Included herein are base materials and methods for use in creation of one-way graphics, including a dye-receptive substrate with a pattern of ink-repellent material over the dye-receptive substrate. An image may be printed selectively onto the base material to leave a visual perforation pattern that allows vision through the printed image under appropriate illumination. Also disclosed are printing methods involving the application of variously ordered layers of light-absorbing, light-reflective, and image mediums to printing substrates with physically raised and lowered areas to create one-way graphics. The invention also includes new forms of one-way graphics, including lenticular and holographic one-way displays, and one-way displays having internal lighting sources.
FIG. 21

FIG. 22

FIG. 23

FIG. 24
ONE-WAY GRAPHICS MATERIALS AND METHODS

[0001] This invention relates to materials for one-way graphics and manufacturing techniques for the production of both those materials and one-way graphic images. In particular, this invention relates to novel substrates for one-way graphics, methods of producing those substrates, and methods of placing images upon them. This application claims benefit under 35 U.S.C. §120 of the filing date for application No. 61/656,681 filed Jun. 7, 2012.

BACKGROUND OF THE INVENTION

[0002] One-way graphic materials are materials that have an image on one side, yet permit vision through the material from the other side. Optical properties are manipulated such that the material appears opaque from the image side, but appears substantially transparent when viewed from the non-image side. Generally, one-way graphic materials are light permeable, with one relatively dark side and one relatively light side. Images are typically placed on the light side of the one-way material. People viewing from that side will see the image. People viewing the material from the back side of the material do not see the image, but instead see the environment on the far side of the one-way graphic. Other forms of one-way graphics use transparent inks and/or retroreflective materials, and rely on differences in illumination and scale perception to create the same effect, with the image typically visible from the brighter, outdoor side of the window, while being substantially invisible from the darker, inner side of the window.

[0003] One-way graphics typically use expensive perforated substrates, upon which an image is printed using digital printers or silk screening. These substrates are typically films of vinyl or acrylic polymers. Other methods of production of one-way graphics involve the application of “print patterns” of bonding material onto the surface of a transparent, non-bonding substrate, as in U.S. Pat. No. 6,267,052 (Hill et al.). Using individually addressable dots of dye that are deposited using a digital printer, a design pattern is then digitally printed onto the “print pattern” with an ink that forms a durable bond to the print pattern, but not the non-bonding substrate. Ink on areas of non-durable bonds outside the print pattern can then be substantially removed through washing, wiping, or selective adhesion. One-way graphics can thus be made using non-perforated films (e.g., 3M™ Scotchcal™ Clear View Graphic Film U8150), wherein a print pattern simulating a perforated surface is used to create unprinted surfaces that simulate the effect of perforation.

[0004] One-way graphic films are usually constructed with solid backing attached to the non-image side of the film or substrate. The backing is typically attached to the one-way film using an adhesive release layer on the non-image side of the film, and is made of a material such that the backing can be removed from the adhesive release layer. The image panel is typically then mounted to the outer surface of the window, with the adhesive in contact with the face of the window and the design layer external to the building as the outermost layer. In other applications, the image is reverse printed, so that the adhesive layer can be applied to the inside of the window, and the image viewed from the outside of the window, with the design layer (i.e., the layer of dye that comprises the image) situated on the far side of the substrate from the window.

[0005] The Hill '052 patent also discloses methods in which a laminate or protective layer is added to the graphic film after the image has been printed on it, so that the ink or dye layer will be protected from the elements after external attachment to a window. Hill does not disclose methods of producing a one-way film that has a protective layer after application to a window, without requiring a lamination step after production of the image.

[0006] One-way vision films have been limited by available production techniques. Typical production methods include digital printing and silk screening or screen printing.

[0007] Digital Printers are the most common method of printing one-way graphics. The process is slow and expensive. “Digital printing” includes methods of electrostatic and thermal deposition or transfer, including without limitation digital forms of thermal mass transfer, thermal dye sublimation, direct thermal, photographic, and ink jet digital printing. Typically, a print design is fed into a computer, and a rasterizer is used to break up the image into individual dots of color, each with its own “address” or location within the print image. Most digital printing is done using a four color CMYK printing process, although processes using fewer or more colors are known to those in the art. For many one-way graphic applications, a layer of white dye, paint, or ink underneath the actual image dye is desired. This requires specialized digital printers capable of applying the white dye, paint, or ink, since normal CMYK printers are not capable of printing the color white.

[0008] Screen printing, or silk screening, is a stencil method of print making in which a design is imposed on a screen of polyester or other fine mesh, with blank areas coated with an impermeable substance. Ink is forced into the mesh openings by a full blade or squeegee and onto the printing surface during the blade or squeegee stroke. Each color is laid as an individual layer over the other colors, so that the layers of colors joined together into a finished picture. As a result, this process is very time-consuming and slow. Because of the labor involved and the time involved in this process, this process is very expensive when compared to other methods of printing. Although automated screen printing presses are available, they are generally designed for production of small images (e.g., a tee shirt), rather than the larger images often desired for one-way graphics. Finally, because of the labor involved, screen printing is generally not economical unless a minimum number of printed images are being prepared.

[0009] Until now, these are the two main methods of creating one-way window graphics. Because of this one-way window graphics have remained very expensive. The methods described above require special printing substrates and specialized printing machines. It would be more economical to produce one-way graphics if images could be printed using mass production techniques such as lithograph, offset, or web-offset printing processes, and/or using cheaper, generic printing materials. One-way graphics produced using the methods above are visually static, in that the image printed on the graphic does not move in any way. They are also non-emissive and rely entirely on ambient light.

[0010] It is an object of the invention to introduce cheaper, mass producible one-way graphics. The invention described below is a process for making one-way Graphic material through such mass production techniques. Another object of the invention is to introduce one-way graphics that allow or simulate dynamic images, and to introduce forms of one-way graphics that have novel lighting effects.
SUMMARY OF THE INVENTION

[0011] This invention relates to materials for one-way graphics and manufacturing techniques for the production of both those materials and one-way graphic images. In particular, this invention relates to novel substrates for one-way graphics, methods of producing those substrates, and methods of placing images upon them.

[0012] This document also relates to a series of different configurations used to modify the perceived vision of light passing through, refracted or reflected by the one-way graphic material. As one becomes familiar with the range products after reading these descriptions, it will become apparent that there are many other uses for these products. Many of these products are designed to be selectively light permeable and will also be permeable or selectively permeable to air or gases, water or other liquids, gels or other viscous fluids, sound, energy, radiation, magnetism, granular solids and, or electromagnetic fields. As such, different products can be designed with the technology herein that combines several of these functions, for example a product that is permeable to both light and gases or a product that is permeable to light and gases yet not permeable to granular solids. Many of the light permeable designs herein have so-called one-way vision properties, where vision from one side of the product is substantially different from vision from a different side or angle. Many one-way vision products have the property of allowing vision through the product in one direction while creating a visual display that is visible from another direction.

[0013] A first embodiment of the invention is a base material for use in creation of one-way graphics, wherein the base material is a dye-receptive substrate, with a pattern of areas of ink-repellent material layered over the dye-receptive substrate to define a non-printing area. In a method of printing using this base material, an image may be printed onto the base material. After a period of drying or curing, dye may be removed from the non-printing area by wiping or washing away the dye from the areas of the panel covered by the dye-repellent layer. Such materials may be used as actual substrates for one-way graphics, or may be used as transfer plates for transfer of images to other materials. Variations on this embodiment can be used depending on whether the dye is ink, paint, toner, or some other form of dye.

[0014] In another embodiment of the invention, one-way graphics may be produced using a panel of material comprising a transparent substrate with a perforated or selectively permeable removable covering over its face. The perforated or selectively permeable layer has adhesive properties so it peels off easily and is very thin. This assembly can be backed with adhesive and a protective release liner. The printable panel would be constructed so that an image may be printed on the panel as a whole. Once the printing is complete, the perforated low tack covering is separated from the assembly leaving behind a pattern that makes up an image. The windows or voids in the image necessary for the one-way graphic effect are created by the removal of the perforated covering. The panel may then be mounted on a window or other transparent surface for one-way graphic effect.

