(Specimens.)

8 Sheets—Sheet 1.

F. C. HÖSCH.

THE PROCESS OF PHOTOMECHANICAL PRINTING IN COLORS.

No. 287,938. Patented Nov. 6, 1883.

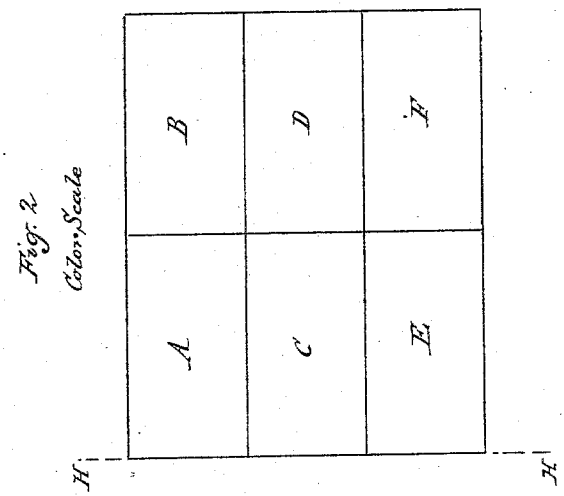


Fig. 2
Color, Scale

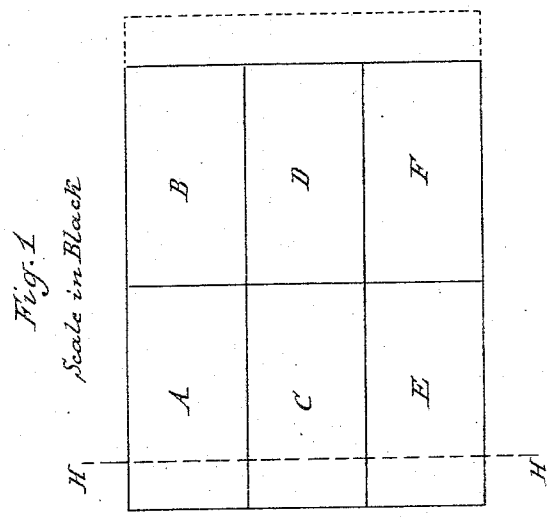


Fig. 1
Scale in Black

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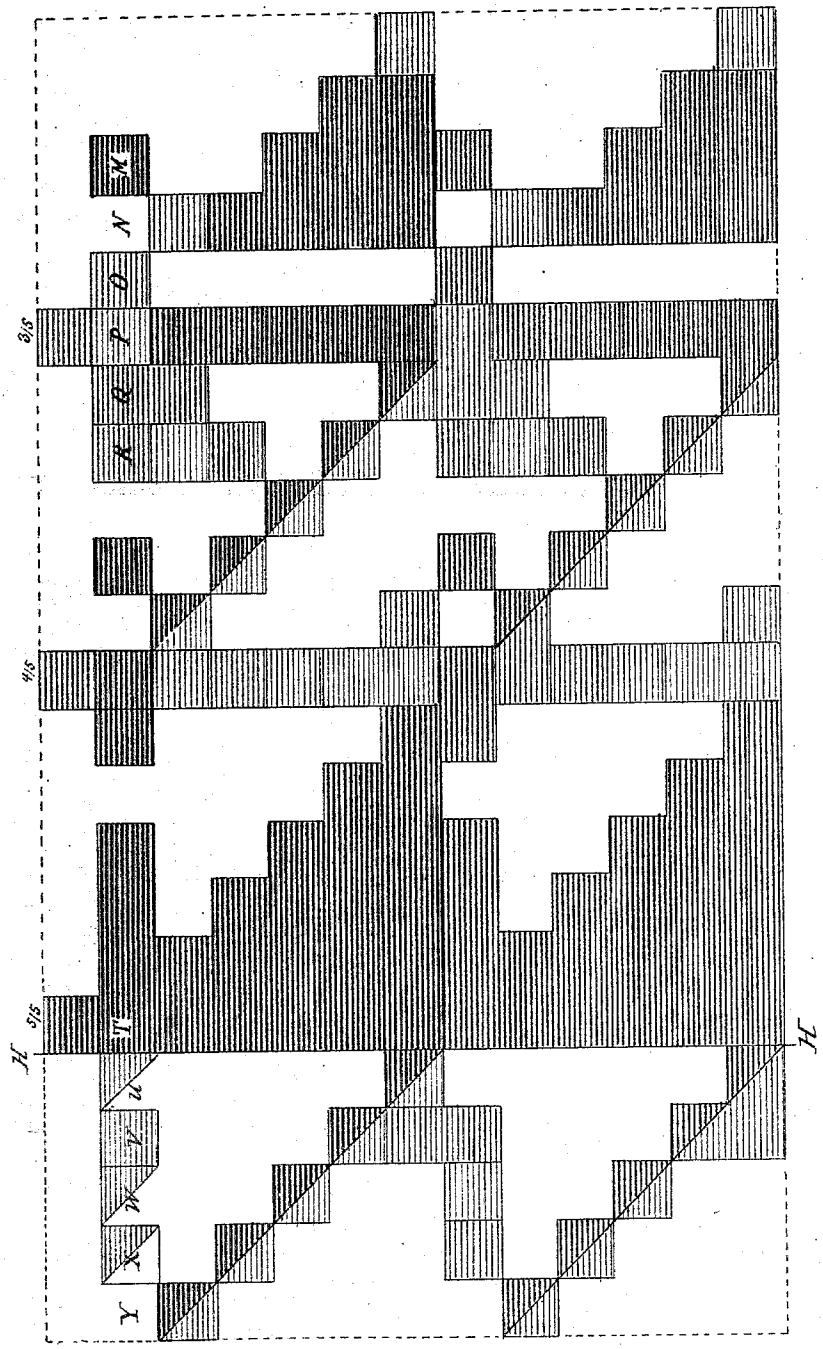


