

Jan. 7, 1969

J. E. SMITH

3,420,170

SINGLE IMPRESSION MULTICOLOR PRINTING

Filed Oct. 11, 1966

Sheet 1 of 4

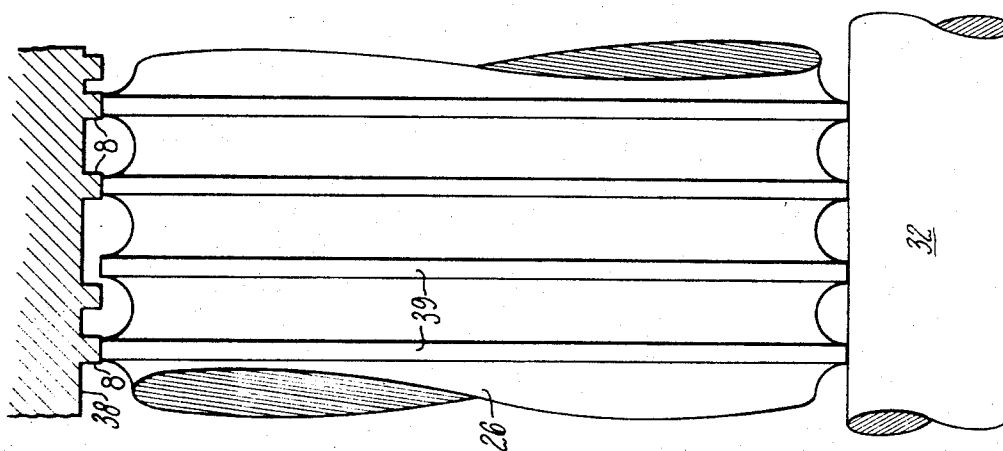


fig. 2

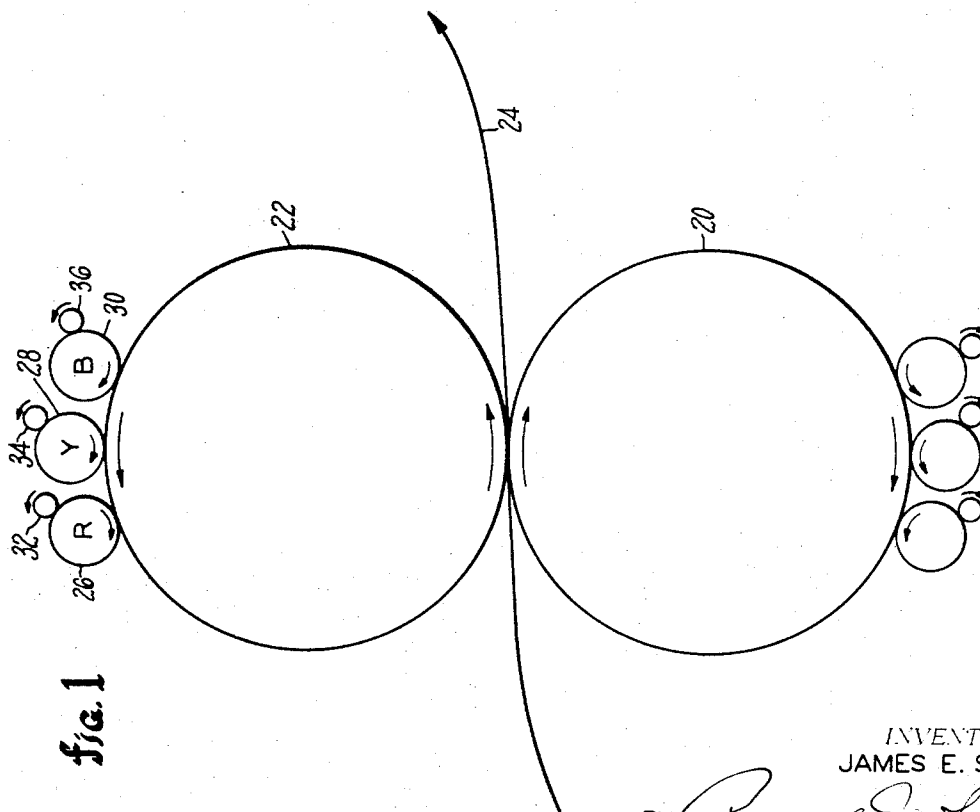


fig. 1

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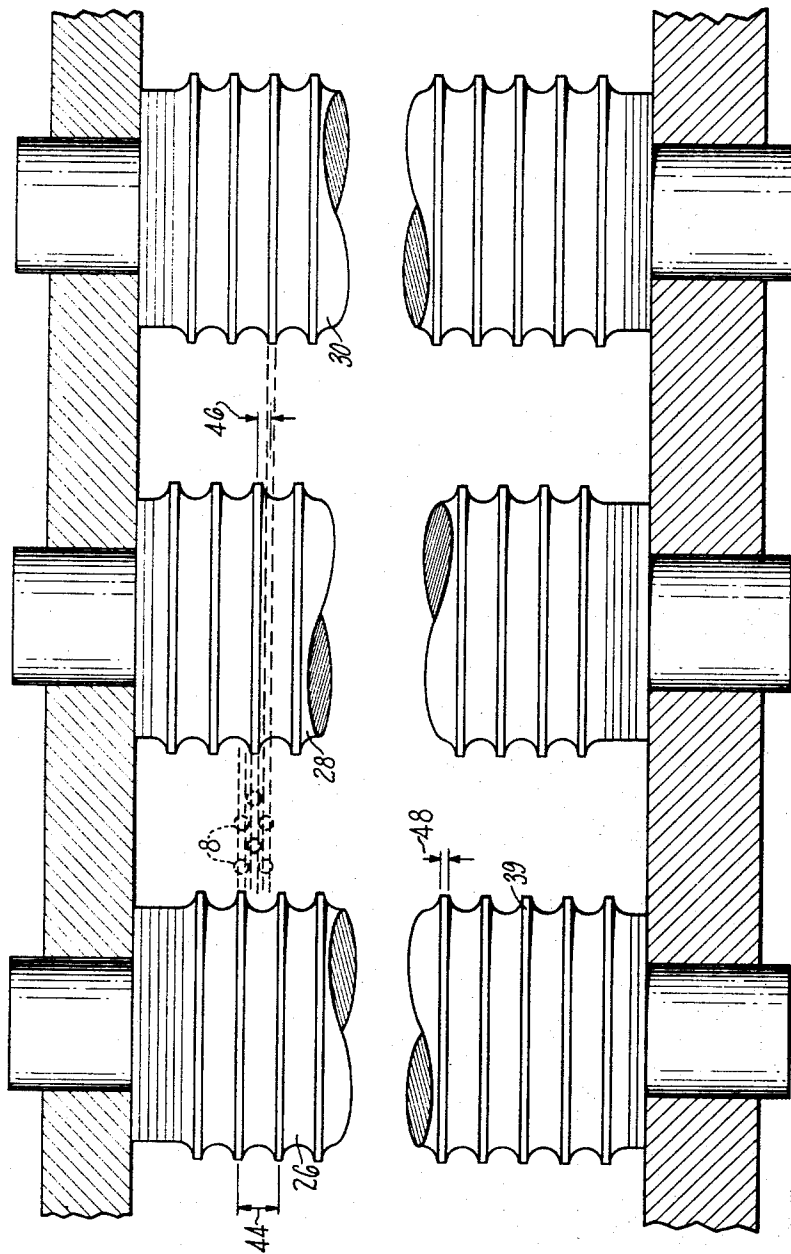
