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54 **Method and underpacking for mounting printing plates on a rotary printing press.**

57 A deformable printing plate is mounted on the plate cylinder of a rotary printing press over an underpacking comprising a flexible film having a major surface having a sufficiently high effective coefficient of breakout friction with the underside of the printing plate. The flexible film cooperates with essentially inextensible supporting means, and supports and stabilizes the printing plate, thereby substantially eliminating or substantially reducing the stretching and distortion of the printing plate during printing. In a preferred embodiment, the underpacking further comprises an essentially inextensible, flexible underlayer. In alternative embodiments, a contact layer may be applied to the underside of the printing plate such that the underside of the printing plate achieves a sufficiently high coefficient of breakout friction with cylinder body.

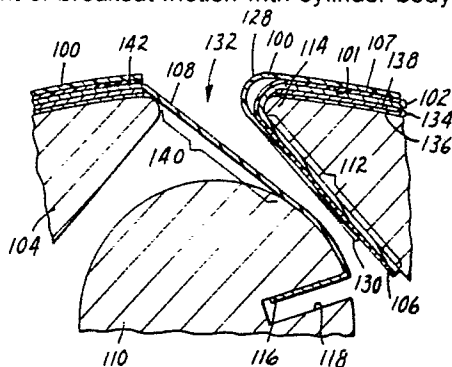


FIG. 2

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METHOD AND UNDERPACKING FOR MOUNTING PRINTING PLATES ON A ROTARY PRINTING PRESSField of Invention

This invention concerns a novel method of, and underpacking for, mounting a deformable printing plate
 5 on the plate cylinder of a rotary printing press.

Background of Invention

10 Many printing processes employ a printing plate, i.e., a member having a major surface that is differentially conditioned, in imagewise fashion, such that some portions of the major surface accept an imaging composition, i.e., ink, and other portions of the major surface do not accept the imaging composition. In a rotary printing process the printing plate, typically rectangular in shape and flexible, is mounted on the plate cylinder of a printing press. In use, the plate cylinder rotates, contacting the major
 15 surface of the printing plate to an imaging composition supply wherein the plate is differentially inked, and then contacting the plate to a surface to which the imaging composition is transferred, e.g., a final substrate such as paper, or an intermediate substrate such as a blanket or web. Examples of common printing techniques in which a printing plate is mounted on a rotary plate cylinder and used in this fashion include lithography, gravure printing, flexography, and letter press printing which may be performed in direct or
 20 offset fashion.

Printing plates are often made from any or a combination of such materials as aluminum or stainless steel. Before being mounted on the plate cylinder, such plates are typically substantially flat or have a curvature approximating that of the plate cylinder.

For the purposes herein, an offset printing press on which is used a lithographic printing plate, i.e., a
 25 lithoplate, is exemplary of rotary printing presses and printing plates in general.

Most lithoplates have a metal base, such as aluminum, and are typically about 5 to 12 mils (125 to 300 microns) thick. On a typical web printing press, the lithoplate is mounted on a plate cylinder with sufficient underpacking to raise the lithoplate to the desired printing height, which is typically at or about 1 mil (25 microns) above the pitch line of the load bearing rings or bearers. Proper underpacking of the lithoplate is
 30 essential to ensure that a sufficient impression squeeze or interference between the inked printing plate and offset printing blanket, which is mounted upon the blanket cylinder, is provided to achieve transfer of ink from the printing plate to the blanket, from whence it is then transferred to paper. A typical interference of about 4 mils (100 microns) is generally provided by packing the blanket to about 3 mils (75 microns) above the pitch line of the bearers of the blanket cylinder.

35 Substantial cost reductions may be realized by using printing plates having a, e.g., plastic base. For instance, U.S. Patent No. 4,204,865, (Kuehnle et al.) discloses a lithographic printing plate having a polyester base. Printing plates have also been made from laminates of paper and plastic, paper and thin metal, e.g., foil, or plastic and thin metal. Such plates, however, typically tend to stretch under the impression stresses encountered during printing on, for instance, a commercial web press, thereby resulting
 40 in a lengthening of the printed image in the machine direction. Such lengthening of the image poses a serious problem, particularly when the printing project involves two or more colors which are sequentially applied with successive printing plates to provide a composite print, wherein stretching of the printing plates tends to interfere with proper registration of the sequentially-applied images. It is believed that no one has yet demonstrated how a stretchable printing plate could be successfully used on the plate cylinder of, e.g.,
 45 a conventional web press.

Furthermore, some printing plates may tend to possess such low dimensional stability and to be of such high flexibility, i.e., are so deformable, as to be incapable of being mounted on a plate cylinder by conventional means, e.g., reel bar or spring finger.

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Other Prior Art

U.S. Patent No. 3,358,598 (Middleton) discloses a method for mounting printing plates on plate cylinders wherein a plate is permanently adhered to a plastic backing fixture which is then mounted on the plate cylinder.

Summary of Invention

The present invention provides, for the first time insofar as known, a method for quickly and securely mounting a deformable printing plate on the plate cylinder of a rotary printing press which eliminates or at least substantially reduces stretching and distortion of the printing plate during printing such that the image will not stretch and the printing plate will remain securely mounted on the plate cylinder. The present invention also provides a novel underpacking for practicing such a method. According to the invention, a set of such plates can be mounted on successive plate cylinders and proper image registration achieved to produce a multicolor, composite print.

"Deformable" printing plates, as used herein, refers to printing plates possessing such low dimensional stability and high flexibility as to be incapable of being mounted on a plate cylinder by conventional means, i.e., secured by only the leading and trailing edges thereof, e.g., with a reel bar lockup or spring finger clamp. Examples include printing plates made from plastic or polymeric materials such as polyester, cellophane, polyethylene, vinyl, polystyrene, polypropylene, and cellulose propionate, as well as those made from laminates of paper and plastic, paper and thin metal layers or foils, or plastic and foils. Such plates typically will tend to stretch or distort when operated on a printing press if mounted by means which only secure the leading and trailing edges thereof, thereby causing the printed image to be stretched in the machine direction or otherwise distorted (skewed in some fashion) particularly when used on a large, high speed press that employs substantial impression forces, e.g., a large lithographic web press. Furthermore, such plates may distort so readily that they will not maintain a required contour for mounting on a plate cylinder in conventional fashion, such as with a crimp near the leading edge secured over the bullnose and a crimp near the trailing edge that is secured by a reel bar. Such plates are therefor typically incapable of being so mounted on a plate cylinder or, if so mounted initially, are incapable of remaining securely mounted throughout the desired period, i.e., throughout a press run of several hundred or several thousand impressions.

Briefly summarizing, the method of the invention typically comprises: 1) mounting on the plate cylinder of a printing press, in cooperation with essentially inextensible supporting means, an underpacking comprising a flexible film or web having an exposed major surface with a sufficiently high effective coefficient of breakout or static friction (as hereinafter defined) with the underside of the printing plate; and then 2) mounting the deformable printing plate on the plate cylinder over the underpacking with the underside of the printing plate in frictional contact with the exposed major surface of the underpacking. By "essentially inextensible" it is meant that supporting means is essentially not stretched or deformed when subjected to stresses of the magnitude of those encountered by the printing plate during printing.

The flexible film is adapted so as to be mounted on the plate cylinder, i.e., the flexible film is sufficiently flexible and conformable and of effective dimensions so as to be mounted on the plate cylinder such as by adhesive, mechanical (reel bar lockup, spring finger clamp, etc.) or other means. The flexible film is also adapted to be mounted so as to cooperate with supporting means for maintaining the dimensional integrity thereof, i.e., means for essentially preventing it from stretching or distorting due to the forces exerted during printing. For instance, the underpacking may be a polymeric film adhered directly to the plate cylinder with adhesive means, e.g., a layer of adhesive or a double-sided adhesive sheet, or a flexible film laminated or coated upon the face of the body of the plate cylinder such that the cylinder body of the plate cylinder acts as supporting means. In a preferred embodiment, the underpacking comprises an essentially inextensible, flexible underlayer to which is adhered the flexible film. Rather than being adhered to the plate cylinder, such an underpacking is typically mounted on the plate cylinder in similar fashion as a metal-base printing plate would be, e.g., magnetically, or with a reel bar lockup or spring finger clamp, thereby achieving the convenience of easy mounting and removal of the underpacking from the plate cylinder.

