# United States Patent

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[54] **FLEXIBLY DIVIDED SILK SCREEN**
**9 Claims, 8 Drawing Figs.**


[52] **U.S. Cl.** ..... **101/127.1,** 101/115, 101/202
[51] **Int. Cl.** ..... **B41n 1/24**
[50] **Field of Search** ..... 101/115, 126, 128.1, 128.2, 202, 128.3, 128.4, 127, 127.1, 129; 156/91, 153



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**ABSTRACT:** A framed silk screen for application of two or more colors, said screen having a thin, flexible divider strip which separates adjoining color areas. The lower edge of the strip is held by a bonded joint to the silk screen. A method for making the framed screen provides forming a linear pervious area in the screen, mounting the strip so that its edge is aligned with the pervious area, and bonding the strip to the screen by means which allow bonding material to pass through the pervious area of the screen.

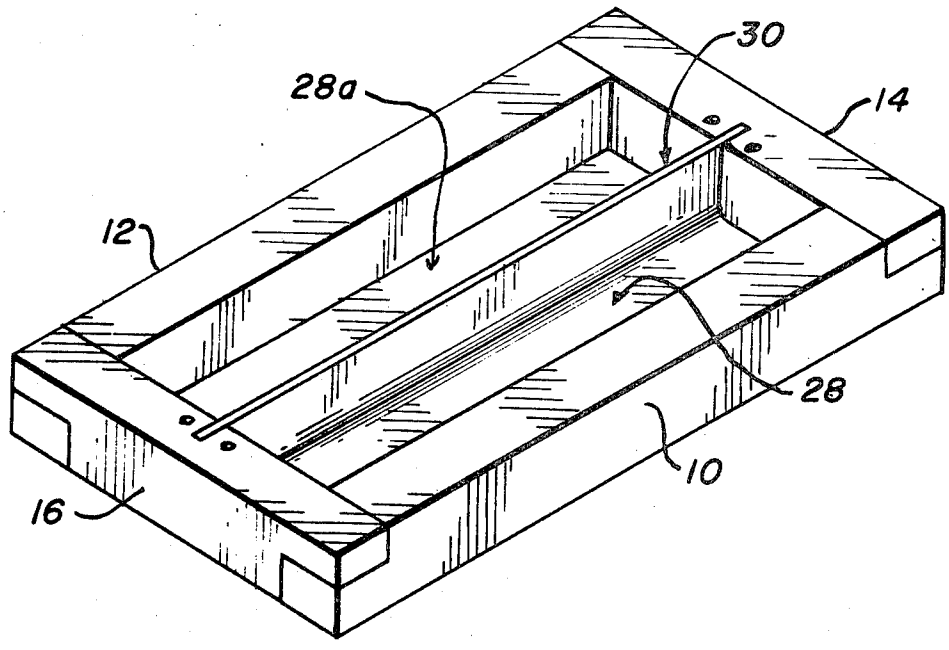



FIG. 1

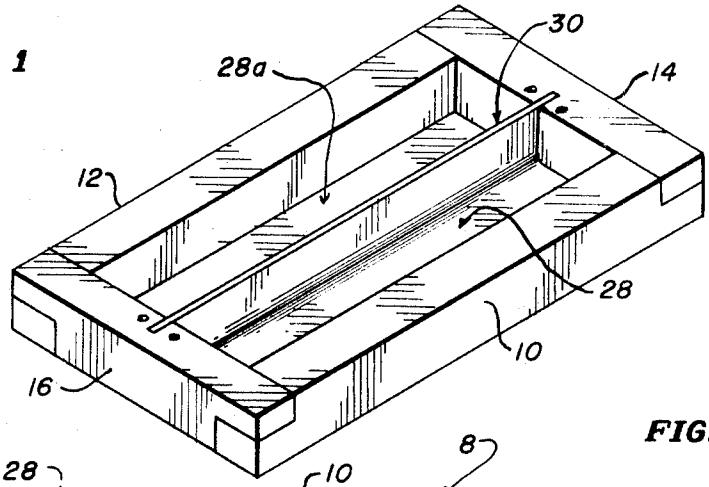



FIG. 2

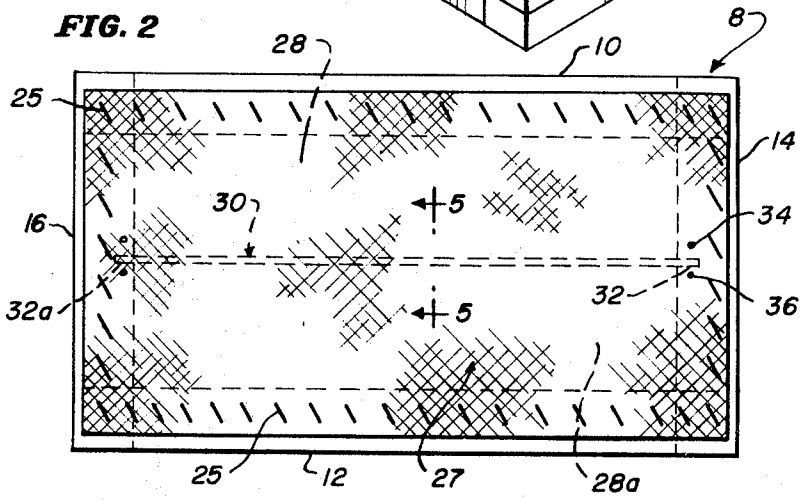



FIG. 4

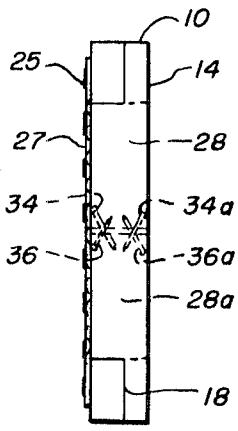



FIG. 3

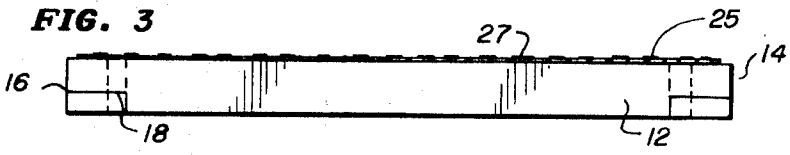



FIG. 6

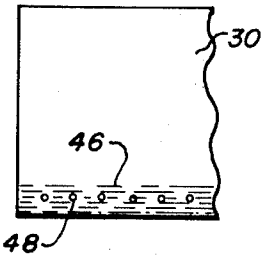



FIG. 7