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fig. 3



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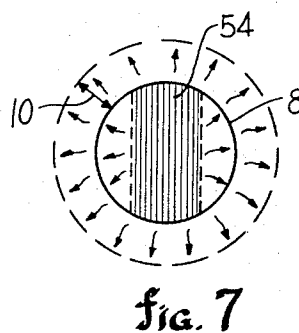
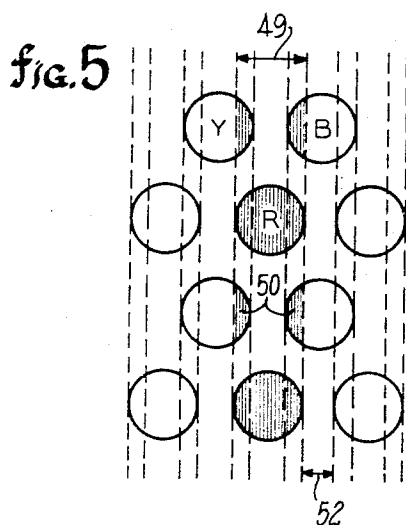
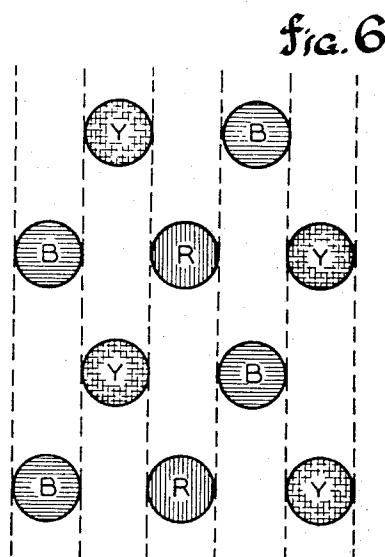
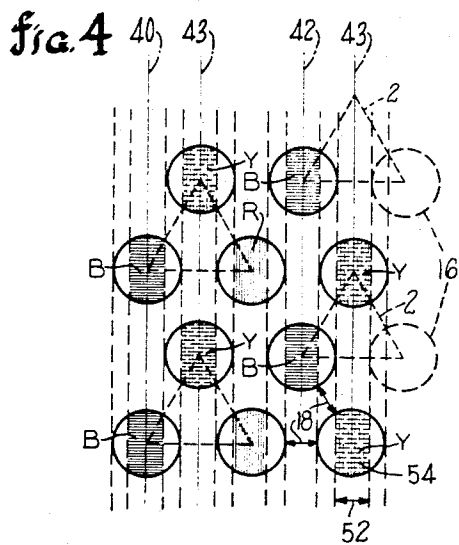
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fig. 8