Effective coefficient of breakout friction (referred to hereinafter as "ECOFB"), as used herein, means the ratio of:

1) the tangential force required to slide an initially static sheet of the printing plate base material, (e.g., polyester) with a 10.0 pound normal load substantially uniformly distributed over a 3 inch diameter area thereof, across the exposed major surface of the flexible film of the underpacking; to

2) the normal or perpendicular load, i.e., 10 pounds. A sufficiently high ECOFB is one at which the static frictional "grip" or interaction between the exposed major surface of the underpacking and underside of the printing plate, is substantially equal to, and preferably exceeds, the stresses tending to deform or stretch the printing plate which are exerted against the printing plate during printing. The underpacking is selected to have the following frictional properties in contact with the underside of the printing plate. During initial rotation of the plate cylinder in contact with, e.g., dampening rolls or the blanket cylinder, the frictional grip between the printing plate and major surface of the flexible film of the underpacking should be low

enough to permit a hand-wound printing plate to creep into intimate contact with the major surface in response to stresses exerted against the printing plate (by the dampening rolls or blanket cylinder), thereby enabling flat seating of the printing plate with no wrinkles. However, upon achieving intimate contact and during printing, the deformable printing plate is supported and frictionally stabilized by the underpacking in cooperation with supporting means, thereby substantially reducing or eliminating the stretching or distortion of the former due to the impression stresses exerted upon it during printing.

In some instances, a deformable printing plate may be mounted directly on a plate cylinder if the underside of the printing plate has a sufficiently high coefficient of breakout friction with the face of the cylinder body as taught herein to prevent stretching and distortion of the printing plate.

The present invention provides a method for mounting deformable printing plates on the plate cylinder of a rotary printing press, and novel underpacking for use in such method. The method and underpackings provided herein may be used in several printing processes that employ printing plates mounted on rotary plate cylinders. Examples of such printing techniques include lithography, gravure printing, flexography, and letter press printing, in either direct or offset fashion. Although the following detailed description makes particular reference to a web press and the mounting of lithoplates thereon, it is to be understood that the scope and utility of the present invention also encompass other printing techniques such as the aforementioned.

Brief Description of the Drawing

The present invention will be further explained in the drawing, wherein,

Figure 1 is a partial illustration of the profile of the plate cylinder of a conventional web press;

Figure 2 shows, in partial schematic cross-section, a plate cylinder of a conventional web press on which a single-crimped deformable lithoplate has been mounted over a preferred embodiment of the underpacking of the present invention comprising a flexible film having an exposed major surface and an essentially inextensible, flexible underlayer, wherein the underpacking has been mounted over a sub-underpacking comprising two sheets of paper;

Figure 3 shows the profile of the leading edge of a deformable lithoplate after it has been double-crimped to be mounted on a conventional web press;

Figure 4 shows, in partial schematic cross-section, a plate cylinder of a conventional web press on which a double-crimped deformable lithoplate has been mounted over a second embodiment of the underpacking of the present invention that comprises a plastic film having an exposed surface adhered to an essentially inextensible underlayer;

Figure 5 shows, in partial schematic cross-section, a plate cylinder of a conventional web press on which a double-crimped deformable lithoplate has been mounted over a third embodiment of the underpacking of the present invention that comprises a flexible film having an exposed surface and is adhered to the plate cylinder; and

Figure 6 shows, in partial schematic cross-section, a deformable printing plate mounted over an underpacking comprising a flexible film and essentially inextensible, flexible metal underlayer that is mounted on the plate cylinder by magnetic means.

These figures, which are not to scale, are intended to be illustrative only and nonlimiting.

Detailed Description of Invention

The present invention is described with reference to a lithographic printing plate mounted on a web offset printing press for clarity. The impression forces and operating conditions encountered by a printing plate mounted on such a rotary printing press are believed to be more rigorous, i.e., tending more greatly to distort and stretch the printing plate, than the conditions encountered by printing plates mounted on other types of rotary printing presses. It will be understood by those skilled in the art, however, that the present invention will have utility with other rotary printing presses. Examples of deformable printing plates with which the present invention may be used include those made from such materials as polyester (e.g., polyester terephthalate), cellophane, polyethylene, vinyl, polystyrene, polypropylene, and cellulose propionate and those made from laminates of paper and plastic, paper and thin metal layers, e.g., foils, or plastic and thin metal layers.

With reference to Figure 1, typical plate cylinder 10 of a conventional web press, on which the lithoplate (not shown) is mounted, comprises cylinder body 12, groove 14, and bearer 16. Plate cylinder 10 also typically comprises a plate clamping device, such as a reel bar lockup or a spring finger clamp (not shown), which secures one or both ends of a conventional, i.e., metal-base, lithoplate to mount the same on plate cylinder 10. Such a clamping device is typically located within the clamping groove (not shown) which extends longitudinally across cylinder body 12. Undercut 18, which is the difference between pitch line 20 of the surface of bearer 16 and the surface of cylinder body 12, serves to accommodate the lithoplate and underpacking (not shown).

In Figure 2, deformable lithoplate 100 is shown mounted over preferred embodiment 102 of the novel underpacking of the invention on plate cylinder 104 of a web printing press (not shown). Preferred underpacking 102 comprises flexible film 106 having a major surface 107 and essentially inextensible, flexible underlayer 108.

Exposed major surface 107 of film 106 has a sufficiently high ECOBF with underside 101 of deformable lithoplate 100 such that, once properly mounted on plate cylinder 104, the friction between the two exceeds the forces tending to stretch or distort lithoplate 100 which are exerted upon it during printing. Film 106 cooperates with essentially inextensible underlayer 108 which acts as supporting means, such that during printing, lithoplate 100 is supported by underpacking 102, thereby substantially reducing or eliminating 1) the stretching of lithoplate 100, and 2) any distortion tending to cause lithoplate 100 to become insecurely mounted on plate cylinder 104, due to the impression stresses exerted upon it. However, the friction between major surface 107 of flexible film 106 and underside 101 of lithoplate 100 should be low enough to permit lithoplate 100 to be mounted and seated properly on plate cylinder 104 before use, as well as easily removed after use. During initial rotation of plate cylinder 104 in contact with, e.g., the blanket cylinder, the dampening rollers, or the ink rollers (not shown), to seat lithoplate 100, the friction should be low enough to permit lithoplate 100 to creep into intimate contact with underpacking 102 in response to the stresses exerted against lithoplate 100, thereby seating it flatly with no wrinkles. In order to achieve that result without wrinkling lithoplate 100, a low initial rate of rotation may be necessary. Gradual application of pressure to lithoplate 100 and plate cylinder 104 may also be helpful in avoiding wrinkling.

The ECOBF between exposed major surface 107 of film 106 and underside 101 of lithoplate 100 typically should be at least about 1.0, and is preferably between about 1.0 and about 4.5. It is most preferably between about 2.0 and 3.0, thereby providing an optimum combination of sufficient friction to prevent stretching of the lithoplate during use and yet permit facile mounting of the lithoplate over the underpacking on the plate cylinder. Materials which provide an ECOBF substantially below about 1.0 may tend to provide insufficient adhesion to support the lithoplate during printing, and therefore tend to fail to prevent stretching. Materials which provide an ECOBF substantially higher than about 4.5 may tend to interfere with the proper, wrinkle-free mounting of the printing plate on the plate cylinder.

Flexible film 106 should be a durable, flexible material which is resistant to common fountain solutions and printing inks, and which can be cleaned with typical press cleaning agents, e.g., mineral spirits and naphtha as well as provide the desired ECOBF. Figure 2 shows a preferred embodiment of the present invention wherein flexible film 106 is a film having the desired ECOBF with the lithoplate on an essentially inextensible, flexible underlayer 108.