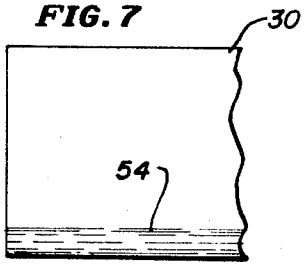
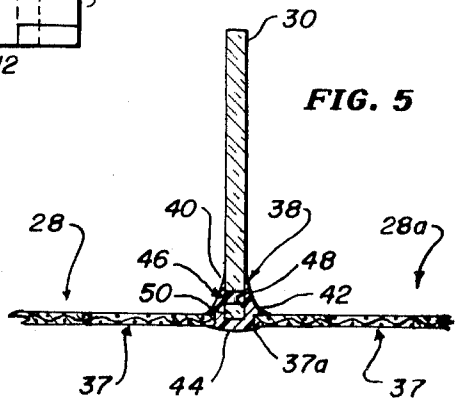



FIG. 5



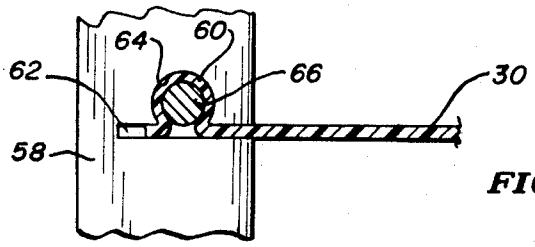




FIG. 8

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# FLEXIBLY DIVIDED SILK SCREEN

This invention relates to a frame silk screen in which a plurality of colors may be employed by using one or more thin, flexible separator strips; and the invention also relates to a method for making such framed screens.

Silk screens are recognized and comprise a part of known silk screening printing including manual fixtures and machines. Pigment or ink is deposited on such a screen and forced through image or fluid previous areas by the action of a member such as a squeegee. Flat screens which are used in such machines have a continuous frame which may comprise a plurality of wooden or metal frame members to circumscribe various areas, commonly a rectangular area. Such screens may be maintained stationary in the machine or fixture for flat printing while the squeegee moves over the ink deposited on the screen from an ink reservoir of the like. Such flat screens may also be linearly displaceable relative to a cylindrical surface while a squeegee remains stationary for moving the ink through the image areas of the screen.