[0015] Also disclosed herein are light masks for producing images for one-way window graphics on electrostatic machines and methods of using those light masks. This light mask can be a perforated, opaque material that screens portions of the image to be copied from the imaging system. The light mask creates a pattern of holes or voids in the pattern of the image created by the electrostatic machine. When the image is then printed onto a transparent substrate, the image has a pattern of holes or voids through which one can see. Another configuration for a light mask is that of a pattern printed upon a transparent sheet. This sheet is placed in between the scanning surface and the image to be copied. The portions of the image to be copied that are visible to the scanner or copier are copied while the blocked portions are not. When this broken up pattern of the image is copied or transferred to a transparent substrate a one-way graphic can be created. Further variations on this invention are described below.

[0016] Also disclosed are printing methods involving the application of variously ordered layers of light-absorbing, light-reflective, and image mediums to printing substrates with raised and lowered areas to create one-way graphics. The invention also includes new forms of one-way graphics, including lenticular and holographic one-way displays, and one-way displays having internal lighting sources.

DESCRIPTION OF THE FIGURES

[0017] FIG. 1 shows cross sections of one-way graphic material produced on top of a substrate that repels certain inks or paints at each step in the process of the material’s production.

[0018] FIG. 2 shows a cross section of one-way graphic material in which an image is printed on a transparent substrate in a pattern that leaves voids, wherein the print pattern is applied as a reverse image.

[0019] FIG. 3 shows cross-sectional views of one-way graphic material that utilizes printing onto a transparent ink-binding substrate with an ink repellent material to create a non-printable area on the ink-binding substrate.

[0020] FIG. 4 shows cross-sectional views of reverse-image one-way graphic material that utilizes printing onto a transparent ink-binding substrate with an ink repellent material to create a non-printable area on the ink-binding substrate, with an optional light reflective layer.

[0021] FIGS. 5A through 5D show one-way graphic materials with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8).

[0022] FIG. 6 depicts a 6-color printing apparatus and process with six stations.

[0023] FIG. 7 shows a method and apparatus of printing a one-way graphic material using and applicator or printer that applies dye material through a perforated roll.

[0024] FIG. 8 shows a variation of the apparatus of FIG. 89.

[0025] FIG. 9 shows a cross-section of a transfer graphic.

[0026] FIG. 10 shows a cross-section of the application of a transfer graphic of FIG. 9.

[0027] FIG. 11 shows the elements of FIG. 10 being separated from one another.

[0028] FIG. 12 shows a cross-section of a transfer graphic in which the image, light reflective material and light-absorbing material stay with the perforated membrane and separate from the substrate and release layer of the transfer graphic material.

[0029] FIG. 13 shows a possible light mask screen for use with color copiers, scanners, or other such graphic input devices.

[0030] FIGS. 14-16 show different patterns of light mask screens.
FIG. 17 shows a palate material for creating one-way graphics.

FIGS. 18-19 show cross sections of variations of printing methods using conductive elements (35) on the back side or the side opposite the printed surface of the substrate (84).

FIG. 20 shows a view of the surface of the configuration of FIG. 19 after an image has been applied.

FIG. 21 shows a variation of FIG. 95 with the addition of a conductive strip (89) along one side of the assembly.

FIGS. 22 and 23 shows a configuration similar to FIG. 96 and with the exception that the conductive elements are on the same surface as the subsequently applied charged colorants.

FIG. 24 shows a view of the surface of the configuration of FIG. 101 after an image has been applied.

FIGS. 25 and 26 show printers or copier machines (94) that apply charged colorants.

FIGS. 27-29 show formation of a material with permeable areas.

FIG. 30 shows a cross section view of a material that has been processed to have a non-printable area.

FIG. 31 shows a material similar to that of FIG. 30 where the areas have a deeper profile.

FIG. 32-41 shows a transparent substrate (68) which has been molded, formed, extruded, vacuum formed or otherwise modified to create raised areas and/or lowered areas, and variations in which coatings and image layers are printed onto the raised surface.

FIGS. 42-46 show a transparent substrate (68) which has been molded, formed, extruded, vacuum formed or otherwise modified to create raised areas and/or lowered areas, and variations in which coatings and image layers are printed using materials that selectively settle into the grooves of the textured surface.

FIGS. 47-49 shows a forward view of a substrate which has been modified to create areas that are raised and areas that are lowered, depicting how the areas of texture may be distributed across the surface of the printing substrate.

FIG. 50 shows a cross-section of a variation of a substrate which has been modified to create areas that are raised and areas that are lowered.

FIGS. 51-53 show additional forward views of a substrate which has been modified to create areas that are raised and areas that are lowered, depicting how the areas of texture may be distributed across the surface of the printing substrate.

FIGS. 54 and 55 show a side view a printing process using substrates with raised and lowered areas and the product of such process.

FIGS. 56-57 show one-way graphic materials utilizing an internal light source.

FIGS. 58-61 show one-way graphic materials utilizing lenticular lenses in conjunction with an image layer and a silhouette pattern to create one-way lenticular patterns.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, “one-way graphic materials” refers to materials that appear essentially opaque and non-transparent from the image side, but appear substantially transparent when viewed from the non-image side under appropriate light conditions. The direction of one-way vision may change with environmental conditions, such as when night falls and lights are turned on inside a building. Images are typically placed on the light side of the one-way material. People viewing from that side will see the image. People viewing the material from the back side of the material do not see the image, but instead see the environment on the far side of the one-way graphic. Generally, one-way graphic materials are constructed using films or sheets that have multiple gaps or perforations in their non-transparent surface, thereby allowing light to permeate through the material.

“Non-printable area” or “non-bonding area” refers generally to any area of print medium which does not bond permanently to ink used during printing, such that any ink on that area may be physically removed during the printing process, leaving behind a gap, absence, or perforation in the target image. The non-printable or non-bonding area may be continuous or discontinuous, and may be of varying sizes or patterns, including holes, dots, grids, matrices, lattices, or random patterns.

“Printing” and “printing processes” include, but are not limited to, screen printing, offset printing, lithography, linotype, rotogravure, inkjet, electrostatic printing, xerography, letter press, web, flexographic, and intaglio or other processes where an image medium such as paint or ink is applied to a substrate. This list is not meant to be exclusive or exhaustive, and those of ordinary skill in the art will recognize additional forms of printing.

“Image medium,” “ink,” and “dye” as used throughout this document include, but are not limited to inks, paints, dyes, pigments, electrostatic and thermal toner materials, colored liquids, pastes, or solids, and any other materials used in various printing, painting, and/or engraving processes to form and create an image. This list is not meant to be exclusive or exhaustive, and those of ordinary skill in the art will recognize additional image mediums.

“Perforation” or “void” refers generally to any void or area of complete transparency in a panel of one-way graphic material. A perforation may be physical, as in the case of a hole cut through or from a material, or visual, as in the case where a physically non-perforated substrate contains areas of transparency. Perforations may be of varying sizes or patterns, including holes, dots, grids, matrices, lattices, or random patterns.

“Perforation pattern” refers to the collective area of perforations and/or voids in a one-way graphic panel. The perforation pattern generally constitutes 35% to 75% of the surface area of a panel, and is usually around 50% of the area. For example, in commercially available perforated PVC films for one-way graphics such as SuperVue™, ImageVue™, and ImageJetVue™ films distributed by Clear Focus Imaging, Inc., and Avery® HP MPI 2728 perforated 65/35 film, the perforated area generally constitutes 50% or 35% of the total surface area of the film.

