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METHOD OF COLOR PRINTING

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This invention relates to improvements in printing and more especially to novel methods of multi-color printing.

In multi-color printing, considerable difficulty is experienced in bringing together a number of differently colored printing inks while all of the inks are in a wet state. This is true of juxtaposed multi-color printing and particularly so of blended multi-color printing. The differently colored inks tend to run and blur, resulting in unsatisfactory quality of work unless great care is exercised. It is now customary to resort to expensive and time consuming drying steps whereby each color printed is dried before another color is associated with it. It is also necessary in present blended multi-color printing to employ inks of a somewhat transparent nature which combine with a dry color to provide a blended effect. This adds further expense and limitation to the process and fails to provide a true blended color effect such as results from blending a number of colors in a wet state.

It is a chief object of the present invention to improve methods of printing and to devise means for facilitating multi-color printing with a view to eliminating to a large extent specific drying operations in connection with color printing, and to making possible the blending of a number of colored inks, in a wet state, to form a blended color image which may be printed down in one operation. The invention also aims to broaden the scope of printing inks and printing members and to provide interchangeability in connection therewith. A still further object of the invention is to increase the scope of intaglio and letterpress printing processes and to combine these and other processes with offset printing procedures to present cheap, fast, and efficient printing.

The nature of the invention and its objects will be more fully understood from the following discussion.

In the usual method of multi-color printing, a number of colors are separately printed with each color being allowed to dry before a succeeding color is applied. This may be effected by direct or offset printing means for each color, and in the case of blended color printing the several ink layers are superimposed over one another on the surface to be printed. Separate application of colors and drying require considerable time which greatly increases the expense of color work. If an offset process is employed, separate offset rolls for each color are also necessary. In allowing a color to dry, the tint of that color is changed and therefore the succeeding color must be of a shade to compensate for this in obtaining a desired blend of color. As a result a true blending of the colors, which would normally result from blending together two colored inks in a wet state, does not occur.

In accordance with one embodiment of the method of the invention, three color plates are prepared in accordance with the three color process. These plates are of the intaglio type and are inked with inks of the primary colors, yellow, blue and red, each of which has a special absorptive character. The plates are arranged in some convenient manner such that they are in register with one another. For example, they may be locked up in a chase. Thereafter a resilient transfer member, registered in gear with the chase, is passed over the plates in one continuous operation to pick up selective amounts of each of the colors and bring them together in a wet state one upon another. The transfer preferably collects the inks in the sequence noted above in which the yellow ink is first, the blue ink is second and the red ink is third. The superimposed wet inks, making up a colored image on the transfer member, are then offset on to a surface to be printed to provide a blended color print.

The film of yellow ink, first applied on the transfer surface, functions to attract and pick up blue ink and to absorb the blue ink within itself. Similarly, the yellow ink and blue ink absorbed in yellow ink, function to pick up and absorb red ink. The inks are completely absorbed in one another which allows a blending action to occur all the way through the superimposed films of ink and provide the same blended color values adjacent the transfer roll surface as those present at the outside of the combined ink films. This is essential to the offsetting operation since the blended color film side adjacent the transfer surface becomes the outside of the offset print. In comparison with the conventional color method outlined above, it will be observed that all of the inks are blended in a wet state, blending occurs on a transfer member instead of the surface to be printed, only one transfer or off-set member is employed in place of separate offset members for each color, and no drying period is necessary at any point.

The novel procedures and results noted are due in large part to the composition and interrelated character of the inks. They are all compounded with some common base, as a drying oil or other suitable vehicle, which renders them attractive to one another, and promotes quick drying character. The inks vary in consistency in a graduated

manner with the first ink, in a series of colored inks, being the heaviest and the remaining inks being of progressively thinner consistencies. This allows the inks to be absorbed in one another when brought together in superimposed relation in the proper sequence. The inks may also be compounded with reagents directed to increasing penetrative power, opacity, body, and ability to resist running or blurring.