Fig. 1.

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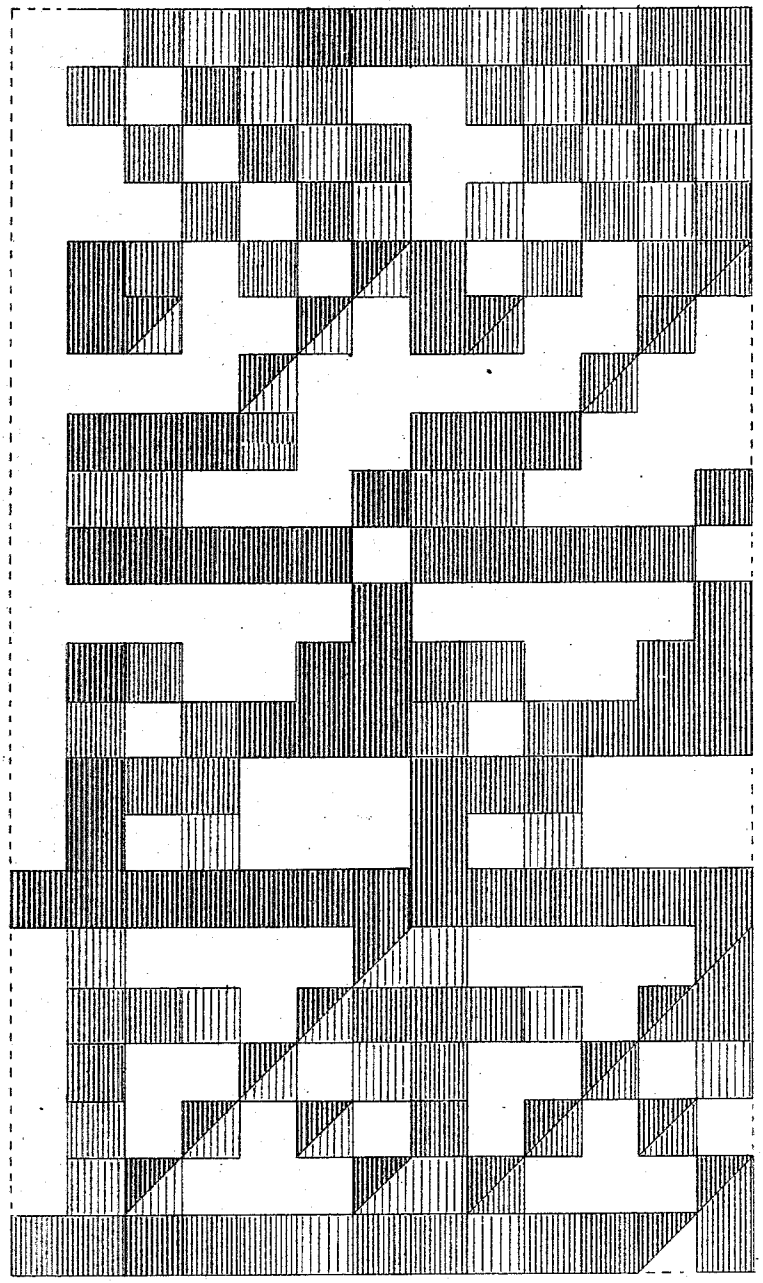


