

Feb. 26, 1929.

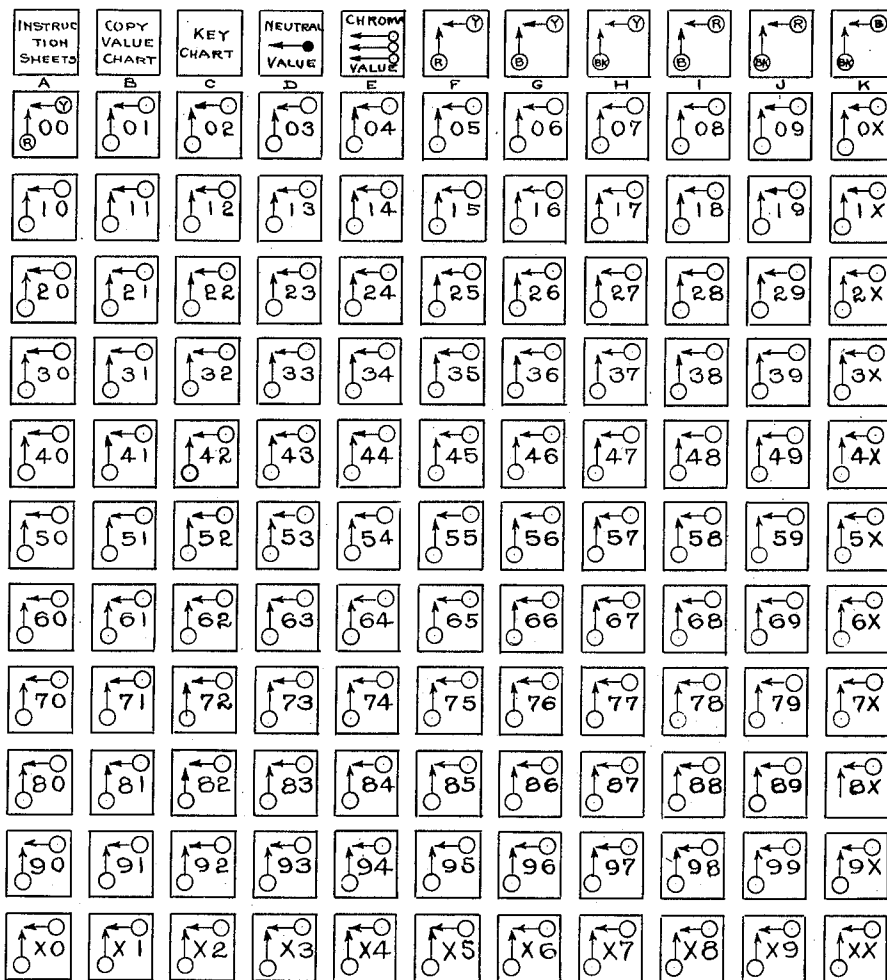
1,703,449

W. C. HUEBNER
METHOD OF AND APPLIANCE FOR COLOR IDENTIFICATION,
ANALYSIS, AND REPRODUCTION

Filed July 13, 1923

8 Sheets-Sheet 1

Fig. 1.



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8 Sheets-Sheet 2

Fig. 2.

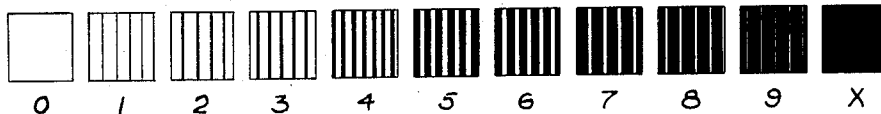


Fig. 3.



Fig. 4.

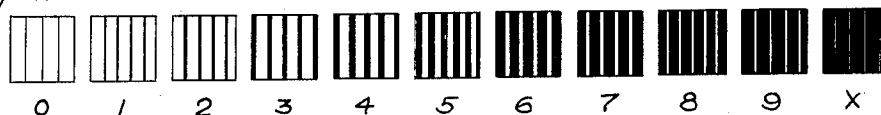


Fig. 5.



Fig. 6.

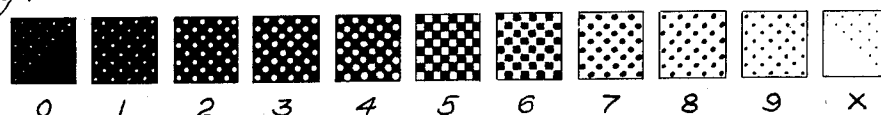


Fig. 7.

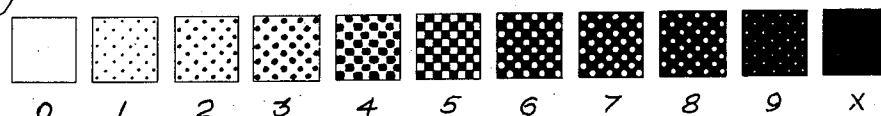


Fig. 8.