The image or fluid pervious areas may be obtained in various ways on such screens, including masking portions of the screen intended to comprise image areas, and then varnishing the screen. The nonmasked areas will of course be fluid pervious. Cut screens may also be used. Photosensitive emulsions may also be applied to the screen in a light pattern directed to those parts of the screen which are intended to be fluid impervious. The masked or blocked portions can then be rendered fluid pervious by photographic processing. This may be done by known direct, indirect or indirect-direct methods. In the pursuit of the goal of screen printing by applying two or more colors with the same screen, rigid separators have been employed. Problems have arisen because the screen flexes during printing which leads to ink bleeding or passing through a parted area between the rigid separator and the screen. The use of such rigid separators in the silk screening process has therefore led to problems which has seriously limited their application and acceptance.

It is accordingly one object of the present invention to provide a frame screen in which a multiplicity of colors may be applied by utilizing an improved flexible separator strip mounted in an improved manner to the framed screen.

Another object is to provide a framed screen having a thin, flexible separator strip which can flex with the screen during the printing operation without parting from said screen.

Yet another important object is to provide a framed screen in which a thin, flexible plastic strip is employed which is inert to ink solvents, and which strip is mounted to frame members and bonded to the silk screen in an improved manner.

Still yet another important object of the invention is to provide a divided framed silk screen in which a thin, flexible, plastic separator strip is mounted to the screen to separate color areas, and in which the lower edge of the strip is coincidental with a linear pervious area in the screen so that bonding material may pass through said pervious areas to more effectively form a bonding joint between the silk screen and the separator strip.

A still yet another important object of the invention is to provide a method for making framed and divided silk screens in which a thin, flexible plastic separator strip is mounted in an improved manner to spaced frame parts of the screen and to the screen itself. This object is attained by steps which allow the flexible strip to be securely mounted to the frame members, and to be bounded to the silk screen in an improved manner.

Still yet another object of the invention is to provide a method for obtaining improved divided framed screens by steps of roughening a longitudinal area of the flexible strip adjacent the screen so that an enhanced bonding joint is obtained. A feature of this object is to process the screen so that a linear pervious area is obtained adjacent the lower edge of the flexible strip, wherein bonding material passes through said linear pervious area to lock the bottom edge of the roughened flexible strip more securely to the screen itself.



The foregoing objects are attained together with still other objects which will occur to practitioners from time to time by the invention which will now be disclosed, such disclosure including drawings wherein:

FIG. 1 is a perspective view of the framed and divided screen;

FIG. 2 is a top plan view of the framed and divided screen;

FIG. 3 is a side elevational view of the screen of FIG. 1;

FIG. 4 is an end view of the screen of FIG. 1;

FIG. 5 is a portional section view, on an enlarged scale, along line 5–5 of FIG. 2;

FIG. 6 is a portional side elevational view of the separator strip used in the divided silk screen of FIG. 1;

FIG. 7 is a portional side elevational view of a flexible, separator strip showing a roughened area which may be obtained in alternative ways; and

FIG. 8 is a portional top plan view showing an alternative embodiment for securing the ends of the thin flexible strips in parts of the frame and the divided silk screen.

The framed and divided silk screen shown in FIGS. 1 and 2 has a generally rectangular frame 8 which includes spaced longitudinal side members 10 and 12 joined at their respective ends to shorter transverse end members 14 and 16. The respective ends of the side and end members are shown joined by a splice or rabbet joint 18. The joint may be variously formed including a 45° bevel, or the like.

The side and transverse members are shown as being substantially rectangular in cross section although the frame members may be variously shaped to satisfy particular printing requirements, such as seating the divided framed screen in a particularly screening machine. The illustrated frame member is shown to consist of frame parts joined by splices or the like, but an integral frame unit could also be provided, and such frame may circumscribe areas other than rectangular. The frame members may be selected from a variety of materials including wood, aluminum, plastic and others.

The illustrated screen circumscribes a rectangular area. The screen 27 is stretched over said area and is tautly mounted by means shown as staples 25, although other fasteners and bonding materials may be used. While reference is particularly made to a silk screen herein, it will be recognized that other screen fabrics may be employed such as nylon. In general, the principles of the present invention apply to any equivalent screen materials which may also include stencils made from a variety of materials. The term "silk screen" is intended to include such equivalent screening materials.