A suitable flexible film 106 which is urethane-based may be formed as follows (all amounts are expressed in parts by weight). A prepolymer is prepared from the following composition:

<u>Component</u>	<u>Amount</u>
2,000 MW Diol (polypropylene oxide)	300.6
4,000 MW Triol (polypropylene oxide)	780
Toluene	134
Toluene Diisocyanate (80/20 by weight of 2,4 and 2,6 isomers)	156
Dibutyltin Dilaurate	1.0

To a nitrogen purged resin flask is added the diol, triol, and toluene. Toluene diisocyanate is added with mixing and the temperature is raised to 80°C and held at that temperature for four hours, then cooled to 60°C and the dibutyltin dilaurate catalyst added. At this point the prepolymer has a Gardner-Holdt viscosity

of about 17 to 27 stokes and a NCO equivalent weight of about 1400 to 1800. The prepolymer is then combined in the order shown with the following ingredients in a mixing vessel over which is maintained a dry nitrogen blanket.

	<u>Ingredient</u>	<u>Generally Useful** Range</u>	<u>Preferred** Amount</u>
5			
10	Titanium Dioxide	18-40	23
	Zinc Oxide	18-40	23
	Carbon Black	0-1	*
15	Talc	150-300	180
	Pyrogenic Silica	23-47	28
	Prepolymer	500	500
20	Toluene	350-490	380
	Xylene	400-540	430
25	Dibutyltin Dilaurate	5	5

* Added to make final coating gray rather than white, not believed to affect the frictional characteristics of the resultant coating.

** With reference to a polyester printing plate.

This composition is similar to a composition disclosed in Example 1 of U.S. Patent No. 3,723,163 (Schumacher).

This composition can be coated on a steel or aluminum underlayer (typically primed), preferably to a dry thickness of about 1.0 to 1.5 mils (25 to 40 microns), and cured to form a flexible film having a major surface with the desired properties. Coating may be achieved by many techniques including spraying or bar coating such as with a wire-wound coating bar. This urethane-based composition is moisture cured, and a 1.5 mil dry thickness layer is typically sufficiently cured after about 24 hours at 65°F to 75°F under a relative humidity of 40 to 50 percent.

The urethane-based composition described here has been found to provide suitable ECOBF values with several common printing plate base materials. Some observed results include the following:

	<u>Plate Material</u>	<u>ECOBF</u>
5	3M Onyx Brand Printing Plate (Polyester Terephthalate)	2.7
10	3M E Base Printing Plate (Polyethylene-coated paper/ aluminum foil laminate)	1.7
	Cellophane	2.3
	Polyethylene	1.8
15	Low Density Polyethylene	1.7
	Cellulose Propionate	1.9
	Vinyl	2.6
20	Polystyrene	2.1

Another material that has been found to be useful for providing a flexible film for the underpacking of the invention is SHELDAHL Brand A-28, a thermally-activated polyester adhesive available from Sheldahl Chemical Company. After coating, the SHELDAHL A-28 is dried at room temperature for about an hour to provide a film having a major surface with the desired properties, i.e., the adhesive is not thermally activated.

Depending upon the compatibility of the coating composition from which flexible film 106 is formed and underlayer 108, it may be desirable to first apply a primer 107 to underlayer 108 before application of the coating composition thereto. For example, in the case where flexible film 106 is formed from SHELDAHL A-28 and stainless steel is used as underlayer 108, the following have been used as primers: SCOTCH-WELD Brand 1945 B/A Metal Primer, an epoxy amine composition, and SCOTCH-CLAD 5896 B/A Deck Coating Metal Primer, a phosphoric acid/butvar composition, both available from 3M, and DOW CORNING 1205 Primer, believed to be an epoxy-silane composition, available from Dow Corning Company. The urethane-based composition described above has been applied to stainless steel and anodized aluminum underlayers which have been primed with DOW CORNING 1205 Primer, conditioned at about 400°F (200°C) for about five minutes, and cooled to room temperature.

Figure 4 shows a second embodiment 32 of the novel underpacking wherein flexible film 36 is a plastic film adhered to underlayer 38 with a layer of adhesive 40. Examples of suitable plastic films include urethane, polyester, and silicone films. Urethane is typically preferred because it provides excellent frictional characteristics and withstands contamination with greasy inks well, i.e., it substantially retains its frictional grip to the base of lithoplate 30, and is not degraded by such inks and typical press cleaning solvents or fountain solutions. Further, its surface 37 is easily cleaned by wiping to remove dirt and ink residue which are often generated in a printing operation. Polyesters such as biaxially-oriented polyethylene terephthalate are also useful. High grade polyesters, e.g., photographic grades, are preferred because lower grades commonly contain additives known as "slip agents" which may tend to interfere with the desired frictional adhesion to underside 31 of lithographic 30 which is critical to this invention.

Examples of other flexible films that may be used in the present invention include materials that have a roughened surface such as fine grit sandpaper, e.g., 500 grit. Underpackings comprising such flexible films will typically be useful with printing plates having relatively soft undersides that the roughened surface can more effectively grip. It may be desired to coat the underside of a printing plate with a softer material to improve the support which is provided thereto by the underpacking, e.g., a urethane coating such as 3M 1706 Urethane Coating may be applied to the underside of a polyester printing plate.

In some embodiments, the flexible film may be dual-layer, i.e., the flexible film may comprise a flexible sublayer and a flexible overlayer. The sublayer may typically comprise a polymeric sheet material such as polyester or vinyl. The overlayer may comprise a polymeric material such as the urethane-based composition discussed above.

It may be desired to apply a material, e.g., a coating, to the underside of the printing plate to improve the effective coefficient of breakout friction that is provided by the major surface of the flexible film. For example, a layer of the urethane-based composition described above could be applied to the underside of a printing plate and cured to improve the support provided by the major surface of a flexible film such as a polyester film.

In general, durable materials providing the desired ECOBF with the underside of the printing plate will be useful for use as a flexible film herein. Such flexible films may typically be extruded or coated, laminated, or adhered with an adhesive layer to the underlayer, depending in part upon the nature of the material used. We have found that flexible films (106 in Figure 2) such as formed from the urethane-based coating composition described above or a layer of dried SHELDAHL A-28 are typically preferred over flexible films such as plastic film 36 in Figure 4 because their frictional properties with the underside of the lithoplate are typically less affected by dirt and ink contamination.

With reference again to Figure 2, essentially inextensible, flexible underlayer 108 acts as supporting means providing sufficient dimensional stability to underpacking 102 to resist the forces exerted during printing which tend to cause lithoplate 100 to stretch and distort. As described above, "essentially inextensible" is defined herein to mean the supporting means is essentially not stretched or extended when subjected to stresses of the magnitude of those encountered by the printing plate during printing and tending to stretch or elongate same. Underlayer 108 may typically be a thin caliper, i.e., about 4 to 8 mils (130 to 230 microns) thick, sheet of metal which is preferably soft enough to be formed, i.e., bent, and mounted on plate cylinder 104, and yet is substantially resistant to distorting, stretching, or tearing under the stresses exerted during printing. Examples of such metals include stainless steel and low carbon steel. Stainless steel typically provides greater fatigue resistance and corrosion resistance, however, low carbon steel is sometimes preferred because of its lower cost. The corrosion resistance of low carbon steel can be improved such as with chromium oxide or electro-tin coat treatments. Lightly tempered low carbon steels, i.e., one-quarter hard condition, or annealed stainless steels, e.g., 430 grade stainless steel, are preferred because they may be readily formed on conventional bending jigs presently used with metal-base printing plates. Also, such materials tend to resist kinking during handling. Aluminum sheets also may be used as underlayer 108, however, such sheets, which typically have a lower fatigue resistance than sheets of either stainless or low carbon steel, may tend to crack with extended use and are therefore less preferred.