Fig. 1 B

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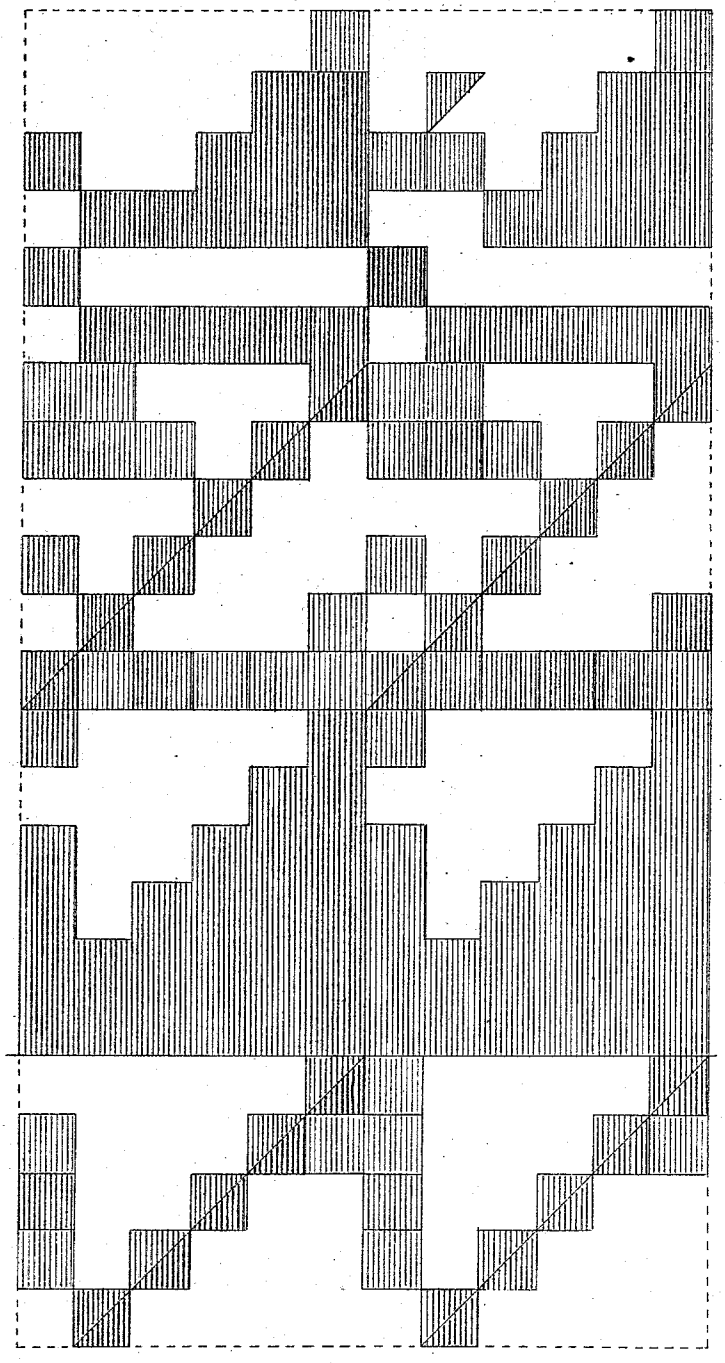


Fig. 1 C.

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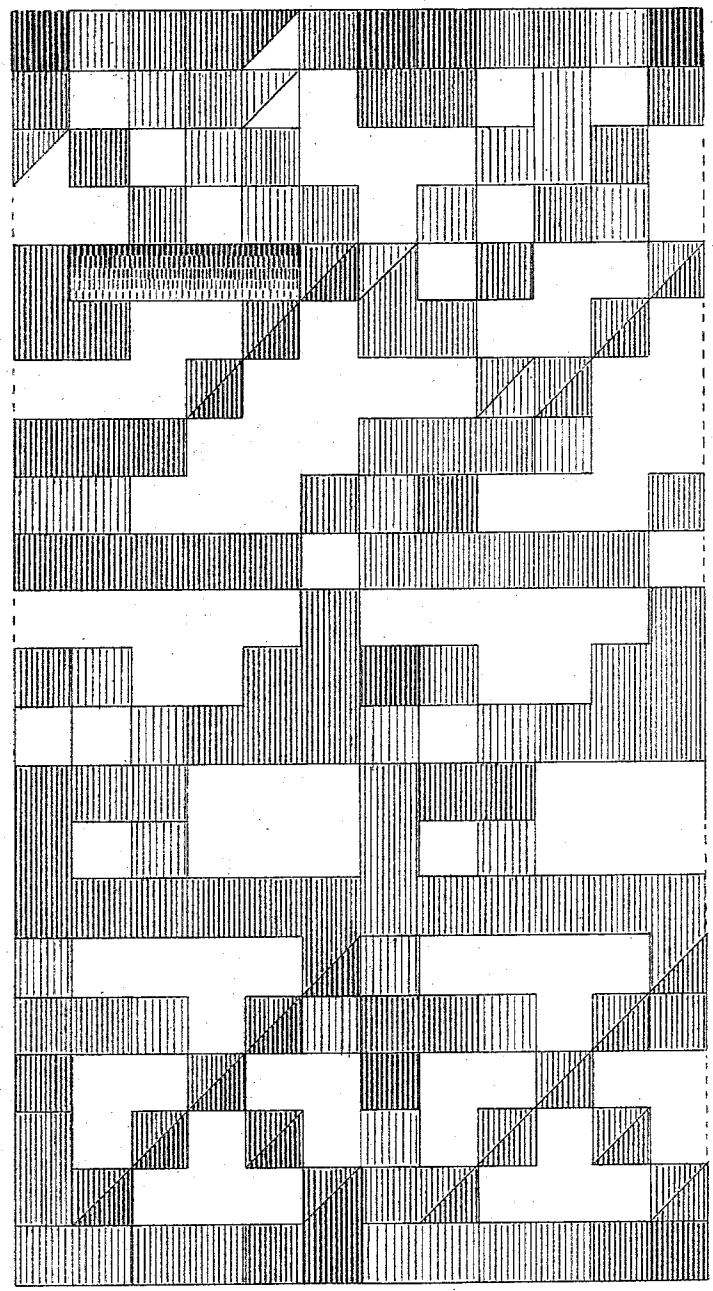


