

Aug. 13, 1946.

A. MURRAY

2,405,754

MULTICOLOR PRINTING

Filed Feb. 26, 1944

2 Sheets-Sheet 1

FIG. 1.

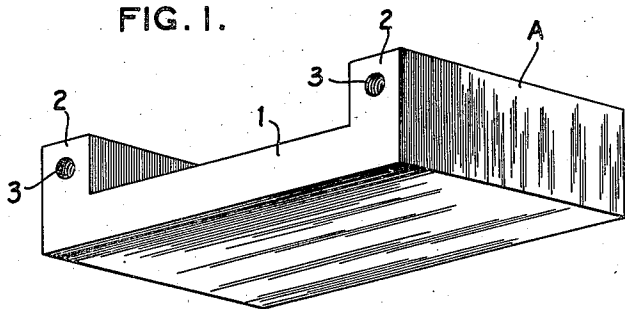


FIG. 2.

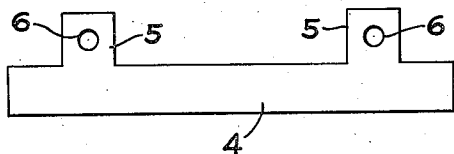


FIG. 3.

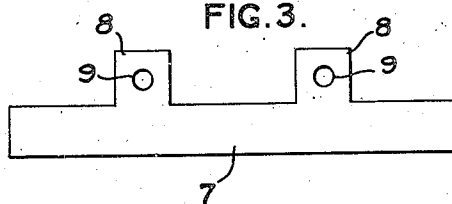


FIG. 4.

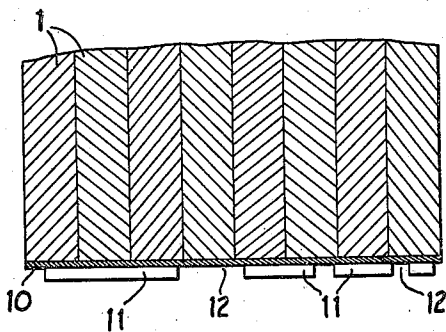


FIG. 5.

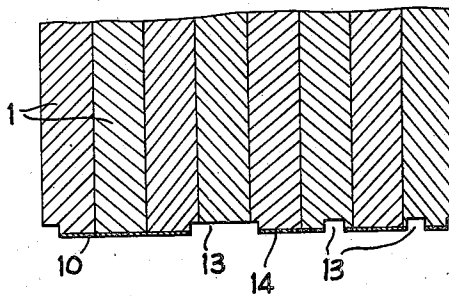
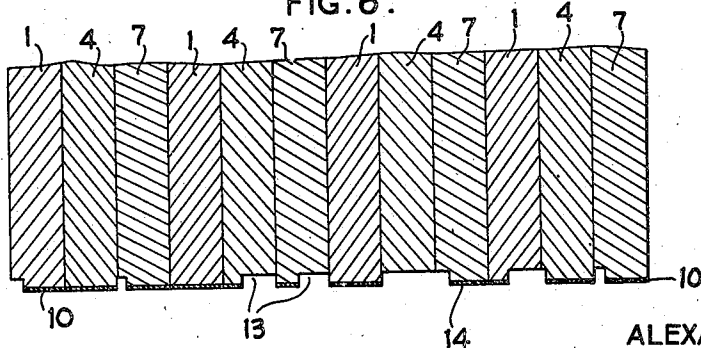


FIG. 6.