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8 Sheets-Sheet 3

KEY CHART

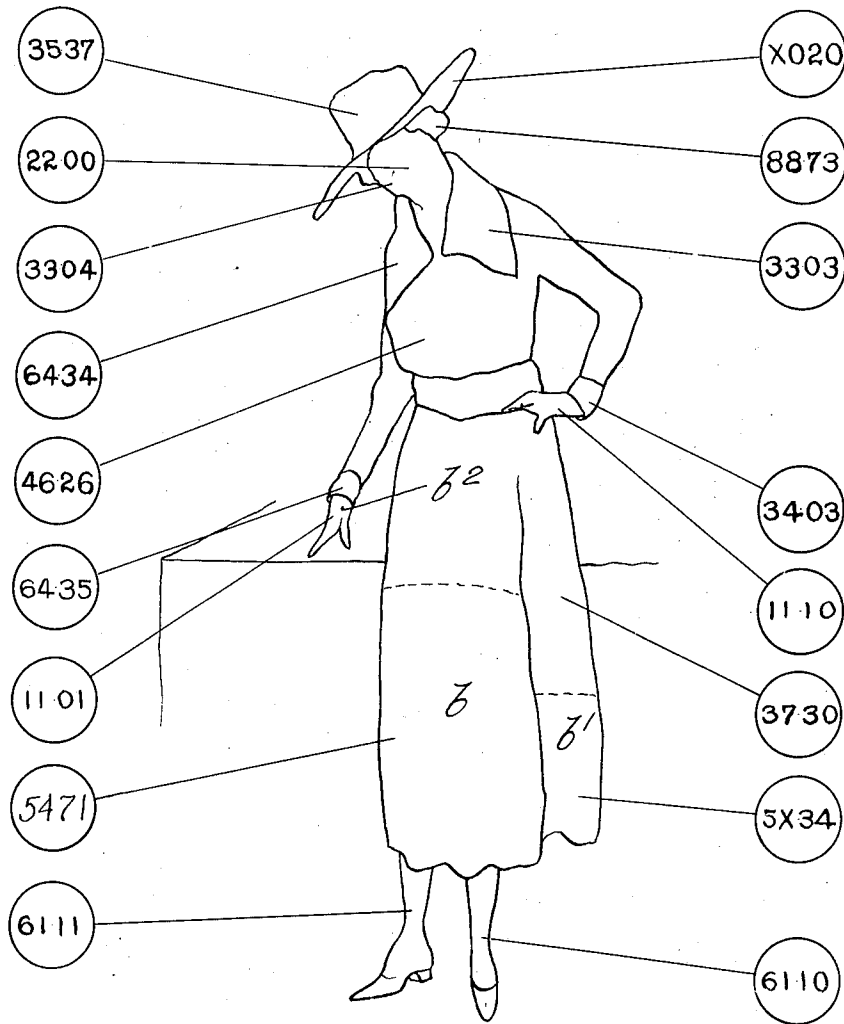


Fig. 9.

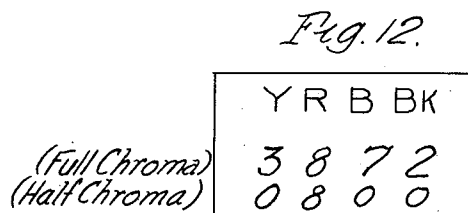
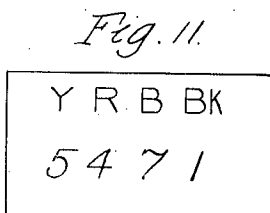
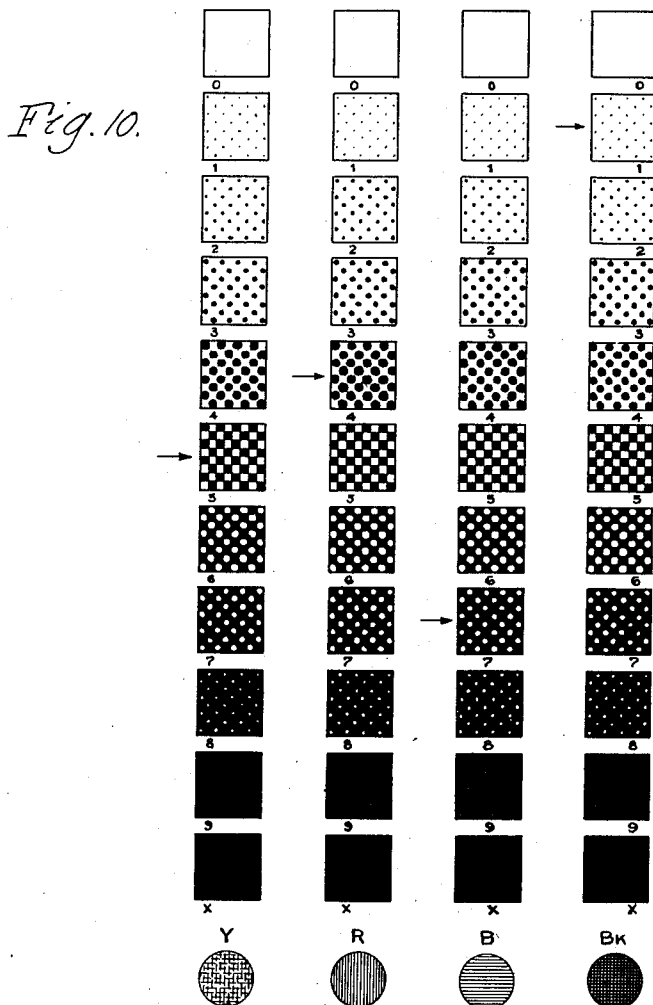
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8 Sheets-Sheet 4



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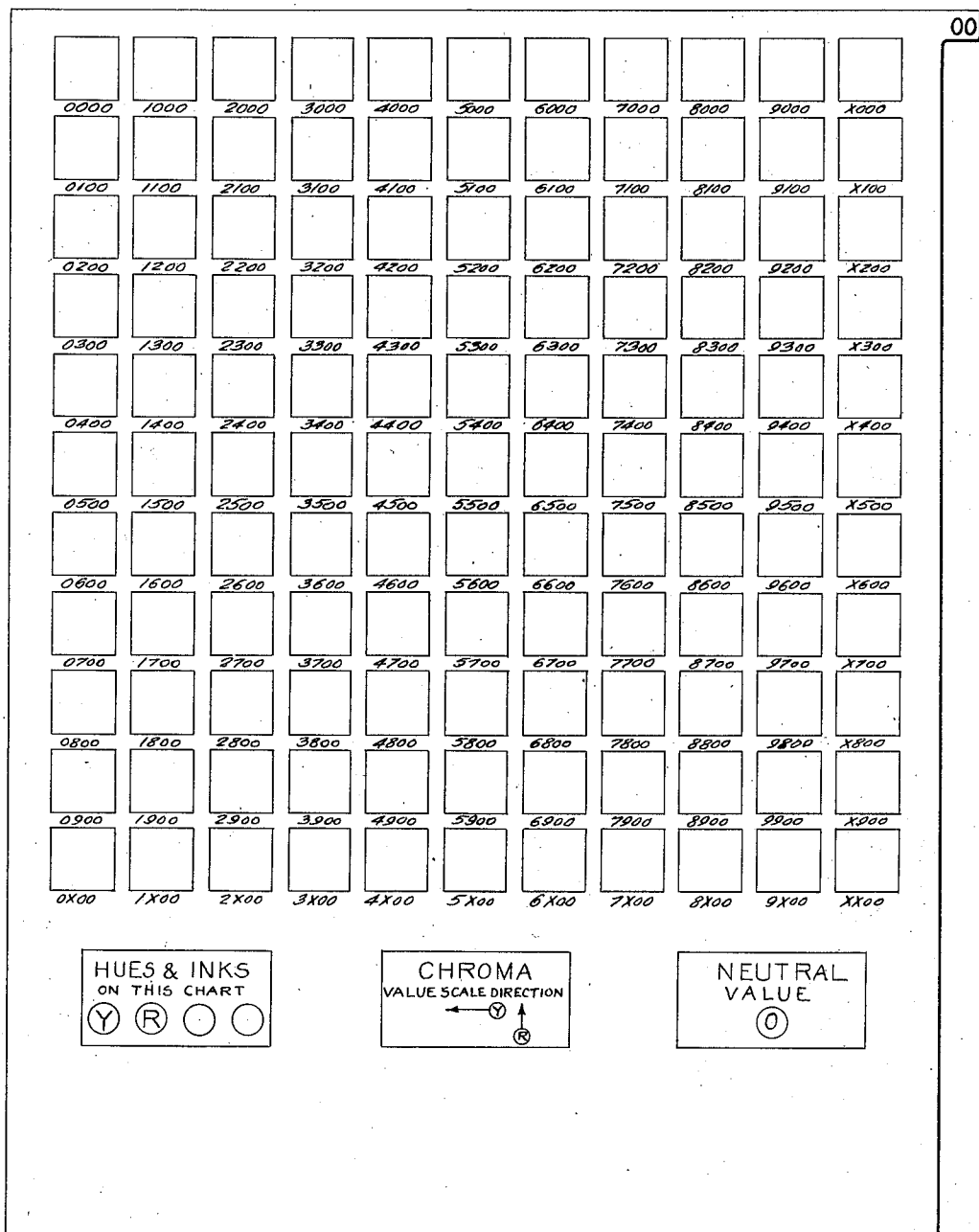