Conveniently, underpackings containing a metal underlayer may typically be crimped then mounted on a plate cylinder in the same fashion as a conventional metal-base lithoplate, e.g., using a reel bar lock up. In Figure 2, underpacking 102 is shown mounted on plate cylinder 104 with reel bar mechanism 110. Alternatively, such underpackings may be mounted on a plate cylinder with magnetic clamping means as illustrated in Figure 6.

A further advantage of embodiments of the invention comprising essentially inextensible, flexible underlayers, such as is disclosed in Figure 2, is that underpacking 102 may be mounted over sub-underpacking 134, typically comprising one or more sheets of metal, plastic (e.g., Mylar), or paper 136, 138, to provide the desired impression squeeze between lithoplate 100 and a blanket cylinder (not shown). For example, a typical polyester-base lithoplate 100 may be about 7 mils (175 microns) thick, flexible film 106 may be about 1 mil (25 microns) thick, and underlayer 108 may be about 5 mils (125 microns) thick. In order to achieve the typically desired packing height of about 1 mil (25 microns) above the pitch line of the bearers (not shown) of plate cylinder 104 having an undercut of about 15 mils (375 microns), lithoplate 100 and underpacking 102 (total thickness about 13 mils) (325 microns) would have to be mounted over about 3 mils (75 microns) of sub-underpacking 134. Because an underpacking containing an inextensible underlayer may be mounted on plate cylinder in the same fashion as conventional metal-base lithoplates, i.e., wrapped around the cylinder and secured by its ends, such an underpacking may be mounted over a sub-underpacking to provide the desired packing height and impression squeeze while supporting the lithoplate during printing thereby preventing the stretching thereof.

A typical deformable lithoplate and an underpacking of the invention may be mounted on a plate cylinder as follows. Sub-underpacking 134, e.g., sheets of paper 136, 138, if necessary, is placed on plate cylinder 104. Leading end 112 of underpacking 102 is formed to fit over bullnose 114 of plate cylinder 104, and trailing edge 116 of underpacking 102 is bent and inserted into slot 118 of reel bar 110 which is then cranked clockwise (as drawn) until underpacking 102 fits tightly over the surface of the plate cylinder 104, securing sub-underpacking 134 in place. After underpacking 102 is securely mounted on plate cylinder 104, lithoplate 100 is mounted thereon.

Deformable lithoplates may not be sufficiently dimensionally stable to be mounted in conventional fashion with a reel bar. If a deformable lithoplate was mounted in the same fashion as underpacking 102 shown in Figure 2, it would typically pull free of reel bar 110 and bullnose 114 when put into service, and in many cases could not be so mounted initially because of the high flexibility and low stiffness of the base of the lithoplate.

One method for mounting a deformable lithoplate on a plate cylinder is as follows. Reference is made to Figure 3 wherein is shown the profile of a deformable lithoplate 30 after it has been crimped to be mounted on plate cylinder 34 of Figure 4. Lithoplate 30 has been formed with two crimps 52 and 54, both parallel to the leading edge 56, with the portion 58 of lithoplate 30 between outer crimp 54 and leading edge 56 extending substantially toward underside 31 of lithoplate 30. Preferably each crimp 52, 54 forms an angle of about 45°, so that portion 58 extends substantially orthogonally to the main surface of the lithoplate 30. U.S. Patent 4,643,093 (Goar et al.) discloses this technique of double crimping a lithoplate.

Referring again to Figure 4, a thin, elongated stiffener 60 is inserted between crimps 52 and 54, and then stiffener 60 and the crimped portion of lithoplate 30 are inserted into longitudinal channel or clamping groove 62 of plate cylinder 34. Stiffener 60 may be a strip, e.g., metal or plastic, which will resist bending under the stresses encountered during press operation, as shown. Alternatively, stiffener 60 may be an extruded plastic strip having a profile such that it may deform during press operation yet still provide the necessary support to the crimped leading edge of the lithoplate. In Figure 5, the leading edge of lithoplate 84 is supported by stiffener 86, which has such a profile. Referring again to Figure 4, a strip of low-tack, repositionable adhesive 64, such as SCOTCH-MOUNT Brand or 75 Repositionable Adhesive, both available from 3M, is applied to the underside of lithoplate 30 near its trailing edge, and then lithoplate 30 is wrapped around and mounted on plate cylinder 34. Adhesives that provide a 90° peel force of between about 0.1 and 0.3 pound/inch-width have been found to be useful with polyester base lithoplates that are about 4 to 7 mils (100 to 175 microns) thick. Strip 64 of adhesive is preferably sufficiently thin that lithoplate 30 may lay over same and underpacking 32 without disruption of the printing surface such as may be caused by an uneven contour.

After adhesively attaching the trailing edge of lithoplate 30, plate cylinder 34 is rotated (counterclockwise as shown) in contact with blanket cylinder or dampening rolls (not shown) to cause lithoplate 30 to flatten out and move into intimate frictional contact with the underpacking 32. In doing so, the low-tack repositionable adhesive 64 at the trailing edge of lithoplate 30 may become gradually resealed until an equilibrium is reached between the contact force on lithoplate 30 and underlying underpacking 32. Once properly seated in wrinkle-free fashion, lithoplate 30 is supported by essentially inextensible underpacking 32, and during printing, lithoplate 30 undergoes essentially no stretching or distortion.

After printing, lithoplate 30 may be removed, e.g., for replacement or substitution, and a new lithoplate mounted over underpacking 32. Lithoplate 30 will typically separate easily and cleanly from underpacking 32.

It may be necessary to wipe the surface of exposed surface 37 of flexible film 36 to remove any ink or other residue which may have accumulated, however, typically no other treatment is required before mounting a subsequent lithoplate and reusing underpacking 102 which may have a useful life of as long as several million printing impressions.

Surprisingly, it has been found that many deformable lithoplates may be securely mounted over an underpacking of the invention on a plate cylinder wherein only a single crimp has been formed in the lithoplate. Such a lithoplate is shown in Figure 2 wherein is shown lithoplate 100 which has a single crimp 128 toward underside 101 of lithoplate 100. Lithoplate 100 is mounted on plate cylinder 104 by inserting leading edge 130 of lithoplate 100 into clamping groove 132 and fitting the crimped portion of lithoplate 100 to bullnose 114. Lithoplate 100 is then intimately seated to underpacking 102 and any wrinkles worked out by applying pressure to lithoplate 100 progressively from near the crimped portion thereof to the trailing edge, e.g., by rolling in contact with the blanket cylinder or dampening rolls (not shown).

Satisfactory results may typically be achieved when the major surface of the flexible film has substantially uniform properties, i.e., the ECOBF is substantially uniform across the entire surface thereof.

It may be preferred, however, that the major surface be divided into segments having substantially different ECOBF's. For instance, in those cases wherein the plate cylinder comprises a clamping groove and wherein the underpacking has been mounted on the plate cylinder so as to extend into the clamping groove, e.g., to be secured with clamping means located therein, in order to facilitate the mounting of a printing plate onto the plate cylinder over the previously mounted underpacking, the major surface of the flexible film may have a band or segment having a lower ECOBF near the trailing edge thereof. Such a band will typically extend the full width of the flexible film (i.e., transverse to the machine direction), and extend from the trailing edge of the flexible film essentially the full length of that portion of the flexible film

that is located within the clamping groove. Figure 2 illustrates such a region 140 provided by removing flexible film 106 (or not providing same initially) from the effected portion of underlayer 108, thereby exposing the relatively less frictional underlayer. Alternatively, a band of material having a substantially lower ECOBF than flexible film 106 may be applied to the effected portion of underpacking 102. Referred to
 5 herein as a mounting-slip-strip, such a region will preferably have an ECOBF of less than 1.0, and more preferably have an ECOBF of less than 0.5. Thus, when printing plate 100 is mounted over such an underpacking 102 and the leading edge 112 of plate 100 is inserted into clamping groove 132, the inserted portion of printing plate 100 will slide substantially freely across mounting-slip-strip 140 into position over
 10 bullnose 114. In some instances it may be preferred to provide a mounting-slip-strip near the leading edge of the underpacking, such a strip typically extending from the leading edge of the underpacking in the machine direction to the bullnose.