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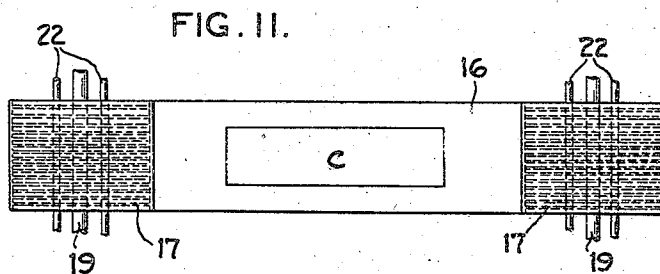
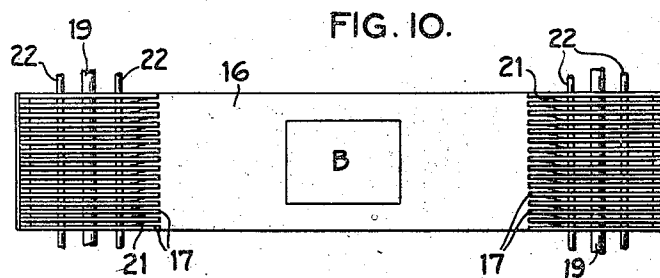
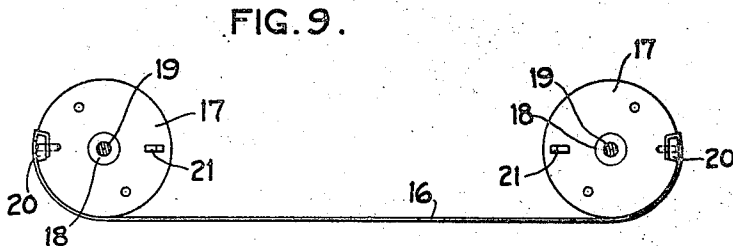
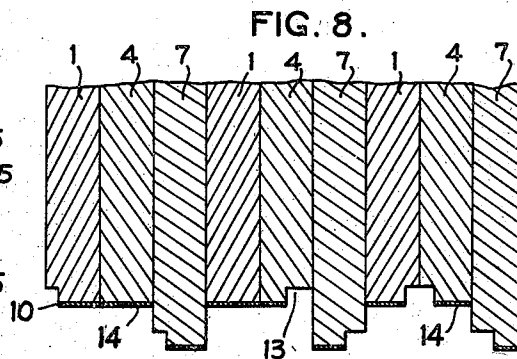
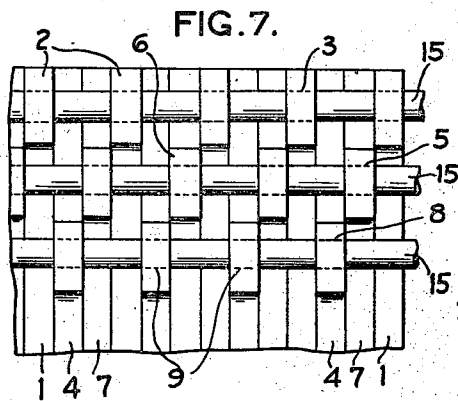
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MULTICOLOR PRINTING

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2 Sheets-Sheet 2



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2,405,754

MULTICOLOR PRINTING

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Application February 26, 1944, Serial No. 523,999

12 Claims. (Cl. 101-211)

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This invention relates to a method of making a multi-color ink picture by a single impression of a suitable press and to apparatus useful in carrying out such a method.

The method comprises the making of color component images on the edges of a pack of metal plates, each component being made on a separate pack by known processes, then separating the packs and reassembling them in succession, one from each pack, thus producing a series of line images. If there are three color components for the cyan, magenta, and yellow colors, every third line will be a part of the same component image. By suitable selective mechanism each set will be separately inked, and the three sets placed with their freshly inked edges in a plane and at once contacted with the impression-receiving surface upon which there will be imprinted a three-color image in the form of fine lines, every third line being of the same color.

In a preferred form of the invention the three packs are each of a certain size, so that when the three packs are assembled, one dimension of the resulting printing surface will be three times the original size of one pack. This is inked and printed upon a rubber blanket stretched in one dimension to several times its unstretched size. The freshly printed rubber blanket is then permitted to resume its normal size, the three-color image being thus also reduced to a desired standard size and at once printed by offset upon the final impression-receiving surface.

Reference is now made to the accompanying drawings in which the same reference characters designate the same parts throughout:

Fig. 1 is a perspective view of a pack of strips constituting one color component;

Figs. 2 and 3 are face views of single strips designed for use in other color component packs;

Fig. 4 is a magnified fragmentary section of the ends of the strips carrying a photographically formed relief image;

Fig. 5 is a similar view after etching and the removal of the resist;

Fig. 6 is a similar view of a pack of strips re-assembled after sorting;

Fig. 7 is a top view on an enlarged scale of a portion of one end of the reassembled packs, supported by rods;

Fig. 8 is an enlarged fragmentary section of the edges of a pack with one set of strips out of line with the others;

Fig. 9 is an edge view of a rubber blanket and its supporting rolls;

Figs. 10 and 11 are top views of the blanket and

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the rolls showing the blanket in unstretched and stretched condition, respectively.

