

July 9, 1957

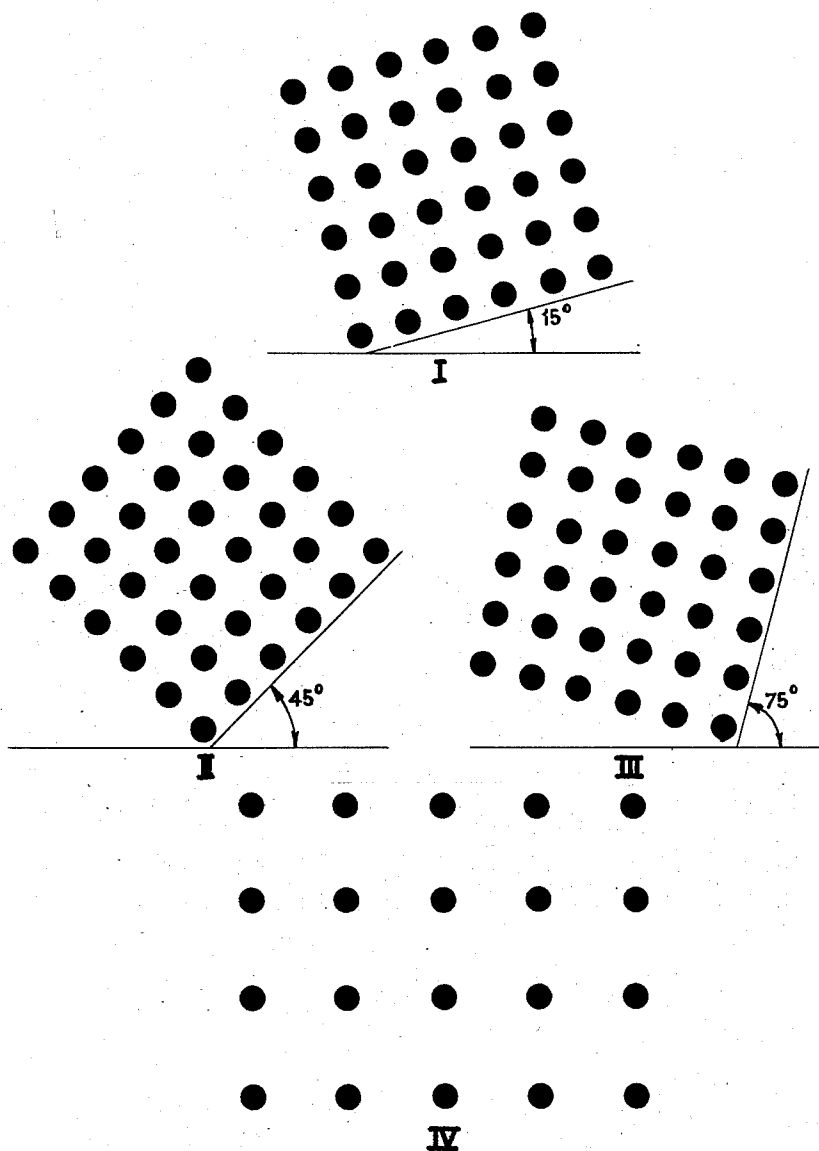
D. TOLLENAAR
PROCESS OF FOUR-COLOUR PRINTING AS WELL AS
BLOCKS TO BE USED THEREFORE AND THE PRINTS
OBTAINED WITH SAID BLOCKS