The illustrated screen 27 is divided into parts or areas 28 and 28*a* by a thin, flexible separator strip 30. Such strip completely divides the screen area by extending to opposite end frame members 14 and 16. The opposite ends of the separator strip are shown as received in slits 32 in end member 14 and 32*a* in end member 16. The slits are dimensioned to receive the thickness of the strip ends in close-fitting proximity. In general, the width of such slits are greater than the width of the separator strip but preferably less than two times the width of such strips. The ends of the separator strip 30 are secured to the opposite end members by fastening means shown here in end member 14, as comprising fasteners or nails 34, 36 passing through opposite sides of the strip end in the slit at the top of the end members; and another pair of fasteners or nails 34*a*, 36*a* passing through opposite sides of the end of the strip at the bottom of the end members. Similar fastening means are provided at end member 16, but such will not be described in detail. The strips may be otherwise mounted to the frame parts, for example, by angle brackets, mounting blocks, clamps which are fastened to the frame by bolts, or the like. In general, the strip ends are held between spaced members with the aid of fasteners, a clamping action or the like.

Looking now at the enlarged scale sectional view of FIG. 5, the screen 27 is diagrammatically illustrated as having an image or liquid pervious area 37 between the bordering verti-

cal lines and a linear pervious area 37*a* adjoining the bottom edge of the separator strip 30. The linear pervious area extends along the length of the silk screen and said linear pervious area will form a junction line which will be coincidental with the separator strip following mounting thereof within the frame. The separator strip 30 is shown secured to the silk screen 27 by a bonded joint shown generally as 38. The bonded joint is illustrated as having opposite chamfered sides 40 and 42, as well as a bulging base 44. The bonded joint is formed preferably by a flexible resin bonding material, although more rigid bonding materials are also operable to some extent. The bonding material is preferably applied to opposite sides of the separator strip adjacent its lower edge, whereupon some of said resin material passes through the linear pervious area 37*a*to form the bulging base 44 following curing. An epoxy adhesive material has been found useful for this purpose for example, Epon 828 cured by V–40 agent, both supplied by Shell Chemical Co., Plastics and Resins Division.

An important feature is the provision of a longitudinal roughened area, shown generally as 46, adjacent the bottom edge of the separator strip. Such a longitudinal roughened area provides an increased irregular surface area to attain better bonding action with the bonding material used. In the view of FIG. 6, the roughened area is indicated as comprising a pierced hole 48 having projecting broken flange portions 50. A plurality of such pierced holes are preferably aligned in a row as indicated in the view of FIG. 6. The bonding action will therefore extend coextensively with the row or pierced holes to the opposite end frame members. Polypropylene and nylon are useful materials to make the separator strips. It will be evident that other thermoplastic, as well as thermosetting materials, are likewise operable for making such strips so long as the resulting strip is flexible and is inert to the solvents commonly employed in the printing inks.

The longitudinally roughened area is diagrammatically represented at 54 in the view of FIG. 7, and this representation is intended to depict various mechanical and chemical roughened areas. Such roughened area may, for example, be mechanically roughened by an abrasive such as sandpaper. It may be roughened by knurling to obtain a plurality of irregular peaks and valleys. The area 54 may also be chemically roughened by contacting the area with chemicals which partially dissolve and break up the surface, such as various mineral or organic acids. A chemical etchant may be employed which is composed of about 120 parts of water, about 1,500 parts of sulfuric acid and about 75 parts of an alkali bichromate. A primer chemical solution may also be used to chemically roughen the longitudinal area 54, and one such composition is provided under the trademark Hercoprime 15 A T by the Hercules Company of Wilmington, Delaware.

The view of FIG. 8 illustrates an alternative embodiment for securing the ends of the separator strip to opposite frame parts of the screen assembly. The end of the flexible separator strip 56 is shown secured to a frame member part 58. The end of the flexible separator strip has a loop 60, and the end of the separator strip is received in a straight slit or groove 62 and in a substantially circular passageway 64 in the end member 58. A complementary insert, such as a peg or dowel, is placed in the circular passageway to secure the end of the strip in the frame part.