The major portion of major surface 107 that is on the outside face of plate cylinder 104, i.e., the middle segment thereof, typically has a substantially uniform ECOBF with underside 101 of lithoplate 100 of between 1.0 and 4.5 as described above. That portion of major surface 107 nearest clamping groove 132
 15 may be provided with a band or segment 142 that is substantially tacky in nature akin to the Scotch-Mount repositionable Adhesive referred to above, i.e., a 90° peel force of about 0.1 to 0.3 pounds/inch-width with the underside of the printing plate. Segment 142 should typically provide greater adhesion, i.e., a higher peel force, when stiffer or less flexible printing plates are used. Segment 142, referred to herein as a holding-strip, typically extends the full width of flexible film 106 transverse to the machine direction. The
 20 holding-strip, which is typically on the order of 3/4 to 2 inches (2.0 to 5.0 centimeters) wide (machine direction) is situated near the trailing edge of the flexible film according to the manner in which the underpacking is mounted on the plate cylinder such that the holding-strip is located at the trailing edge of the outside face of the cylinder. For instance, if the underpacking is mounted such that the trailing edge thereof is extended into the clamping groove of the plate cylinder to cooperate with securing means, e.g., a
 25 reel bar, such as shown in Figure 2, the holding-strip will be spaced from the trailing edge of the underpacking. If the underpacking is mounted on the outside face of the plate cylinder, such that the trailing edge thereof does not extend into the clamping groove the holding-strip may extend to the trailing edge of the flexible film. Preferably the thickness of the holding strip is such that the printing plate may lay over same and the middle segment of the major surface of the flexible film to ensure no disruption of printing as
 30 may be caused by an uneven printing plate surface. Thus, an underpacking with such a holding strip may be preferred over use of an adhesive layer such as strip 64 in Figure 4.

A third embodiment of the invention is illustrated in Figure 5. Therein is shown plate cylinder 70 on which has been mounted underpacking 72 comprising simply a flexible film such as polyester or urethane. In this embodiment, the flexible film having a major surface 73, is adhered to plate cylinder 70 with a layer
 35 of adhesive 82, such that the surface of plate cylinder 70 functions as supporting means for the underpacking 72, thereby maintaining the dimensional integrity thereof.

Such underpackings are mounted by first bending underpacking 72 to a similar profile as was the preferred embodiment of underpacking discussed in connection with Figure 2. A stiff L-shaped retainer 74 is then bonded, e.g., by adhesive 76, to the trailing edge of underpacking 72 to permit it to be secured in
 40 slot 78 of reel bar 80. After applying a layer of adhesive 82 between the flexible film and plate cylinder 70, underpacking 72 is mounted on plate cylinder 70 using reel bar 80 and becomes immovably bonded to plate cylinder 70.

Deformable lithoplate 84 is crimped and mounted, e.g., as discussed in connection with Figure 4. Plastic stiffener 86 shown in Figure 5 has an arcuate face 88 which hugs bullnose 90 of plate cylinder 70 and an opposite sharply angled edge 92 for contacting the relatively sharp angle at inner crimp 94 of
 45 lithoplate 84. The profile of stiffener 86 is such that it may deform during printing and yet still provide the necessary support to the crimped leading edge of deformable lithoplate 84.

During printing, lithoplate 84 is supported by underpacking 72 and undergoes essentially no stretching or distortion. Removal of lithoplate 84 and cleaning, if necessary, of the surface of underpacking 72 are
 50 performed as outlined above in connection with the earlier discussed embodiments. This third embodiment of an underpacking is typically less preferred than the two embodiments heretofore discussed, however, because underpacking 72 is mounted on plate cylinder 70 with an adhesive 82, which typically tends to make mounting and removal of underpacking 72 less convenient than mounting and removal of the preferred mechanically-mounted, embodiments discussed above.

Figure 6 illustrates a preferred embodiment of the present invention wherein underpacking 200
 55 comprises metallic underlayer 202 and flexible film 204, and is mounted on plate cylinder 206 by magnetic means, e.g., the entire plate cylinder or sufficient portions thereof are magnetic. Such plate cylinders are presently known and used to mount magnetically-attracted, e.g., steel-base, printing plates thereon.

Underlayer 202 comprises a magnetically-attracted material such as 430 grade stainless or low carbon steel. It will typically be preferred that underpacking 200 be formed to have an arcuate profile approximating that of plate cylinder 206 to reduce any tendency of the underpacking, particularly the ends 210, 212 thereof, to separate from the plate cylinder and thus ensure that secure mounting is achieved. Because underpacking 200 is mounted on plate cylinder 206 in this fashion, the trailing and leading edges thereof 210, 212 are not needed to provide a mechanically-secured mounting method such as discussed previously.

Surprisingly, printing plate 214 may be mounted over underpacking 200, also without being mechanically secured at either the trailing or leading edges 216, 218 thereof. Similarly as with underpacking 200, it is preferred that printing plate 214 have an arcuate profile. Thus trailing edge 216 and leading edge 218 of printing plate 214 may substantially butt together to provide an essentially continuous printing surface, such as may be used in gravure printing processes. It may be preferred to provide an underpacking for such applications with holding strips (not shown) at both the leading and trailing edges thereof or to apply a strip of adhesive (not shown) to the underside of the printing plate at each end thereof to secure the ends 216, 218 of printing plate 214. Furthermore, underpackings will typically preferably provide an ECOBF of at least 3.5, and more preferably more than 4.5, with the underside of the printer plate in such applications. During printing, the major surface 208 of flexible film 204 of underpacking 200 will frictionally stabilize printing plate 214 such that printing plate 214 does not stretch or distort so as to become unmounted from plate cylinder 206..

Underpackings of the invention may be adapted for easy registration and mounting on the plate cylinder. For instance, underpackings may comprise such aids to registration as markings, registry lines, or pin registration holes. The underpackings disclosed herein may also comprise such mounting aids as preformed creases, tabs, notches, or fittings which are adapted to cooperate with mounting or clamping means of a plate cylinder. If desired, the underpacking may also comprise registration markings or other means for properly aligning and mounting the printing plate.

In some instances, it will be possible to mount a deformable printing plate directly on a plate cylinder. In such instances, the underside of the printing plate has an exposed major surface with a sufficiently high coefficient of breakout friction with the face of the cylinder body such that the friction between the underside of the printing plate and the cylinder body substantially equals or preferably exceeds the forces tending to stretch or distort the printing plate which are exerted thereon during printing. It may be necessary to modify the surface properties of the underside of the printing plate such that the exposed major surface will achieve the desired effective coefficient of breakout friction. For example, the printing plate may comprise a contact layer applied to the bottom thereof to provide an exposed major surface having the desired frictional properties with the face of the cylinder body which may comprise such materials as aluminum, steel, chrome, or nickel. For instance, a contact layer comprising the urethane-based composition described above could be applied to the bottom of a polyester printing plate. The exposed major surface provided by such a layer will provide a sufficiently high coefficient of breakout friction with some metal cylinder bodies such that the printing plate is supported and stabilized by the cylinder body during printing thereby substantially reducing or preventing stretching or distortion of the printing plate.

The invention will be further explained by the following non-limiting examples. Unless otherwise indicated, the amounts of all compositions are described in parts by weight.

Example 1

A sheet of tin free steel, approximately 36.5 inches wide, 25.5 inches long, and 8.5 mils thick (92.7 centimeters $\times$ 64.8 centimeters $\times$ 210 microns) was primed and then coated to approximately 0.5 mils (12 microns) thickness with SHELDAHL A-28, a thermally-activated polyester adhesive available from Sheldahl Corporation of Northfield, Minnesota. The coated plate was dried for about 24 hours. The ECOBF of the coating to a polyester-base ONYX Brand Lithoplate, available from 3M, was measured and found to be about 3.0.

