July 4, 1939. F. L. WURZBURG, JR 2,165,169

MEANS FOR DETERMINING THE PRIMARIES IN A SYSTEM OF COLOR REPRODUCTION BY PRINTING

Original Filed Sept. 28, 1936

Fig. 1.

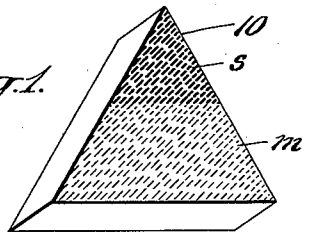


Fig. 2.

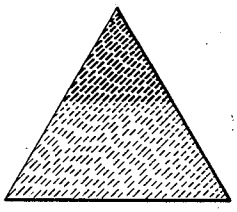


Fig. 3.

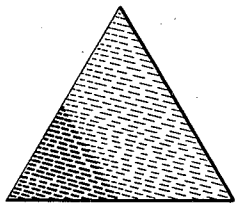


Fig. 4.

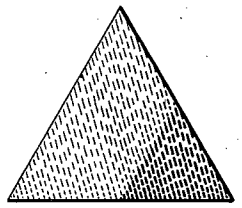


Fig. 5.

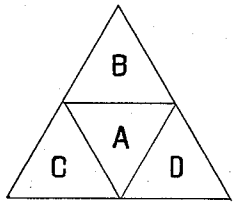


Fig. 6.

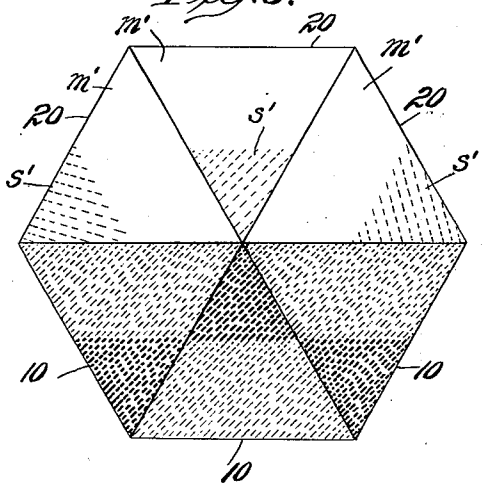
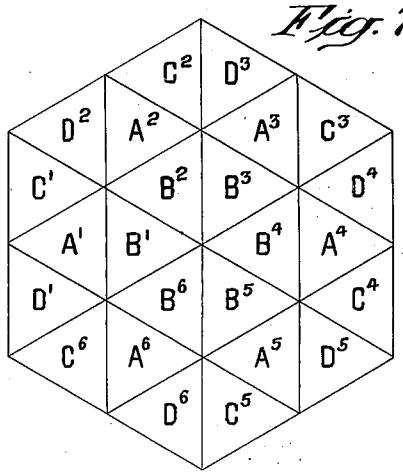


Fig. 7.



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MEANS FOR DETERMINING THE PRIMARIES IN A SYSTEM OF COLOR REPRODUCTION BY PRINTING

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Application September 28, 1936, Serial No. 102,957
Renewed October 11, 1938

5 Claims. (Cl. 88—14)

This invention relates to means for determining the primaries in a system of color reproduction by printing.

In co-pending application of Arthur C. Hardy, Serial No. 99,416, filed September 4, 1936, there is described and claimed a method for determining the primaries of a color reproduction system. In that method, use may be made of a differential print to compare the color of a specified combination of colored materials with the color of other combinations in each of which the amount of one of the colored materials differs by a small increment from its amount in the specified combination.

In applying this method to determine the primaries of a reproduction system by half-tone printing or other printing where definite screen lines or grain lines occur on the printing blocks used for the different colored inks, the occurrence of moiré effects may make the color comparison difficult. I have devised a set of printing blocks which permit the making of the required differential prints for a three-color system in a symmetrical manner and at the same time avoid moiré effects. My printing blocks are also adapted for use in reproduction systems in which three colored inks and one black or gray ink is used and which are sometimes inaccurately termed "four-colored systems".