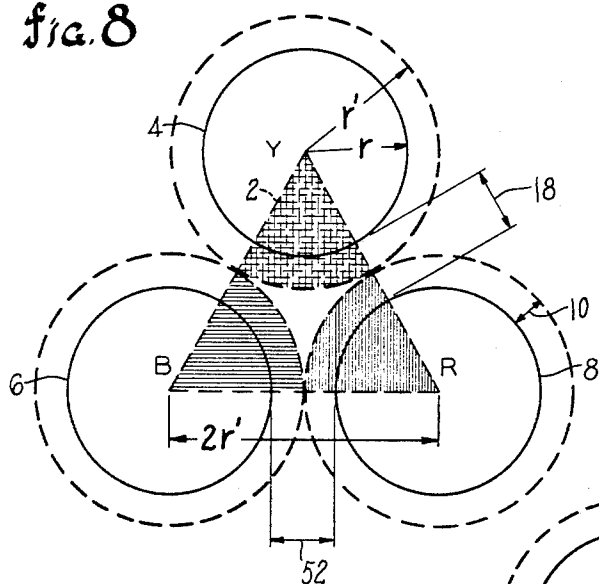


fig. 10

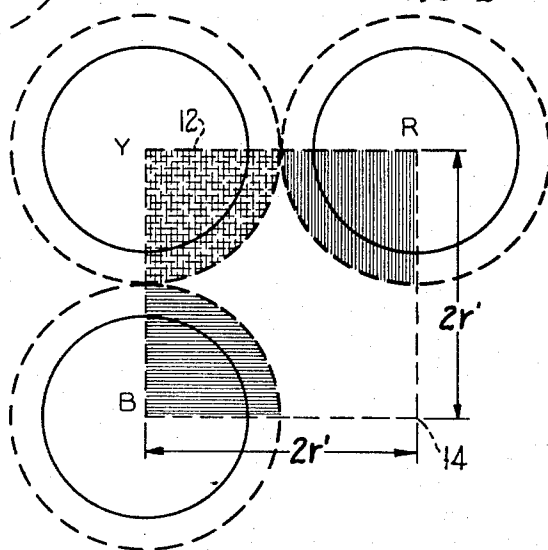
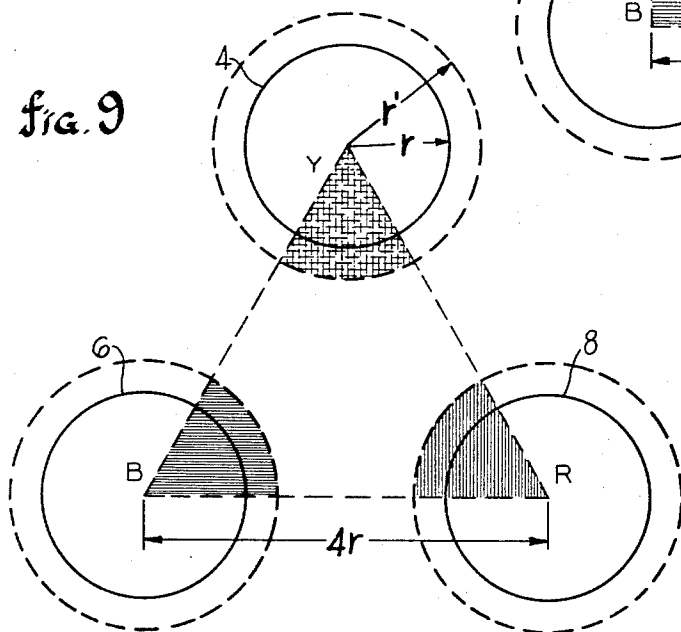


fig. 9



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3,420,170

SINGLE IMPRESSION MULTICOLOR PRINTING
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Filed Oct. 11, 1966, Ser. No. 585,920

U.S. Cl. 101-175

17 Claims

Int. Cl. B41f 5/18

This invention relates in general to the art of color printing and, more particularly, to those printing processes wherein multicolor reproductions are effected in a single impression in high speed presses.

Despite extensive developmental efforts in the field, the printing of full color reproductions on high speed presses, such as those used by the large daily newspapers, remains a tedious, expensive and relatively inexact process. Such reproductions are still usually made through the use of multiple impressions of single colors in successive passes of the paper or other material to be printed past the individual single-color printing plates. Separate plates are prepared, one for each color to be applied, and successive separate impressions are made on the paper with each plate, one color imprint being superimposed over the other with appropriate registration to provide the full color illusion in the finished product.

In order to achieve high quality reproduction in this manner, extreme care is necessary in the preparation of the plates to assure proper registration of the various colors, as well as with the alignment of the plates and with the sequencing operations in the presses. Achieving good initial registration of the various color patterns, at very high press speeds and under the usual adverse environmental and schedule conditions prevailing, is usually a substantial task in itself. Even though advances in the field permit a fairly precise alignment of the color patterns, to within 0.001 inch in some cases, the requisite registration is so sensitive that changes occurring during the press run, such as shrinkage or expansion of the paper due to changes in humidity, for example, readily lead to discernible changes in registration, even though the initial alignment was accurate.

