

[54] **DEVICE FOR DETERMINING PROPER COLOR BALANCE IN COLOR PRINTING**[75] Inventor: **Joseph J. Smajo**, Chicago, Ill.[73] Assignee: **Unilux Graphics, Inc.**, Hackensack, N.J.[22] Filed: **May 14, 1971**[21] Appl. No.: **143,358****Related U.S. Application Data**

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[58] Field of Search.....355/88, 79, 4, 32, 35; 95/1 R, 95/10 R; 96/1.2, 27 E; 356/175

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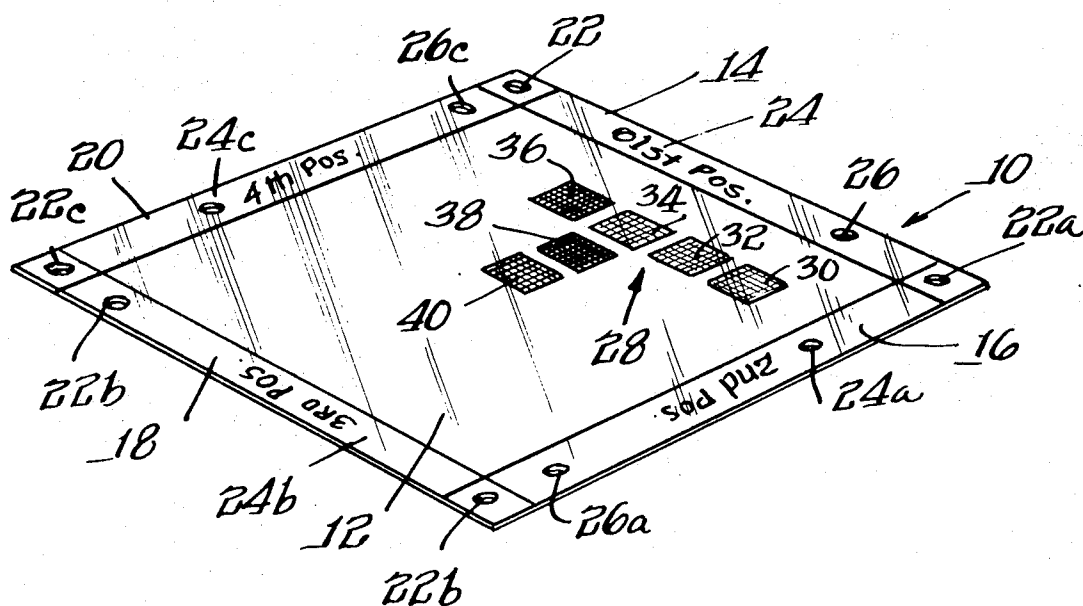
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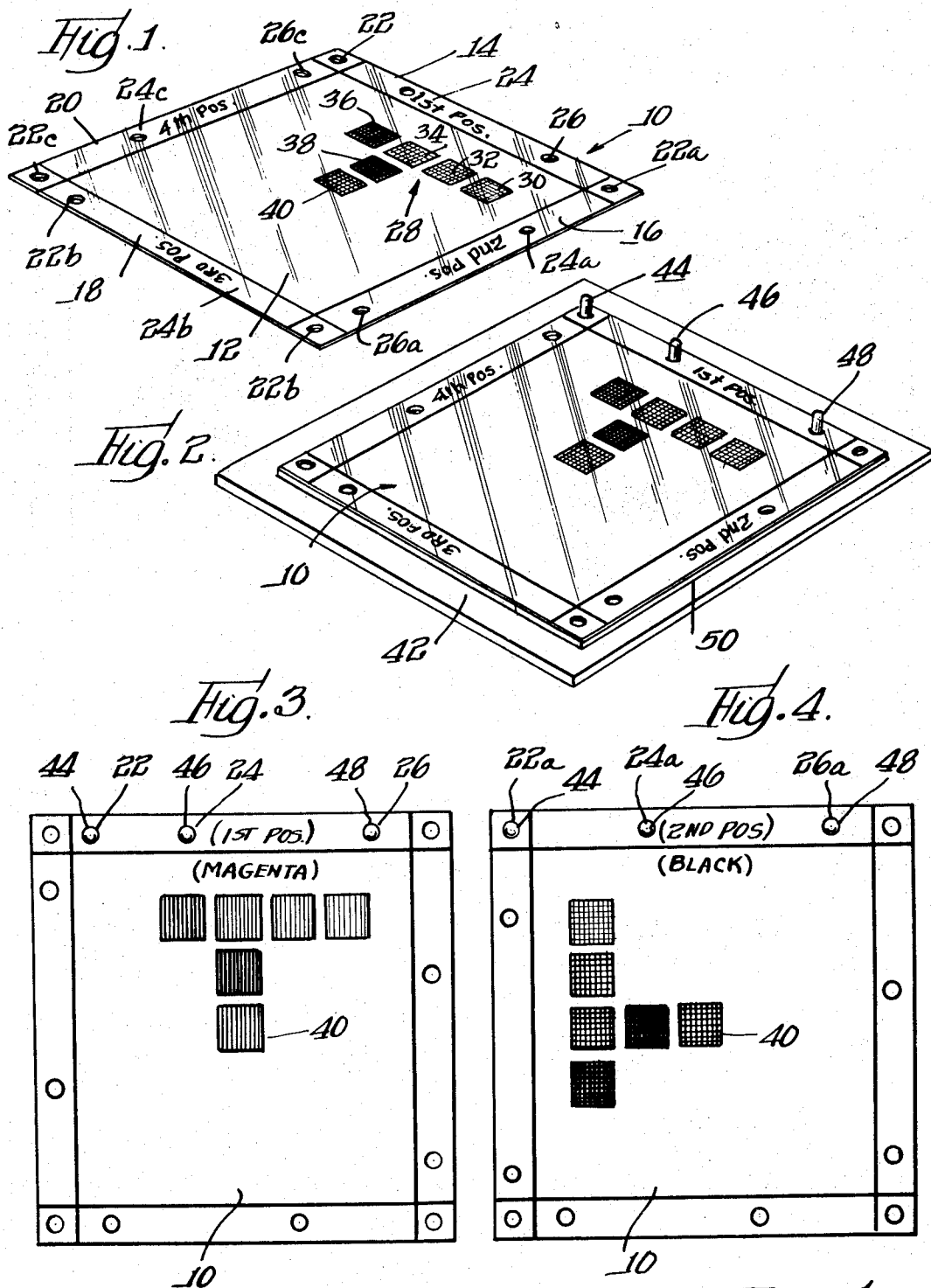
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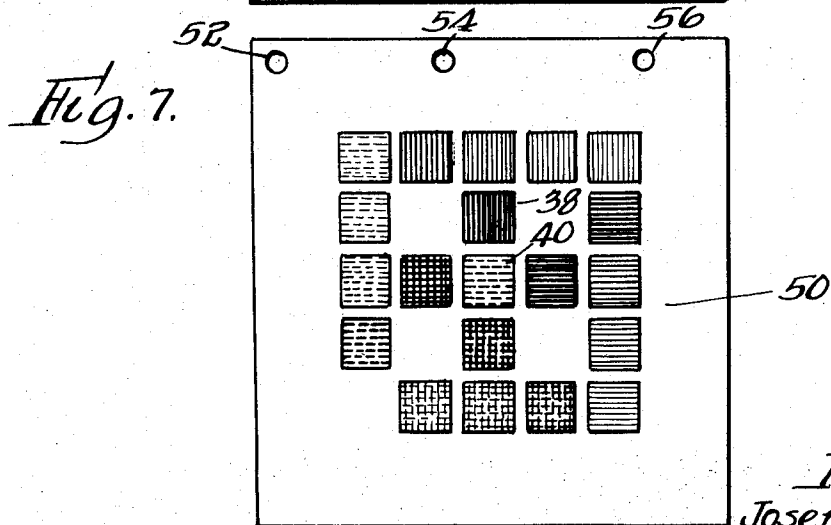
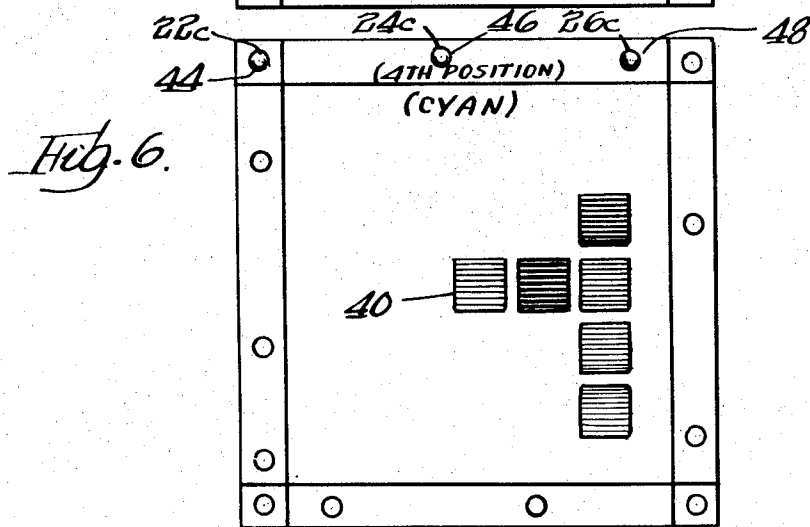
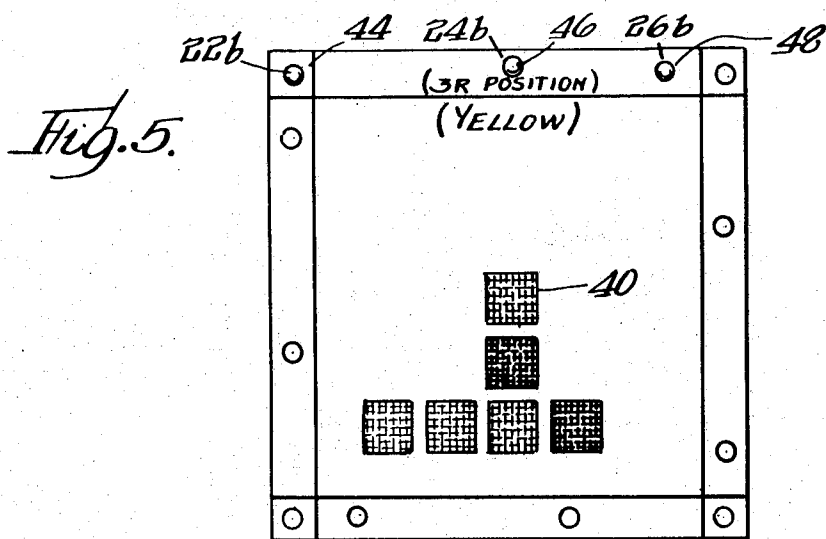
[57] **ABSTRACT**