The underpacking was then mounted on the plate cylinder of a Harris M700 web press. An ONYX Brand lithoplate, approximately 36.5 inches wide, 20.0 inches long, and 8.5 mils thick (93.0 centimeters $\times$ 50.0 centimeters $\times$ 210 centimeters) was double-crimped to the profile shown in Figure 3, with about 0.5 inches (12.5 millimeters) between the crimps. A spring-tempered, reusable steel stiffener, about 36.5 inches (92.7 centimeters) long, 0.4 inch (1.0 centimeter) wide, and about 20 mils (500 microns) thick, was inserted

between the crimps of the lithoplate. 3M No. 75 Repositionable Adhesive was lightly sprayed onto the underside of the lithoplate to cover the area within about 2 inches (5 centimeters) from its trailing edge. The lithoplate was then mounted on the plate cylinder (hand tension), and its adhesive-bearing trailing edge was pressed against the underpacking as shown in Figure 2.

5 The press was then run with the plate cylinder under an interference with the blanket cylinder of about 4.0 mils (100 microns), for two to three slow revolutions to seat the lithoplate. As the plate cylinder revolved, a tearing sound was heard as the plate "seated" itself to the plate cylinder. This sound was believed to be the adhesive layer being repositioned on the plate cylinder with each revolution as a result of "ironing out" looseness (wrinkles, etc.) and misalignments, due to the normal forces from contact with the blanket
10 cylinder. Adjacent scribe marks were then made on the lithoplate and underpacking near the trailing edge of the former.

The press was then run for approximately 500 impressions at a press speed of approximately 370 rpm. The scribe marks were found to be still aligned, indicating that the lithoplate had not stretched. Furthermore, the lithoplate was observed to have remained securely mounted on the plate cylinder

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Example 2

20 An underpacking comprising a 7.5 mil (190 microns) thick film of photograde polyester was adhesively bonded to the plate cylinder of an A.T.F. web press utilizing an L-shaped aluminum retainer or reinforcement which had been adhesively bonded to the trailing edge of the underpacking to hold it securely within the slot of the reel bar, as shown in Figure 5.

A polyester-base ONYX Brand plate was mounted over the underpacking as in Example 1. The polyester underpacking had been measured and found to have an ECOBF with the polyester base of the
25 lithoplate of about 2.0.

The press was run slowly under an interference of about 3.5 mils (90 microns) to seat the lithoplate. Repositioning of the trailing edge of the lithoplate was again noted during roll up. Scribe marks were then made on the lithoplate and underpacking as in Example 1.

30 The press was then run for approximately 500 impressions at a press speed of approximately 400 rpm. As in Example 1, the scribe marks were found to be still aligned, indicating that the lithoplate had not stretched. As in Example 1, the lithoplate remained securely mounted on the plate cylinder. Several polyester-base lithoplates were mounted in this manner and tested under normal blanket and form roller pressures with similar results.

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Example 3

40 A polyester underpacking 7.5 mils (190 microns) thick was adhesively bonded to the plate cylinder of a Harris M700 web press without using the reel bar lockup mechanism, and its trailing edge was trimmed off at the trailing edge of the plate cylinder. A lithoplate similar to that used in Example 1 was double-crimped as before. The double-crimped lithoplate and stiffener were inserted into the clearance groove between the leading edge of the plate cylinder and the unused reel bar, while the trailing edge was adhered per the description given in Example 1.

45 The press was run slowly under an impression of about 4.0 mils (100 microns) to seat the lithoplate. Repositioning of the trailing edge of the lithoplate was again noted during the roll up operation as any wrinkles were removed and the lithoplate was seated flatly. The plate and underpacking were scribed as in Example 1.

50 The press was run for approximately 500 impressions at a press speed of approximately 370 rpm, after which the scribe marks were found to still be aligned, indicating that no stretching of the lithoplate had occurred.

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Example 4

Lithoplates were mounted as in Example 3 on four different plate cylinders (utilizing two printing units or towers). The lithoplates were inked up and run for approximately 500 impressions at a press speed of approximately 370 rpm. Unit-to-unit and front-to-back registration during this test were found to be equal to or better than that achieved with aluminum-base lithoplates mounted in the conventional manner, indicating that essentially no stretching of the polyester-base lithoplate occurred.

10 Comparative Example A

A tin-plated steel underpacking 7.5 mils (190 microns) thick was mounted on the plate cylinder of a Hantscho web press utilizing the reel bar lock up as illustrated in Figure 2. A polyester-base lithoplate of approximately the same dimensions as that of Example 1 was mounted on the plate cylinder per the description given in Example 1. The underpacking had an effective coefficient of breakout friction of about 0.4 with the base of the lithoplate. Repositioning of the trailing edge of the lithoplate was again noted as the press was run slowly under impression pressure to seat the lithoplate.

After making scribe marks as in Example 1, the press was run for approximately 500 impressions at a press speed of approximately 370 rpm. According to the position of the scribe marks, the lithoplate was found to have had stretched over 50 mils, (1.3 millimeters) unlike similar lithoplates in Examples 1-4 which had each been mounted, according to the invention, over an underpacking comprising clinging means having a sufficiently high effective coefficient of breakout friction with the bases of the lithoplates.

25 Example 5

The adhesive used in Example 1 was diluted with a sufficient amount of 1,1,2-trichloroethylene to permit spraying, and then spray coated onto a 4.5 mil (110 micrometer) thick primed sheet of #430 stainless steel to provide a film having a dry thickness of about 1.0 mil (25 microns) to form an underpacking of the invention. After being dried, the underpacking was crimped and mounted on the plate cylinder of a Goss web press using the standard spring finger clamping.

An ONYX Brand lithoplate was single-crimped and mounted over the underpacking by securing the single crimp over the bull nose of the plate cylinder. After being "ironed out" scribe marks were etched into both the printing plate and the underpacking. The plate was then run for approximately 500 impressions during which it was observed to remain firmly seated on the plate cylinder. Visual inspection after the test revealed that the scribe marks were still in alignment, thus indicating that the printing plate had 1) remained firmly seated on the plate cylinder despite there being only one crimp therein, and 2) not stretched under the impression forced to which it had been subjected.

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Example 6

A sheet of 430 grade stainless steel, approximately 17.5 inches wide, 23 5/8 inches long, and 4 mils thick (44.5 centimeters by 60 centimeters by 100 microns), was primed with DOW CORNING 1205 Primer, conditioned at about 400°F (200°C) for about 5 minutes, cooled to room temperature and then coated with the following urethane-based coating composition:

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	<u>Ingredient</u>	<u>Amount</u>
5	Titanium Dioxide	23
	Zinc Oxide	23
	Carbon Black	1
10	Talc	180
	Pyrogenic Silica	28
	Prepolymer*	500
15	Toluene	380
	Xylene	430
	Dibutyltin Dilaurate	5

*Prepolymer is product of reaction of the following:

	<u>Component</u>	<u>Amount</u>
25	2,000 MW diol (poly-propylene dioxide)	300.6
30	4,000 MW triol (poly-propylene dioxide)	780
	Toluene	134
	Toluene Diisocyanate (80/20	156
35	by weight of 2,4 and 2,6 isomers)	
	Dibutyltin Dilaurate	1.0

and cured to yield a flexible film having a dry thickness of about 1.0 mil (25 microns). A holding strip approximately 3/4 inch (2 centimeters) wide was applied to the trailing edge of the underpacking. The strip was made with a modified formulation of the urethane coating composition described above. The composition of the material used in the holding strip was as follows:

	<u>Ingredient</u>	<u>Amount</u>
	Titanium Dioxide	23
5	Zinc Oxide	23
	Carbon Black	1
	Talc	180
10	Pyrogenic Silica	28
	Prepolymer	3000
	Toluene	1350
	Xylene	2080
15	Dibutyltin Dilaurate	30

The film formed from this formulation has a higher ECOBF with polyester (e.g., greater than 4.5), than does the flexible film formed from the coating composition described above (e.g., about 2.7). The holding strip provided in this example is also substantially tackier in nature than the flexible film provided herein.