A printing block made in accordance with my invention is provided with a printing surface in the form of an equilateral triangle consisting of two printing areas, one of which is a triangular area in one corner of the printing surface constituting one-fourth of the whole printing surface, and the other of which is a trapezoidal area containing three-fourths of the whole printing surface. The printing surface is so formed that the density of the ink printed by the triangular area is slightly different from that printed by the trapezoidal area. I most desirably provide a set of such printing blocks in all of which the screen or grain lines make the same angle with the base of the trapezoidal area.

My invention includes also the triangular and hexagonal differential prints which may be formed by such printing blocks.

The accompanying drawing shows specific printing blocks and prints illustrating my invention. In the drawing:

Fig. 1 is a perspective view of a printing block;

Figs. 2, 3 and 4 show three impressions from the block shown in Fig. 1;

Fig. 5 shows diagrammatically a print made by superposing the three impressions shown in Figs. 2, 3 and 4;

Fig. 6 shows six printing blocks assembled as a hexagon; and

Fig. 7 shows diagrammatically a hexagonal differential print made from the printing blocks shown in Fig. 6.

The printing block 10 shown in Fig. 1 is a half-tone plate having a printing surface in the form of an equilateral triangle. The printing surface is provided with the usual projections for printing half-tone dots.

The dot density of the printing surface, which I define as the proportion of the printed area which is covered by ink from the dots, is different in different parts of the triangular printing surface. The printing surface consists of a triangular area *s* occupying one-quarter of the total printing surface, and a contiguous trapezoidal area *m* occuping three-quarters of the printing surface. The dot density of the printing surface in the triangular area *s* is slightly different from the dot density in the trapezoidal area *m*. The screen lines, which may be regarded as illustrated by the dotted lines shown in Fig. 1, run in the same direction throughout the printing surface. In the form illustrated, these lines make an angle of about 45° with the base of the trapezoidal area.

A plurality of printing blocks, such as that shown in Fig. 1, are provided, and in all the blocks the screen lines make the same angle with the base of the trapezoidal area. The dot density of the printing surfaces of the different blocks may be selected as desired, but in each block the density of the triangular area is slightly different from that of the trapezoidal area.

Fig. 5 shows diagrammatically a differential print which may be made from three impressions of the block shown in Fig. 1 or by one impression of this block and two impressions from corresponding blocks. In making the differential print shown in Fig. 5, three impressions of the block shown in Fig. 1 made in different colors may be superposed. The way in which the block is turned in making the three impressions is shown in Figs. 2, 3 and 4. From these figures, it is apparent that between the first and second impressions the block is rotated 120° to the left, and between the second and third impressions the block is rotated 240° to the right, that is, it is turned 120° to the right from the position which it had in the first impression. From this turning of the block, it results that the screen lines in the three superposed impressions cross each other at wide angles so that there is no moiré effect. This procedure and the form of the blocks also result in making a symmetrical differential print having central area A and three outer areas B, C, D, all four of equal size, and so arranged that the combination of the colored inks in each one of the outer areas B, C, D is like the combination of the inks in the center area except for a slight difference in the density of one of the three colored inks. Such a print is

convenient for determining the three primaries of the system by comparing the color of each outer area with the color of the central area A.

Fig. 7 shows a hexagonal differential print which is convenient for determining the primaries of a three-color system for areas colored by each single colored ink separately and areas colored by each combination of two of the colored inks. This print may be made from three superposed impressions of three printing blocks 10 like that shown in Fig. 1, which may be assumed to have a dot density of seventy per cent. in their trapezoidal areas and a dot density of eighty per cent. in their triangular areas, and three similar printing blocks 20, in each of which the density of the trapezoidal area m' is zero and that of the triangular area s' is a small increment above zero, for example, five per cent. The six printing blocks may be assembled in the form of a regular hexagon as shown in Fig. 6. Three differently colored impressions from the assembled blocks are then made with a turning of the assembled blocks corresponding to the turning of the single blocks already described in connection with Figs. 2 to 5.