Fig. 1D

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THE PROCESS OF PHOTOMECHANICAL PRINTING IN COLORS.

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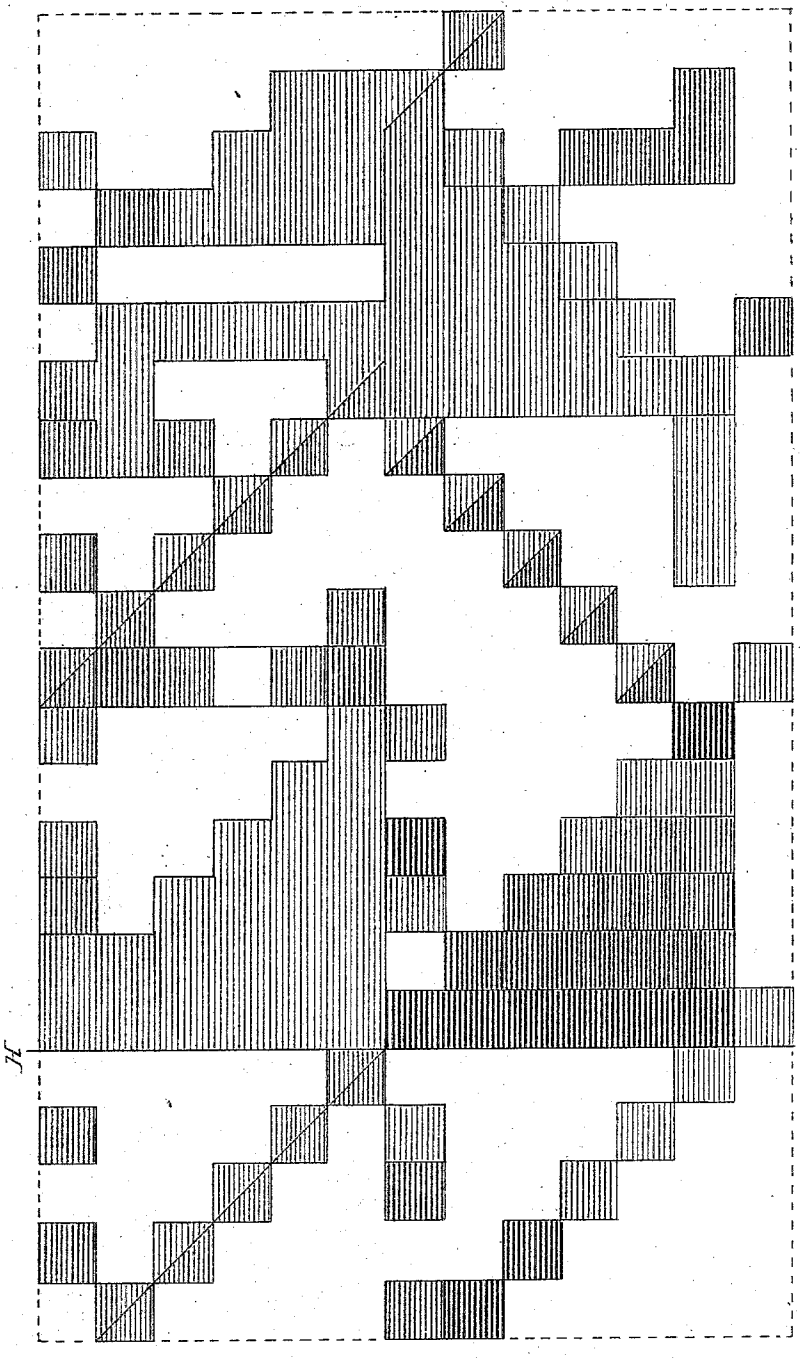