The ink which is to be printed first and which may be considered as the foundation ink, usually the yellow ink, is made with the heaviest body or consistency. The second ink, usually the blue ink is made with a consistency of about one-half that of the yellow ink. Similarly, the third ink, usually the red ink, is made with a further decreased body or consistency, preferably having a viscosity of about one-half that of the blue ink.

The following preparation of a yellow ink, a blue ink, and a red ink is intended to be illustrative of one ink series presenting suitable relative absorptive character, adapted to effect the complete wet blending of the invention.

A heavy, dense yellow ink is first prepared by mixing ground lead with a yellow dye of a purity such as to provide a paste having a tint approximately of lemon yellow. The dye employed should be one which has no red or blue in it. To this mixture is added a linseed oil of pronounced drying character, such as a double boiled linseed oil. An amount of this oil is added sufficient to provide a mass of paste-like consistency, which in turn is thinned with a penetrating agent such as turpentine, to provide a thick viscous fluid of a consistency generally resembling that of honey.

A blue ink is next prepared, using a mineral pigment such as the ground lead above referred to, which is tinted by means of some conventional blue dye to provide a mass having a shade of blue of the color known as "Milory blue." To this mixture is added a linseed oil of a substantially thinner character than the linseed oil used in connection with the yellow ink, for instance a linseed oil which has been boiled only once is suitable. The blue mixture thereafter is thinned with a small amount of materials such as lithographic varnish to provide a viscous fluid of much thinner consistency than the yellow ink described. Preferably an ink of about one-half of the viscosity of the yellow ink is provided.

The red ink is prepared from a mineral pigment as used before, such as ground lead, and a true red dye containing no yellow or blue is added to it. A red dye of the scarlet type such as "alizarin crimson" is satisfactory. This mixture is entirely thinned with a relatively thin linseed oil product such as lithographic varnish to provide a fluid of about the consistency of enamel, and preferably of about one-half of the consistency of the blue ink above described.

It will be observed that in each of the several inks described, a common base of linseed oil with the mineral pigment is employed. However, the base is utilized in graduated consistencies. In the yellow ink it is used in a very heavy form such as obtained by double boiling; in the blue ink it is of considerably lighter nature although still somewhat heavy bodied, as obtained by a single boiled linseed oil; and in the red ink it is of a still thinner consistency from dilution with the lithographic varnish. The base acts as a vehicle for each of the inks and it provides a medium for rendering each of the inks attractive to one another. It also provides slickness and highly absorbent character and makes possible a very pronounced drying action. The ground lead is effective in furnishing a highly opaque film, and yet providing a body which may absorb each of the three inks without too great difficulty. The use of turpentine in the yellow ink is to increase penetration and reduce the gloss of the linseed oil.

It is pointed out that the consistencies described for each of the several inks cited greatly exceed the consistencies of inks usually employed with intaglio or recessed printing plates. However they have a slickness resulting from the use of the ingredients noted, which it has been found allows a doctor blade to carry out effective removal of such inks from the non-printing surfaces of an intaglio plate. This ability of the inks to modify the usual intaglio process may be made use of in various connections other than blended color work, as for example juxtaposed color work and the like. Also other ink series may be resorted to generally adhering to the blending principle of the invention, the foundation ink or yellow ink may be made of some other colors, a greater number of colors utilized, and other modifications practiced.

An important feature of the invention consists in the use of the transfer member to bring together and blend a series of differently colored inks in a wet state. Preferably this member consists of a rubber blanket generally resembling a lithographic blanket. It has been found that a transfer roll of resilient character is effective in picking up a film of a base or foundation ink, such as the yellow ink described. This film by its thinness, its association with the roll, its double contact with air, or by some other reason, makes possible blending and release of blended colors successively applied thereto in a wet state. The association of inks of the character noted, in the amounts possible from operation of the transfer roll, results in all of the colors succeeding the first color becoming completely absorbed in and through the thickness of the yellow ink film. Absorption and blending action which occurs throughout the thickness of the ink films overlying one another, is highly important since it allows the bottom of the ink image as it occurs on the offset blanket to become the top side of the printed image with true blending of colors being maintained. The transfer member, together with the drying agents employed in the inks noted, cooperate to effect a quick drying of the blended image. This drying effect is developed to a point where the wet blended image printed down on a desired surface by the offset operation almost instantaneously becomes dry.