The permeable materials as used in the descriptions herein can be constructed, assembled, manufactured, extended, introduced, induced, grown, molded, constrained, shaped or otherwise formed by any one or combination of the following methods; weaving, formed with holes, capillary action induced, foamed, sintered, crushed, deposited, optical deposition, thermal deposition, chemical deposition, electric or magnetic deposition, gas deposition, liquid deposition, gel out, formed in strips, non-woven mat, printed, foam sheet or other such method or compositions whereby some portion of electromagnetic wave, light, liquid, solid, plasma, and or gas can pass through the material.
The products, materials and methods described herein can be constructed, grown, formed, constrained, shaped, molded or otherwise made to conform to significantly one, two, or three-dimensional shapes. These shapes can be used as advertising media, stage props, masks, art, sculpture, medical, filtration, protective devices, or the like. Many other products, processes and possibilities will become apparent as one understands the technology described herein. The descriptions herein or in no way mean to limit the scope of the technology described herein but merely to illustrate the potential of the technology in many different industries.

Printing of One-Way Graphics Using Offset Methods

One embodiment of the invention is a process that works on the same principle that is used in the offset type of printing press, in which ink adheres to some materials and not to others. A stencil of the image is created that has areas that attract ink and other areas that repel the ink. When the stencil is rolled in contact with an ink roller, the ink having an oil- or grease-type base does not adhere to the wet areas of the stencil (i.e., those covered with the repellent) but to the dry areas. The ink and the ink repellent do not mix. Using multiple plates, it is possible to deposit successive layers of different colors to create an image.

The same principle can be used to create one-way graphics. The surface of printed piece can be treated to act like a stencil, to attract the marking material in some areas and to repel the marking material in other areas. Many different patterns are possible to give a great choice in the resulting ratio of open areas (i.e., non-printed areas) around the marked areas and the texture or grain size of the non-printed pattern.

In one embodiment of the invention, a repelling compound is applied to a substrate after a pattern of a first material (e.g., an ink-receptive material) is printed onto the substrate. As with the case of the stencil above, the interaction between the repelling compound and the previously printed pattern would be such that the repelling compound would not adhere to the portions of the substrate covered by the pattern, but would coat all areas not printed with the pattern of the first material. This would create an ink-receptive pattern along with a non-printable area of the repelling material, so that the successive colors printed onto the substrate would be built up precisely on the pattern of the first material.

Another embodiment of the invention described herein consists of a substantially clear or transparent base material capable of bonding with ink, with a pattern deposited upon it of a material that repels subsequent layers of ink, thereby creating a non-bonding silhouette area. In this embodiment, the image is printed onto the clear base material, and ink is subsequently removed from the non-bonding area using standard means, such as a washing or physical pressure, leaving behind a printed image.

In another embodiment of the invention, the base material is a transfer medium designed so that the image can be transferred from the base material to another material. The transfer medium or substrate would be treated with the pattern of a repelling compound prior to the printing process to create one or more non-printable areas. The transfer medium then could be printed onto using standard printing practices. Ink sitting on the non-printable area of the transfer medium could then be selectively removed, and the printed area of the transfer medium could be used to transfer the image to the print surface.

In these various embodiments, the pattern of the repelling compound could be used to create a series of voids or windows in the printed surface. These windows could allow light or vision through the finished product, which could be either a clear substrate that is printed onto directly or a clear material that the image would be transferred onto indirectly. The repelling compound could be on the transfer medium prior to the printing process. In other embodiments of a transfer or printing process, it could be on the clear material before the image is transferred onto it. The repelling compound could be used to coat embedded foils, reflectives, semi transparencies, or other effects that would need to remain substantially print- or ink-free.

The print-repelling media is formulated so that subsequent layers (e.g., layers of different color applied during offset printing) will not transfer over to that portion of the substrate covered with a pattern of the print repelling compound. The repelling compound and the subsequent layers can be applied to the transfer medium by any combination of a printing process, a transfer process, attraction, deposition, a direct deposit process, a spray or jet application process, or other comparable means. The repelling compound may be applied to the medium and be allowed to dry before the medium is used in the subsequent processes. Or the repelling compound may still be wet when the medium goes through the subsequent processes. For example for multi-station printing processes such as 4, 5, 6 or more color process, it may be desirable to print the print repelling pattern onto the medium at the first station, with the different colors following immediately. Alternately, a person of skill in the art will recognize that the above embodiments describe not only methods of printing one-way graphics, but also substrates that could be distributed as printing materials for one-way graphics on generic or specially adapted printing apparatuses.

Depending on the nature of the subsequent layers used, different disbursements or repellents may be used. For example it may be desirable to use a water-based compound when using oil-based layers, or oil-based compounds when using water-based inks or paints. Silicone based compounds may work with both oil-based and water-based inks and paints.

The non-printable area created by the repellent surface may be any of a variety of patterns, including a pattern of lines, dots or preferably a random pattern. In one preferred embodiment, the ink-repelling compound would be printed in a random pattern. The use of a random pattern will be less noticeable when the eye is looking out through the material. This is due to the fact the human perception looks for color and pattern in recognizing shapes color and objects. With a random pattern one does not see a recognizable shape, especially if the pattern is of a neutral color. Alternately, if the base material can accept the ink or paint used in the printing process, then the initial pattern need only be of a compound that repels the ink or paint used in the printing process. If the base material is such that it repels the ink or the paint used in the printing process, then the initial pattern need only be of a compound that attracts and bonds to the subsequent layers and/or colors of ink or paint used in the printing process.

The printing process described herein could use a modified source material or modified manufacturing techniques. With the modified source material, it would use a transparent material that is pre-printed with an area that repels ink. When the material is printed using an offset web printing process, it first goes through a black ink process, next it goes
through a white printing process, and then it goes through a four or six color process as needed. Each layer and color of ink is bonded only in those areas desired and not in those areas which repel the ink.

[0068] For the modified manufacturing technique, a new station would be added which would apply the repelling compound to the material as it is fed through the web printing process. The repelling compound would be such that it would adhere to the material yet the ink would not adhere to it. The areas to be left clear can be done in a random pattern so that a pattern in not as discernible.

[0069] FIG. 1 shows a one-way graphic material produced from a substrate that repels certain inks or paints. In step A, the transparent or translucent substrate (1) is printed with a bonding material that is a dark, light-absorbing color (2) in a pattern that leaves voids. In step B, a material with a light reflective color (3) is printed, painted or otherwise applied where it bonds to the light-absorbing material (2) but not to the substrate (1). Step C shows a monochromatic or multicolor image (4) printed, painted, or otherwise applied onto the assembly where the image bonds to the light reflective coating (3) but not to the substrate of (1). Steps A, B and C may be done one right after the other within seconds or fractions thereof or they may be done with longer periods of time between the steps such as days, months or years. A product of step A or steps A and B may be produced and marketed as a ready-to-print material. A substrate material prepared in this way could be printed upon with standard printing equipment through various printing methods or combinations thereof, or could be printed upon using specialized equipment optimized for printing on the substrate.

[0070] Each of the steps in FIGS. 1 through 5 can be done through methods such as lithography, web-fed or sheet-fed offset printing, electrostatic transfer, paint jet, inkjet, stamp process, painting or the like, or through combinations of those methods. The products of FIGS. 1 through 5 can be produced through a combination of methods such as lithography, web-fed or sheet-fed offset printing, electrostatic transfer, screen printing, paint jet, inkjet or the like.

[0071] FIG. 2 shows a transparent substrate (1) that is printed with a monochromatic or multicolor image (4) in a pattern that leaves voids in step A. The image would be applied as a reverse image so that the image would be correct when viewed through the transparent substrate. In step B a dark or light-absorbing coating (2) is then printed, painted or otherwise applied that adheres to the image pattern but not to the substrate of (1). As with the product of FIG. 1, the product can be produced through methods such as lithography, web-fed or sheet-fed offset printing, electrostatic transfer, paint jet, inkjet or the like.

[0072] It is possible to produce a product with a transparent substrate that is then coated with a transparent or translucent bonding material. This bonding material is adhered to the substrate in a pattern that leaves voids. This assembly is then imaged as in FIG. 2A, where the ink or paint that makes up the image coating adheres and bonds to the bonding material, but is repelled from the surface in the area of the voids. The image would be applied as a reverse image so that the image would be correct when viewed through the transparent substrate. The product of this configuration would have a dark or light-absorbing coating applied as in FIG. 2B. As with the product of FIG. 1, the product of this configuration can be produced through methods such as lithography, web-fed or sheet-fed offset printing, screen printing, electrostatic transfer, paint jet, inkjet or the like.