Fig. 1E

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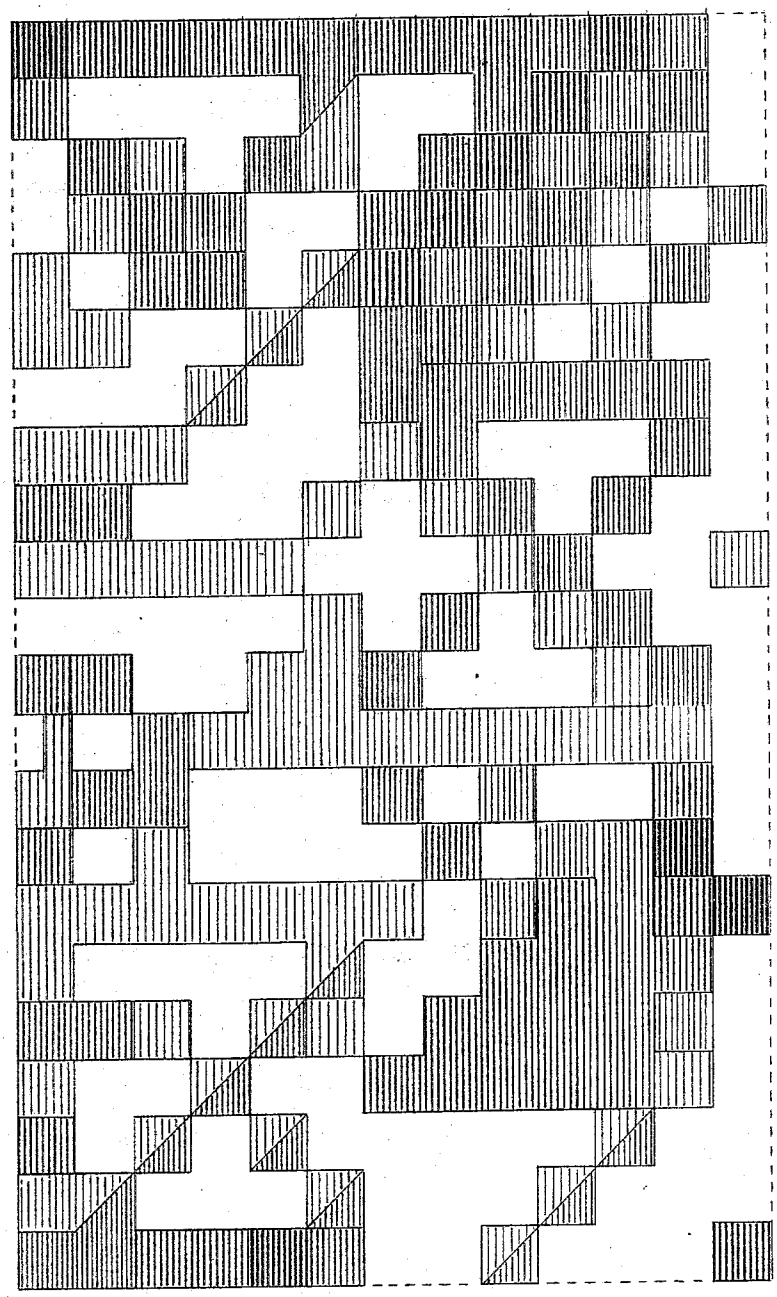