This procedure produces the hexagonal differential print shown in Fig. 7, containing twenty-four equal triangular areas of different colors. Assuming that the three impressions were made with yellow, magenta and blue-green inks, the area A1 shows the color of the yellow ink, the area A3 the color of the magenta ink, and the area A5 the color of the blue-green ink. The intermediate areas A2, A4, A6 show the colors produced by combining pairs of the inks in equal proportions. A2 shows the color of a combination of the yellow and magenta inks, A4 of a combination of the magenta and blue-green inks, and A6 of a combination of the blue-green and yellow inks.

The areas B1, C1, D1 show the changes in the color of the area A1 which are produced by adding separately a small increment of each of the three colored inks, and the same is true of the areas surrounding each of the triangles from A2 to A6. The density of each colored ink in each area is indicated in the following table:

Area	Density of yellow ink	Density of magenta ink	Density of blue-green ink
A1	70	0	0
B1	80	0	0
C1	70	5	0
D1	70	0	5
A2	70	70	0
B2	70	70	5
C2	70	80	0
D2	80	70	0
A3	0	70	0
B3	0	80	0
C3	0	70	5
D3	5	70	0
A4	0	70	70
B4	5	70	70
C4	0	70	80
D4	0	80	70
A5	0	0	70
B5	0	0	80
C5	5	0	70
D5	0	5	70
A6	70	0	70
B6	70	5	70
C6	80	0	70
D6	70	0	80

By comparing the colors of the surrounding triangles with the colors of the triangles A1 to A6, the primaries of the system for six different colored areas may be determined as described in the application of Arthur C. Hardy aforementioned.

If desired, the plate for printing the print shown in Fig. 7 may be made in a single piece, instead of by assembling triangular printing blocks.

What I claim is:

1. Means for use in determining the primaries of a color reproduction system by printing, comprising a printing block having a lined printing surface in the form of an equilateral triangle, said surface being so formed as to print a different density of ink from two parts of its printing surface, which consist respectively of an equilateral triangular area constituting one-quarter of the printing surface and a contiguous trapezoidal area constituting three-quarters of the printing surface, the lines being parallel throughout the whole printing surface.

2. Means for use in determining the primaries of a color reproduction system by printing, comprising a half-tone printing plate having a triangular printing surface whose dot density is slightly different in two areas, consisting respectively of an equilateral triangular area occupying one-quarter of the printing surface and a contiguous trapezoidal area occupying three-quarters of the printing surface, the screen lines being parallel throughout the whole printing surface.

3. A differential print for determining the primaries of a color reproduction system, consisting of superposed lined impressions of three differently colored inks and having a central triangular area in which each ink has a selected density, and three adjacent triangular areas in each one of which two of the colored inks have the same density as in the central area and one colored ink has a density slightly different from that which it has in the central area, the lines of the three impressions crossing each other at angles of 60°.

4. A differential print for determining the primaries of a color reproduction system, consisting of superposed impressions of three differently colored inks having the form of a hexagon containing twenty-four equal differently colored areas, each in the form of an equilateral triangle, including six spaced triangular areas and six sets of three triangular areas surrounding each of said six areas and showing the effect of an increment of one of the colored inks on the color of the area which they surround.

5. A differential print for determining the primaries of a color reproduction system, consisting of superposed impressions of three differently colored inks having the form of a hexagon containing twenty-four equal differently colored areas, each in the form of an equilateral triangle, including six triangular areas showing the colors produced by each of the three inks separately and each of the pair of the three inks in equal proportions, and six sets of three triangular areas surrounding each of said six areas and showing the colors produced by changing the color of the area which they surround by increments of each one of the three inks.

FRANCIS LEWIS WURZBURG, JR.