush, roll, squeegee, or in various other ways. Various other modifications and extensions of the principles of the invention will become apparent from a study of the disclosures herein provided and such alterations and extensions are contemplated as coming within the scope of the present invention as defined in the appended claims.

What is claimed is as follows:

1. A method of preparing a printing surface for one-pass multicolor intaglio printing with a plurality of differently colored and mutually incompatible liquid inks, comprising the steps of: (a) forming on a photosensitive resist layer a recurring pattern of groups of unit areas, at least one unit area of each group corresponding to each color to be printed, each unit area being photoexposed to a degree inversely corresponding to the color value of its corresponding color at that point, the unit areas being separated by a uniformly intensely photoexposed pattern of grid lines; (b) removing unexposed resist material and chemically etching a smooth printing surface through the remaining resist layer to the point of incipient etching of the areas directly underlying said grid lines, to provide in the printing surface a plurality of cavities corresponding to said unit areas and separated by ridges having a common surface plane; and (c) activating the cavities corresponding to each color for wettability solely by the corresponding one of the said mutually incompatible differently colored liquid inks.

2. An article having a printing surface suitable for one-pass intaglio application of a plurality of mutually incompatible liquids, said printing surface comprising liquid-receiving cavities arranged in a recurring pattern of groups of cavities, each group including, for each of said liquids, at least one cavity which is wetted solely by that one of said liquids.

3. An article having a printing surface suitable for one-pass multicolor intaglio printing with a plurality of mutually incompatible liquid inks, said printing surface comprising ink-receiving cavities and intervening ridges, said ridges having a common surface plane, said cavities being arranged in a recurring pattern of groups of cavities, each group including, for each of said inks, at least one cavity which is wetted solely by that one of said inks, the volume of each cavity being in accordance with the color value of the corresponding color required at the corresponding point in the print.

4. An article as defined in claim **3** and having a plurality of groups of cavities, in which each group of cavities is distinct in wettability from each other group and is wettable by a single composition from the class consisting of hydrophilic, organophilic and fluorophilic compositions.

5. In one-pass multiple-liquid intaglio printing from a printing surface as defined in claim **2**, the steps comprising: providing at said surface a plurality of mutually incompatible liquids each capable of wetting a single species of activated cavities and in amount just sufficient to fill each cavity with an appropriate liquid; and contemporaneously transferring the liquids from the printing surface to a receptive surface which is to be printed.

6. In one-pass multicolor intaglio printing from a printing surface as defined in claim **3**, the steps comprising: applying to said surface an excess amount of a number of mutually incompatible liquid inks equal to the number of different species of activated cavities, each ink being capable of wetting a single species of said activated cavities; removing from said printing surface all ink in excess of that required to fill said cavities; and contemporaneously transferring the inks remaining in said cavities to an ink-receptive surface.

7. The method of selectively treating cavities in a one-pass multicolor intaglio printing surface having a recurring pattern of groups of cavities, adapted for printing with a plurality of differently colored and mutually incompatible liquid inks, comprising placing over said surface a close-fitting fractional stencil having stencil openings aligned with cavities corresponding to a first color, and applying through said openings a chemical treating solution for rendering the cavities selectively receptive of an appropriate colored ink; and repeating the operation at cavities corresponding to each additional color; so as to activate the cavities corresponding to each color for wettability solely by the corresponding one of said inks.

8. A method of preparing a printing surface for one-pass multicolor intaglio printing with a plurality of differently colored mutually incompatible liquid inks, comprising the steps of: (a) providing on a metallic printing surface a recurring pattern of groups of ink-receiving cavities, each group including at least one cavity corresponding to each of the colors to be printed, each cavity having a volume corresponding to the color value of the color to be printed at that point, said cavities being separated from each other by ridges having a common surface plane; (b) placing over said surface and against said ridges a fractional stencil having stencil openings aligned with those of said cavities corresponding to one of said colors; (c) applying a chemical treating solution through said opening to said corresponding cavities to render said cavities selectively receptive of an ink composition of the said one of said colors; and (d) repeating steps (b) and (c) at cavities corresponding to each remaining color; so as to activate the cavities corresponding to each color for wettability solely by the corresponding one of said inks.

9. A method of preparing a printing surface for one-pass intaglio application of a plurality of chemically different mutually incompatible liquids, comprising the steps of: (a) forming on a photosensitive resist layer a recurring pattern of groups of unit areas, at least one unit area of each group corresponding to each of said liquids to be printed, the unit areas being separated by a uniformly instensely photoexposed pattern of grid lines; (b) removing unexposed resist material and chemically etching a smooth printing surface through the remaining resist layer to the point of incipient etching of the areas directly underlying said grid lines, to provide in the printing surface a plurality of cavities corresponding to said unit areas and separated by ridges having a common plane; and (c) activating the cavities corresponding to each of said emit areas for wettability solely by the corresponding one of said liquids.

10. In one-pass multicolor intaglio printing from a printing surface as defined in claim 3, the steps comprising: applying to said surface an excess amount of an ink mixture consisting of a number of mutually incompatible liquid inks equal to the number of different species of activated cavities, each of said inks being capable of wetting a single species of said activated cavities; removing from said printing surface all ink in excess of that required to fill said cavities; and contemporaneously transferring the inks remaining in said cavities to an ink-receptive surface.

11. An article having a printing surface having a plurality of groups of differently selectively ink-accepting cavities, at least one cavity of each group being fluorophilic.

12. An article having a printing surface suitable for one-pass three-color intaglio printing, said printing surface comprising liquid-receiving cavities arranged in a recurring pattern of groups of cavities, each group including at least one cavity having a hydrophilic surface for retaining an aqueous liquid, at least one cavity having an oleophilic surface for retaining an oily liquid, and at least one cavity having a fluorophilic surface for retaining a fluorochemical liquid.

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