Furthermore, the necessity for the close control of ink viscosities and drying rates imposes additional limitations on the system, particularly where one primary color is to be overlaid over another in the printing sequence. In some processes, two or more primary colors are blended to achieve a desired intermediate hue, the initially deposited ink being physically mixed or blended with that subsequently overlaid thereon. In this type process, the first ink must remain sufficiently fluid to admix freely with the ink of the second color when the second impression is made.

In other inking processes, an "optical blending" technique is used, the second color being laid over the first only after the first deposited ink has dried. In some cases, the second color partially bleeds into the first with a resultant nonuniformity of print rather than the crisp color pattern intended. In any event, the press speeds and sequencing must be coordinated with the ink compositions, compatibilities and drying rates in order to attain satisfactory results.

The use of full color techniques compatible with the usual black and white printing processes, or run-of-the-paper color, would, of course, be a tremendous boon to the large daily newspapers which generally find it necessary to compete with the other advertising media primarily on their black and white capabilities. What is obviously still needed in the industry is a color printing system which will produce clear and faithful full color reproductions by means and at speeds compatible with the normal newspaper press runs, and which is economi-

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cally justifiable in view of the nature of the newspaper business.

It is a primary object of the present invention to provide apparatus and methods for single impression multi-color printing in perfect registration in high speed presses.

A further object is to provide means effecting full color registration in a simple and economical manner.

A still further object is to provide means for reducing the cost of printing plate preparation, the production of a single printing plate for each new picture in color replacing the usual multiple plates currently utilized in these processes.

An additional object is the provision of a printing system wherein the adjustment of just a single variable is necessary to effect and maintain a precise alignment of the ink transfer rollers and with the printing plates.

Still another feature of the instant invention is the provision of apparatus and methods for color printing in which the necessity for precise rotational alignment of the ink transfer rollers is eliminated, the only alignment necessary being an axial coordination of the rollers with the printing plate.

An additional feature is the provision of a printing system wherein the intelligence provided on the printing plate comprises interadjacent projections arranged in triangular array for high color saturation of the paper.

A still additional feature is to provide a color printing system wherein no mixing of ink or overlay of one color impression upon another is required to achieve optical blending to provide the intermediate hues.

These and other objects and advantages of the present invention will be described in the detailed description which follows or will be evident therefrom or from practice of the invention.

When referring to the present printing system in detail, it will be convenient from time to time to make reference to the attached drawings of which:

FIG. 1 is a somewhat schematic view of the general arrangement of the overall printing and inking system, the view being taken in a plane perpendicular to the axis of the various cylinders arranged in parallel in a rotary press.

FIG. 2 is a fragmentary top view, partially in cross-section, of the inking system taken in a plane parallel to the longitudinal axis of the cylinders.

FIG. 3 is a top view of the ink transfer cylinders, illustrating particularly the alignment of the circumferential ribs provided thereon, which is a preferred construction as described hereinafter.

FIG. 4 is a fragmentary view of the projection array as provided on a typical printing plate, illustrating particularly the triangular arrangement, projection interlacing, and ink striping.

FIG. 5 illustrates the results of conventional inking of a close-packed interlaced array, such as that shown in FIG. 4.

FIG. 6 illustrates the projection separation necessary in the prior art methods.

FIG. 7 shows the finished impression made by a single projection on somewhat absorptive paper, such as newsprint.

FIG. 8 demonstrates the high color saturation attainable with the interlaced triangular projection pattern on newsprint.

FIGS. 9 and 10 illustrate the extent of color saturation attainable with the spaced triangular array (FIG. 9) and closed-packed square array (FIG. 10).

It is readily observable that the principal problem in run-of-the-paper color stems from the necessity of employing separate printing plates for each color to be applied, since both the material and labor costs and the problem of precise registration of the individual impres-

sions are related to the use of multiple plates. What is really needed is a printing system which utilizes a single plate for color application wherein only one impression is required to lay down the full color pattern. While the advantages of full color printing in a simple impression has been previously recognized, as indicated by the patents to Miller, 3,213,787; Marinier et al., 680,533; Japanese Patent 36/8,139; and Austrian Patent 51,285; no such system apparently enjoys much utility in the current printing art.

There are several quite obvious problems attendant to the use of a single plate which is adapted to print several colors simultaneously and the difficulties stem, in substance, from one basic problem, i.e., that of applying the proper color ink to each of the minute projections on the printing plate and no other projection. Of course, in order to correctly accomplish the requisite inking, precise dimensional alignment of the inking system with the printing plate is necessary. This has severely restricted the size of the individual projections and the possible array patterns which can be employed on the printing plate.

A color printing plate with a plurality of large area projections in widely-spaced array may, quite naturally, be more readily inked than a corresponding plate with much finer projections in close-packed array. On the other hand, for good pattern resolution and high color saturation, the dot pattern is preferably held as small as possible, the developed surface area of each projection preferably encompassing an area of approximately $1-9 \times 10^{-6}$ square inches with a separation between projections of perhaps 0.005 inch. With projections of this size, the problem of applying the correct color ink to the correct surfaces and to no others is manifest.