20 This underpacking was mounted on the plate cylinder of the first unit of a Harris 500T Business Forms Web Press with a reel bar hookup.

A second underpacking was fabricated in the same fashion and mounted on the second unit of the press.

25 A 4 mil thick ONYX Brand Printing Plate was contact exposed in pinned registration with a positive grid pattern on a clear film. The image was about 19.6 inches (50 centimeters) long in the machine direction. The exposed plate was single crimped at about 3/8 inch (1 centimeter) from the lead edge thereof and mounted over the underpacking of the first unit of the press. The ECOBF of the surface of the underpacking and underside of the printing plate was measured to be about 2.7. The impression squeeze between the plate and blanket was about 3.5 mils. A second printing plate was exposed in the same fashion and
30 mounted over the underpacking on the second unit of the press.

Upon initial printing, the sequentially applied images were observed to be in substantial registration except for a slight (about 10 mil (250 micron)) downweb skew. This condition was corrected by moving the tail of the second plate laterally in the reel bar, i.e., "kicking" the plate. After proper alignment, the press was run for about 5000 impressions with unit 1 printing green ink and unit 2 printing black ink. Precise
35 alignment of the grid, i.e., black image on green image was observed. Both printing plates appeared to have remained securely mounted on the respective plate cylinders.

40 Comparative Example

A sheet of the same steel used for the underpacking in Example 6 was mounted on the first unit of the press as an uncoated underpacking.

45 A printing plate similar to those used in Example 6, that had been exposed in the same fashion, was double crimped as shown in Figure 3 with crimps about 0.5 inch (1.1 centimeters) apart. The ECOBF between the surface of the underpacking and underside of the printing plate was measured to be about 0.3. A metal strip, 0.5 inch wide (1.1 centimeters) and 15 mils (375 microns) thick was inserted between the crimps, and a strip of Spray 75 Adhesive was applied to the underside of the trailing edge of the printing plate. The printing plate was mounted on the plate cylinder over the underpacking as in Example 1. The plate was mounted with an impression squeeze with the blanket of about 2.5 mils.

50 The press was run for several hundred impressions. Overlay of the positive film to the impressions printed in the comparative example revealed that the image had stretched about 40 mils (1000 microns) in comparison to the Example 6.

Example 7

A 430 grade sheet of stainless steel, approximately 25.5 inches long, 36 inches wide, and 8 mils thick (65 centimeters by 91 centimeters by 200 microns), was coated with the formulation of the urethane coating composition used as a holding strip in Example 6 to yield a flexible film having a dry thickness of about 1 mil (25 microns). This underpacking was mounted on the plate cylinder of a Miller 36 Perfector Sheetfeed Printing Press.

A 7 mil thick ONYX Brand Printing Plate was mounted over the underpacking without clamping or mechanically securing either end of the printing plate such that the leading edge and trailing edge of the plate were exposed on the outside surface of the plate cylinder rather than inserted into a clamping groove or clamping means. Thus the printing plate was securely mounted on the plate cylinder by only the action of the major surface of the flexible film of the underpacking to the underside of the printing plate.

The press was run for about 500 impressions during which the plate remained securely mounted on the plate cylinder with no tendency to lift therefrom being observed. No stretching of the images printed was observed.

Various modifications and alterations of this invention will become apparent to those skilled in the art without departing from the scope and spirit of this invention.

Claims

1. A method of mounting a deformable printing plate on the plate cylinder of a rotary printing press, characterized in that said method comprises:

(A) mounting on said plate cylinder, in cooperation with essentially inextensible supporting means, an underpacking comprising a flexible film having an exposed major surface with a sufficiently high effective coefficient of breakout friction with the underside of said printing plate such that the friction between said underside of said printing plate and said exposed major surface of said underpacking substantially equals or exceeds the forces tending to stretch or distort said printing plate which are exerted thereon during printing; and

(B) mounting said printing plate on the plate cylinder over said underpacking such that the underside of the printing plate is in frictional contact with the exposed major surface of said underpacking, said printing plate being mounted without being crimped at the leading edge thereof.

2. The method of claim 1 further characterized in that mounting said underpacking on said plate cylinder comprises adhering said underpacking to said plate cylinder with adhesive means.

3. The method of claim 1 further characterized in that said supporting means is an essentially inextensible, flexible underlayer attached to the underside of said flexible film and said underpacking is mounted such that said underlayer is located between said flexible film and said plate cylinder.

4. The method of claim 3 further characterized in that said underlayer is selected from the group consisting of: stainless steel, low carbon steel, and aluminum.

5. The method of any one of claims 1-4 further characterized in that said flexible film is dual-layer and comprises a flexible sublayer and a flexible overlayer.

6. The method of any one of claims 3 or 4 further characterized in that said flexible film is a surface coating on said underlayer.

7. The method of any one of claims 1-6 further characterized in that said flexible film is a polymeric film.

8. The method of any one of claims 1-7 further characterized in that said flexible film comprises at least one of the following: polyester, silicone, or urethane-based composition.

9. The method of any one of claims 1-8 further characterized in that said flexible film has a roughened surface.

10. The method of any one of claims 3 and 4 further characterized in that said underpacking is mounted over a sub-underpacking.

11. The method of claim 10 further characterized in that said sub-underpacking comprises at least one sheet of at least one of the following: metal, plastic, or paper.

12. The method of any one of claims 1-11 further characterized in that mounting said printing plate further comprises the application of a low tack repositionable adhesive to the underside of the trailing edge of said printing plate.

13. The method of any one of claims 1-12 further characterized in that said underpacking comprises at least one mounting-slip-strip.

14. The method of any one of claims 1-13 further characterized in that said underpacking comprises at least one holding strip.

15. A method of mounting a deformable printing plate on the plate cylinder of a rotary printing press, characterized in that said method comprises:

5 mounting said printing plate on said plate cylinder such that the underside of said printing plate is in contact with the face of the cylinder body of said plate cylinder, said underside of said printing plate having an exposed major surface with a sufficiently high effective coefficient of breakout friction with said face of said cylinder body such that the friction between said underside of said printing plate and said face of said cylinder body substantially equals or exceeds the forces tending to stretch or distort said printing plate
10 which are exerted thereon during printing, said printing plate being mounted without being crimped at the leading edge thereof.

16. The method of claim 15 further characterized in that said printing plate comprises a contact layer having said exposed major surface, said contact layer being applied to said underside of said printing plate before said printing plate is mounted on said plate cylinder.

15 17. The method of any one of claims 1-16 further characterized in that the leading edge of said printing plate is single-crimped before being mounted on said plate cylinder.

18. The method of any one of claims 1-14 further characterized in that said method comprises applying a coating to the underside of said printing plate before said plate is mounted over said underpacking.

20 19. The method of any one of claims 1-18 further characterized in that said coefficient of breakout friction is at least about 1.0.

20. The method of any one of claims 1-19 further characterized in that said coefficient of breakout friction is between about 2.0 and about 3.0.

21. A printing plate characterized in that said printing plate comprises a contact layer on the underside thereof, said contact layer having an exposed major surface having an effective coefficient of breakout
25 friction of at least 1.0 with at least one of the following: aluminum, steel, chrome or nickel.