Fig. 13.

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8 Sheets-Sheet 6

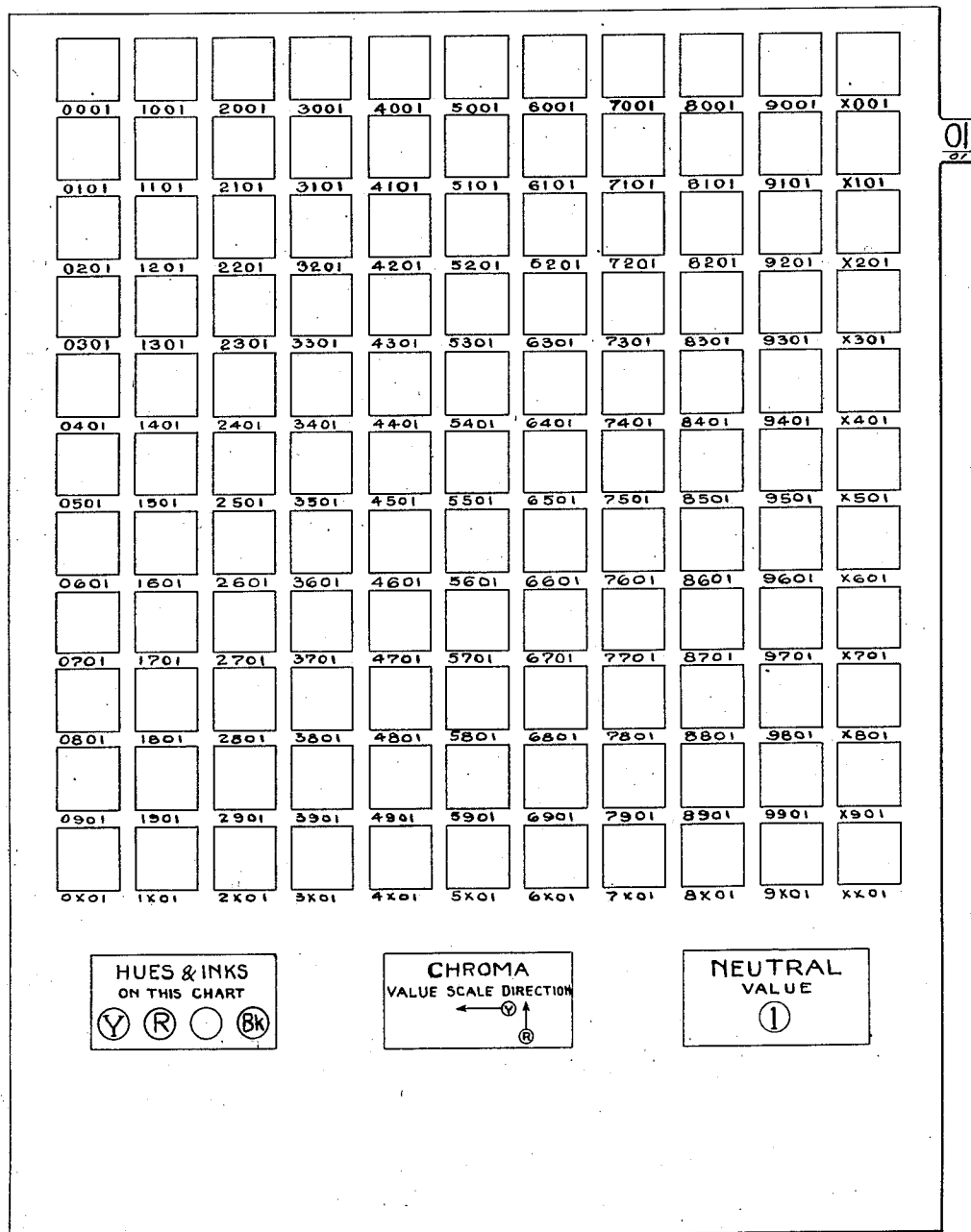


Fig. 14.