In Fig. 1 is shown a color component pack A, consisting of a series of strips or leaves 1 having registering lugs or ears 2, having accurately registering apertures 3 therein. A second pack is made up of leaves or strips 4, one of which is shown in Fig. 2, having accurately registering lugs or ears 5 having registering apertures 6, and a third pack is made up of strips or leaves 7, one of which is shown in Fig. 3, having registering lugs or ears 8 having accurately registering apertures 9 therein.

The three packs are identical except for the position of the lugs or ears. The leaves are made of any suitable metal such as copper, brass, steel, or zinc. The strips are made accurately of the same dimensions so that when assembled in a pack, their long lower edges will lie in a plane. In use they will be clamped together as explained later. If desired, the face of the pack thus formed may be ground or dressed to a plane surface. It is then preferably electroplated with a thin skin of copper, nickel, silver, or other suitable metal to give a continuous surface bridging the interstices between the leaves.

As an example of the dimensions, the following may be mentioned. A convenient size of the face of a pack constituting a color component may be five by seven inches. A leaf thickness of .003 inch is suggested as suitable. The electroplated metallic skin is very thin, of the order of .0001 inch.

Each pack is securely clamped together prior to electroplating, and on the electroplated layer is coated a continuous sensitive layer, ordinarily a bichromated colloid, in which a relief image of the appropriate color component is formed by well known photographic methods. This would be a negative with the half-tone separations and angles as usual.

Fig. 4 shows on an exaggerated scale a section of the edges of a few strips 1 after a relief image is formed but before etching. The thin metal skin is designated 10, and the relief images 11, with spaces 12 between them. Fig. 5 shows the same strips after etching and the removal of the relief images. It is to be understood that the pack is etched through the relief images, and the latter removed as is customary in photoengraving processes. It is to be noted that, opposite the points where there were spaces 12, there are now etched depressions 13.

The clamps are now removed from the three packs and the strips 1, 4, and 7, constituting the three packs, are sorted and reassembled in suc-

cession. Because of the extreme thinness of the metal skin 10, this will break with a clean line along the cracks between the strips. The edges of the reassembled strips will then appear as in Fig. 6. Every third strip is from the same pack, and the resulting face of the assembled strips comprises depressions 13 and faces 14 of the plated metal coating 10 lying in a plane.

It is to be understood that the assembled strips are not at this point clamped tightly together, but each set of strips is supported by rods 15 passing through the registering apertures 3, 6, and 9 of the respective sets of ears, 2, 5, and 8, as shown in Fig. 7. The strips are thus supported with their etched edges forming the lower face of the pack. Two of the sets of strips are then lifted slightly by their supporting rods, leaving the edges of the third set in a lower plane, as shown in Fig. 8. An ink roller of appropriate color is then passed over this surface, inking the exposed set. This set is then raised and one of the others lowered and inked with a second color, after which the third set is similarly inked. The three sets are then restored to the position shown in Fig. 6 and clamped tightly together with the edges lying in a common plane. The inking of the three sets would of course be done rapidly and successively and the edges of the assembled pack carrying broken lines of differently colored inks at once brought into printing contact with the surface to be impressed. It is obvious that an image made as above described would consist of broken lines of three different colors and, in one direction, would be three times the required dimension.

This dimensional difficulty may be avoided by making the original half-tone separation prints through an anamorphic optical system or by other means such as mechanical or photoelectric scanning and reproduction systems that will reproduce one dimension on one-third the scale of the other. If the final image is to be 5 by 7 inches, the color separation images will be $1\frac{2}{3}$ by 7 inches, so that when reproduced as above described, the reassembled triple pack of strips will be 5 by 7 inches. In this case the laminae may be only .001 inch thick.