2,798,428

Filed Nov. 21, 1951

2 Sheets-Sheet 1

FIG. 1



INVENTOR
DANIEL TOLLENAAR,

BY

Robert B. Pearson
ATTORNEY

July 9, 1957

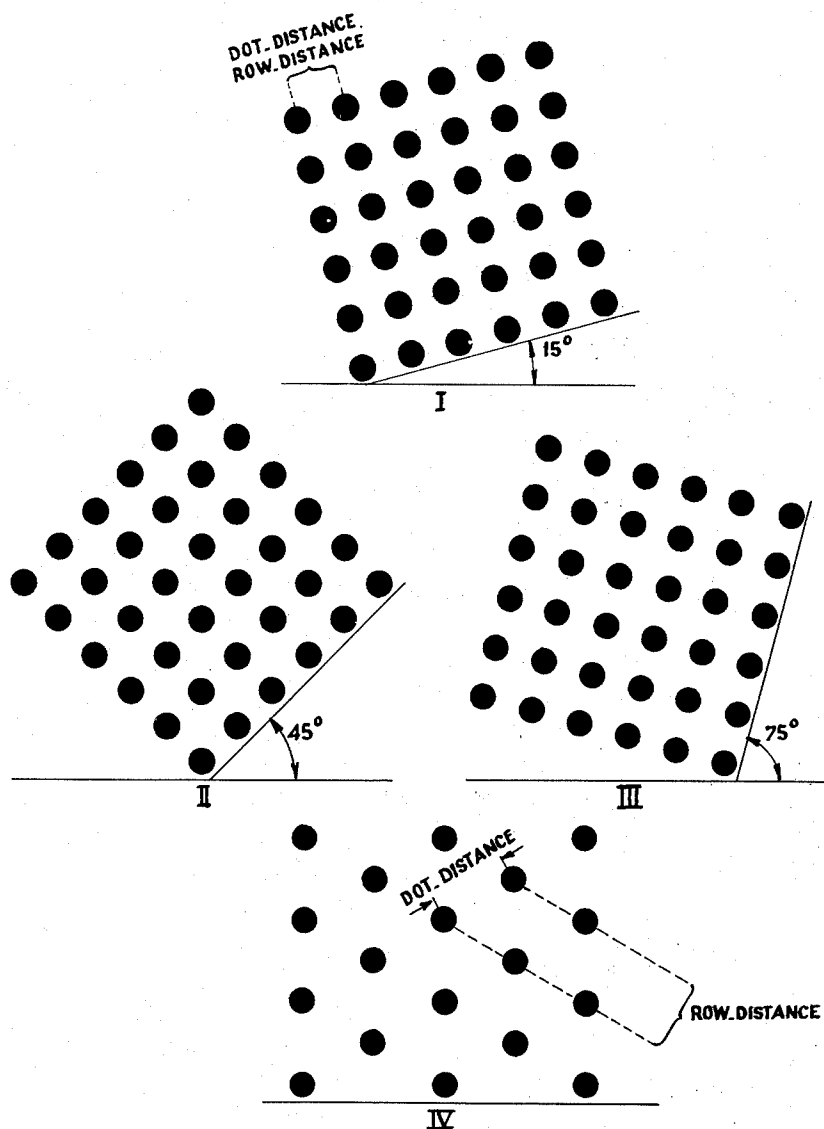
D. TOLLENAAR
PROCESS OF FOUR-COLOUR PRINTING AS WELL AS
BLOCKS TO BE USED THEREFORE AND THE PRINTS
OBTAINED WITH SAID BLOCKS

2,798,428

Filed Nov. 21, 1951

2 Sheets-Sheet 2

FIG. 2



INVENTOR
DANIEL TOLLENAAR,

BY

Robert B. Pearson

ATTORNEY

1

2,798,428

PROCESS OF FOUR-COLOUR PRINTING AS WELL AS BLOCKS TO BE USED THEREFOR AND THE PRINTS OBTAINED WITH SAID BLOCKS

Daniel Tollenaar, Amsterdam, Netherlands, assignor to Stichting Instituut voor Grafische Techniek T. N. O., Amsterdam, Netherlands, a corporation of the Netherlands

Application November 21, 1951, Serial No. 257,596

Claims priority, application Netherlands November 22, 1950

3 Claims. (Cl. 101—211)

As a rule quaternary Levy screens configurations of dots are used for four-colour printing. According to this process each of the four colour plates has a screen of identical period. The positions of the different screens are taken different to avoid interference. With the use of two identical quaternary screens the interference is negligible small if the angle between the corresponding axes of symmetry of the screens amounts to 30°.