Fig. 1st

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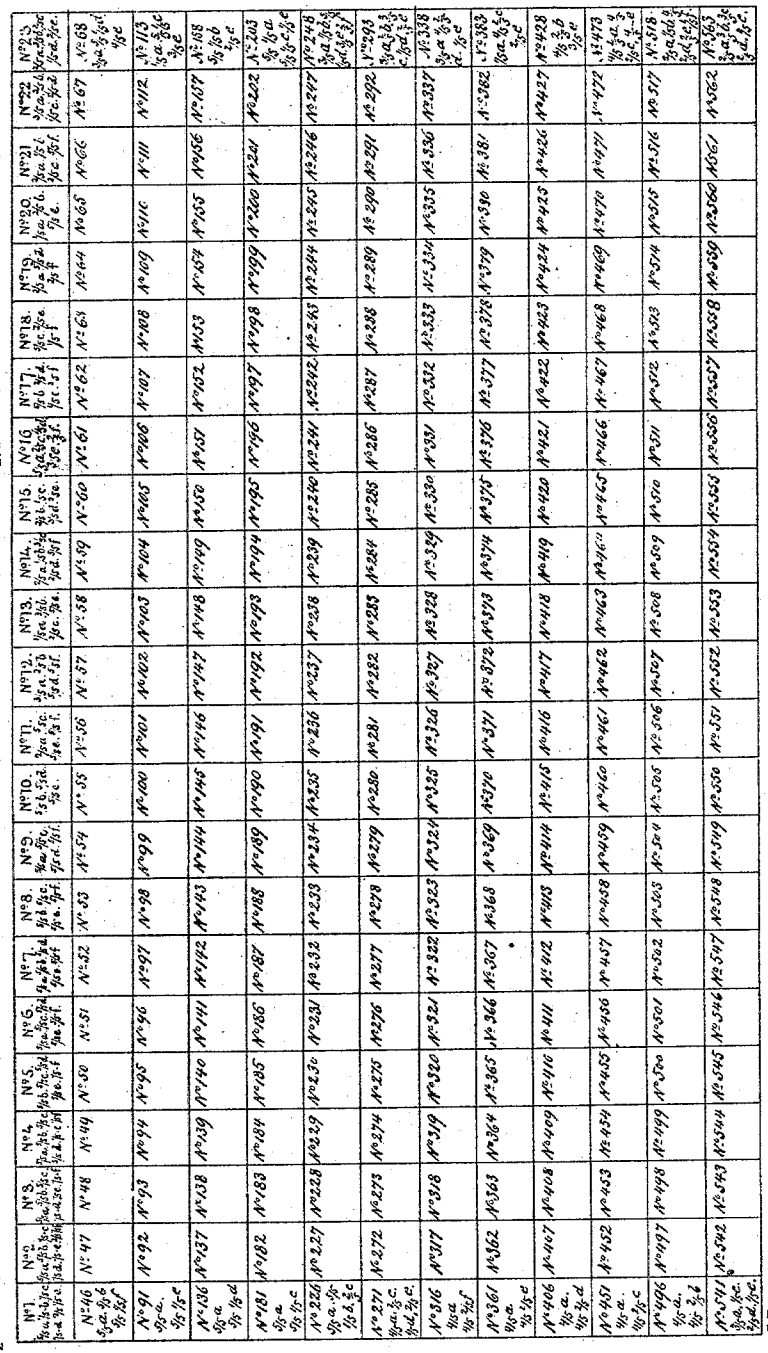
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THE PROCESS OF PHOTOMECHANICAL PRINTING IN COLORS.

No. 287,938. Patented Nov. 6, 1883.

Fig. 24



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UNITED STATES PATENT OFFICE.

FRIEDRICH CARL HÖSCH, OF NUREMBERG, BAVARIA, GERMANY.

PROCESS OF PHOTO-MECHANICAL PRINTING IN COLORS.

SPECIFICATION forming part of Letters Patent No. 287,938, dated November 6, 1883.

Application filed October 20, 1881. (Specimens.) Patented in Germany June 5, 1881, No. 17,410; in England August 12, 1881, No. 3,504; in Austria-Hungary October 6, 1881, No. 33,363; in France October 22, 1881, No. 145,472, and in Belgium October 29, 1881, No. 56,100.

To all whom it may concern:

Be it known that I, FRIEDRICH CARL HÖSCH, of Nuremberg, Kingdom of Bavaria, Germany, have invented an Improvement in the Process of Photo-Mechanical Printing in Colors by Means of a Color-Scale, of which the following is a specification.

The nature of my invention relates to new and useful improvements in that class of photographic-printing processes which are known as "licht druck" or "light printing;" and my invention consists in an improved process for photo-mechanical printing in colors, whereby all objects from nature or paintings are reproduced photographically, in any desired size and with their exact original colors, upon paper, fabrics, porcelain, glass, enamel, &c.; and the invention also consists in devising a color-scale, by means of which any color, in all its shades and tints, may be mechanically defined, for the purpose of reproducing it by light printing or any like process of superimposing colors, all as fully hereinafter described and set forth. From a given negative of the desired object are printed, by the well-known process of photo-mechanical printing, as many prints as may be required, their number being determined by the number of colors to be combined, one print being required for the production of a monochrome for each color. According to the current theory of colors, each color-tone is to be regarded as composed of given percentages of the three primary colors—yellow, red, and blue—and according to this theory all colors in nature could be perfectly reproduced in printing by the use of any or all of these three colors. The nature of our coloring materials, however, presents an unsurmountable obstacle to carrying this theory into practice, as none of our coloring materials possess the depth, brilliancy, and transparency combined which we see in the prismatic colors in nature. We are therefore forced, in order to imitate all and every natural color in print, to enlarge upon our means for producing it. For this purpose I devised a color-scale containing practically all the colors, in various shades and tints, as they are found in nature or in paintings, and wherein each color has been produced and can be reproduced in a mechanically well-defined manner by means of photo-mechanical printing in colors. The practical use of such a color-scale is self-evident when it is considered that the photographic negatives of colored objects very often do not furnish true lights and shades of the colors, that in the process of light printing the superimposed colors, owing to lack of transparency, more or less destroy the effect of the underlying colors, and that the transfer of the colors from the plate to the print is different in degree, according to the color coming on printed or unprinted spots. All these influences, which have made heretofore light printing in colors totally uncertain in its final results, are all anticipated in the use of my color-scale, which gives a mechanically well-defined way for obtaining a desired result.