A step-wedge is reprinted four times, one for each of three colors plus black and white as a mask. The reprinting is in a different position each time, giving a total of four different positions with one selected value overprinted by each color to show the effect of the overprint, namely to demonstrate a neutral. If a neutral gray is obtained, then it is known that the printing is correct. If no neutral is obtained, a ready reference, not requiring the use of a densitometer or separation filters is immediately at hand.

5 Claims, 7 Drawing Figures



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DEVICE FOR DETERMINING PROPER COLOR BALANCE IN COLOR PRINTING

This is a division of application Ser. No. 845,288, now U.S. Pat. No. 3,620,727 filed July 28, 1969.

BACKGROUND OF THE INVENTION

Tri-color printing process of various types are known in the art. In order to balance the three colors it is common practice to provide a photographic step-wedge or step tablet, comprising a graduated exposure index, which is reprinted on itself. With the aid of a densitometer a skilled operator can study the overprinted step-wedge, and determine whether the color balance is proper, or whether it is necessary to add or subtract one or more colors. This is time consuming and requires a skilled operator, and is hence quite expensive.

SUMMARY OF THE INVENTION

A step-wedge is provided with images more or less in the shape of an off-center T. Four square or other geometric areas run from nearly clear through dark gray, and form the crossbar of the T. The stem of the T underlies the third area, thereby being somewhat off-center, and comprises two squares or other geometric areas, the most remote one relative to the crossbar duplicating one of the afore mentioned gray areas of the crossbar, and the immediate area being black (opaque). An easel or base is provided with pins, and the exposure index is successively positioned in four different positions, relatively rotating about the most remote geometric area of the stem, whereby this area is overprinted in three different colors plus black and white. If this particular area ends in a neutral gray, then it is known that the color balance is correct. If it has a hue of one color, it is known that this color must be reduced, or one of the others intensified, and the intensities of the other areas covered in different colors indicate relative intensities of the colors readily without requiring a densitometer or a skilled operator, thereby greatly facilitating color correction.