During the process of four-colour printing the position of the screens is as a rule such that the screens of the different colour plates for red, blue and black, vary 30°, and the screen for yellow is at an angle of 15° resp. 75° to the screens for the blue and the red (separation) colour plates, and at an angle of 45° to the screen for black.

On printing according to this method, a disturbing pattern occurs in orange and in green, as these colours are formed by cooperation of the yellow and the red resp. the yellow and the blue colour plates, the relative screen positions of said colour plates varying only 15°. This phenomena is often called the 15° pattern. It is visible as small squares in the oranges and in the greens. When the picture shows much orange the axis of the screens of black and red may be changed; by this measure the great orange areas become free from 15° pattern, but as a rule a disturbing pattern then occurs in other colours of the picture.

The pattern of two systems of parallel lines or of systems of parallel row of dots, having the equal period d , has a period itself:

$$k = \frac{d}{2 \sin \frac{1}{2} \alpha}$$

in which α is the angle between the corresponding axis of the two screens. k becomes $= d$, if α has a value of 60°; if α has a value of 30°, k becomes approximately 1.9 d which means that the interference pattern is not yet large enough to show up clearly in the combination-print of the screens. If α is 15°, however, k equals 3.8 d and the pattern is now clearly visible as a disturbance in the combination-picture.

An effective measure against this 15° pattern is the use of an mezzograph screen in the yellow, in which the screen dots are distributed at random, so that no interference is possible.

The disadvantage of these screens is that it is exceedingly difficult to produce them with the uniformity of density which is required for reproduction. In consequence thereof such prints, as a rule makes a cloudy impression; moreover the production of these screens is very costly.

It has been tried to use 3 quaternary screens, the axes of these screens mutually forming an angle of 30°, said 3 screens being combined with one quaternary screen, the axis of which forms an angle of resp. 15°, 45° or 75°

2

with the axes of the first-mentioned screens and by choosing the dot-distance of this latter screen 1.1 times as small as the dot-distances of the other screens. By this measure no appreciable improvement is, however, obtained in comparison to the use of four screens with equal dot-distances.

In the German patent specification Number 646,441 it has been proposed to choose for the yellow a screen with double dot-distance and to put this into the same position as e. g. the screen of the red. This, however, leads to difficulties when it comes to printing, as, if this measure is taken, it is necessary in order to produce an equable colour impression that the dots of the two screens always have the same relative location, as shiftings of only a few hundredths of a mm. already cause a fundamental modification in the coincidence of the dots, deviations of colour being the consequence hereof.

The 15° pattern may be avoided by choice of screen positions relatively varying 22° 30', so that 4 screens may be placed within 90°; however, an extremely disturbing configuration of dots occurs if two equal screens are printed at an angle of 45°. It is the mean object of the invention to avoid the 15° pattern by providing a special combination of screens for four-colour printings.

It was found, that according to the invention a 15° pattern is substantially prevented by the use of 3 identical quaternary screens, the axes thereof forming angles of 30° respectively 60° and combining said screens with a fourth screen, which has approximately the double dot-distance, and an axis of which forms an angle of respectively 15°, 45° and 75° with the axes of the first-mentioned three screens.

Preferably this deviating screen is used for the yellow as the human eye is less sensitive to the contrast yellow-white than to contrasts between other colours and white; a yellow print of a certain screen gives the impression of being much finer if it is compared with a red, a blue or a black print of the same screen. Thus, the yellow may be printed in a coarser screen and yet give the same impression as prints made with finer red, blue or black screens. Only on the use of the fourth screen, the dot-distance thereof being at least 1.5 times as great as the dot-distances of the other three screens, a considerable improvement in the pattern is obtained, whereas the pattern becomes almost imperceptible at a dot-distance which is at least twice that of the other three screens.