Another way of obtaining the same end result will now be described, reference being made to Figs. 9, 10, and 11.

An elastic blanket 16, preferably of natural or synthetic rubber, is attached at its ends by clamps 20 to separated discs 17 mounted with ball bearings 18 on shafts 19 and together acting as rollers upon which the blanket may be wrapped. The discs carry and are separated by light leaf springs 21 which tend to force them apart. The ball bearings permit the discs both to turn and to slide easily on the shafts 19. Rods 22 pass through the discs and hold them in alignment but with sufficient play to permit the discs to slide upon them.

When the blanket is not under tension, as shown in Fig. 10, the discs are separated. The rods 22 may be used to turn the discs as a group and to stretch the rubber blanket 16 as shown in Fig. 11; stretching in a lengthwise direction also tends to contract the blanket transversely and also forces the discs toward each other, thus shortening the length of the effective roller constituted by them. The discs are shown in dotted lines in Fig. 11, as the blanket 16 is rolled around their periphery. The relative distortion of the two dimensions will differ with different blankets, but a typical effect is illustrated in Figs. 9 and

10. An area B, 5 by 7 inches in size, is distorted into the area C, $3\frac{1}{2}$ by 15 inches. That is, the lengthening of the band 2.1 times results in the lessening of its width to .7 of its original dimension. If a "one way stretch" fabric coated with rubber is used, the distortion will be in one dimension only.

If a picture image, therefore, is imprinted on the area when in its distorted form C, and the band is then restored to its normal size and shape B, an image which is similarly distorted in both dimensions and imprinted on C will appear correctly when the band is unstretched. In order to obtain an undistorted 5 by 7 image, I make three undistorted color component images on three laminated packs of the structure described, each being $3\frac{1}{2}$ by 5 inches, the laminations being five inches long. These three packs are sorted and reassembled into a pack $3\frac{1}{2}$ by 15 inches; and the three sets are then separately inked in different colors and at once imprinted simultaneously on the rubber band while stretched. After the impression is made, the tension is released and the picture area assumes the 5 by 7 inch shape and size, and the dye image is at once printed by offset upon paper.

Instead of rotating the discs, the shafts 19 could be drawn away from each other to stretch the rubber blanket to the desired extent.

To prevent contamination of the colors by capillary absorption of ink in the interstices the sides of the strips may be wiped, or the interstices may be fed with a water-repelling oil where an aqueous ink is used, or with a glycerin mixture, for example, when an oily ink is used.

If an additive color image is desired, the inks would be ones not readily diffusing one into another; but if, as is preferable and usual, the image is a subtractive one, the inks should diffuse, thus mixing the closely adjacent colors and overcoming the impression of fine lines. The fluidity of the inks, plus the capillary action of the paper fibers, together with the compression of the lines of inks with the contraction of the rubber band is usually sufficient, when ordinary typographic inks are used, to cause a considerable intermingling of the three inks. This does not extend beyond a very few lines and produces an effect of a continuous image. The finer the screen ruling, the more complete will be the intermixture of colors.

It is to be understood that two- or four-color prints may be made and that any selection of colors may be used, although ordinarily in three-color subtractive processes cyan, yellow, and magenta inks are used.

Having thus described my invention, what I claim is:

1. The method of making a multi-color impression with a single printing operation that comprises forming separate color component printing images upon the faces of separate packs of strips, the strips of each set having their edges in a common plane, reassembling in succession in a single pack the sets of strips from all the separate packs, separately applying inks of different colors to the edges of the strips of each set, then placing the freshly inked edges of all the sets in a common plane and printing from them simultaneously upon a print-receiving surface.

2. The method of making a multi-color impression that comprises forming separate color component printing images upon the faces of separate packs of strips, the strips of each set having their edges in a common plane, reassem-

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bling in succession in a single pack the sets of strips from all the separate packs, separately applying inks of different colors to the edges of the strips of each set, then placing the freshly inked edges of all the sets in a common plane and printing from them upon a print-receiving surface.