22. The printing plate of claim 21 further characterized in that said contact layer is a urethane-based material.

30

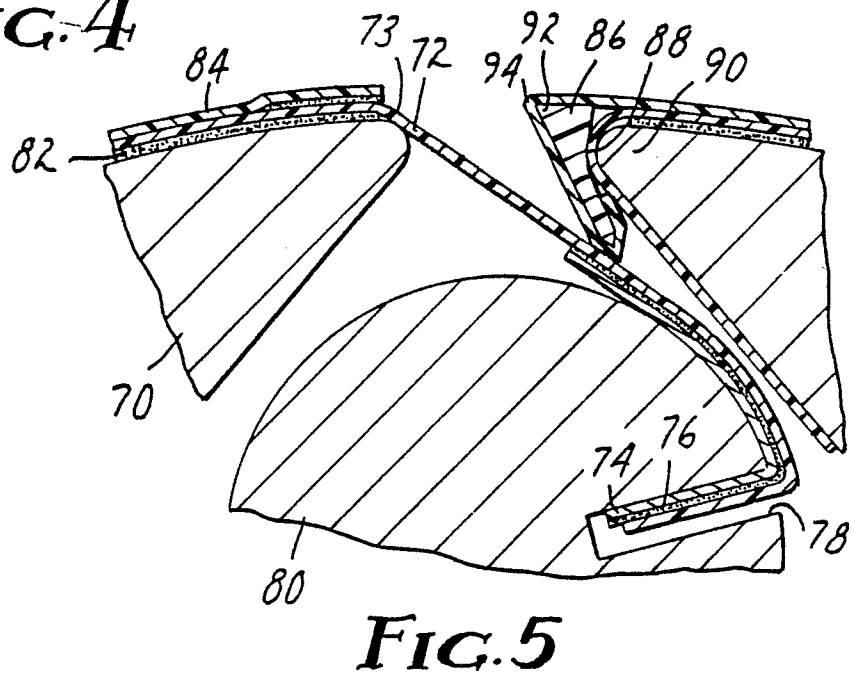
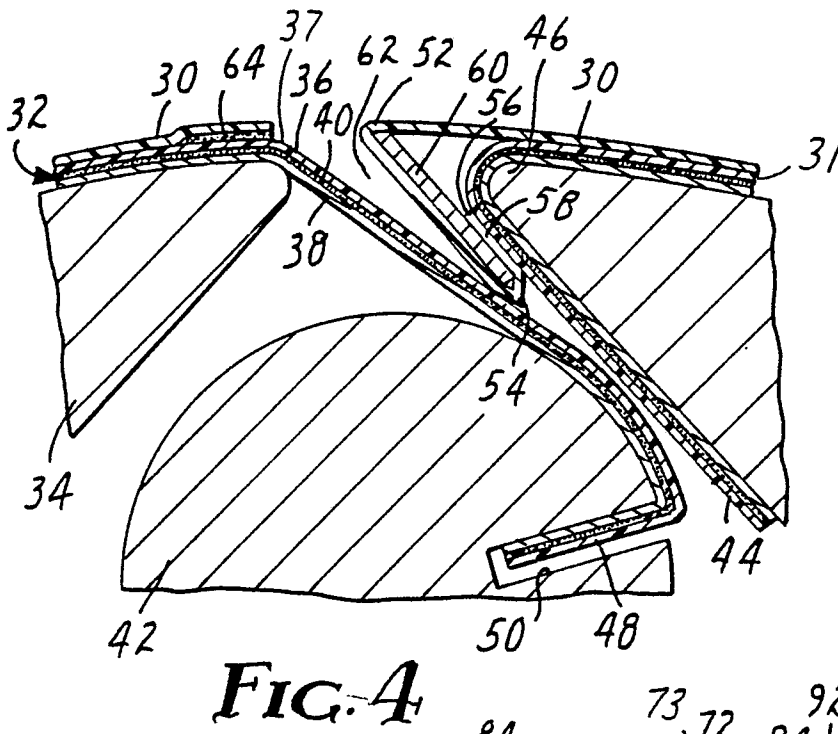
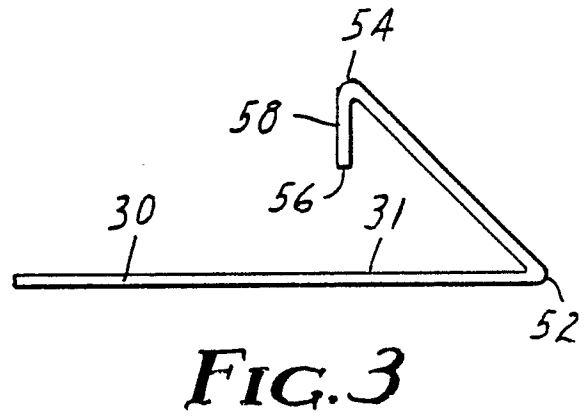
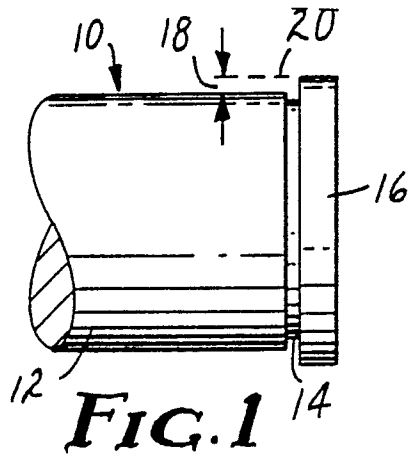
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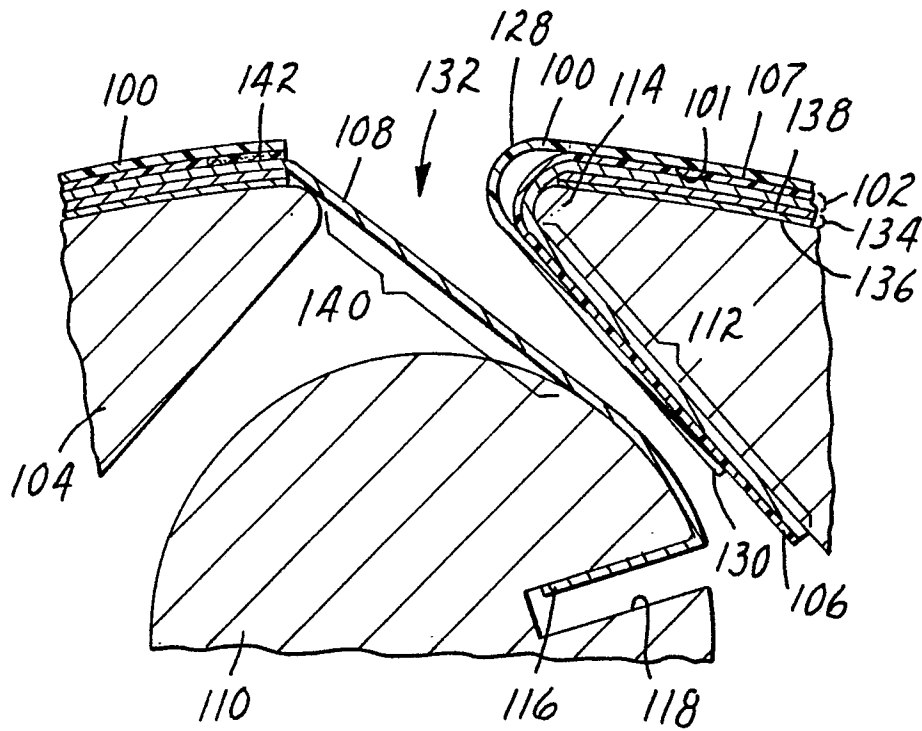


FIG. 2

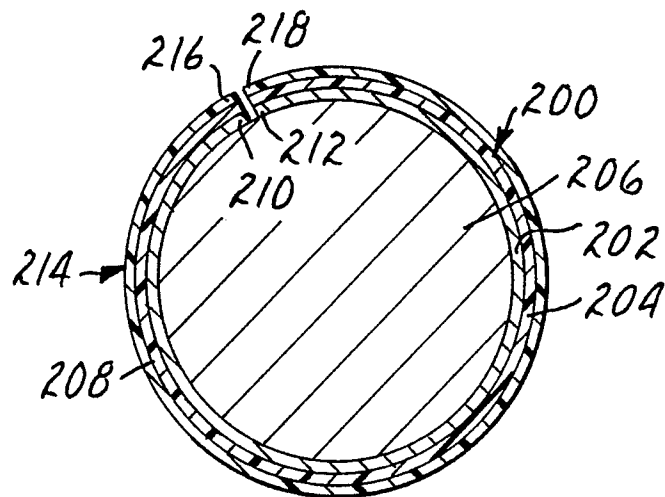


FIG. 6