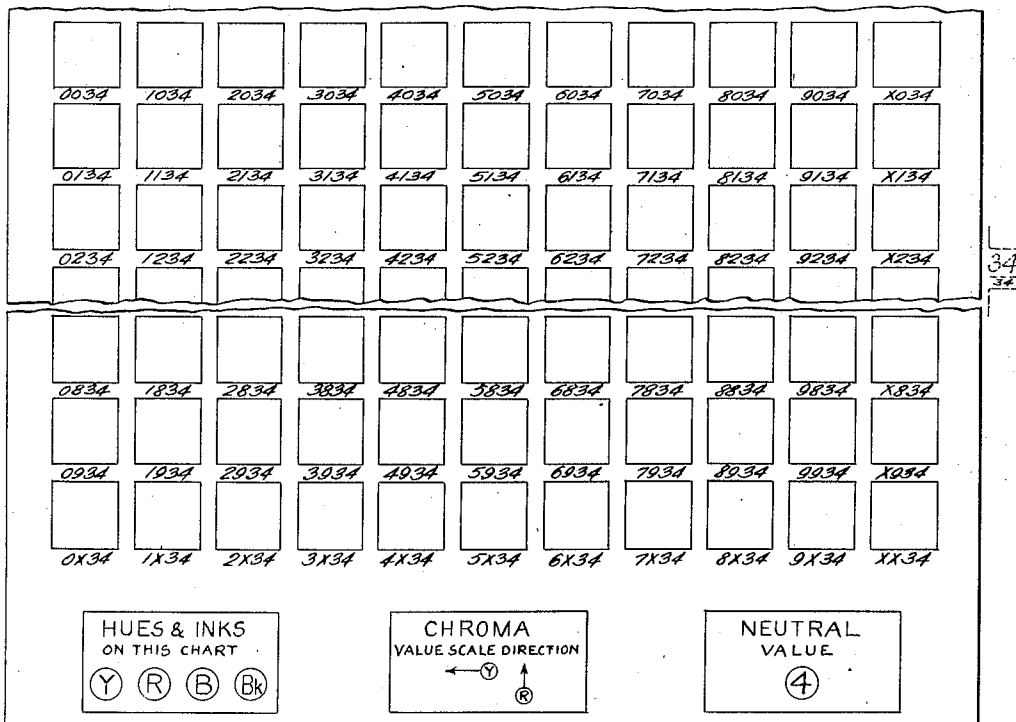
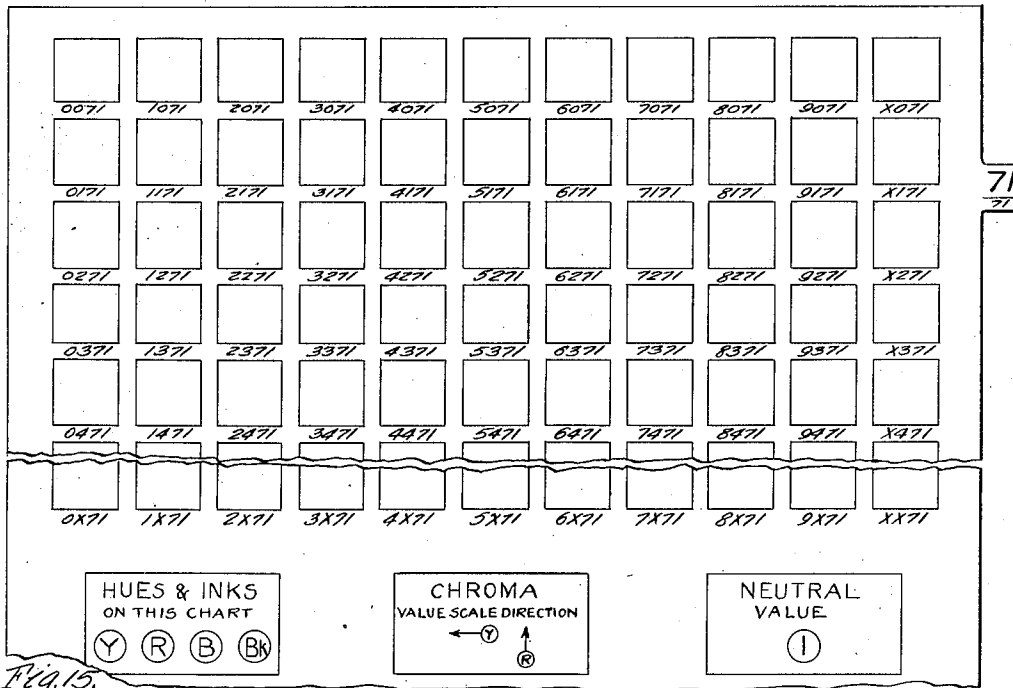
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8 Sheets-Sheet 8

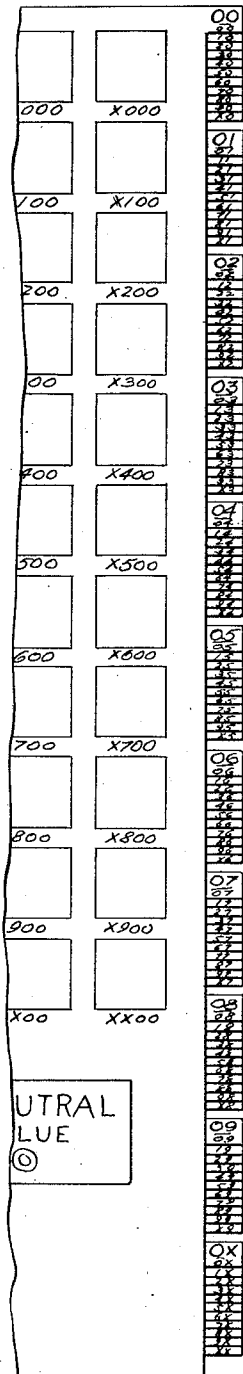


Fig. 17

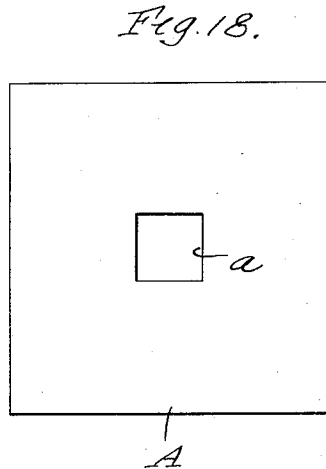


Fig. 18.

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPLIANCE FOR COLOR IDENTIFICATION, ANALYSIS, AND REPRODUCTION.

Application filed July 13, 1923. Serial No. 651,280.

This invention relates to a method of and appliance for color nomenclature, identification, analysis and reproduction for use in multi-color printing and for other purposes.

Heretofore, the color printing industry has lacked a practical and accurate system by which any color can be identified, analyzed and reproduced in practical printing inks along scientific and predetermined steps which eliminates all guess work.