Several advantages are obtained from the procedures noted. A true blended color image is obtained and printed in substantially dry state, with very considerable saving of time and materials and improvement in quality. The use of a number of separate offset rolls, as are employed by many conventional color processes, is obviated and one offset roll does all of the work. A speed of operation is available, greatly beyond anything now possible with present printing procedures. The use of inks of the character noted in connection with intaglio plates increases the scope of intaglio printing and provides a quality of blended color printing of superior character.

If desired, certain procedures may be utilized to further improve the operations described. For example, the printing plates may be specially prepared to provide for varying the amounts of the specially prepared inks which are to be brought

together in securing a proper blended effect. This is done by employing different types of screens and etching procedures in the forming of each of a series of color plates to make differently sized ink depressions.

For example, if a blended color job is to be made of yellow, blue and red inks of the character described, a yellow printing plate will first be formed in accordance with some conventional plate making method in which a screen is employed. In carrying out the method of plate making a relatively coarse size of screen may be employed. This plate may be etched by a bath etch, which allows the etch to be directed squarely into the metal. The plate thus prepared is particularly suitable to holding relative large amounts of a heavy foundation ink and to releasing such a heavy ink from its depressions. This provides for a foundation film of an opaque character which is well suited to blending of subsequent inks. A second plate, as the blue ink plate, will then be similarly prepared from a blue photographic negative, employing a different size of screen, as for instance one smaller which modifies the ink-receptive character of the plate as a whole as compared with the yellow plate. Also, a different etching procedure may be resorted to. For example, an acid blast etching procedure may be used, which will effect dots in the metal of an undercut nature. These dots are adapted to provide for suitable retention of lighter bodied inks such as the blue ink above described and yet allow for their release on the offset blanket. Similarly, a red plate may be prepared with a still different dot pattern, depth or other formation, and this plate in turn may hold suitable amounts of another type of ink such as the red ink above described, allowing it to be attracted by and absorbed into films of blue and yellow inks disposed on an offset blanket.

I may also desire to employ other types of printing members, as relief plates, with the special absorbent inks and an offset blanket, to secure my novel blended printing effects. These relief plates may also be formed to collect and retain varying amounts of ink, depending upon the type of ink which they are to handle, in the same manner as has been described in connection with preparing a series of gravure color plates. Similarly, combinations of both gravure and relief plates, and relief or planographic plates, with offset printing members, may be resorted to with respective inks and plates being modified so that they are adapted to function properly with one another.

Most printing members require a specific type of ink to be used with them. For instance, it is usually necessary to employ, with an intaglio plate, a relatively light ink, which can be easily scraped by a doctor blade, and which may be readily pulled from an intaglio plate by a tacky surface such as that of paper. Increasing the body of the ink tends to cause faulty separation of the ink from the plate on to a blanket surface and to interfere with proper transfer of the ink from the blanket to the surface to be printed upon. This is also particularly the case in connection with transferring a heavy ink of the letterpress type from a relief plate on to a blanket. Similar difficulty is experienced with substantially all printing members.

According to the invention, these difficulties are minimized by treating the surfaces of such printing members to substantially modify their ink handling character. This is effected by applying or forming an ink-trapping medium or film on the surface of a given printing member. The film acts as a carrier for attracting and retaining inks, and also as a separating agent for allowing the ink to be readily separated from the printing member and applied to some other surface.