[0073] FIG. 3A shows a transparent substrate (5) and a transparent compound (6) that repels selected inks or paints. The transparent compound (6) is applied to the substrate with such methods as lithography, web-fed or sheet-fed offset printing, screen printing, electrostatic transfer, paint jet, inkjet or the like. The transparent compound (6) is applied in a pattern to the substrate. The pattern of the transparent compound (6) applied to the substrate (5) is one that leaves voids in the pattern. A light-absorbing ink or paint (2) is then applied to the assembly of FIG. 3B that is repelled from the areas of the transparent compound pattern, yet bonds to the areas of the substrate (5) devoid of the transparent compound (6). An optional light reflective compound (3) is then applied to the assembly in step 3C such that the light reflective compound (3) adheres to the light-absorbing compound (2) but is repelled from the transparent compound (6). In step 3D the image is applied to the assembly where it adheres to the optional light reflective coating (3) or the light-absorbing compound (2) but is repelled from the transparent compound (6).

[0074] FIG. 4A shows a transparent substrate (5) and a transparent compound (6) that repels selected inks or paints. The transparent compound (6) is applied to the substrate with such methods as lithography, web-fed or sheet-fed offset printing, screen printing, electrostatic transfer, paint jet, inkjet or the like. The transparent compound (6) is applied in a pattern to the substrate. The pattern of the transparent compound (6) applied to the substrate (5) is one that leaves voids in the pattern. An image (4) is then applied to the assembly of FIG. 4B that is repelled from the areas of the transparent compound pattern (6), yet bonds to the areas of the substrate (5) devoid of the transparent compound (6). The image would be applied as a reverse image so that the image would be correct when viewed through the transparent substrate. An optional light reflective compound (3) is then applied to the assembly in step 4C such that the light reflective compound (3) adheres to the image (4) but is repelled from the transparent compound (6). In step 4D a light-absorbing material is applied to the assembly where it adheres to the optional light reflective coating (3) or the image (4) but is repelled from the transparent compound (6).

[0075] FIGS. 5A through D show the previously mentioned configurations with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8). FIG. 5A shows the product of FIG. 1C as number (9) with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8). FIG. 5B shows the product of FIG. 2B as number (10) with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8). FIG. 5C shows the product of FIG. 3D as number (11) with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8). FIG. 5D shows the product of FIG. 4D as number (12) with the addition of a protective backing layer (7) and either an adhesive coating or a surface modified to provide static cling properties (8). Virtually all of the different configurations described herein may have the addition of layers or panels (7) and (8). FIG. 6 shows a diagram of a printing apparatus and process with six stations. Such a printing process is commonly known as six color process printing.
The print drum (13) transfers the print medium, transparent compound, ink or paint (14) onto the substrate (16) which is to be printed upon. The print medium, transparent compound, ink or paint (14) is stored in a reservoir that supplies the desired substance to the feed roller (15).

Six similar stations are shown as 6A through 6F. For the production of the assembly of FIG. 1 by means of offset process or the like, the first station (6A) would apply a light-absorbing coating that bonds to the desired substrate, the second (6B) would apply a light reflective coating. The stations 6C through 6F would apply the desired inks, paints or compounds to complete the desired image. The compounds applied bond to the previously applied compounds and not to the substrate. More or fewer stations can be used as desired or as required for any particular application. Each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

For the production of the assembly of FIG. 2 by means of offset process or the like the first stations would apply the desired colors and a light reflective coating if also desired. The last station would apply the light-absorbing coating. Alternately, the last station could (6F) could apply a protective coating to the assembly. More or fewer stations can be used as desired or as required for any particular application. Each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

For the production of the assembly of FIG. 3 by means of offset process or the like the first station (6A) would apply the repelling compound. The second (6B) would apply the light-absorbing coating that bonds to the areas of the substrate devoid of the repelling compound but are repelled from the areas coated by the repelling compound. The remaining stations would apply the desired colors and a light reflective coating if also desired. The last station could apply a protective coating to the assembly. More or fewer stations can be used as desired or as required for any particular application. As with the other configurations, each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

For the production of the assembly of FIG. 4 by means of offset process or the like the first station (6A) would apply the repelling compound. The second (6B) would apply the light reflective coating that bonds to the areas of the substrate devoid of the repelling compound but are repelled from the areas coated by the repelling compound. The remaining stations would apply the desired colors and finally a light-absorbing coating. The last station could apply a protective coating to the assembly. More or fewer stations can be used as desired or as required for any particular application. As with the other configurations, each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

The following is a set of steps for the production of one configuration of a base material by means of offset process or the like for use with inkjet, painting or paint jet, or other such imaging processes. The first station (6A) would apply the repelling compound to the desired substrate. The second (6B) would apply a light-absorbing coating that bonds to the areas of the substrate devoid of the repelling compound but are repelled from the areas coated by the repelling compound. The next station would apply a light reflective coating if also desired. The last station could apply a protective coating to the assembly. More or fewer stations can be used as desired or as required for any particular application. As with the other configurations, each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

In subsequent steps the assembly above is then imaged with such means as a painting, inkjet, paint jet, or the like, where the applied compounds bond to the light reflective coating areas but not to the areas of the assembly with the repelling compound.

The following is a set of steps for the production of another configuration of a base material by means of offset process or the like for use with inkjet, processes using charged toner particles, transfer processes, printing or paint jet, or other such imaging processes. This configuration would use a substrate with inherent repelling properties. The first station (6A) would apply a light-absorbing coating that bonds to the substrate. The next station (6B) would apply a light reflective coating if also desired that bonds to the light absorbing coating but is repelled from the areas of the substrate that are devoid of the light absorbing coating. More or fewer stations can be used as desired or as required for any particular application. As with the other configurations, each of the steps can be done in a continuous manner or can be done at different times and/or be done at different locations as desired.

In subsequent steps the assembly above is then imaged with such means as a painting, inkjet, paint jet, or the like, where the applied compounds bond to the light reflective coating areas but not to the areas of the repelling substrate that are uncovered by the bonding light-absorbing coating and the light reflective coating.

Another configuration for a one-way graphic base material for imaging through such processes as inkjet, painting or paint jet, processes using charged toner particles, transfer processes, or other such imaging processes can be produced by means of offset process or the like. This configuration would use transparent substrate or one that transmits a portion of light. The first station (6A) would apply a repelling compound to areas of the substrate. In subsequent steps the assembly above is then imaged with such means as a painting, inkjet, paint jet, or the like, where the applied compounds bond to the substrate in the areas that are free of the repelling compound. The image is printed in reverse and then covered with an optional light reflective coating and then a light-absorbing coating, both of which bonds to the substrate but not to the repelling compound.

Alternately, the light-absorbing coating and the light reflective coating can be applied to the assembly of the substrate and the repelling compound as shown in FIG. 3A. Next the assembly is coated with a light-absorbing coating and then a light reflective coating.

Then the image is produced through painting, inkjet, paint jet or the like. Each of the coatings applied after the repelling compound is repelled from those areas of the substrate that are coated by the repelling compound.

A base material that can be transparent, translucent or opaque that will hold an image can be coated with a pattern of repelling material in the first station 6A. This assembly can then be imaged and coated with a light-absorbing material and an optional light reflective material between the image and the light reflecting layer. These coatings temporarily adhere to the substrate in the areas without the repelling compound and are repelled from the areas with the repelling compound. The combination of image, optional light-reflecting layer and light-absorbing area can then be transferred to a
transparent material to create a one-way graphic material. The order of the image, optional light reflective layer and light-absorbing areas may be changed if desired to create a one-way graphic material with a different orientation. Alternately, a substrate with repelling properties may be coated with a temporary bonding material in a pattern and then be coated and processed as above with materials that transfer to a transparent material.

[0088] Other printing or painting processes can be used to apply the various compounds and substances as outlined here.

