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HALF-TONE COLOR PRINTS

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Fig. 1.

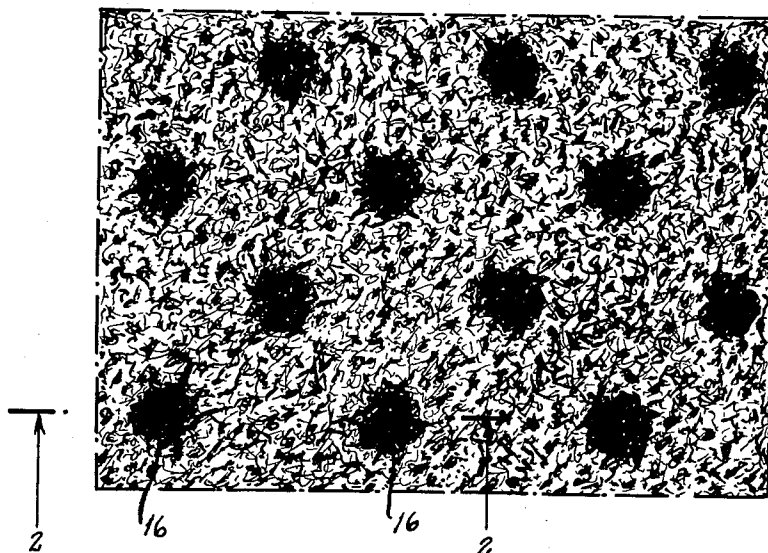


Fig. 2.

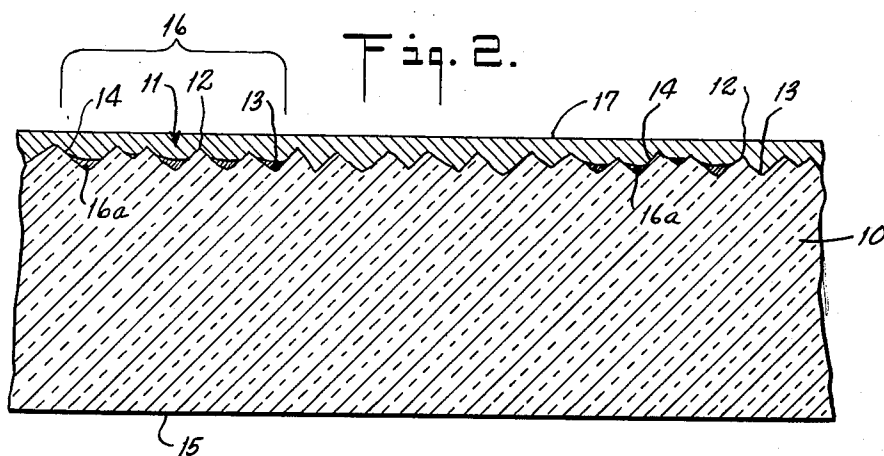
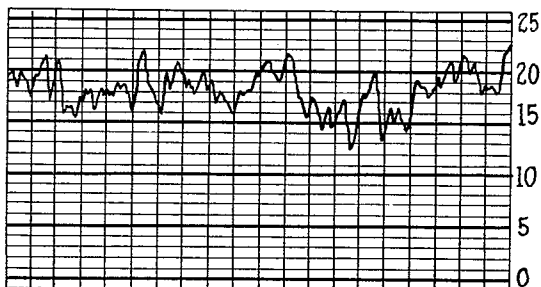


Fig. 3.

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HALF-TONE COLOR PRINTS

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8 Claims. (Cl. 41-21)

This invention relates to half-tone color prints and to a method for printing such prints.

The present application is a continuation-in-part of abandoned application Serial No. 431,252, filed May 20, 1954.

One object of the present invention is to make a half-tone color print giving the visual impression of substantially enhanced color density and brilliance, sharpness and depth, as compared to a prior art or conventional print of the same subject matter and using the same printing plates and inks. In achieving this object this invention provides a number of other advantages described hereinafter.

