United States Patent [19]

Milligan

[11] **3,926,117**

[45] **Dec. 16, 1975**

[54] **COLOR PRINTING METHOD**

[75] Inventor: **Donald Dunn Milligan,** North Balwyn, Australia

[73] Assignee: **Triprint Pty. Ltd.,** North Balwyn, Australia

[22] Filed: **Apr. 11, 1974**

[21] Appl. No.: **460,056**

[30] **Foreign Application Priority Data**

Apr. 13, 1973 Australia 2981/73

[52] **U.S. Cl.** **101/211;** 101/401.1

[51] **Int. Cl.**[2] **B41C 1/12;** B41M 1/14

[58] **Field of Search** 101/211, 401.1, 395

[56] **References Cited**

UNITED STATES PATENTS

2,243,486	5/1941	Ormond	101/211
2,798,428	7/1957	Tollenaar	101/211
3,253,917	5/1966	Flynn	101/211
3,381,612	5/1968	Lecha	101/401

Primary Examiner—J. Reed Fisher

Attorney, Agent, or Firm—Bacon & Thomas

[57] **ABSTRACT**

Disclosed is a color printing method for forming a print including half-tone work and line work comprising separating the work into its primary red, primary blue, primary yellow and black components in any suitable manner, reducing the dot sizes of the half-tone work in the primary color components such that the half-tone work is clearly reproduced in the required colors in the finished print, combining the separated black component with each of the separated primary color components and producing red/black, blue/black and yellow/black combination plates or the like, and forming a print using said combined plates with rubine red ink, a suitable process blue ink and a transparent process yellow ink (or equivalent inks) wherein the screen positives for the primary color components are additionally etched; yellow about 4–6% red 8 to 10% and blue 8 to 12%, and the job is printed with higher blue and red ink densities to achieve closer approximation of the black in the job. If necessary, small amounts of black ink are added to the red and blue primary colors to ensure close approximation to black in the line work.

7 Claims, No Drawings

COLOR PRINTING METHOD

BACKGROUND OF THE INVENTION

This invention relates to an improved method of color printing.

In all presently known color printing processes involving half-tone work, and those processes involving both line work and half-tone work, such as are used in the printing of labels for canned products, it is necessary to have a separate plate for the line work and half-tone shading which is required to be black in the finished job. When using a single color machine, it is necessary to run a separate pass for the black work. For work involving three or more colors, an additional pass is required on a two color machine. Similarly, a three color press will require an additional pass where four colors are required, and so on.

One method of excluding the black run from a three color half-tone printing process has already been proposed. This method involves the combination of the primary color components of the work with the black shading component of the work, the standard process colors being used with the combined primary color/-black printing plates to produce a three color print having simulated black shading areas. The method is described more fully in U.S. Pat. No. 3,381,612 to Lecha.

The above proposed method suffers from several practical problems. Firstly, using the inks described in the specification, the shading and other half-tone work which is required to be black may tend to take on a brownish appearance, thus producing substandard prints. Magenta red does not balance properly with the other inks used, whereas the process yellow is too opaque and suppresses the other colors. Secondly, the process does not provide for the situation where there is both half-tone work and black line work. Using the process as taught by the U.S. Patent would not result in acceptable black line work.

SUMMARY OF THE INVENTION

It is the primary object of this invention to provide a color printing method which results in good quality half-tone color work, and which can be used to produce color half-tone work combined with black line work.

In its broadest aspect, the inventive method of color printing half-tone work is characterized by the use of plates or the like representing the combined blue and black components of the work, the combined red and black components of the work, and the combined yellow and black components of the work, the half-tone work of the red, blue and yellow components having their dot sizes reduced sufficiently before combination with the black component such that the half-tone work is clearly reproduced in the required colors in the print. The method is also characterized by the use of rubine red, a suitable process blue and a transparent process yellow (or equivalent inks).

More particularly, the invention provides a color printing method for forming a print including half-tone work and preferably including line work comprising separating the work into its primary red, primary blue, primary yellow and black components in any suitable manner, reducing the dot sizes of the half-tone work in the primary color components such that the half-tone work is clearly reproduced in the required colors in the finished print, combining the separated black component with each of the separated primary color components and producing red/black, blue/black and yellow/-black combination plates or the like, and forming a print using said combined plates with rubine red ink, a suitable process blue ink and a transparent process yellow ink (or equivalent inks).