[0089] For the web process production or other continuous painting production of any of the configurations the substrate (4) could be supplied by roll material in a continuous manner. After going through one or more of the steps 6A through 6f, the assembly would then be cut to the desired size. This could create a one-way graphic feed stock or base material for other printing processes.

[0090] Inkjet Printing

[0091] One-way materials can also be produced through an inkjet printing process. Since many base materials naturally repel the inkjet printing liquid it would be easy to apply the principles outlined here for the production of inkjet-printed one-way graphic materials. For inkjet-printed one-way graphic materials, a clear substrate with inkjet liquid repelling properties is printed with a bonding material capable of bonding to both the clear substrate and to the inkjet liquid in a pattern that contains voids. This bonding material can be of a black or dark color that is then over-printed with a white compound. This one-way material would be produced for mounting the graphic material with the image visible on the outside of the transparent surface on which the material would be mounted. Shaped or three dimensional products can be similarly constructed with the structure of the material being deposited as desired. Such products can be constructed by any of the deposition methods.

[0092] To create an inkjet base material for mounting the graphic to enable viewing it through the glass, the bonding material would be transparent or translucent. Colors are printed using different colored inks, which attract to and bond to the areas of the substrate with the bonding material, but are repelled from areas of the substrate without the bonding material. Once all of the colors are printed then the remaining areas of the bonding material pattern are printed with white inkjet liquid. The final stage is the over-printing of all colors, including the white, with black inkjet liquid. Of course this sequence can be reversed so that the image is visible on the opposite side of the assembly.

[0093] Equipment modifications to the inkjet printer may be required to accomplish the necessary steps. Alternately, one can run the graphic through the printer one or more times after changing the inkjet color cartridge.

[0094] For printing, forming, constructing, growing, developing, or deposition processes using particulate matter, a pattern of particulate receptive areas and particulate areas can be printed or otherwise deposited onto or created on a clear substrate or onto a transfer medium. The particulate matter in subsequent operations is attracted or transferred to the receptive areas and rejected from the repelling areas, which are transparent. The pattern created allows light passages through the area of the repelling compound. Both the receptive and the repelling compounds can be printed, formed, constructed, grown, developed, deposited or copied onto a clear medium or transferred onto a clear medium or substrate. The patterns created could have the image broken up into blocks or pixels with the light passages around the individual pixels. The areas around the pattern can create voids, holes, or windows in the pattern, which become the light passages.

[0095] Different variations are possible with this theme. For example, receptive areas may be created on a substrate with natural repelling properties, or repelling areas may be created on a substrate that can attract and hold the particles. If the particles are deposited onto a transfer material, the transfer material may have areas with receptive areas or repelling areas. The receptive and/or attractive areas of any of the products described herein can have these properties through the use of chemical, mechanical, thermal, electrical, or magnetic manipulation, or any combination thereof. The transfer material may have natural repelling properties and be made to have a pattern of receptive areas, or the transfer material may have natural attracting properties and be made to have a pattern of repelling areas. Additionally it is possible that a typical or unmodified transfer material that has been printed or otherwise imaged transfers the image onto a substrate with receptive areas or repelling areas as described above.

[0096] The repelling areas may be areas with an inherent charge of the same polarity as the particles. Or the repelling areas may be created through conductive inks that dissipate the charges that are applied to the print medium during the process in order to attract the charged particles. If this charge is dissipated on areas on the medium during the process, the particles are not attracted to those areas. These areas become the light passages or windows that create the one-way graphic effect.

[0097] The substrate may be constructed of a number of stacked elements one or more of which is a dielectric coating or material and one or more of which is an electrically conductive coating or material. One or more of the conductive layers can have a pattern which can either attract or repel the layers into specific patterns when charged electrostatically with the charge the same or different polarity than that of the inherent charge of the particles.

[0098] Four or more color processes can be built up side-by-side or one on top of the other in order to achieve different effects. For the creation of directly imaged one-way graphics, the electrostatic copier or printer could be directed to print a continuous layer of neutral dark color which would be broken up into a pattern by the attraction or the repulsion of the particles. This is accomplished by the charge that is present in the conductive layers of the substrate. Conversely, the conductive layers of the substrate may fail to attract the particles. The other layers that make up the image are deposited on to the pattern as needed to achieve the desired image. Voids in the image are created by the pattern of attracted or repelled particles which when copied or printed onto a clear substrate with clear dielectric ink conductive coatings, or when transferred onto a clear substrate, permit the passage of light and the ability to see through the assembly, through the voids.

[0099] FIG. 7 shows a method of printing a one-way graphic material onto a transparent substrate (5) through such processes as inkjet printing, paint jet printing, processes using sprayed inks, processes using sprayed paints, processes using sprayed particles, processes using sprayed toner particles, processes using sprayed powders, or the like. The applicator or printer (80) is inside a perforated roll or tube (82) and can move back and forth inside the tube. Conversely the printer may be stationary while the tube (82) and a substrate (5) move back and forth. The applicator or printer (80) sprays or otherwise applies the desired colorant onto the substrate (5).
through the perforations of the perforated tube (82). The perforated tube can be in contact with the substrate (5) so that the desired material is sprayed or otherwise applied cleanly through the perforations. Multiple spray heads or applicators on the printer or applicator (80) can apply many different colors or types of material in a single pass. As areas of the substrate are printed or coated as desired the substrate moves as indicated, the perforated tube or roll (82) rolls on the surface of the substrate and rotates through an optional cleaning station (81). The substrate, in addition to various different plastic materials, may be a glass substrate. Additionally, the applied colorant may be fusing powders that fuse to the substrate in the presence of energy for example heat, directed energy, ultraviolet light, radiation, microwaves, magnetic field, electrical field, electrostatic field, laser light, or other such energies source.

FIG. 8 shows a configuration similar to that of FIG. 89 without the optional cleaning station (81), which is not needed if the perforated roll or tube is constructed of or coated with a material that sheds were repel the applied materials. The product of FIG. 90 is also oriented differently with the image applied first and then light reflective coatings and light-absorbing coatings applied. FIG. 89 showed the light-absorbing coatings applied first.

[0101] Transparent Substrate with Perforated Covering

[0102] Another method of producing one-way graphic material is to use a transparent substrate with a perforated or selectively permeable covering over its face. The perforated or permeable layer has adhesion properties so it peels off easily and is very thin. This assembly can be backed with adhesive and a protective release liner, using electrostatic static cling properties, magnetic, gas pressure or other such methods designed to keep the permeable layer in close proximity to the substrate. This assembly can be packaged for use with various different imaging methods. In practice for an exterior amount one-way window graphic material, a dark light-absorbing coating would be printed or applied first, next an optional light-reflecting coating may be applied, then the image is printed. Once the printing is complete the perforated low tack covering is separated from the assembly leaving behind a pattern that makes up an image. The windows or voids in the image necessary for the one-way graphic effect are created by the removal of the perforated covering.

[0103] An interior mounted one-way window graphic material would have the image printed first in reverse followed by an optional light reflective coating, then a dark light-absorbing coating. This configuration would also have the low tack perforated covering separated from the assembly after imaging, creating voids in the image. The view through these voids is from the side opposite where the image is visible. Any ink or paint that is applied to the low tack perforated covering is removed from the assembly along with the low tack perforated covering. If this low tack perforated covering is thin enough virtually any type of printing process may be used to create one-way window graphics.

[0104] Since the one-way graphic effect is dependent on two primary factors, the first being perception and the other being lighting, a random pattern works best on fooling perception. Human perception works by recognizing colors and shape patterns. When a random pattern is used and overprinted with a dark ink or paint, the human eye does not see the color or the pattern on the surface of the one-way graphic, so the eye looks beyond to where there is color and pattern. On the opposite side, the color and patterns are printed on the graphic surface so the eye stops at the surface and generally does not see beyond the surface. The one-way effect works best when the lighting is greater on the side of the graphic image and not behind the graphic surface.