Accordingly, it is an object of the present invention to provide an improved target or exposure index having a novel step-wedge thereon which is overprinted in each of the printing colors with one gray area being overlapping in each instance to provide an indication of color balance.

It is likewise an object of the present invention to provide a novel step-wedge and method of using the same which does not require a densitometer or a skilled operator.

Other and further objects of the present invention will be apparent, and the invention will be readily understood from the following description when taken in connection with the accompanying drawings wherein:

FIG. 1 comprises a perspective view of the graduated exposure index of target;

FIG. 2 comprises a perspective view of the easel usable therewith and having a sheet of paper thereon;

FIG. 3 is a view showing the position of exposure for the magenta print;

FIG. 4 is a similar view showing the position of exposure for the black and white print;

FIG. 5 is a similar view showing the position of exposure for the yellow print;

FIG. 6 is a similar view showing the position of exposure for the cyan print; and

FIG. 7 is a similar view showing the multi-color print as actually made.

Turning now in greater particularity to the drawings, and first to FIG. 1, there will be seen a device or target 10 constructed in accordance with the present invention. This device includes a clear sheet base 12, constructed of suitable material such as cellulose acetate. The base is provided with four ruled margins 14, 16, 18, and 20, respectively, and individually labeled as to first, second, third, and fourth position.

Each margin is provided with three keyed holes, the holes in the first margin being identified as 22, 24, and 26. The like holes in the subsequent margins are identified by similar numerals with the respective addition of suffixes *a*, *b*, and *c*. In addition, the target base is provided with a step-wedge identified generally by the numeral 28.

The step-wedge is generally in the shape of a slightly off-center T. The crossbar of the T comprises four aligned squares, 30, 32, 34, and 36. The stem of the T is aligned with the square 34, and includes additional squares 38 and 40. It is to be understood that the square shape is arbitrary, and that other geometric shapes could be used. However, a square shaped is easy to make, and fits other requirements, as will appear hereinafter. The first square (or patch) 30 is very nearly clear, but preferably has a 0.05 defuse optical density to separate the image formed thereby from the background. The adjacent three patches, 32, 34, and 36 are logarithmically related to one another. The patch 38 is opaque, having density of 2.0 or higher, while the center patch 40 has a density of 0.30 although this value is not critical. The center square 40 is the same optical density of one of the other squares or patches, and in the illustrative example it is the same as the patch 36.

Turning now to FIG. 2, I also provide an easel 42. Since the present invention is practiced with particular utility in electrostatic printing the easel is preferably metal and is grounded. The paper can be charged direct on an easel to avoid undue handling of the paper. The easel is provided with three upstanding pins 44, 46, and 48 respectively mating with the holes 22, 24, and 26 in the margin of the target. (It will be understood that the pins also subsequently mate with the like numbered holes with the respective suffixes *a*, *b*, and *c*.) A sheet of printing paper 50 having holes along only one edge designed to mate with the pins 44, 46, and 48 is placed on the easel with the holes receiving the pins, as seen in FIG. 2. The final printed paper 50 is shown in FIG. 7, the pin receiving holes being identified at 52, 54, and 56. In accordance with the first example of the present invention, the paper is coated with a zinc oxide and resin formulation so that the paper can be electrically charged in accordance with known techniques, preferably direct on the easel 42, but optionally elsewhere. The target is likewise placed on the easel, overlying the paper 50, and first in the first position as shown in FIGS. 2 and 3.

As will be understood in this first position the holes 22, 24, and 26 are centered on the pins 44, 46, and 48. Light is projected through the target 10 onto the paper 50 through a green filter. Subsequent to the exposure the target is removed, and the paper is processed in a liquid toner containing magenta dye whereby a positive magenta image of the step-wedge is produced on

the paper. Preferably only the surface of the paper is wet during the processing, as in accordance with the application of Meyer L. Sugarman and Joseph H. Jaeger, Ser. No. 692,234, filed Dec. 20, 1967 recently refiled as two Divisional applications, Ser. No. 859,219 now Pat. No. 3,643,628, filed July 11, 1969, and Ser. No. 841,097 now U.S. Pat. No. 3,621,814 filed July 11, 1969.