A method for making the framed divided screen with the thin flexible separator strips includes the steps of preparing the screen 27 so that a linear pervious area 37*a* is formed thereon. This is preferably done after the screening material is mounted by stapling or the like to the frame. Such screen may be coated with a photosensitive emulsion and then exposed with a positive element having a black line so that the light does not fix the corresponding longitudinal area on the screen. When the screen is processed by washing, the linear pervious area is obtained as an open image which extends the length of the screen. One end of a thin flexible plastic strip, which may be nylon of about 0.015 inch thickness, is then roughened along its lower edge, placed in a slit in one frame part, and fastened to the frame member. The strip is preferably softened by exposing the strip to warm air or the like, and thereafter the strip is placed under tension by stretching. This may be done by pulling the free end toward the slit in an opposite frame part. The opposite free end of the strip is then securely attached in such opposite frame part. The bonding material is then applied to the opposite sides of the lower edge of the strip which has been previously roughened to obtain the longitudinally roughened area. The bonding material will move through the linear pervious area to attain bonding action at the bottom edge of the flexible separator strip. To attain the tension of the strip by stretching, it is desirable to employ a thermoplastic material such as polypropylene which softens in a sufficiently warm environment to attain the stretching thereof. Warm air may be used as described, or the stretching operation may be employed in an oven. No critical temperature levels are required since thermoplastic material need only be slightly softened to attain the tension by stretching. It will be realized that some materials may be stretched at room temperature. Strips may also be mounted without stretching.

The separator strip has been illustrated as providing separated color areas by extending to opposed frame parts, but the strip may be otherwise disposed and fastened to parts of the framed silk screen to effect such color area separation. The strip may be arcuately conformed and attached at its ends to spaced frame parts other then 180° apart. Likewise strip parts may be joined at spaced points to sides of a continuous member within the screen. Such a member may have a circular wall defining an image area through which pigment is moved to form a circular ink image. The strip parts may be joined to the wall at one of their ends, and to opposite frame parts at the other of their ends. Similarly, the strip parts may be partly fastened to one another to provide angular and curvilinear patterns for the separated color areas. All such fastening points may be considered as "frame parts" for purposes of the present description. It will be understood that the term "linear pervious area" will likewise include such angular and curvilinear dispositions when used in describing the image areas of the screens.

The invention may now be practiced in the various ways which will occur to practitioners, and it should be understood that all such practice will comprise a part of the present invention so long as it comes within the terms of the following claims.

What I claim is:

1. A color-separating framed silk screen including
   - a continuous frame which forms a circumscribed frame area,
   - a silk screen secured to said frame and stretched over said circumscribed area, said screen having areas which are pervious and impervious to fluid material,
   - a thin flexible, elongated separator strip fastened to parts of the frame and having a bottom edge secured to the screen to provide separated color areas,
   - one of said fluid pervious areas being a linear pervious area in the screen adjoining the bottom edge of said strip, said linear area being pervious to a fluid adhesive material, and
   - a bonded joint formed by said cured adhesive material holding said bottom edge to said screen by extending into said linear pervious area.

2. A framed silk screen as in claim 1 wherein said bonded joint comprises a cured flexible resin, and said flexible resin bonded joint extends continuously along said bottom edge and linear pervious area.

3. A framed silk screen as in claim 1 in which said strip extends to opposite frame parts, and the opposite ends of said flexible separator strip are fastened to said opposite frame parts.

4. A framed silk screen as in claim 1 wherein said flexible separator strip is a plastic strip which is substantially inert to printing ink which contacts said strip.

5. A framed silk screen as in claim 1 which further includes a roughened area along the lower edge of said flexible separator strip to increase the surface area to enhance the bonding action at said bonded joint.

6. A framed silk screen as in claim 1 wherein said frame is rectangular and includes a plurality of frame members comprising longitudinal side members joined at their opposite ends by shorter end members, the respective ends of said members being spliced to one another,

said silk screen having a rectangular area, a slit provided in each of the opposite end members, the opposite ends of said flexible separator strip extending into said slits and being fastened therein, and



said bonded joint holding said bottom edge of the flexible separator strip to the screen, said bonded joint extending continuously between said opposite end members.

7. A framed silk screen as in claim 5 wherein said roughened area along the bottom edge of said flexible separator strip to increase the bonding area comprises a row of holes with projecting, broken flange portions.

8. A framed silk screen as in claim 5 wherein said roughened area comprises an irregular rough surface.

9. A framed silk screen as in claim 8 wherein said roughened area is a knurled surface having a plurality of irregular valleys and peaks.