For maximum color saturation, the intelligence provided on the printing plate preferably comprises a plurality of minute projections oriented in close-packed triangular array, an equilateral triangular array having the projections interlaced in a direction parallel to the principal axis of the individual unit triangles being preferred. The triangular array is capable of giving a higher degree of color saturation than the more conventional square array, as best illustrated in FIGS. 8, 9 and 10.

FIG. 8 shows a unit triangle 2 of projections 4, 6, 8 in close-packed triangular array, the individual projections being so spaced as to preclude any overlap of the ink from the "dots" due to ink spread 10, as defined by the dashed lines. This spread as indicated in FIG. 7 will be greater or lesser depending upon the ink composition utilized in the process, but, more importantly, upon the absorptivity of the paper. The relationship between the various arrays, and particularly the projection spacing, is shown in the various drawings, r equalling the radius of the projection, r indicating the radius of the impression including ink spread. With the so-called "slick" papers common to the magazine field the ink spread will be correspondingly less than that expected with common newsprint. In a sense, however, the ink spread is of some value in the present invention since it permits a somewhat greater spacing between adjacent projections than would be the case with the less absorptive papers. The amount of ink spread can vary from close to zero in the case of slick paper to about 40 percent in the case of newsprint and newspaper ink.

The triangular array of FIG. 8 can yield a maximum saturation of 90.7 percent, this value being from two (for slick papers) to four (for newsprint) times as much as the saturation in the loosely-packed array of FIG. 9. The square array of FIG. 10 is capable of yielding a maximum of only 59.8 percent. The close-packed triangular array yields a significant advantage in color printing, wherein the degree of color saturation which is achievable heavily influences the fidelity of the color reproduction which can be attained.

It will be noted that in the unit cell 12 of the square array of FIG. 10 there appears to be a dot missing at the lower right-hand corner. This stems from the fact that

only three colors are illustrated. In today's printing art, this site 14 is sometimes filled with a fourth color, although the fourth color is not necessary to achieve all of the color hues required in the final reproduction, providing the three colors are properly selected. Although in the drawings and in the specification, reference is made to red (R), yellow (Y) and blue (B) for the sake of simplicity, according to fundamental physics, the proper colors would normally be magenta, yellow and cyan. Some mixture of the three basic colors may be used as the fourth color.

Although a combination of the three basic colors may be used, the usual practice is to occupy the unoccupied site with black ink to reduce the amount of white background showing through the color thereby deceiving the eye of the viewer and leading to the belief that there is greater color saturation than actually exists. This technique is particularly effective when black ink is used in this location. The pseudo-saturation thus achieved would then amount to about 78.5 percent, which is still considerably less than that achieved with the triangular array of FIG. 8 and is accomplished, generally, only with the addition of a fourth color. In any event, the fact that this stratagem is used to gain less than a 20 percent addition in saturation is evidence in itself of its fundamental importance.

In the context used herein, the term "color saturation" will be seen to have reference to the percentage of the paper which is covered by colored ink. The smaller this percentage the greater the background white of the paper shows through. As observed by the viewer, the background serves to dilute the colors which are perceived, the reds appearing pink, etc. While dilution of the deposited colors by optical blending with the background of the paper is the method used in the instant case to achieve the pastel colors and other shading in the finished reproduction, it is used effectively only in combination with areas of high saturation and color brilliance. And the requisite brilliance cannot be attained using arrays wherein the background is prominent. In the present invention the area density of the projections is selectively varied on the printing plate to provide the different and sometimes subtle degrees of shading required to produce flesh tones, for example, while retaining high brilliance and color saturation in other areas as desired.

In each unit triangle on the printing plate, the projections occupying the individual apex positions are each inked with a different color, such as red, yellow and blue, as seen in FIG. 4, for example. To adapt the printing plate for color, some or all of the projections are removed from selected areas of the pattern, as indicated at 16 in FIG. 4. Since the ink is transferred to the individual projections in such a manner that a specific projection receives ink of a single color, elimination of the surrounding surfaces which normally carry a different color will result in the printing of only one color in that area of the paper. And as previously indicated, by varying the projection area density in that portion of the pattern, the color may be shaded as desired into the pastels.

In a somewhat similar manner, by the selective elimination of one or more of the projections carrying a given color, various intermediate hues may be provided from the three basic colors. Assuming that red, yellow and blue inks are applied to the projection surfaces forming the apexes of each unit triangle, elimination of the red projection, while retaining both the yellow and blue, will provide to the viewer an overall physiological impression of green in the finished print, darker or lighter shades of green being effected by employing more or less blue and, correspondingly, less or more yellow in a given area. And if the surface area of the individual dots is small enough, the human eye will not discern the individual blue and yellow impressions but only the overall green effect. The overall optical blending effect, moreover, is

accomplished with no physical mixing of the various inks or overlay of an ink of one color upon another. The intelligence provided on the single printing plate will, accordingly, not only provide the desired picture pattern but, also, the appropriate precise coloring thereof.