The blue ink may be concentrated process blue or any other suitable blue ink.

Other objects, features and advantages of the invention will become apparent from the detailed description of the invention which follows.

DETAILED DESCRIPTION OF THE INVENTION

A preferred form of the invention will now be described in relation to lithographic printing using the three primary colors to produce a four color print. However, it will be appreciated that the invention is equally applicable to other color printing processes, such as Gravure, Letterpress and "Nyloprint".

As will be clear from the above description of the broad aspects of the invention, the method of the invention is based on the use of combination black/primary color plates or the like and the approximation of black line work by suitable balancing the primary color inks. In the preferred form, the inks used are as follows:

1. Collies New Era Rubine (Pantone) Red 062545
2. Collies New Era Cyan Concentrated Blue 062170
3. Collies New Era Extra Transparent Yellow 319511

The preferred method of preparing the black/primary combination plates involves the following steps:

1. On receipt of the color reflection copy or transparency copy and the line section of the work to be printed, register marks are included on the copy prior to photography.

2. The usual workshop accepted method of color masking is carried out and a conventional four color set of continuous tone separation negatives are made with a density range of approximately 0.4 to 1.9. The most preferred method is to prepare the negatives from transparency copy, and separation negatives are made in a contact frame with a point source light enabling sharpest screen positives obtainable by one step projection. Final size line negatives are made when there is line work to be combined with screen work.

3. Screen positives are prepared by use of a process screen enlarger using grey or magenta contact screens; the following screen angles are recommended: yellow 90°, red 45°, blue 105°, and black 75°.

4. If the screen ruling to be used is 150 lines per inch, the yellow, red and blue positives are made with this screen and the black is made using a 133 screen ruling. Alternatively, using a 133 ruling for the three colors, the black will then be made on a 150 ruling.

5. A normal set of screen positives for the yellow, red and blue are made. The black positive can be slightly flatter than normal; the reason for this will be apparent because of combining methods used.

6. In the re-touching department the dot etching will be increased slightly to enable the printer to increase the ink density readings above normal to achieve the best blacks. The increased etching found necessary is approximately: yellow 4–6% red 8 to 10% and blue 8 to 12%. This can vary with experience and will depend to some extent on the stock the job will be printed on. Any line work present is not etched.

7. The black positive is then combined by registering carefully on to the back of the color positives and con-

tacted to negative. The black positive will be out of contact by the thickness of the film used, normally 0.004 of an inch, but by experience and the use of a point source light, and having made a slightly lower contrast black positive, the gain in contrast can be controlled.

8. The three color/black set of negatives are used to produce a proof and etching corrections can be made at this stage. A final set of positives will then be contacted from these negatives.

The purpose of screening the black positive on a different screen ruling to the other three colors is to minimize the risk of any screen ruling clash or moire. When combining a black positive with a screen angle which is going to be duplicated into each other color with their own separate screen angles there exists a fine print register situation. As the exclusion of the black printer is made possible by the above method, the need for accuracy in combining is apparent.

In label or carton work there is black line work demanded, the black screen positive is combined with the line type etc. prior to the final combination with the yellow, red and blue positives.

It is possible to convert an existing set of four color process and line positives to a new three color set by adopting the above etching and combining procedure. If it is considered that the old positives may not stand this etching correction, the same result may be obtained by increasing the exposure time in contacting to negative to achieve the desired loss of dot size. The black positive in an existing set of positives will be on the same screen ruling as the yellow, red and blue positives and this may necessitate the removal of some black screen areas before combining of the black into the red positive. Removal would be necessary in areas of a flat brown tone where the duplication of the black dot into yellow, red and blue printing may introduce a screen clash which must be avoided. By combining such areas only in yellow and blue this problem would be overcome.

The three combination plates produced as described above are used in the normal manner to print a four color job using the three primary inks defined above. It is preferred that the job is printed in the order blue, red and yellow. This allows the blue and red to fuse properly with the transparent yellow and ensures that no one color dominates, thus achieving black half-tone and line work closer to the spectrum than with conventional colors.