When it is desired to reproduce a color copy, made with various combinations of pigments, by a photo-mechanical process, whether planographic, relief or intaglio, a set of printing plates must be produced and a different colored ink used on each to make a reproduction of the color copy. In order to reproduce the varied colors of the original copy, one, two, three or four inks, such as yellow, red, blue and black may be used, it being understood that combinations of two or more of these inks will produce various other tints or shades, the black being used as a neutral tint. These inks must be carefully chosen, both for their theoretical chroma, or color intensity, and their practical working qualities. All sets of inks now available, however, are a compromise of the above stated qualities and are not ideal.

At present, there is no scale for definitely measuring the different values of a color, so that it is impossible to accurately reproduce color values without "cut and try" methods. Resort must be had to trial proofs, corrections and make-overs, before the final values are close enough to make a satisfactory reproduction. At best, the judgment of the operator is only guesswork. His skill is the result of experience and observation, which, however, is insufficient to enable him at all times to accurately determine the component colors and their values in the infinite number of color combinations occurring between white and black.

One object of my invention is to provide a practical method or system and means by which any color, either pure or broken, may be identified, analyzed and reproduced in practical printing inks, by scientific, controlled and definite steps whereby all guess work is eliminated.

Other objects are to provide a color scale, preferably graduated in separate portions between no color and the full chroma or intensity of the yellow, red, blue and black

inks used, so that the various negative or positive color plates and proof sheets therefrom may be accurately gaged as to the values of various areas thereof; also to provide one or more charts having printed thereon facsimile repeats of said color scales of two or more colors combined in such relations to each other as to produce graduated combinations of these colors so that a complete number of four color combinations may be formed, preferably based on 11 divisions of chroma in each scale.

Still other objects are to provide means whereby any color combination or area in an original copy may be readily identified and analyzed from the color charts above described; and to provide each of the many color combinations of said charts with a different symbol or number indicating the scale values of the component colors so that selected areas of the original may be designated by the same key numbers as the corresponding color combinations on the charts and so that the selected areas can always be readily identified or reproduced by means of a permanent record without the necessity of again matching the areas with the color combinations of the charts.

Other objects of the invention will appear from the description and claims which follow:

In the accompanying drawings:

Fig. 1 is a diagram indicating the various charts or sheets and their preferred relative disposition in a color atlas arranged in accordance with the invention.

Fig. 2 is a graphic representation in the form of a graduated scale of a theoretical value copy to be reproduced.

Fig. 3 represents a dry-plate or continuous-tone negative made direct from Fig. 2.

Fig. 4 represents a dry-plate or continuous-tone positive made direct from the negative shown in Fig. 3.

Fig. 5 represents the positive shown in Fig. 4 after having been retouched to correct faulty values and to agree with the copy, Fig. 2.

Fig. 6 represents a half tone negative of the corrected positive, Fig. 5.

Fig. 7 represents a half tone positive which is made from the negative, Fig. 6, and which may be a metal printing plate, an ink print on paper, or otherwise.

Fig. 8 represents a grained plate, or ir-

regular grain positive print made from a negative such as shown in Fig. 3.

Fig. 9 is a specimen key chart as produced by my system, such specimen preferably comprising one of the pages of the atlas.

Fig. 10 is a graphic representation of the four chroma scales or color wedges, graduated from white or no color to full chroma, which are used to gage and correct the values of the various color plates.

Fig. 11 is a specimen key number as found on the key chart, Fig. 9, the values of which, as indicated by the figures, are located by arrows in Fig. 10.

Fig. 12 is a similar key number, supplemented by an additional key number representing the addition of half tints.

Figs. 13, 14, 15 and 16 represent four of the color sheets or charts containing the various color combinations and from which are obtained the key numbers used on the key chart, Fig. 9, of the various areas of the original color copy.

Fig. 17 indicates one method of indexing for the color charts.

Fig. 18 is a view showing one form of spotter used to isolate the color patches on the charts and the color areas of the original copy when matching one with the other.

In the practical application of this system, a pigment or chroma value measuring scale or wedge such as shown in Fig. 2 is used. This scale comprises a series of patches or portions of color graduated from white or no color at one end to full color at the other end. The number of color portions is arbitrary, eleven being shown, as it has been found that this number is sufficient to give the necessary values for the majority of color jobs.

Figs. 3-7 are graphic representations, which like the scale of Fig. 2 are printed in black ink, preferably on a single sheet or chart designated the "copy value chart" to show the successive photo-mechanical steps or operations which are performed when making a reproduction of an original color copy. The final result, Fig. 7, is an accurate half tone positive having the same color values as the scale in Fig. 2, so that the color plates produced from a given color copy by the use of these steps when printed together, will make a reproduction having the same chroma values as the original. Reproductions of this scale or wedge, Fig. 7 are printed in each of the four colors, yellow, red, blue and black, as shown in Fig. 10, on a sheet designated the chroma value chart. The inks comprising these colors, however, are of full strength or chroma and are not diluted or mixed with white pigment or ink to obtain the gradations for the color scales. The gradations are obtained by reason of the fact that the color scales or wedges are printed from half tone dots, grains or the like, and the intensity of the color is controlled by the

relative distance apart of the dots or grains which are printed on a white background. The several portions of each scale are numbered serially, as shown, from 0 for white or no color to X for full chroma, and the four scales form an accurate guide whereby the positive color plates, Fig. 4, may be retouched to correct values, as indicated in Fig. 5. The drawings show half tone dot formation, to be used as ink-conveyors on the printing plates, but this system can be applied equally well in methods of plate making where the ink conveyors are formed by chemical or photo-mechanical or other means or processes. For instance, Fig. 8 shows a grained plate adapted for this purpose.

In making the color sheets or charts, Figs. 13-16, repeat prints of the color scales of Fig. 10 are printed in various definite combinations, as will be described.

The first color sheet, Fig. 13, is prepared by printing eleven repeats of the yellow scale, preferably in horizontal rows, one below the other, with the full color squares at the right, and then printing eleven vertical repeats of the red scale over the yellow prints with the full color squares at the bottom. The result is indicated in Fig. 13, in which will be found one hundred and twenty one combination color patches or portions. The upper left hand unit designated 0000 will be pure white or colorless, and each of the other units will be a different combination of yellow and red, increasing in intensity towards the lower right hand corner patch designated XX00, which has the full value of both yellow and red.