If however the dot-distance is taken very large, even the yellow gives the impression of being printed in a coarse screen because each separate dot becomes clearly visible.

Therefore double dot-distance is preferably used for the screen, and a distance more than 2.5 times the dot-distance of the other screens is avoided.

So was obtained as an example a very good result with three quaternary screens each having 123 rows of dots per inch, and a fourth quaternary screen, having only 63 rows of dots per inch. This fourth screen was used for yellow, the axis of the screen being horizontal. The axis of the red, black and blue screens forming angles with the axis of the yellow screen of respectively 15°, 45° and 75°.

In the annexed drawings is given in Figure 1 in an enlarged scale a picture, indicating the screens according to this example.

In this figure the red screen is indicated with I, the black screen with II, the blue with III and the yellow with IV.

An even better result is obtained if a senary screen is used for the yellow, this screen being placed in a symmetrical position relative to the screens for red, black and blue, the position of these three screens mutually

3

varying 30°, thus in such a way that an axis of the senary screen is at an angle of resp. 15°, 45° and 75° with an axis of each of the other three screens. In that case the period of the dots in the yellow screen is chosen about twice as large as the period in the other screens. According to this method the structure of "15° pattern" becomes imperceptibly small.

An example of these screens is given in Figure 2, wherein are indicated in an enlarged scale three quaternary screens for blue (I), red (II) and black (III), having 133 rows of dots per inch and a senary Schulze screen (IV) having 97 rows of dots per inch, and a dot distance of $\frac{2}{3}\sqrt{3}$ the rows distance, the position of the screens for blue, red, black and yellow being 15°, 75°, 45° and 0°.

The invention can be applied for letterpress-printing, for litho printing (e. g. offset plates) as well as for intaglio.

Senary screens are known as such and are occasionally applied for the printing of textiles; however, they have not been used in combination with three quaternary screens for multicolour printing.

I claim:

1. A process for the production of four-colour prints, using three identical square screens, the corresponding symmetry axes thereof forming angles respectively of 30° and 60° for printing respectively three colours and using a fourth hexagonal screen, an axis of which forms an angle of 15°, 45° and 75° respectively with an axis of the three first-mentioned screens, the dot-distance of said fourth hexagonal screen being between 1.5 and 2.5 times the dot distances of the other screens for printing the fourth colour.

2. Devices such as blocks, offset-plates, intaglio cylin-

4

ders and plates for four-colour printing, whereby three of the devices are provided with an identical square screen, the axes thereof forming angles respectively of 30° and 60°, and a fourth hexagonal screen, an axis of which forms an angle of respectively 15°, 45° and 75° with the axes of the other three screens, the dot-distance of said fourth hexagonal screen being between 1.5 and 2.5 times the dot distances of the first-mentioned three screens.

3. Four colour prints comprising dots of three colours, said dots being arranged in square basic nets of a same colour the symmetry of which making mutual angles of 30°, and dots of a fourth colour being arranged in a hexagonal basic net the symmetry of which making angles with said three other symmetry axes of 15°, 45° and 75° respectively, the dot distance of the fourth colour being between 1.5 and 2.5 times the dot distances of the other colours.

References Cited in the file of this patent

FOREIGN PATENTS

497,194	Great Britain	Dec. 12, 1938
646,441	Germany	June 14, 1937

OTHER REFERENCES

Ilford Manual of Process Work, Clerc, 1944, published by Ilford Limited, Ilford, London, England, pages 358-367. (Copy in Div. 17.)

Photographic Journal, publication of the Royal Photographic Society of Great Britain, January 1938, pages 24-26. (Copy in Scientific Library.)

Commercial Engraving and Printing, Hackleman Commercial Engraving Publishing Co., Indianapolis, Indiana, 1921, page 272. (Copy in Div. 17.)