The principle upon which my color-scale is constructed will be clearly understood from the following practical example, reference being had to the drawings, of which—

Figures 1^A to 1^F, inclusive, show a scale in black and different tones of gray in a variety of geometrical combinations; Fig. 2^A, a portion of the color-scale printed therefrom. Figs. 1 and 2 are diagrams.

In the drawings, in Figs. 1^A to 1^F, inclusive, are shown a number of black and gray squares, half-squares, and other geometrical figures arranged in various combinations, from jet black to light gray, in five well-defined degrees of shade. The absolute black we will characterize by $\frac{5}{5}$, while the different gradations of gray may be represented by the fractions $\frac{4}{5}$ $\frac{3}{5}$ $\frac{2}{5}$ $\frac{1}{5}$, the latter representing the lightest shade of gray. These shades are in practice produced with the brush, although they are on the drawings shown in lines, (to allow of their being photo-lithographed.) From this scale (in black and gray) a photographic negative is obtained and a light-printing plate produced, from which plate six impressions are to be printed in the following six colors: first, a yellow color, *a;* second, a red color, *b;* third, a blue color, *c;* fourth, a neutral tint, (modulation tone,) *d;* fifth, a local or flesh tint, *e;* sixth, a second red color, *f.* The printing is done in the following manner: After the first color is print-

ed, the second color, which is red, is not printed so as to register with the first or yellow print; but the plate is now printed upon the yellow impression in a position which is removed from the first the width of one square to the right, and so each successive color is printed upon the preceding one by shifting the plate the width of one square to the right. Thus, for instance, the square M in Fig. 1^A will register in the second impression with the square N, in the third with the square O, in the fourth with the square P, in the fifth with the square Q, and in the sixth and last impression with the square R. Now, if we characterize the six colors above named in their given order with the letters *a b c d e f*, the color upon the square M, after the six impressions have been made, will be composed, first, of $\frac{5}{5}$ yellow; secondly, no red, (the square N being a blank one, and therefore takes up no color on the plate;) thirdly, of $\frac{3}{5}$ blue; fourthly, of $\frac{1}{5}$ of neutral tint; fifthly, of $\frac{3}{5}$ of flesh tint; sixthly, of $\frac{2}{5}$ of red, superimposed in the order herein named.

In Fig. 2^A is shown the composition of the colors thus obtained from Fig. 1^A, beginning with the line H H, the printed squares to the left of this line being omitted, as they would be unnecessary repetitions of colors mostly obtained at the end of the scale. When obtained in practice, the color-scale thus produced by the six successive impressions in the manner described will show one thousand six hundred and twenty colored fields, (this being the number of squares on Fig. 1^{AF},) which contain a great variety of colors differing (with few exceptions) from each other, or where alike are often produced in a very different manner, as their exact definition in figures will show. Each field of this large collection of colors and tones displayed upon this color-scale is now numbered and marked in figures (as shown in Fig. 2^A, whereon the colors are, however, omitted,) denoting the composition of the colors. Thus No. 1, which is produced by printing upon the field T first yellow, then red from field U, blue from field V, neutral from field W, flesh tint from field X, and red from field Y, in the order described, is marked $\frac{5}{5}$ *a*, $\frac{1}{5}$ *b*, (meaning the half square,) $\frac{1}{5}$ *c*, $\frac{1}{5}$ *d*, $\frac{2}{5}$ $\frac{1}{5}$ *e*, (for each respective half-square.)

With the help of this color-scale thus perfected it is a very easy matter for the artist by comparison with any color of an original to find out how many color-plates will be needed for the production of such color, and, further, what percentage of each color has to be taken, the same succession of colors as given on the scale to be followed in the printing.

The manner of obtaining color-scales after the above-explained principle can be greatly varied as the succession and number of the foundation-colors may be changed. The color-scales may also advantageously be arranged according to color-tones, whereby the looking up of colors is greatly facilitated.

The process of colored light printing by the use of the above-described color-scale is conducted as follows: As mentioned in the beginning, a number of light prints in neutral gray are obtained from the given negative, and serve as foundation for the production of monochrome-plates. First, a comparison of the original with my color-scale will easily decide how many and what plates are necessary for the production of the colored object. Upon one of the light prints is then marked out on all necessary places the number of the color on the scale corresponding with the original color. The percentage of each color found in the color-scale is now marked upon the remaining prints upon the proper places—one print for each color. The prints thus obtained are now regulated with the brush, so that on the required places the desired percentage of color is represented in its equivalent in gray or black, a monochrome in gray and black for each color being thus obtained. Of these regulated prints, negatives of exactly corresponding sizes are produced, and light-printing plates of them prepared in the usual manner. The plate which has been obtained for the yellow color is now printed with yellow color, the plate for the red color is printed with red color, and the plate for the blue color is printed in blue color, the plates being made to register properly. These three colors combined give now a tolerably well-colored picture, which will be greatly improved and appear more finished by the use of the fourth plate, which is printed with the neutral tone. For the production of finer effects the use of the fifth plate, with which the local or flesh tint is printed, is in certain places often very desirable, where flesh or local tints enter into the composition. The use of the sixth plate is required when it is desired to heighten the effect of the red color, as madder-lake, owing to lack of body, often requires strengthening.