While any convenient method may be utilized in the fabrication of the printing plate, that taught by the instant inventor in his copending application Ser. No. 546,996, filed May 2, 1966, is preferred, the black and white plate of that application being further provided with the requisite color intelligence as hereinbefore discussed. Although in the instant case, the ink-carrying surface of the projections have been illustrated and described as "dots," for the purposes of this invention other surface configurations, such as squares, triangles, parallelograms, etc., are contemplated.

The spacing 18 between the individual projections, although preferably uniform on each printing plate, will nevertheless vary from plate to plate as a function of the ink-paper combination. Accordingly, the spacing utilized for the slick papers will normally be less than that suitable for the more absorptive materials. However, once the spacing has been correctly established for the given ink-paper combination in question, it will be substantially invariant in that operation thereafter. The optimum spacing between projections will be such that the ink from one projection, including the spread thereof, will just abut that of the adjacent projections, thereby minimizing effect of the white background and, hence, maximizing the color saturation of the paper.

The general arrangement of a typical printing press assembly adapted to be used in the practice of the subject invention is illustrated somewhat schematically in FIG. 1. It consists, as shown, of two printing plate cylinders 20 and 22 which are positioned on opposite sides of the paper web 24, thereby permitting simultaneous printing on both sides of the web. Each cylinder may carry one or more printing plates in the usual manner, each plate representing a page or impression to be printed on the paper. As hereinbefore discussed, one or more of the printing plates used may be provided with the appropriate intelligence to effect the simultaneous printing of a plurality of colors in the pattern and form required in the finished reproduction. Since the printing plates in this apparatus are to be mounted upon cylindrical rolls 20 and 22, the printing plates (not shown in this figure) are normally curved to conform to the curvature of the printing plate cylinder and are attached thereto so that the plates are concentric therewith. Further, the respective projections on the printing plate will be substantially identical as to configuration and height to simplify the alignment and fabrication problems.

The printing plates are inked by three or more sets of ink transfer rollers 26, 28, 30 with cooperating inking rollers 32, 34, 36, respectively, the number of inking sets depending upon the number of colors to be applied to the printing plate. For full color reproductions, three ink transfer rollers will normally be used in the preferred embodiment of the invention. All of the primary colors and the intermediate hues and shades may be provided from these three basic colors which are referred to herein as red, yellow and blue, although as previously discussed, other colors may be advantageously employed to yield the optimum results.

As indicated most clearly in FIG. 2, each of the ink transfer rollers 26, for example, is provided with a plurality of ribs 39 on its exterior surface, the ribs receiving ink from the inking roller 32 and transferring it in due course to the appropriate projections 8 on the printing plate 38. In a preferred arrangement, the ribs comprise circumferential rings on the ink transfer roller, the ribs being equally spaced therealong and formed to the same shape and height.

It is essential that the means of transferring the sepa-

rate ink colors to the dot projections on the printing plate be such that only red ink is deposited on the "red projections," only blue ink on the "blue projections," etc. The projections on the printing plates are arranged, therefore, whereby the red, yellow and blue dots occupy the identical apex positions in each unit triangle, as illustrated in FIG. 4. Each of the projections occupying the corresponding position in each unit triangle is accordingly provided with ink of the same color. The projections occupying the corresponding apex positions in each of the unit triangles furthermore lie in spaced parallel rows 40, 42, and the projections occupying the other apex positions in the unit triangles may be seen to interlace in a direction parallel to those rows, this direction being defined as the principal axis 43 of the unit triangle 2. It will be noted in the embodiments illustrated in the drawings that this axis extends vertically of the paper, or, in other words, circumferentially of the printing plate cylinder. This is a preferred orientation as hereinafter discussed in detail, but it will be obvious that other orientations are feasible in the practice of the invention.

The ink transfer rollers are aligned axially so that the ribs provided on the red ink roller are in alignment with the rows of the red projections, the ribs of the blue ink rollers are aligned with the blue projections, etc. When three colors are used in this apparatus, therefore, the ribs on each individual roller will be spaced apart by a distance 44 corresponding to three times the spacing between adjacent rows of projections. Furthermore, the respective rollers will be axially aligned with the printing plate such that the ribs thereon are axially displaced from those on each other roller by a distance 46 corresponding to the unit spacing between adjacent rows of projections. This is most clearly illustrated in FIG. 3.

Since the use of a close-packed triangular array with interadjacent projections is contemplated, it may be seen that the width 48 of the respective rib surfaces on the ink transfer rollers is critical. If the width of the ribs is commensurate with the diameter 49 of the individual projections on the printing plate, such that as a rib rolls over a specific row of projections, the entire surface of each projection in that row is entirely covered with ink. Ink will also be transferred to the outer edges 50 of the projections in the adjacent rows, as seen in FIG. 5. Thus, in this situation, it is impossible to deposit just a single color of ink on a given dot projection from a continuous rib. The obvious solution to this problem, and that usually used, is to retreat to the more loosely packed array, such as that shown in FIG. 7, for example. This, however, is a generally unsatisfactory solution to the problem and, as discussed extensively, this leads to a serious dilution of the color in the final reproduction, because of low color saturation of the paper.