Other objects may be inferred from the following disclosure.

In the accompanying drawings FIG. 1 is a very high magnification photomicrograph of the reverse side of a very small portion of a print made in accordance with this invention, FIG. 2 is a cross section taken on the line 2-2 in FIG. 1, and FIG. 3 is a profile record of the surface on which the print is made.

According to the invention the print is made on a fully transparent base 10 made of colorless material such as a sheet of plastic. This may be any of the optically clear sheets made available by the plastics industry. The thickness of the sheet depends mainly on the use for which the print is intended, small display prints and textbook prints normally using relatively thin sheet material while outdoor signs and the like will normally use a greater thickness. A typical thickness range is from .2 millimeter up to 1 millimeter. The base 10 may be a transparent colored or tinted material to provide special effects.

This base 10 has a back surface in which a dense and substantially uniform grain is formed by depressions 11 having relatively sharply cornered peaks 12 and valley bottoms 13 with substantially flat surfaces 14 therebetween. Both the size and distribution of the depressions are relatively uniform and the depressions are located as closely together as possible. The effect is crystalline in character.

In addition to the above the depressions should be relatively deep. They have a depth approximately one-third of the grain size or a little more. In other words, the depths from the peaks 12 to the valley bottoms 13 are at least about one-third as deep as the distance from one peak 12 to the next adjacent peak. Necessarily the depressions are somewhat random as to, uniformity, size and contour but they should approximate the conditions described.

In addition to being completely clear and transparent the base 10 has a front surface 15 which is transparent for viewing through the base of the back surface described above. This surface 15 is a polished surface as free from roughness as possible.

Plastic sheets are commercially available with a polished surface finish which is satisfactory. However, the grained surface described above cannot be obtained as a commercial plastic finish. Plastic sheets are available commercially with a dull or mat surface intended to facilitate printing on these surfaces but this kind of surface is unsuitable for the present invention. Its fault appears to be that the depressions forming the dull or mat effect are very shallow and have relatively rounded terminal portions with relatively few if any flat surfaces.

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The grain required by the present invention may be imparted directly to the plastic sheet by the equipment and technique disclosed by Patent 2,516,222, issued July 25, 1950, to the present applicant. Alternately this equipment and technique may be used to grain a metal plate which is then used to imprint the desired grain into plastic sheets one after another. With care the exact pattern of the metal plate may be given the plastic sheets so that it is substantially impossible to detect that these sheets were not grained directly.

As a specific example of the use of the above patented equipment and technique, a good grain surface satisfactory for the present invention, may be imparted by using flint sand of the required degree of particle size with the blasting nozzle set to give an angle of incidence of the blast of about 120 degrees, using a blasting pressure of 3 kg./cm.², with the nozzle's mouthpiece about 7 centimeters from the surface being grained, and, of course, using judgment. This is an art and not an exact science. The eye must be relied upon to a considerable degree as a guide. Every effort should be made to obtain sharp, very deep and uniformly dispersed graining.

With the transparent base 10 grained as described a half-tone color print is printed on this back or grained surface. Preferably the print is a full color print such as a four color print, although more colors can be printed. The print is viewed backwards through the surface 15 so it is necessary to make the print reversed both in subject position and color imposition as compared to the manner in which the same print would be made on an opaque base for direct viewing. That is to say, the print is reversed in its left to right relationship. If on paper the print would be made in the order of yellow, blue, red and black half-tone color printing plates, the sequence with the present invention is to print reversely or, in other words, in succession with the black, red, blue and yellow half-tone printing plates.