[0105] In addition to an image being printed onto the graphic surface, an image can be projected onto a one-way surface. In this configuration a panel with a black or dark surface on one side has a light colored surface that can have embedded light reflective components on the opposite side. This assembly is light permeable so that light and vision passes selectively through the assembly. Painting a black or light-absorbing pattern on a transparent sheet, and then printing a white or light-reflecting coating on top of the light-absorbing layer is another method of producing a projection one-way screen. When a transparent substrate with ultraviolet screening properties is used, the printed portion of the screen is protected by ultraviolet light coming through the screen. This protects the screen image from fading in bright sunlight. The screen would show a pattern of light reflective material on one side of the screen and voids in the pattern through which one can see. The opposite side would show a dark, light-absorbing pattern with voids through which one can see.

[0106] Alternately, the light reflective coating can be printed first which is then overlaid with a dark layer of printing. The substrate material can be various different materials that have a clear adhesive layer on the backside that is protected by a release layer. The release layer is peeled away from the substrate to expose the adhesive layer prior to the installation of the one-way projection screen to the glass surface. The substrate may also be a material with static cling properties; materials with an embedded electrostatic charge that is attracted to the window or glass surface through electrostatic attraction.

[0107] FIG. 9 shows a substrate (36) that contains a release layer (78) a light-absorbing material (2) and optional light reflective material (3) and an image (4) that as an assembly is referred to as the transfer graphic. The transfer graphic can be mass-produced with or without the layers (2), (3), and (4). These layers can be added at later times. An assembly consisting of (36), (78), (2) and (3) can produce a material ready for imaging. A perforated membrane (79) is between the above described assembly and a transparent substrate (5).

[0108] FIG. 10 shows the elements and assemblies of FIG. 85 pressed together. Under pressure and/or heat the image (4) is pressed through the holes of the perforated membrane (79) to contact and bond with the substrate (5).

[0109] FIG. 11 shows the elements of FIG. 10 being separated from one another. Stacked elements consisting of image layer, light reflective material, and light-absorbing material bond to the substrate (5) in the areas through the holes of the membrane (79). FIG. 87 shows that it is possible that portions of the image, light reflective material in the light-absorbing material that were prevented from transferring to the substrate by the perforated membrane remained on the transfer graphic.

[0110] FIG. 12 is similar to FIG. 11 with the exception that the image, light reflective material and light-absorbing material stay with the perforated membrane and separate from the substrate and release layer of the transfer graphic material.

[0111] Light Mask One-Way Graphics

[0112] Images for one-way window graphics can be produced on electrostatic machines with the use of a light mask. This light mask can be a perforated, opaque material that screens portions of the image to be copied from the imaging system. Such electrostatic machines use a roller or plate that
is electrostatically charged. Light reflected onto the roller or plate modifies the charge according to the image to be copied. When the light is interrupted and broken into a pattern by the light mask the image on the roller or plate is similarly broken into a pattern. When the image is then printed onto a transparent substrate, the image has a pattern of holes or voids through which one can see. Another configuration for a light mask is that of a pattern printed upon a transparent sheet. This sheet is placed in between the scanning surface and the image to be copied. The portions of the image to be copied that are visible to the scanner or copier are copied while the blocked portions are not. When this broken up pattern of the image is copied or transferred to a transparent substrate a one-way graphic can be created.

[0113] Alternately, the roller or plate mechanism of the electrostatic copier can be modified so that areas of the roller or plate are unaffected by either the charging process or the modification by the light.

[0114] Inks or paints that settle or separate during the drying and curing process can produce one-way graphic materials. These inks or paints would be printed onto a transparent substrate and could work in either of two ways. The first way is that once the image is printed in a series of dots a dark color moves to the bottom of the dot which is in contact with the surface of the substrate while the different colors migrate to or stay at the surface of the dot. From the printed surface one sees the different colors in a pattern with voids that make up an image. From the reverse, one looks through the transparent substrate to see a dark pattern with voids. Since one does not see color or a recognizable pattern in the black pattern one sees through the voids to where there is color and pattern.

[0115] The second method of producing a one-way graphic material through separating inks, dyes or paints uses inks, dyes or paints that separate with the dark color rising to the surface of the printed pattern, while the color moves to the bottom of the printed pattern which is in contact with the transparent substrate.

[0116] The motive force for the separation of the different colors can be such forces as electrostatic attraction/repulsion, magnetic attraction/repulsion, gravity, centrifugal force, laser, microwave, particle beam, electron beam, or other such energy source.

[0117] It is possible to create one-way graphics through the use of inks or paints in which the surface changes color when exposed to energy sources such as electrostatic attraction/repulsion, magnetic attraction/repulsion, gravity, centrifugal force, laser, microwave, particle beam, electron beam, heat, cold, or other such energy source. The graphic would be applied to a transparent material in a pattern that would leave voids for the transmission of light. Energy would be directed to the ink or paint which would change the color of the inks or paint's surface. The energy could darken the pattern uniformly on the surface, yet the color and pattern when viewed form the opposite side (through the transparent material) would appear unaffected. An observer would see a pattern of dark areas on the surface of a transparent material from one side, and would see a graphic image from the reverse when looking through the transparent material.

[0118] Alternately, the graphic image can be exposed to energy through the transparent material that changes the color of the ink or paint layer that is in contact with the transparent material. The exposed surface of the ink or paint would appear unaffected. An observer with this configuration would see a graphic image when looking at the side of the transparent material with the ink or paint. From the opposite side the observer would see the pattern, changed by the energy, through the transparent material.

[0119] Similar products can be produced through the use of inks or paints that change colors when exposed to other elements, compounds, solvents, chemicals, gases, or the like. The surface of the ink or paint in this configuration can be changed by such means or the layer of ink or paint that comes in contact with the transparent material can change due to contact with the transparent material or a substance applied to the transparent substrate. Materials that change properties when exposed to temperature variations, external force, radiation, stress, electromagnetic fields, magnetic or electrical fields or charges, electromagnetic radiation, field effects or the like can be used in many different products described herein for different effects.

[0120] FIG. 13 shows a possible light mask screen for use with color copiers, scanners, or other such graphic input devices. The light mask screen consists of a transparent substrate (83) which has been printed with a white or a light reflective coating (83) in FIG. 13 the areas are transparent areas, devoid of the white or light reflective coating of (83). Although the screen type of pattern is shown in FIG. 13, virtually any type of pattern can be used for the light mask screen. The light mask screen could also be constructed of a white material that has been perforated. The purpose of the light mask screen is to break up a solid original graphic into a duplicate graphic with holes or voids creating light passages for a one-way graphic effect. There are many different ways such a light mask screen can be used to create one-way graphic materials. One-way is through the use of a black and white or color copying machine. The light mask is placed on the scanning surface and then the desired image is placed upon the light mask. The light mask is in between the scanning surface and the desired image. When the desired image is copied onto a transparent substrate there are holes or voids in the pattern of the image on the copy. A one-way graphic effect is created when the either the first or the last color applied to the transparent substrate is that of a dark light-absorbing material. Other uses for the light screen in creating one-way graphics is to screen stencils, photo-emulsion materials, scanned images, or other processes that copy, scan, duplicate, digitize, or otherwise make replications of graphic images.

[0121] FIGS. 14, 15, and 16 show some of the limitless different patterns possible for the light mask screen. A one-way graphic material may be created from a transparent medium that has areas that can attract and hold toner particles and/or areas which repel or do not attract toner particles. A pattern of transparent conductive material printed, painted or otherwise applied to the surface of the transparent material could be used for such purposes. The conductive areas could dissipate any charges that would attract and hold the charged particles of the toner. Additionally, the conductive areas may be charged either directly or through such methods as induction of a charge that would actively repel the toner particles. The transparent medium could be covered with a pattern of a material that has an inherent charge that repels the toner particles. Many such materials and compounds are well known in the prior art, however their use for creating such a one-way graphic medium is novel and unknown.
It is also possible to use a transparent substrate that has dielectric properties, that is the ability to insulate and not transmit or dissipate electrical charges. Prior to imaging the graphic through an electrostatic process, the substrate may have areas of its surface charged with a pattern of electrostatic charge. The toner particles with their inherent charges would then be attracted or repelled from the areas of the substrate with electrostatic charges depending on the respective polarities of the charges.