In accordance with the present invention, the width 48 of the rib surface is held less than the spacing 52 between the inner periphery of alternate rows of projections, and the ink is deposited on each projection in the form of a thin stripe 54, as seen in FIG. 4. In other words, the entire projection surface is not covered with ink during the initial transfer process. This allows a considerable measure of control to be exercised on the subsequent transfer of ink to the paper. The stripe of ink is squeezed between the projection surface and the paper during the impression portion of the printing cycle, causing the ink to spread over the entire dot surface. The spread of ink is thus more or less confined to the geometry of the projection surface itself, although there will, of course, be some side spread of ink due to the absorptive nature of the paper, as shown in FIG. 7. By spacing the adjacent projections such that the ink, including the spread portion on the paper, deposited by one projection just abuts that deposited by each adjacent projection, distinct deposits of the individual colors with no dilution results, on the printed page. By appropriate adjustment of the ink

composition and viscosity, very vivid and faithful reproductions are accordingly achieved.

Another significant advantage of the interlaced triangular array is worthy of mention at this point. It is, of course, advantageous to maintain the developed area of each of the unit impressions on the paper of such small magnitude that the individual dots are not discernible to the naked eye. However, even when this is done in many of the current multicolor printing systems and, for that matter in much half-tone printing, the overall effect on the viewer is often less than satisfactory. While the eye is not able to segregate each individual dot as printed, it is, nevertheless, frequently able to discern a distinct linear pattern made up of microscopic impressions laid without interruption in distinct rows, as in FIG. 6. And this is particularly true in those instances where the orientation of the rows coincides with the normal direction of eye scan for the viewer. For this reason, it is a quite common practice to orient the rows at some angle to normal vertical and horizontal directions of scan. In the instant invention, as best seen in FIGS. 4 and 8, while the various projections are arranged in distinct rows, the effect of lineation is, to a substantial degree, markedly reduced in most instances and completely eliminated in others, particularly in those areas wherein a plurality of colors are printed. When the complete ink pattern is laid down on the paper, there is not only no color lineation vertically and horizontally, but none in any direction.

As previously mentioned, a preferred orientation of the rows of projections and, correspondingly the ribs on the ink transfer rollers, is circumferential as shown in the drawings. While not essential, this orientation is preferred because it permits a precise alignment of the ribs with the correct projection rows by means of a single axial adjustment of the ink transfer rollers, thereby eliminating the necessity for a corresponding rotational adjustment as well. This greatly simplifies the procedures in the press room, and the requisite alignment may be readily achieved by either manual or automatic controls.

Another preferred arrangement (not shown) would be to have the projection rows and roller ribs oriented axially of the respective cylinders, in which case only a rotational adjustment and alignment problem is presented. And, of course, a combination of the two systems may be utilized, wherein an axial alignment is required in the case of some of the ink transfer rollers and a rotational alignment is required in the case of the remaining rollers. In any event, only a single direction alignment problem is presented at each row.

The other possible orientations, wherein the ribs and rows extend neither circumferentially nor axially of the cylinders but at an angle thereto, while workable in the context of the instant invention, are less preferred techniques, since both an axial and rotational registration problem is presented to the press room personnel.

It will be noted that in the system described there is perfect registration of the separate color patterns in the finished print, this perfect registration being inherent in the system in the printing plate itself and, accordingly, any stretching, shrinkage or weaving of the paper during the press run may be expected to exert no influence on the registration of the colors. Colors properly applied to the printing plate are faithfully reproduced on the paper regardless of changes in the press room environment. Furthermore, costs as compared to the color printing system currently enjoying utility, are much reduced since the preparation of only a single printing plate is required and the present alignment problems associated with full color printing are much reduced. And the system described is compatible with the equipment and facilities currently available in the usual newspaper plant.

While the present invention has been described in connection with particular preferred embodiments and arrangement of parts, various modifications, additions and alternative arrangements will be evident to those skilled

in the art within the true spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. Apparatus for printing color reproductions of high resolution, color fidelity and color saturation in a single impression in a printing press, comprising:

a printing plate mounting;

a printing plate affixed to the mounting and having the intelligence to be printed provided thereon in relief, the intelligence comprising a plurality of interadjacent microscopic projections in an overall triangular array, each of the projections having a discrete surface area for receiving ink, the projections which occupy the corresponding apex positions in each of the unit triangles of the array lying in spaced parallel rows;

a plurality of ink transfer members in contact with the printing plate projections, each of the members having a plurality of spaced ribs thereon oriented parallel to specific rows of projections and in alignment therewith, the surface of each rib being adapted to carry ink and having a width not exceeding the spacing between the inner portion of alternate rows of projections, the spacing between ribs being a multiple of the projection row spacing, the respective ink transfer members being aligned with each other in the press so that the ribs on each ink transfer member are displaced from those on each other member; and means for inking the rib surfaces of the respective ink transfer members with the desired color.