Referring again to the drawings it can be seen that the half-tone color print comprises half-tone ink dots 16. The previously described grain should have a grain size substantially smaller than at least the largest of these dots 16. Maximum attainment of the object of the invention results from using a grain size about 1/4 of the size of the largest ink dots. As the grain size is decreased relative to the size of the largest ink dots the desired effect gradually diminishes. When the grain size approaches or is in the neighborhood of 1/200 of the size of the largest ink dot the desired effect is substantially lost and the results are no better than are obtained when printing in the same fashion, meaning reversed in composition and color imposition, on the commercially available dull mat finish. At the other extreme too coarse a grain size results in a condition where the graining begins to be plainly visible to the observer and is objectionable for this reason. Plainly the grain size used depends to some extent on the distance the observer will be from the print, a textbook illustration requiring a very close observing position while an outdoor sign permitting relatively distance viewing.

In all cases the grain size imparted to the plastic sheet either directly or by imprinting from a grained metal plate, depends on the particle size of the sand used for the sandblasting. Therefore, the particle size of the sand must be chosen in accord with the intended use of the final print. The described patented equipment and technique when properly used permits great uniformity and the desired sharpness or crystalline effect. In addition, it permits relatively deep depressions to be formed.

Under the foregoing conditions the ink 16a forming the half-tone dots, appears to collect in the valley bottoms 13 and extend up their sides and from tiny pools

in each of the depressions 11. The ink does not appear to remain on the higher ones of the peaks 12 when an impression is made. In color printing there would, of course, be separate impressions of the ink dots 16 for each of the various colors, and these dots, of course, vary in size according to the half-tone density and the dots of differently colored ink are printed in their respective patterns one after another so that their respective colors blend to produce the hue required.

In normal half-tone color printing on paper the intensity of the color depends entirely on the size of the dots in the case of photolithography or half-tone letterpress printing. Therefore, there is a limit to the color intensity that can be obtained. Under normal printing conditions there is a tendency for the variously colored dots to smudge which greatly reduces the sharpness obtainable for any given half-tone screen fineness. During printing by photolithography the printed sheets drop on each other one after another and trouble is sometimes experienced with the ink dots being further smudged and possibly offsetting on the backs of the sheets above.

By visual observation a print made in accordance with the present invention has greatly enhanced color intensity, sharpness and an appearance of depth. It is believed that these results are due to the fact that the ink collects in pools in the crystalline grain depressions peculiar to the present invention. The ink cannot wander from its imprinted position and the ink actually is printed as dots made up of very minute dots or pools of relatively thick although tiny masses of ink. Presumably the flat surfaces 14 provide a prismatic effect so that light entering the surface 15 is reflected as though from tiny colored prismatic beads.

The printing process itself provides substantial advantages because not only are the dots imprinted clearly and very sharply but as one sheet falls on another when delivered by the printing press the peaks 12, on which there is little or no ink, shield the ink in the valleys from contact with the printed sheet above in each instance. The tendency for plastic sheets to acquire troublesome electrical charges appears to be substantially diminished.

The most remarkable results are achieved by the present invention in the case of photolithography printing a full color print comprising four or more colors. When fine half-tone screens are used in conjunction with appropriate grain size for the grain surface, it becomes difficult even for experts to detect that the print is a half-tone print. It not only compares with a full color photographic print but actually surpasses it in quality.

Printing inks are transparent and the print of the present invention may be viewed as a transparency. For direct viewing the unusual results are enhanced by applying an overlay 17 of white or some light color. This may be printed on as a final step. The base 10 may be safely secured to a rigid backing by an adhesive since this will not unduly effect the appearance when viewed through the surface 15.

Optimum results are obtained by offset photolithographic printing in full color. Half-tone letterpress full color printing may also be used but with a reduction in the unusual quality which has been described. In general, any half-tone color printing method may be used. In photolithography the printing is done by dots which vary in size to provide the differing intensities with color differences effected entirely by the ability of the eye to blend the three primary colors used to provide the intermediate hues or colors. In this case a comparison of a print made by the present invention and one made on paper by the conventional method although using the same photolithographic plates and technique otherwise, provides the most startling comparison.