In these color charts the colors comprising the several patches are always indicated in the same order, as for instance in the order, yellow, red, blue and black, black being considered as the neutral. Any other order could be used. If now it be remembered that each portion of the scale for each color has a different value number from 0 to X inclusive, the reading of the yellow-red chart, Fig. 13 will be horizontally from left to right, as follows: The first portion in the top row having no yellow or red is designated 00 in red and yellow value, and as no blue or black is used on this chart, the value of this square in all four colors is 0000. Reading the top row to the right, the yellow increases in value one digit at a time, while the red remains at 0 (zero), so that the second portion is designated 1000, the third 2000 and so on to the last portion of this row which is X000. The second horizontal row comprises yellow running from 0 to X as before, with the addition of 1 value of red, so the designations read 0100, 1100, 2100, 3100 and so on to X100. Therefore, by reading horizontally or vertically, the color values in any portion may be obtained between the first portion at the top left corner 0000 having no color and the last portion

at the lower right corner which is XX00, having full chroma yellow, full chroma red, no blue and no black. A total of one hundred and twenty one of these yellow-red charts or sheets are printed. If, therefore, eleven of these sheets are combined with blue, each sheet with a blue of different value, a total of 1331 different combinations will result. The blue, however, is printed in the same value on all of the portions of each sheet, that is, the first sheet, Fig. 13 as just described, will remain a yellow-red sheet with no blue, as the first value of blue is 0. The next sheet will be printed by superimposing value 1 blue on each of all of the one hundred twenty one squares, the next with a like number of value 2 blue and so on until the eleventh sheet will be over-printed with portions of the value X blue. Thus, the top row of the second sheet reads 0010, 1010, 2010, and so on indicating 0 yellow, 0 red, 1 blue, 0 black; 1 yellow 0 red, 1 blue, 0 black; 2 yellow, 0 red, 1 blue, 0 black; to X010, the last square in top row. Similarly the other squares of this sheet will be numbered with symbols having as the first two digits the various value figures of the yellow-red sheet plus 10 as the last two digits indicating the 1 value of blue and 0 black.

The next sheet is over printed with squares of value 2 blue and the symbols all end in 20. The last of the eleven red-yellow-blue sheets is over printed with value X blue and reads 00X0, 10X0, 20X0 and so on in the top row, the bottom right hand square now being XXX0 indicating X value yellow, X value red, X value blue and 0 value black.

The remaining sheets are now combined with both blue and black combinations, such as 0 blue, 1 black; 1 blue, 1 black; 2 blue, 1 black; 2 blue, 2 black, etc.; making a total of 121 sheets having thereon a grand total of 14,641 different color combinations of yellow, red, blue and black.

In this way a value 0 yellow combined with value 2 red, a value 3 blue and value X black will read 023X. The 121 sheets, therefore, include one sheet having yellow and red combinations only, ten having yellow, red and blue combinations only, and one hundred and ten having both blue and black values from 0 to X combined with the yellow, red colors.

When using the color charts for the purpose of reproducing a color copy, an outline copy or a black and white photo print of the copy is preferably made, either of which is used to prepare what is herein called a "key chart," see Fig. 9. Various portions of the original copy are selected as dominant color areas, and are "spotted" or isolated from the surrounding portions of the subject by means of a spotter, such as is shown in Fig. 18 and which comprises a white card or the like A provided with an aperture a of approximately the same size and shape as the color portions of the charts. Assuming it is de-

sired to identify the exact color and component ink chroma of the lower left hand portion b of the picture shown in Fig. 9, then this area or a part of it is isolated by means of a spotter, and the charts are examined to find approximately the same shade or color. Then another spotter is preferably used on the chart to isolate the exact shade from its neighbors. In this large number of combinations all shades may be matched to a degree that will insure accurate practical results. The symbol or number of the color portion selected is written on the margin of the key chart and connected by a lead line to the area thereof corresponding with the selected color area on the original. For example, assuming that the shade of the area b is designated 5471 on the color chart, then this number is placed on the key chart and connected by a line to that area. Similarly the area b' may be designated by the symbol 5X34. These color portions will be found on the charts represented in Figs. 15 and 16 of the drawings, while the area b^2 , for example, of the outline will be designated by 1101 and the corresponding color appears on the chart shown in Fig. 14. In this way, repeat orders or jobs required from a given original color copy may be produced from the key chart which constitutes a permanent record of the analysis of the particular job, without further reference to the original copy or the color charts. Upon referring to the sheet represented in Fig. 10, and which contains the four color scales, it will be apparent that each component color value of a particular shade, one on each of the four color plates employed to print reproductions of the copy may be matched, or retouched to match with the correspondingly numbered portion on its color scale. Figs. 10 and 11 illustrate this in connection with the color number 5471, that is the selected area of the yellow color plate should match scale value 5 of the yellow scale; while the red plate should match value 4 of the red scale; the blue plate value 7 of the blue scale; and the black, value 1 of the black scale.

This method of correcting or retouching is pursued in working up all the various areas on the four color plates. When prints are made from these plates in the like inks or chromas to those used in the color sheets, the result will be an accurate reproduction of the original obtained without guess work or trial.

In making reproductions of certain color copies it may be decided that one or more of the colors of the original will require strengthening or that one of the colors is too strong. In such cases the use of half tints or half chroma may be resorted to.

If, for instance, a pink shade of half the strength of the normal red chroma is desired, for the purpose of enriching the red color printing, a scale is made by reducing the red

ink to half strength and printing a scale so that the X value of the pink is equal in strength to the 5 value of the red. The other values of the pink will be graduated so that the alternate portions from X to 0 will match the values 5, 4, 3, 2 and 1 respectively of the red, thus giving ten shades and 0, five of the values being between the values 5—4—3—2—1—0 of the normal red. A duplicate red color plate may be produced and used with half strength red or full strength pink ink matching the pink scale to overprint the red plate impression produced from the red plate.

The formulæ or symbols for a job of this sort would be written as shown in Fig. 12, 3872 in which the full chroma value of 3 yellow, 8 red, 7 blue and 2 black is supplemented by a pink of the value 8 which will be half chroma 0800. Where such original is considered too strong in red the symbols for the above example would be 3072 plus 0800, indicating value 8 on the pink scale or only half strength red with the other colors remaining full strength.