3. The method of making a multi-color impression with a single printing operation that comprises assembling sets of thin strips into packs with the edges of each set in a common plane, forming separate color component printing images upon the faces of the packs thus formed, reassembling the sets of strips from all the packs into a single pack with the strips in recurring sequence, causing the edges of the strips of the original sets to be successively protruded from the pack and while thus protruded to be inked with inks of different colors, realigning all the freshly inked edges in a common plane and at once printing from them simultaneously upon a print-receiving surface.

4. The method of making a multi-colored image that comprises assembling sets of metal strips having registering apertures into packs, the corresponding edges of the strips lying in a plane and constituting a face of each pack, forming upon such faces of the several packs color component printing images of different colors, separating the strips of the packs and reassembling them in a single pack, passing rods through the registering apertures of each set, moving the sets relatively by means of said rods to cause the image-carrying edges of each set in succession to protrude from the pack, applying ink to said edges while thus protruding, repositioning all the inked edges in a common plane, and printing therefrom upon a receptive surface.

5. The method of making a multi-color impression that comprises forming color component printing images upon the face of separate packs of strips, reassembling the strips from all the packs in recurring sequence into a single pack, separately inking the edges of the strips of each original pack, printing from all the inked edges upon a stretched elastic band, and then permitting the band to return to an unstretched condition.

6. The method of making a multi-color impression that comprises forming color component printing images upon the edges of strips which form the faces of separate similar packs of strips, reassembling the strips from all the packs in recurring sequence into a single pack one dimension of which is a multiple of the dimension of the original packs, separately inking the edges of the strips of each original pack, printing from all the inked edges upon an elastic band stretched to an extent such that its elongation is the same multiple of its original dimension, thus producing a distorted multi-color image, and then permitting the band to return to an unstretched condition, whereby an undistorted image is formed.

7. The method of making a multi-color impression that comprises forming color component printing images upon the faces of separate packs of strips, reassembling the strips from all the packs in recurring sequence into a single pack, separately inking the edges of the strips of each original pack, printing from all the inked edges upon a stretched elastic band, then permitting

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the band to return to an unstretched condition, and then printing by transfer from the elastic band upon a print-receiving surface.

8. The method of making a multi-color impression that comprises forming color component printing images upon the edges of strips which form the faces of separate similar packs of strips, reassembling the strips from all the packs in recurring sequence into a single pack one dimension of which is a multiple of the dimension of the original packs, separately inking the edges of the strips of each original pack, printing from all the inked edges upon an elastic band stretched to an extent such that its elongation is the same multiple of its original dimension, thus producing a distorted multi-color image, then permitting the band to return to an unstretched condition, whereby an undistorted image is formed, and then printing by transfer from the elastic band upon a print-receiving surface.

9. The method of making a multi-color image of a standard size that comprises forming separate color printing images of less than standard size upon the faces of separate packs of assembled strips, reassembling in recurring sequence in a single pack the sets of strips from all the packs, separately inking the edges of the strips of each original pack, printing from the assembled pack upon an elastic band stretched longitudinally, and then permitting the band to return to an unstretched state.

10. The method of making a multi-color image of a standard size that comprises forming separate color printing images of less than standard size upon the faces of separate packs of assembled strips, reassembling in recurring sequence in a single pack the sets of strips from all the packs, separately inking the edges of the strips of each original pack, printing from the assembled pack upon an elastic band stretched longitudinally and contracted transversely, and then permitting the band to return to an unstretched state.

11. The method of making a multi-color image of a standard size that comprises forming separate color printing images of less than standard size upon the faces of separate packs of assembled strips, reassembling in recurring sequence in a single pack the sets of strips from all the packs, separately inking the edges of the strips of each original pack, printing from the assembled pack upon an elastic band stretched longitudinally and contracted transversely, then permitting the band to return to an unstretched state, and then printing by transfer from the elastic band to a print-receiving surface.

12. The method of forming a multi-color impression that comprises forming color component printing images upon the faces of separate packs of strips, the face of each set being formed by the edges of the strips lying in a common plane, reassembling in succession in a single pack the sets of strips from all the packs, causing the edges of the strips of the original packs to be successively protruded from the reassembled pack and inking them while thus protruded, realigning the inked edges in a common plane and printing therefrom upon a stretched elastic band, and then permitting the band to return to an unstretched state.

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