After drying of the paper, should this step be necessary if the toning is carried out by an emersion process, the paper is returned in the same position to the easel. However, in this instance the target is placed in the second position with the holes 22a, 24a, and 26a positioned over the pins 44, 46, and 48 respectively. As will be understood, the paper is charged before the target is positioned over it. Exposure then is made by means of white light with no filter, and development is in black and white to produce a positive black and white image. It will be noted that the gray patch 40 is in identically the same position in FIGS. 3 and 4, although turned 90 degrees, the remainder of the stepwedge pattern being turned 90 degrees likewise.

Following toning of the paper in black and white, it is returned to the easel in the same position, being charged on the easel, or before hand. The target then is placed over the paper in the third position, as shown in FIG. 5, the holes 22b respectively overlying the pins 44, 46, and 48. As will be observed, the target is in 180 degree inverted position relative to the first position with the center gray patch 40 again being precisely positioned over its previous positions. In the third position exposure is through a blue filter, and the image is toned in a toner containing a yellow dye, whereby to provide a yellow positive image of the step-wedge.

Following toning the paper is again returned to the easel in a dry condition, and is charged thereon, or before hand. The target is placed over the paper in the fourth position with the holes 22c, 24c, and 26c respectively receiving the pins 44, 46, and 48. The paper is then exposed through the target and through a red filter, toning subsequently being done in a positive toner containing cyan dye.

The final print of FIG. 7 will have a row of magenta squares of varying intensities across the top, a row of gray squares along the left, a row of yellow squares along the bottom, and a row of cyan squares along the right. The adjacent square 38 in each instance will be of the same hue as the adjacent row. Finally, the center square 40 comprises all three colors (plus black) printed in a single area. If the three colors have been printed in proper relative intensities, then this center square 40 will be a neutral gray. If it is shaded with one of the three hues, or two thereof, it is known immediately that the relative intensity of that particular hue (or hues) is too great, and that a subsequent test print should be made giving a shorter exposure with the complimentary light color to that hue (or hues). Meanwhile the three rows of different color hues and the three squares immediately adjacent the center square of different hues give a ready indication of the relative intensities of the three hues, thereby making an estimate on the part of the operator as to the additional printing time to be added or subtracted for any one given hue a relative simple matter requiring no den-

sitometer and requiring only a minimum of experience. As will be understood, the gray row and adjacent square are provided to give an indication of the degree of masking.

As will be apparent, I have not disclosed an improved step tablet or step-wedge and a method of using the same to make a color test print providing a ready reference which does not require the use of a densitometer or separation filters. The relative strength of each component color can be seen immediately, whereby the operator or printer can quickly make a judgment as to the degree of correction needed and to what extent the correction should be made.

The invention has particular utility to electrostatic printing, due to the ability to lay down one color at a time, and due to the speed of operation. With respect to the latter, printing times for the various times run on the order from several seconds to a few minutes, while toning or printing time runs only a matter of seconds with drying time to be negligible when toning is handled with only the face of the paper being exposed to the toner, as in accordance with aforesaid co-pending application referred hereto.

Since the colors are printed sequentially, it is essential that the toners already laid down not accept any electrostatic charge themselves, although the area under each toner will still accept the charge. It has been found that certain yellow toners do tend to accept the charge, and such yellow toners are still usable provided that the yellow toned print is made last.

Although reference has been made by way of example to electrostatically printing, it will be understood that the principles of the invention are applicable to any tri-color printing. For contact prints, substantially any light source can be used for making the exposure. However, it is convenient to use a photographic enlarger as the light source, inasmuch this is readily adaptable in projection prints as well as contact prints, it being understood that a small step-wedge would be used for making a projection test print.

The invention is claimed as follows:

1. A color test printing target comprising a pellucid base having a plurality of patches thereon of different densities arranged in a predetermined pattern, and position determining means for sequentially positioning said base in a plurality of different positions for printing replicas of said target on a printing base in different positions with one of said patches overlapping in all of said positions.

2. A target as set forth in claim 1 wherein said position determining means sequentially positions said base in a plurality of sequentially rotated positions, said one patch being at the center of rotation.

3. A target as set forth in claim 2 wherein the pattern is substantially T-shaped.

4. A target as set forth in claim 3 wherein said T-shape is off center.

5. The combination set forth in claim 1 wherein the position determining means comprises a plurality of keyed holes, and further including an easel having a plurality of pins thereon cooperable with said holes to position said target in exposing position relative to a sensitized printing base.

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