The several charts or sheets are preferably bound together to form an atlas or otherwise conveniently arranged, and for the purpose of indexing the one hundred and twenty one color charts or sheets to facilitate ready analysis of color copies and for reference, an index sheet is prepared as indicated in Fig. 1 which shows diagrammatically the arrangement of the charts in the atlas. Each square below the upper row indicates one of the color sheets and shows at once the blue and black values by the numerals thereon, which comprise the last two digits of the symbols on a given sheet. As shown, on the index sheet the blue values increase vertically downward and the black values horizontally to the right. Each sheet is provided with an index tab having as its number its blue and black symbols similar to those on the index sheet, the tabs being arranged, for example, as in Fig. 17, with the blue values increasing vertically downward and the black values increasing from front to back of the atlas. In this way any combination of the yellow and red together with the various values of blue or black, or both, may be readily located.

In the upper row of Fig. 1 reading from left to right, the first three squares are self-explanatory; the fourth and fifth squares indicate pages having respectively the black scale and the yellow, red and blue scale of Fig. 10 printed thereon. The remaining six squares indicate six pages each having 121 color squares printed thereon by repeats as in the case of the yellow and red combination sheet 00, Fig. 13, the color squares comprising a complete series of two color combinations for any two chromas selected.

The index may be arranged in any other suitable or desired manner. While the color charts are described as being preferably

bound in an atlas, the invention is not limited to such arrangement, as various other methods of grouping or arranging the charts may be employed.

From the foregoing description, it will be apparent that a system of multi-color nomenclature, identification, analysis and reproduction has been devised which permits of scientifically accurate reproduction of color copies without trial and guesswork and which therefore materially reduces the cost and time in the preparation of work of this sort.

I claim as my invention:—

1. An appliance for the purpose described comprising a plurality of monochromatic scales each of different color and each composed of a graduated series of portions serially numbered, and a color chart composed of facsimile prints of two or more of said scales combined so as to form different color combinations each designated by a symbol composed of the serial numbers of the separate scale portions of the colors of which it is composed.

2. An appliance for the purpose described comprising a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions serially numbered, said facsimiles being combined so as to form different color combinations, and each of said different color combinations being designated by a symbol composed of the serial numbers of the separate scale portions of the colors of which it is formed.

3. An appliance for the purpose described comprising a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions serially numbered, said facsimiles being combined in a predetermined order so as to form an orderly series of different color combinations, and each of said different color combinations being designated by a symbol composed of the serial numbers of the separate scale portions of the colors of which it is formed, the numbers in the symbols representing portions of the same scale being arranged in the same order.

4. An appliance for the purpose described comprising a color chart composed of repeat facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, the facsimiles of one scale being repeated in rows running one way and the facsimiles of the other scale being repeated in rows running a different way and combined with the facsimiles of the first scale so as to form different color combinations.

5. An appliance for the purpose described comprising a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of

a graduated series of portions, said facsimiles being combined in a predetermined order, and facsimiles of a portion of one or more additional scales being also combined with the facsimiles of said two or more scales so as to form different color combinations.

6. An appliance for the purpose described, comprising a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed.

7. An appliance for the purpose described comprising a plurality of monochromatic scales each of different color and each composed of a graduated series of portions, a color chart composed of facsimiles of two or more of said scales combined so as to form different color combinations each designated so as to indicate the particular scale portions of the colors of which it is composed.

8. An appliance for the purpose described, comprising a color chart composed of repeat prints of two or more monochromatic scales each of different color and each composed of a series of portions graduated from no color to full chroma, the prints of the different scales being combined so as to form a graduated series of color combinations each designated so as to indicate the particular scale values of the colors of which it is composed.

9. An appliance for the purpose described, comprising a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, and a key chart having means thereon for identifying selected areas of an original color copy to be reproduced with like color combinations on the color chart.

10. An appliance for the purpose described, comprising a plurality of monochromatic scales each of different color and each composed of a graduated series of portions, a color chart composed of facsimiles of two or more of said color scales combined so as to form different color combinations, each designated so as to indicate the particular scale values of the colors of which it is composed, and a key chart having means thereon for identifying selected areas of an original color copy to be reproduced with like color combinations on the color chart.

11. An appliance for the purpose described, comprising a copy value chart, a plurality of monochromatic scales each of different color and each graduated in corre-

spondence with said copy value chart, a color chart composed of facsimiles of two or more of said color scales combined so as to form different color combinations, each designated so as to indicate the particular scale values of the colors of which it is composed, and a key chart having means thereon for identifying selected areas of an original color copy to be reproduced with like color combinations on the color chart.

12. An appliance for the purpose described, comprising a color chart composed of repeat prints of two or more monochromatic scales each of different color and each composed of a series of portions graduated from no color to full chroma, the prints of the different scales being combined so as to form a graduated series of color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, and a key chart comprising a representation of an original color copy to be reproduced, said representation having selected color areas of the original indicated thereon bearing the designations shown by the color chart for the color combinations of corresponding areas of the original.

13. An appliance for the purpose described, comprising a copy value chart, a color chart composed of repeat prints of two or more monochromatic scales each of different color and each composed of a series of portions graduated from no color to full chroma, the prints of the different scales being combined so as to form a graduated series of color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, said copy value chart indicating successive steps for making color plates from an original color copy to be reproduced which plates when used to make a multicolor print will give an exact color reproduction of the original.

14. An appliance for use in making multicolor reproductions from an original color copy including a plurality of color scales each of a different color, color charts each produced by making repeat facsimile prints of one of said color scales in rows extending in one direction on each chart and superimposing thereon repeat facsimile prints of one or more of the other color scales in rows extending in a different direction to said first mentioned rows to produce on each chart a plurality of combinations of said colors, each combination being different from the others on the same chart and each chart bearing a different set of color combinations from the other charts.

15. An appliance for use in making multicolor reproductions from an original color copy including a graduated monochrome scale, a printing plate made from said monochrome scale, a plurality of graduated color

scales each of different color printed from said plate, a color chart comprising superimposed facsimile prints of two or more of said color scales and forming different color combinations on said chart, means for identifying selected areas of said original with color combinations on said chart, said identifying means constituting a key where-
 5 by color plates of said original may be compared with said color scales to produce an accurate reproduction of said original.