2. Apparatus for printing color reproductions of high resolution, color fidelity and color saturation in a single impression in a printing press, comprising:

a rotatable printing plate cylinder;

a printing plate affixed to the cylinder and having the intelligence to be printed provided thereon in relief, the intelligence comprising a plurality of microscopic projections in triangular array, each of the projections having a discrete surface area for receiving ink, the respective projections which form the apexes of the individual unit triangles being interlaced in a direction parallel to the principal axis of the triangle, the projections which occupy the corresponding apex positions in each of the unit triangles lying in spaced parallel rows;

a plurality of ink transfer rollers rotatable in coordination with the printing plate cylinder and in contact with the printing plate projections, each of the rollers having a plurality of spaced ribs thereon oriented parallel to the specific rows of projections and in alignment therewith, the surface of each rib being adapted to carry ink and having a width not exceeding the spacing between the inner edges of alternate rows of projections, the spacing of the similarly-oriented ribs corresponding to that between adjacent rows of projections times the number of different inks to be applied to the printing plate in that direction, the respective rollers being aligned in the press so that the ribs thereon at contact with the printing plate are displaced from those on each other roller by a distance corresponding to the spacing between adjacent rows of projections;

and means for inking the rib surfaces of the respective rollers with the desired color.

3. Apparatus as set forth in claim 2 having printing plate intelligence wherein:

selected projections on the printing plate are eliminated to provide the requisite hues in the finished reproduction; and

the area density of the projections is selectively varied over the printing plate area to provide different degrees of shading, brilliance and color saturation in the finished reproduction.

4. Apparatus as set forth in claim 3 wherein:

the respective projections on the printing plate are sub-

stantially identical as to configuration and height; and the printing plate is curved to conform to the curvature of the printing plate cylinder and is attached concentrically thereto.

5. Apparatus as set forth in claim 4 wherein: the respective rows of projections extend circumferentially of the printing plate; and the ribs on the ink transfer rollers are oriented circumferentially.
6. Apparatus as set forth in claim 4 wherein: the respective rows of projections extend axially of the printing plate, and the ribs on the ink transfer rollers are oriented axially.
7. Apparatus as set forth in claim 3 wherein: three ink transfer rollers are provided, the first roller being inked with a first color, the second roller being inked with a second color, and the third roller being inked with a third color.
8. Apparatus as set forth in claim 7 wherein: the first, second and third colors are selected to provide the entire color spectrum desired in the finished reproduction.
9. Apparatus as set forth in claim 7 wherein: the first, second and third inks are colored cyan, magenta and yellow, respectively.
10. Apparatus as set forth in claim 2 wherein: the spacing between adjacent projection locations is selected so that the ink pattern deposited by one projection just abuts that deposited by an adjacent projection.
11. Apparatus as set forth in claim 10 wherein: the developed printing surface area of the individual projections is $1-9 \times 10^{-6}$ square inches.
12. Apparatus for printing full color reproductions of high resolution, color fidelity and color saturation in a single impression in a rotary printing press, comprising: a rotatable printing plate cylinder; a conforming printing plate affixed to the cylinder and having the intelligence to be printed provided thereon in relief, the intelligence comprising a plurality of microscopic projections in overall triangular array, each of the projections having a discrete surface area for receiving ink, the respective projections which occupy the apexes of the individual unit triangles being interlaced circumferentially, the projections which occupy the corresponding apex positions in each unit triangle lying in spaced parallel rows extending circumferentially of the printing plate, each projection row lying parallel to each other row; three ink transfer rollers rotatable in coordination with the printing plate cylinder and in contact with the printing plate projections, each roller transferring an ink of a different color and having a plurality of axially spaced circumferential ribs thereon, the surface of the ribs having a width less than the spacing between inner portions of alternate rows of projections, the spacing between ribs corresponding to three times the projection row spacing, the respective rollers being axially positioned in the press so that the ribs on each roller are axially displaced from those on

each other roller by a distance corresponding to the spacing between adjacent rows of projections; and means for inking the rib surfaces of each of the respective rollers with ink of a different color.

13. Apparatus as set forth in claim 12 wherein: the respective projections on the printing plate are substantially identical as to configuration and height.
14. The method of printing color reproductions in a single impression which comprises the steps of: providing a printing plate having the intelligence to be printed provided thereon in relief, the intelligence comprising a plurality of interadjacent microscopic projections in overall triangular array, the projections occupying the corresponding apex positions in each unit triangle being oriented in spaced parallel rows; depositing a thin stripe of ink on the respective rows of projections in a direction corresponding to the projection row orientation; and impressing the printing plate on the material to be printed with sufficient force to cause the ink to spread over the entire surface of each projection.
15. The method of printing full color reproductions in a single impression which comprises the steps of: providing a printing plate having the intelligence to be printed provided thereon in relief, the intelligence comprising a plurality of interadjacent microscopic projections in overall triangular array, the projections occupying the corresponding apex positions in each unit triangle being oriented in spaced parallel rows; depositing a thin stripe of ink on the respective rows of projections in a direction corresponding to the projection row orientation, adjacent rows of projections being inked with a first, second and third color, respectively; and impressing the printing plate on the material to be printed with sufficient force to cause the ink to spread over the entire surface of each projection.
16. The method of claim 15 wherein: the first, second and third colors are magenta, yellow and cyan.
17. The method of claim 15 wherein: the printing plate is installed in a rotary press; and the projection rows extend circumferentially.

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