The best results appear to be obtained in the case of offset photolithography using a half-tone screen of 133 lines per inch or greater and with the grain size of the described grain surface, being in the order of about $\frac{1}{64}$

of the size of the largest ink dots printed. Finer half-tone screen prints give correspondingly improved results.

It is to be understood that as with all color half-tone the various colors printed overlap or overlap each other in some instances although in general they are out of registration with each other. Therefore, the ink collected in the depressions previously described, will vary somewhat in depth depending upon the number of color dots printed together. Ordinarily the plastic sheets will be printed by running them through the press for a plurality of times. A four color printing press permits one pass through the press to print four colors, of course.

The profile record, shown by FIG. 3, illustrates the surface roughness of a plastic sheet grained in a manner suitable for the present invention, when it is to be reversely printed as previously described with the half-tone screen size comparable to what would ordinarily be used in the case of good quality photolithography suitable for viewing at normal distances. FIG. 3 reproduces without magnification or reduction the actual record obtained from tracing an example of the grained surface required by the present invention. The surface tracing and recording instrument used to make this record, magnified 100 times in the horizontal direction and 1000 times in the vertical direction, both directions being relative to the surface traced. Although this makes the grain appear to be unrealistically sharp and deep, it permits the record to be compacted to reasonable dimensions.

In this record shown by FIG. 3, the vertical lines are spaced 5 millimeters apart and the horizontal lines are spaced 2 millimeters apart. Keeping in mind the relative magnifications, the horizontal space between any two of the vertical lines and the vertical space between all of the horizontal lines, from the line 0 to the line 25, represent respectively horizontal and vertical grain dimensions having equal values, namely .05 of a millimeter.

Like most practical profile records, it is difficult to place a general valuation on this surface from inspection of this magnified profile. It does show the flat sides or facets previously described and it suggests the general uniformity of the size and distribution of the grain impressions encompassed by the area covered.

FIG. 1 may be more helpful because this drawing reproduces, as accurately as pen and ink permits, an actual photo-micrograph of the back or reverse side of an actual print made in accordance with this invention. This shows that in the horizontal plane there is a substantially uniform grain pattern in the practical sense. The vertical plane is shown by FIG. 2 entirely schematically and in an idealized form. The profile record of FIG. 3 may be referred to for a better understanding of the general degree of uniformity and contour as to both vertical and horizontal planes.

I claim:

1. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots but not less than $\frac{1}{200}$ of the size of said largest dots.

2. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject

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position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots, said grain size being about $\frac{1}{64}$ of the size of said largest ink dots.

3. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots but not less than $\frac{1}{200}$ of the size of said largest dots, said print having a minimum half-tone screen of 133 lines per inch.

4. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots, said grain size being about $\frac{1}{64}$ of the size of said largest ink dots, said print having a minimum half-tone screen of 133 lines per inch.

5. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots, said grain size being about $\frac{1}{64}$ of the size of said largest ink dots, said print having a minimum half-tone screen of 133 lines per inch and being at least a four-color print.

6. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with

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substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots but not less than $\frac{1}{200}$ of the size of said largest dots, said depressions having depths at least approximating said grain size.

7. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots but not less than $\frac{1}{200}$ of the size of said largest dots, the ink of said dots being located within said depressions in contact with said flat surfaces thereof and being substantially free from said peaks.

8. A half-tone multi-color print including a transparent base having a back surface in which a dense and substantially uniform grain is formed by depressions having relatively sharply cornered peaks and valley bottoms with substantially flat surfaces therebetween, said base having a front surface which is transparent for viewing of said back surface through said base, and a half-tone color print printed on said back surface and reversed in subject position and color imposition as compared to the same print for direct viewing, said print comprising half-tone ink dots and said grain having a grain size substantially smaller than at least the largest of said dots, said grain size being about $\frac{1}{64}$ of the size of said largest ink dots, said print having a minimum half-tone screen of 133 lines per inch and being at least a four-color print, the ink of said dots being located within said depressions in contact with said flat surfaces thereof and being substantially free from said peaks.

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