Often short runs of graphic materials are produced through such means as an electrostatic plotter. Often the output of the electrostatic plotter is that of an image on transfer paper. This transfer paper is constructed so that its surface will accept an image from the electrostatic plotter, yet when the image side of the transfer paper is placed in contact with other media through pressure and heat, the image bonds to and is transferred to the other media.

A one-way graphic transfer media may be created for such printing methods as electrostatic plotters, inkjet printers, paint jet printers, electrostatic copiers of other such imaging processes. The one-way graphic transfer media would be constructed of a base material such as paper, plastic, or other such media that is coated with a light-absorbing coating and a light reflective coating both of which are made to release form the substrate and transfer to another media. An image is applied to the light reflective coating of the one-way graphic transfer media through such means as mentioned above or any other means as may be developed. The portions of the image, the light-absorbing coating and the light reflective coating, are transferred to a transparent media through such means as heat and/or pressure.

There are many different ways to limit the areas that are transferred. One method is to place a screen between the transparent media and the one-way graphic transfer media. The transfer to the transparent media is only made where the transparent media makes contact through the screen with the one-way graphic transfer medium.

Additionally, one or more rollers which supply heat and/or pressure may have a pattern of raised or lowered areas so that certain areas of the roller produce the heat and/or the pressure required for the transfer. The roller may even have holes or voids that draw up a portion of either the one-way graphic transfer medium or the transparent media through gravity, positive or negative air pressure, electrostatic, magnetic, or other such force. Any of these methods and other as well can transfer the image, the light-absorbing coating and the light reflective coating to the transparent media while leaving portions or areas void for the transmission of light and/or vision.

Additionally either the transparent media or the one-way graphic media after imaging may be coated with a pattern that either assists or hinders the transfer process in order that the finished product would have holes or voids in the graphic to allow light transmittance.

Alternately, the transparent substrate can have areas of embedded charge, which repel the toner particles. This substrate can be used for all printing processes that use charged particles or inks such as electrostatic printers, color electrostatic printers and electrostatic plotters.

Often a greater degree of one-way effect is desired, for greater security. Or, the application may require installation where the image side of the graphic has a lower light level than the see through side of the one-way graphic. One-way graphics with a transparent substrate allow too much light through for the one-way effect to be properly perceived. In installations such as these a tinted or a semi-reflective substrate material may be substituted for the transparent substrate. A tinted or a semi-reflective substrate may be used for all embodiments where there is a transparent substrate.

FIG. 17 shows a palatte material for creating one-way graphics through the use of different processes using charged particles, charged droplets, charged fluids, charged slurries, or other such charged materials. FIG. 17 shows a substrate (84) with a series of conductive elements (35). The conductive elements can be made of a transparent conductive material, be extremely fine so as to appear invisible, or may be thicker and visible, depending on the use of the palate material, whether it is to be used as a finished product or if it is to be used as a transfer material. For use as a finished product the substrate (84) should be transparent and either be a dielectric material or be coated with a dielectric material, and the conductive elements should be transparent or so thin that they appear nearly invisible. The conductive elements may be covered or coated with a dielectric material as desired as long as a charging pathway is maintained. A palatte material for the transfer of charged colorant can have a transparent or opaque substrate and/or transparent, thin or visible conductive elements as desired. The graphic itself, consisting of layers of charged colorant materials on the substrate (84), would be transferred to a second, transparent substrate.

FIG. 18 shows a cross section view with the conductive elements (35) on the back side or the side opposite the printed surface of the substrate (84). The image light reflective coating (86) has been applied first and then a light absorbing (85) coating has been applied. When the conductive elements are charged with an electrostatic charge the same as the charged colorant materials, the charged colorant materials are repelled from the areas of the substrate closest to the conductive elements. This process creates holes or voids in the image, the light reflective coating, and the light absorbing coating, creating a one-way graphic material.

FIG. 19 shows a configuration similar to FIG. 18 with the exception that the order of application of the image or light reflective coating (86) and the light-absorbing coating (85) has been reversed. FIG. 19 can be pre-made as a base material for quick and easy printing. Such a base material would have a light reflective coating without an image. The image would be applied onto the surface in one or more subsequent steps.

FIG. 20 shows a view of the surface of the configuration of FIG. 19 after an image has been applied. The charged colorants that make up the graphic have been repelled from the areas of the charged conductive elements. Although FIGS. 17-23 show the conductive elements as straight lines in a grid pattern, many other patterns are possible, especially through the use of such materials and processes as conductive appliques, conductive inks and paints, conductive films, conductive polymers, or the like. Additionally, any of all of the products of FIGS. 17-23 can be constructed with a conductive substrate which has been coated or covered with a dielectric material with a pattern of holes or voids.

FIG. 21 shows a configuration similar to FIG. 17 with the addition of a conductive strip (89) along one side of the assembly.

FIGS. 22 and 23 shows a configuration similar to FIG. 96 and with the exception that the conductive elements are on the same surface as the subsequently applied charged colorants.
FIG. 24 shows a view of the surface of the configuration of FIG. 23 after an image has been applied. The charged colorants that make up the graphic have been repelled from the areas of the charged conductive elements.

This charged grid in each of the FIGS. 17 through 24 can be a part of the assembly, or it can be a separate unit that is placed adjacent to the base material. Additionally the charged grid can be in the shape of a continuous grid in the shape of a drum similar to the perforated drum of FIGS. 13 and 14.

FIGS. 25 and 26 show printers (94) that apply charged colorants. The material of FIG. 17, 18, 19, or 20 can be in roll form as shown by (91). A charging unit (93) that is shown below the material in FIG. 25 and above the material in FIG. 26 charges the conductive elements in the material. The printer applies the charged colorants as desired. The imaged product emerges from the other side (92). A person of skill in the art will recognize that this method and apparatus are adaptable to create a copier as well. The imaged product can be the product of FIGS. 18-24, or any of the other products described in this section. The product can be a transfer material in which the image is transferred onto a transparent image, or the product can contain a transparent substrate to create a one-way graphic medium.

Permeable Materials for One-Way Graphics

The permeable materials as used in the descriptions herein can be constructed, assembled, manufactured, extended, introduced, induced, grown, molded, constrained, shaped or otherwise formed by any one or combination of the following methods: weaving, formed with holes, capillary action induced, foamed, sintered, crushed, deposited, optical deposition, thermal deposition, chemical deposition, electric or magnetic deposition, gas deposition, liquid deposition, gel out, formed in strips, non-woven mat, printed, foam sheet or other such method or compositions whereby some portion of electromagnetic wave, light, liquid, solid, plasma, and gas can pass through the material.

Below is a list of light permeable materials suitable for the construction of one-way graphic vision materials. Each of these materials would be constructed so that an image is visible on one side of the assembly and yet one can see through the assembly when viewing from the side opposite the image. Each of these materials could also have an adhesive material applied and or a protective layer applied to protect the adhesive or assembly. Also additional protective layers could be applied to the image side of the assembly to protect the image from environmental factors such as weather, cleaning agents or processes, light degradation, soil, UV exposure, etc.

Materials may be constructed as woven materials, where strips or threads of substrate are woven so that light may pass through the assembly. The woven material could then be pressed flat to minimize the surface variations caused by the warp and weft of the weaving process. The flattening process could also bond the material together, thereby increasing strength.

Foamed materials that are thin and permit light to pass through may be imaged, printed or painted to create one-way graphic materials. Foamed materials may also be pressed flat to minimize the surface variations.

One-way graphics may be constructed from light permeable non-woven materials. As with other materials the non-woven material may be pressed flat to minimize surface variations or the non-woven material may be made upon a flat surface so that the resulting material is substantially flat enough to readily be imaged through many different printing processes. These materials could be monofilaments, threads, strings, fibers or the like.

Upright pins on a form into which a material is formed could create a light permeable material suitable for one-way graphics. A granular, fluid or plastic material would be poured, spread or otherwise placed on the form where pins would create voids in the finished product, creating a light permeable material.