16. An appliance for the purpose described, comprising a color chart composed of repeat prints of two or more monochromatic scales each of different color and each composed of a series of portions graduated from no color to full chroma, the prints of the different scales being combined so as to form a graduated series of color combinations, and a series of repeat prints of any one portion of one or more of the remaining color scales superimposed on said color combinations, each of said color combinations being designated so as to indicate the particular scale portions of the several colors of which it is composed.

17. The method of making reproductions of an original color copy including using a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color composition of said areas, and using in the corresponding areas of the reproduction the scale values of the colors indicated in the color combinations selected from the chart.

18. The method of making reproductions of an original color copy, including using a plurality of monochromatic scales each of different color and each composed of a graduated series of portions, using a color chart composed of facsimiles of two or more of said scales combined so as to form different color combinations each designated so as to indicate the scale portion of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color composition of said areas, and using in the corresponding areas of the reproduction the scale values of the colors indicated in the color combinations selected from the chart.

19. The method of making reproductions of an original color copy including using a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations

each designated so as to indicate the particular scale values of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color composition of said areas, preparing a color plate for each of the several colors composing the color combinations selected from the chart; the different areas of each plate having the color values indicated by the chart in the corresponding areas of the original, and making a multicolor print from said plates.

20. The method of making reproductions of an original color copy including using a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color composition of said areas, making a photographic printing plate from the original for each of the several colors comprising the color combinations selected from the chart, correcting said color plates to give the different areas of each the color values indicated by the chart in the corresponding areas of the original, and making a multicolor print from said plates.

21. The method of making reproductions of an original color copy including using a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color composition of said areas, making a photographic printing plate from the original for each of the several colors composing the color combinations selected from the chart, correcting said color plates by the aid of the corresponding color scales to give the different areas of each the color values indicated by the chart in the corresponding areas of the original, and making a multicolor print from said plates.

22. The method of making reproductions of an original color copy including using a color chart composed of facsimiles of two or more monochromatic scales each of different color and each composed of a graduated series of portions, said facsimiles being combined so as to form different color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, comparing different color areas of the original with said color combinations of the chart to determine the color com-

position of said areas, making a key chart having areas representing the selected areas of the original and respectively designated like the selected color combinations of the color chart, and using in the corresponding areas of the reproduction the scale values of the colors as indicated by the key chart.

23. In an appliance for the purpose described, a value-measuring scale comprising a plurality of portions arranged in a graduated series from no color to full chroma at its extremities, the portions between said extremities being each composed of half tone dots or the like of different size and spacing from those comprising the remaining portions of the scale, and a plurality of monochromatic scales each of different color comprising reproductions in full chroma pigments of said value-measuring scale, and which are combined so as to form different color combinations by reason of their different half tone portions.

24. In an appliance for the purpose described, a value-measuring scale comprising a plurality of portions arranged in a graduated series from no color to full chroma at its extremities, the portions between said extremities being each composed of half tone dots or the like of different size and spacing from those comprising the remaining portions of the scale, and a color chart composed of repeat facsimiles of two or more monochromatic scales each of different color, each facsimile comprising a reproduction in full chroma pigment of said value-measuring scale, the facsimiles of one scale being repeated in rows running one way and the facsimiles of the other scale being repeated in rows running a different way and combined with the facsimiles of the first scale so as to form different color combinations.

25. In an appliance for the purpose described, a value-measuring scale comprising a plurality of portions arranged in a graduated series from no color to full chroma at its extremities, the portions between said extremities being each composed of half tone dots or the like of different size and spacing from those comprising the remaining portions of the scale, and a plurality of monochromatic scales each of different color comprising reproductions in full chroma pigments of said value-measuring scale and which are combined so as to form different color combinations each designated so as to indicate the particular scale value of the colors of which it is composed.

26. An appliance for the purpose stated, comprising a copy value chart, a color chart composed of repeat prints of two or more half tone monochromatic scales each of different color and each composed of a series of half tone portions graduated from no color to full chroma, the prints of the different scales being

combined so as to form a graduated series of half tone color combinations each designated so as to indicate the particular scale values of the colors of which it is composed, said copy value chart indicating successive steps for making half tone color plates from an original color copy to be reproduced, which plates when used to make a multicolor half tone print, will give an exact color reproduction of the original.

27. A color chart upon which are displayed a plurality of spots representing the hues and luminosities of mixtures in various combinations of three diverse hues, one of said three diverse hues being a common ingredient to, and having a uniform degree of luminosity in, each mixture, each of the other two of said three diverse hues which separately form the other ingredient for double mixtures being arranged in graded degrees of luminosity, and mixtures of the other two of said three diverse hues which form the other ingredient for triple mixtures, each of said mixtures of the other two of said three diverse hues being formed by mixing a color like one of said graded degrees of luminosity of one of said two hues with a color like one of the said graded degrees of luminosity of the other of said two hues.

28. A color chart upon which are displayed a plurality of spots representing the hues and luminosities of mixtures in various combinations of two diverse hues with neutral gray, the neutral gray being a common ingredient to, and having a uniform tone in, each mixture, each of said two diverse hues which separately forms the other ingredient for double mixtures with the neutral gray being arranged in graded degrees of luminosity and each ingredient hue of the mixtures of the two hues used in making the triple mixtures with the neutral gray being arranged in graded degrees of luminosity.

29. A color chart upon which are displayed a plurality of spots representing the hues and luminosities of mixtures in various combinations of three diverse hues with neutral gray, the neutral gray being a common ingredient to, and having a uniform tone in, each mixture; and one of said three diverse hues being a common ingredient to, and having a uniform degree of luminosity in, each mixture, each of the other two of said three diverse hues which separately forms the other ingredient for triple mixtures with the neutral gray being arranged in graded degrees of luminosity, said two hues being so arranged that their most luminous parts converge toward a common point and each ingredient hue of the mixtures of the other two of said three diverse hues used in making quadruple mixtures with the neutral gray being arranged in graded degrees of luminosity, the most luminous colors of the said mixtures of the other two hues

used in making the said quadruple mixtures converging generally toward said common point.

30. A color chart upon which are displayed in separate patches, first two diverse hues, in graded degrees of luminosity, the hues being so arranged that their most luminous colors converge toward a common point, and second,

the hue in graded degrees of luminosity which results from the mixture of said first two hues, and a plurality of colors which form graded variations of hue and luminosity between said resultant hue with its graded degrees of luminosity and each of said first two hues with their graded degrees of luminosity.

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