For example, the surface of a transfer blanket of rubber may be treated to change its ink retentive character by the application thereto of certain organic materials, which attack the rubber. One substance suitable for modifying the ink retentive character of a blanket of rubber is gasoline; another mixture found to be suitable is one composed of fuel oil, gasoline, and xylol. Also, mixtures of these and other materials may be utilized in a jelly form. Rubbing over the surface of a blanket with materials such as these may change its ink retentive character so that it will take increased amounts of printing ink, and at the same time allow the blanket to transfer the ink to a relatively more tacky surface such as that of paper without any undesirable sticking. By a film such as that described, an ink is associated with the surface of a plate in the same way that a greasy ink is lightly disposed over the hygroscopic film of a planographic printing plate in its non-printing parts before the plate is developed.

In a somewhat similar manner, printing plates as intaglio and relief plates may be treated with a chemical reagent, or some other means to form a film in the engraved parts of the plates. An example of such a procedure is the use of a mild acid, such as hydrochloric acid, which will lightly attack the metal surface of a printing plate and provide a film attractive to the ink. Another procedure is to provide an ink of water-repellent character and to apply, in the printing portions of the plate, a film of moisture which tends to keep the ink in a separated condition from the metal of the plate, so that it may be readily pulled therefrom. Other means and reagents for treating the plates to facilitate handling of inks may be desired to be employed, as alkalies, organic materials, and the like.

Modifying the ink retentive character of printing members is particularly advantageous in connection with offset printing procedures. It is pointed out that a plate which is to be used in an offset process must not only take up ink in relatively large amounts, but must also release the ink fairly readily to a transfer blanket. The blanket must in turn release the ink fairly readily to the surface to be printed. This relative ink handling character between the transfer blanket and the plate may be developed by the method described for either relief plates, intaglio plates, or other types of plates, or combinations thereof. The procedure is also useful with respect to using a relief plate with an offset printing plate, since an exceedingly heavy ink of usual printing ink character can be picked up by the films or mediums described, and effectively released on to a blanket, and then transferred without the large pressures usually employed to hold such inks from relief plates. Similarly gravure or intaglio printing can be combined with offset printing members without the usual difficulties.

The procedure or principle of treating a surface which is to pick up or handle an ink may be also extended to ink films themselves as they occur on a printing member. For instance, it is possible to treat an ink film before it is printed on to a sheet of subject matter to facilitate drying and develop other effects. It is pointed out that treatment of ink films on a blanket or on a plate

just before being passed to a blanket may be effected and utilized to advantage not only for multi-color work but for single-color printing directly from a plate. Such treatments allow for very desirable drying effects which can be carried to a point not heretofore practical as excessive drying would prevent ink being removed from a plate, while with the film procedure of the invention such drying would not affect releasing of the ink from the film. By use of the films, it becomes more practical to use one offset blanket for picking up all of a number of colored inks instead of using separate blankets for each color as is now the custom to a great extent.

It will be seen that novel methods of printing have been disclosed. These methods combine offset printing operations with various types of printing plates to broaden the scope of both offset printing and other processes of printing. Procedures for improving inks and printing members are indicated. Accurate wet color blending may be quickly attained, greatly improved drying effects are arrived at, and a cheaper, simpler, and more efficient printing procedure is made available.

While there has been described a preferred embodiment of the invention, it should be understood that various other applications of the means and procedures disclosed may be resorted to and other reagents and materials employed in connection with various types of printing plates in keeping with the spirit of the invention.

Having described my invention, I claim:

1. That improvement in methods of printing which consists in applying on an offset printing member a dense absorbent printing ink, selectively applying over the first ink while wet a second differently colored printing ink of a relatively thinner consistency adapted to penetrate into the first ink and form blended color parts throughout the thickness of the layer of the said first ink, then again selectively applying over the first and second inks while wet a third differently colored printing ink of a consistency different than that of either of the said first and second inks and adapted to be absorbed by each of the said first and second inks, thereby to effect further blending throughout the thickness of the layers of each of the said first and second inks, and then offsetting the blended inks in a wet state upon a surface to be printed, to provide a substantially dry printed, blended color image.