As mentioned above, additional ink is used to ensure that the line work closely approximates black. It has been found preferable to aim for the following densitometer readings for a half-tone job (Gretag D1 Reflection Densitometer): Yellow 0.85, Red 1.2, Blue 1.2. For a half-tone/line combination the following readings are suggested: Yellow 1.0, Red 1.5, Blue 1.5.

It has been found that it is desirable to add black ink in different quantities to the red and blue primary inks where the paper stock is discolored beyond a densitometer reading of about 0.05. For example add ⅛ oz. black to one pound Rubine and ¼ oz. black to one pound blue. The transparency of the yellow should be increased to achieve a densitometer reading of about 1.10. However, these values may be modified to achieve desired results in various circumstances.

The number of passes required to achieve the final print depends on the type of machine used but it will be appreciated that one pass and/or one deck will be saved by the present method. Thus, if a two color press is used, the second pass leaves one deck free for varnishing, special background or other special color, or any other suitable purpose. A three color press will produce a four color print in one pass while four or five color presses have one and two decks left free for any one of the above mentioned purposes.

The resulting print includes line work which closely approximates black and includes half-tone work having greater color depth and three dimensional properties. The better quality of the half-tone work is believed to be due to the fact that the usual black shading, which tends to mask the colors, is replaced by three balanced primary colors applied through the "black part" of the combined plates giving a pure color effect rather than a masking effect. When this is added to the saving associated with the removal of need to print in black ink, it will be appreciated that the method of the invention is economically attractive.

One further advantageous feature is made possible by the method described: it is possible to produce a special scarlet red color in a job by overprinting the rubine red with the transparent yellow. Scarlet red is used in cartons or labels where special shelf appeal is required and normally adds considerably to the cost of a job requiring the manufacture of a specially mixed ink and an extra run. This red can be closely approximated by overprinting 100% rubine red with transparent yellow using a screen of the order of 60% so that the special scarlet red can be printed at the same time as the rest of the job. Other special red colors can be achieved by overprinting with transparent yellow having strengths of from 5 to 100%.

What is claimed is:

1. An improved method of preparing half-tone combination primary color and black printing plates and using said plates in a half-tone primary color printing process including black line work where the black color is approximated by balancing the primary color components of the print and where the printing process involves using three primary color printing passes only, in a manner known generally per se, comprising, as the improvement, the steps of:

a. preparing separated, differentially angled screen images having normal dot densities of the primary color and black components of the combination plates in a manner known generally per se;

b. reducing the dot sizes of the normal dot density screen images corresponding to the respective red, blue and yellow components of the combination plates prior to the combining of each image with its respective black component, while leaving the dot sizes of the normal dot density black component of the prepared screen images unreduced;

c. preparing combination primary color and black half-tone printing plates in a manner generally known per se using the prepared screened primary color images having reduced dot sizes as the primary color component image of each combination plate;

d. printing the final color image using said plates and primary color inks; and

e. maintaining the density and volume of said inks during said printing process within a range suitable to maintain optimum color density in the final half-tone image despite the reduction of dot sizes of the primary color components of each printing plate, whereby dense black line work is obtained and the

appearance of the half-tone color work is enhanced.

2. The method recited in claim **1,** wherein the said dot size reduction of the primary color screened images is carried out within the range of 8 to 10% for the red screened image; 8 to 12% for the blue screened image and 4 to 6% for the yellow screened image.

3. The method recited in claim **1** wherein the printing of said final image is carried out using a color balanced rubine red ink, a color balanced process blue ink and a transparent process yellow ink, in that respective order.

4. The improved method recited in claim **3,** further wherein said balanced process blue ink is a Cyan Concentrated Blue.

5. The improved method recited in claim **1** wherein said screened primary images are made using screen angles of 45° for the red component, 105° for the blue component, 90° for the yellow component and 75° for the black component.

6. The improved method recited in claim **5,** further including the step of using a screen ruling of 150 lines per inch for producing the primary color screened image components of the half-tone plates, and a screen ruling of 133 lines per inch for producing the black screened image components of said plates, whereby a moire pattern in the shadow areas of the final print due to screen clash is avoided.

7. The improved method recited in claim **5** using a screen ruling of 133 lines per inch for producing the primary color screened image components of the half-tone plates and a screen ruling of 150 lines per inch for producing the black screened image components of said plates, whereby a moire pattern in the shadow areas of the final print due to screen clash is avoided.

* * * * *