By means of the above-described process even persons of little artistic ability can succeed after a short time to produce very fine and faithful colored reproductions, which far surpass in softness and strength of color all chromolithographic pictures, in which the colors necessarily lose much of their strength and purity by considerable additions of varnish; and while I obtain with four or five plates in my process practically a better result than is obtained in chromography with fifteen or twenty plates, the preparation of my plates does not require more time than often does a single plate in any of the other processes. Another advantage of my process is the ease with which the production of different sizes of pictures can be simultaneously carried forward.

The above-described manner of producing monochrome-color originals may in certain cases be departed from, and the same may then be drawn directly with the brush and pencil.

My process for light printing in colors by the use of a color-scale can be applied with great advantage to the production of color-

photographs upon porcelain, enamel, and glass, producing easier, quicker, and better results for the following reasons, viz: The printing from properly-hardened chrome-gelatine plates with porcelain colors compactly mixed with the necessary amounts of a proper oil and flux presents less difficulties than the printing from lithographic stones, which soon fill up with the pigment, and as the admixture of oil or varnish to the colors in printing is a necessary evil in porcelain-printing, as it has to be dried and evaporated before the colors are burned in, to prevent blotting, the advantage of the light-printing process is obvious when it is considered that with the thick pigments used in light printing flatter and softer tones can be produced than with the much-diluted pigments necessary for flat tones in lithography. Finely-ground flux forms a necessary addition to the pigments to produce their burning in under the glaze, and generally three times the weight of the pigment is the amount of flux required. The pigment and flux are then intimately mixed together with balsam of copaiba, to the proper consistency, which will allow, when desired, the powdering-in process to be combined with the light-printing process. The color-prints are first mounted upon a temporary support on a thin film of copaiba-balsam laid on with the roller, or on a film of collodion.

To prepare my color-scale adapted to the production of pictures upon porcelain, I proceed as above described, except where otherwise stated. The printing is done upon a temporary support and with porcelain colors. The succession in which the pigments are printed depends upon their relative fusibility, and the printing is temporarily interrupted as soon as those pigments which easily fuse together and are mixed with the same flux are printed upon the temporary support, from which they are now transferred upon a porcelain plate and burned in. After this is done, the printing on a temporary support is then proceeded with, transposing the plate with each new color the width of one square to the right. This second color-scale, containing the remaining colors — such as purple and cobalt, the flux for which (borax) is different from that of the other colors—is then transferred upon the porcelain plate in its proper place, in which it would have come if no interruption had taken place. After a second burning in, the color-scale upon the porcelain plate is completed, and will show as a collection of different colors in as large a variety of shades and tints as the color-scale on paper. Should this scale not be sufficiently extended, more pigments may be made to enter into its composition.

For the powdering-in process a color-scale constructed after the principle herein described will be found of very great use for such process, as the colors can be thereby likewise mechanically defined. By comparing the object to be reproduced with the color-scale upon porcelain it is now easy to tell how many and what colors are required, and also how often they have to be burned in, so that a fine oil-painting can be reproduced upon porcelain in all its strength and effects, together with its technical qualities. The color-scale upon porcelain gives to the artist an intimate knowledge of the relative influences of the pigments upon each other and of their behavior in the fire—a knowledge which formerly required many years of practical experience; and combined with my process of light printing in colors the technical difficulties of painting upon porcelain have been entirely done away with by the photographic transferring.

I am aware of the Patent No. 173,408, and I do not claim a color-sample card having directions for mixing the colors, as described in said patent.

What I claim as my invention is—

1. The process herein set forth of producing color-printing plates by the aid of a color-scale, consisting in first producing a number of neutral prints from a given photo-negative, next marking upon one of the neutral prints, on all necessary places, the number or symbol of the color or combinations of color on the scale corresponding with the original color, next representing upon the remaining neutral prints the desired percentage of color in its equivalent shade in gray or black, and finally using said prints to produce relief-printing plates, substantially as specified.

2. As a new article of manufacture, the color-scale herein described, provided on its surface with separate series of a number of colors in different tints, and a separate series of different shades of a neutral tint, to correspond with the tints of the colors, the depth of the shade and tint being designated by figures or other symbols, and the whole adapted to be used to indicate the shade of neutral tint corresponding with the desired tint of color upon the print or object desired, substantially as specified.

F. CARL HÖSCH.

Witnesses:
OTTO ELTERICH,
PAUL REISSMANN.