2. That improvement in methods of printing which consists in applying on an offset printing member a layer of a dense absorbent printing ink having a base of a highly polymerized drying oil, selectively applying over the first ink while wet a second differently colored printing ink which has a base of a drying oil of a relatively thinner viscosity adapted to blend with the first ink layer throughout its thickness, then again selectively applying over the first and second inks while wet a third differently colored printing ink which has a base of a drying oil thinner than the oils of the first and second inks, said third ink being adapted to blend throughout the thickness of the layers of the first and second inks, and then offsetting the blended inks in a wet state upon a surface to be printed to provide a substantially dry blended color image.

3. That improvement in methods of printing which consists in applying on an offset printing member a dense absorbent printing ink having a vehicle of a highly polymerized linseed oil, selectively applying over the first ink while wet a second differently colored printing ink of a relatively thinner viscosity and having a vehicle of a linseed oil of a relatively thinner character than the linseed oil of the said first ink for the purpose of facilitating penetration of the second ink into the first ink and forming blended color parts throughout the thickness of the layer of said first ink, then again selectively applying over the said first and second inks while wet a third differently colored printing ink of a different viscosity than that of either of the said first and second inks and having a vehicle of a linseed oil of a character thinner than the linseed oil vehicles employed in said first and second inks, for the purpose of effecting blending of the third ink throughout the thickness of the layers of the first and second inks, and then offsetting the blended inks in a wet state upon a surface to be printed to provide a blended color image.

4. That improvement in methods of blended color printing which consists in preparing a series of printing inks of graduated absorptive character, forming a series of printing plates for a given multi-color subject matter to be printed, with differently sized screens and differently applied etching materials to form recessed areas of respective plates of graduated ink receptive character, inking the plates in a definite sequence in which the most absorptive ink of the said series is applied to the plate of greatest ink receptive character, then treating the surface of a transfer printing member to increase its ink receptivity, applying the most absorbent ink of the series on the treated surface of the transfer member, then applying, in a wet state, the remaining inks in order of their absorptivity one upon another, and then offsetting the several inks in a blended substantially dry state.

5. That improvement in methods of printing which consists in providing a series of differently colored printing inks absorbent one to another, preparing a series of intaglio printing plates for each of the colored inks, the recessed parts of the plates being modified by the use of varying sized screens and etching procedures in accordance with the respective ink which each plate is to accept, combining on a transfer member superimposed layers of the colored printing inks in wet blended color relation throughout the thickness of each of the layers, and then offsetting the blended inks.

6. That improvement in methods of printing which consists in providing a series of differently colored printing inks, of different degrees of absorbency, forming on a transfer member a film receptive to the most absorbent ink of the said series, then collecting on the film-coated transfer member the said inks in order of their absorbency, and then offsetting the blended image.

7. That improvement in methods of printing which consists in providing a series of intaglio plates, each of said plates being etched in accordance with differently sized screens, inking said plates with a series of inks which are absorptive one with another, applying said inks one upon another from said plates on to a resilient transfer member in a wet state, and offsetting the inks to comprise a blended printing image.

8. That improvement in methods of color printing which consists in successively superimposing in a definite sequence on an offset blanket a number of wet colored inks of graduated absorptivity with respect to one another to form an image in which blending occurs throughout the thickness of each of the layers of color, and then offsetting.

9. That improvement in methods of printing which consists in blending on a transfer member one in another a plurality of layers of differently colored wet printing inks, and then offsetting the blended inks.

10. That improvement in methods of printing which consists in blending together in a wet state, a series of inks of graduated absorptive character with respect to one another.

11. That improvement in methods of printing which consists in developing on the surface of a printing member an ink trapping film for modifying the ink handling character of the member, then applying a printing ink over the ink-trapping film and then applying over the said printing ink a thinner ink, and then printing.

12. That improvement in methods of color printing which consists in preparing a series of color printing plates with progressively modified etched character, providing a series of colored inks of graduated absorptive character and adapted to blend completely through one another, applying the said series of inks to the said series of plates in a definite sequence, then applying the inks one upon another on a transfer blanket, and then printing.

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