One-way graphic materials could be constructed through a fractured method, where two dissimilar materials, one transparent and the other opaque are bonded together and then the opaque material fractures, leaving voids or open areas. These voids or open areas expose areas of the transparent material creating light permeability. This could be accomplished by use of a transparent material that expands relative to the opaque material causing the opaque material to fracture, or by use of an opaque material the fractures and shrinks relative to the transparent material or both. The opaque material would carry the image.

FIG. 27 shows a material that is formed into a material with permeable areas. In this illustration, a material (95) as depicted at is made up of bits, foam, strips, chunks, fibers, monofilaments, pieces, or other bits of material that are pressed into a material that has permeable areas (96). Such material can be a product that is woven of formable materials, including but not limited to thermoframeable and thermoset materials. Although rollers (94) are shown in this illustration, other types of means may be used including adhesion, thermal, mechanical, radiation, or other such forces, or combination of forces. The material may be formed, shaped or otherwise constructed into shapes of multiple dimensions if so desired. This shaping or forming can be done at this stage or before or after this stage. This process can be used to create materials with both two and three dimensional elements.

FIG. 28 illustrates a permeable material at (100) that is formed from bits, strands, strips, filaments, monofilaments foam, or other such material (98) that is disposed, sprayed, extruded, or otherwise formed and then subsequently bonded together using adhesion, thermal, mechanical, radiation, or other such forces, or combination of forces. Although the illustration depicts a roller (99) being used to apply heat and or pressure other bonding means may be used.

FIG. 29 shows that a permeable material can be formed from strands, strips, filaments, monofilaments or other such material that is formed, grown, constructed, or otherwise made to conform to a multidimensional shape. In this illustration a mold or form (102) serves as the constraining medium for the material (101). The material (101) may be bits, foam, strips, chunks, fibers, monofilaments, pieces, or other bits of material may be adhered together or otherwise bonded together to create a three dimensional material that has permeable areas.

FIG. 30 shows a cross section view of a material that has undergone a process that creates different areas on a substrate. Some areas (104) are textured, crazed, crackled, embossed, etched eroded, stressed, machined, nanomachined, grown, ablated, molded, formed, foamed, or otherwise created so that the surface or the interior structure of the material is modified. Such modification can be used to attract (105) or repel (104) subsequent layers, coatings or operations. The modification can change the optical qualities of the substrate such that some areas are substantially transparent.
while other areas are substantially not transparent (104). The areas that are substantially transparent are left substantially un-obstructed by subsequent operations. The areas that are textured, crazed, cracked, embossed, etched eroded, stressed, machined, nanomachined, grown, ablated, molded, formed, foamed, or otherwise created can have layers, coatings, paint, ink, markings, graphics, decoration or other such decoration or design so that the decoration is visible under certain conditions while a vision through the assembly is possible under other conditions. As with all of the other configurations described herein this assembly may be formed into planar and/or complex shapes. Further, each or the configurations described herein may be provided with adhesive means. Such adhesive means may take the form of an adhesive layer protected by a removably-attached protective layer. Layers or coatings (111) may be applied to surfaces that are at different levels than other areas of the material.

FIG. 31 shows a material similar to that of FIG. 30 where the areas have a deeper profile. The configurations of either FIG. 30 or 31 can be created with these different areas in different patterns.

Mass-Printing Materials with Raised/Lowered Surfaces

FIG. 32 shows a transparent substrate (68) which has been molded, formed, extruded, vacuum formed or otherwise modified to create raised areas and/or lowered areas. One or more of these processes may be done prior to the printing process in order to create a print ready medium, or it may be done during the printing process. The substrate may be a material with ink or paint repelling properties to which different bonding materials are applied to desired areas, a material to which certain inks or paints will bond and yet other inks or paints will be repelled, or a material to which repelling materials are applied to certain areas. This transparent substrate which has been molded, formed, extruded, vacuum formed or otherwise modified can be processed similarly to the product of FIGS. 1-6.

FIG. 33 shows a light-absorbing coating (2) that is repelled from areas of the substrate and settles into the depressions of the substrate.

FIG. 34 shows a light-reflecting coating or an image coating (4) which bonds to the previously applied light-absorbing coating.

FIG. 35 shows a to light-reflecting coating or an image coating which is printed in reverse (4) that is repelled from areas of the substrate and settles into the depressions of the substrate.

FIG. 36 shows a light-absorbing coating which bonds to the previously applied light-reflecting coating or image coating.

FIG. 37 shows a transparent substrate (68) which has been molded, formed, extruded, vacuum formed or otherwise modified to create raised areas and/or lowered areas. As with FIG. 32, one or more of these processes may be done prior to the printing process in order to create a print ready medium, or it may be done during the printing process.

FIG. 38 shows the application of a light-absorbing coating (2) that is applied to the raised areas of the transparent substrate. Many different printing processes may be used where the ink, paints, toner particles, or others such print material comes in contact with the raised areas of the substrate but not with the lowered areas.

FIG. 39 shows the application of a light-reflecting coating and/or an image coating which bonds to the previously applied light-absorbing coating.

FIG. 40 shows the application of an image printed in reverse and/or a light-reflecting coating that is applied to the raised areas of the transparent substrate.

FIG. 41 shows the application of a light-absorbing coating which bonds to the previously applied light-reflecting coating and/or image coating.

FIG. 42 shows a transparent substrate which has been molded, formed, extruded, and vacuum formed or otherwise modified to create raised areas and/or lowered areas.

FIG. 43 shows a light-absorbing coating that settles in to the lowered areas of the substrate and/or is wiped, or otherwise removed from the areas of the transparent substrate which are raised.

FIG. 44 shows a light-reflecting coating and/or an image coating that bonds to the previously applied light-absorbing coating. The light-reflecting coating and/or image coating settle into the lowered areas of the substrate and/or is wiped or otherwise removed from the areas of the transparent substrate which are raised.

FIG. 45 shows a light-reflecting coating and/or an image coating that settles in to the lowered areas of the substrate and/or is wiped or otherwise removed from the areas of the transparent substrate that are raised.

FIG. 46 shows a light-absorbing coating applied to the previously applied light-reflecting coating and/or image coating that settles into the lowered areas of the substrate and/or is wiped or otherwise removed from the areas of the transparent substrate that are raised.

FIG. 47 shows one possible configuration of a substrate with the areas which has been molded, formed, extruded, vacuum formed or otherwise modified to create areas that are raised (70) and areas that are lowered (69). From the opposite side of this panel the areas (69) would signify areas that are raised while (70) would show areas that are lowered.

FIG. 48 shows a different possible configuration of a substrate with areas that are raised and areas that are lowered. This configuration shows that it is possible to have raised bands and lowered bands that may be oriented in any direction.

FIG. 49 shows a different possible configuration of a substrate with areas that are raised and areas that are lowered in a more random pattern.

FIG. 50 is a cross-section view of a transparent substrate with raised areas and lowered areas (71). A light-absorbing coating (2) is applied to the substrate that settles into the lowered areas of the substrate and/or is wiped or otherwise removed from the areas of the transparent substrate that are raised. A light reflective coating (4) and/or an image coating is applied to the previously applied light-absorbing coating (2). The light reflective/image coat (4) settles into the lowered areas of the substrate and/or is wiped or otherwise removed from the areas of the transparent substrate that are raised.

FIG. 51 shows a possible configuration for the cross-section view of FIG. 55. FIG. 56 shows a series of ridges or troughs.

FIG. 52 shows another possible configuration for the cross-section view of FIG. 50. FIG. 52 shows a random pattern of either raised or lowered areas.
Fig. 53 to shows another possible configuration for the cross-section view of Fig. 50. Fig. 53 shows an ordered pattern of either raised order lowered areas. Figs. 51-53 show three possible configurations for a panel with raised sections and lowered sections the possibilities for other configurations and other patterns are raised and lowered sections are virtually limitless. These three drawings are not intended to limit the numerous configurations that are possible.

Fig. 54 shows a side view of a substrate (5) which has stacked elements consisting of a light-absorbing material (2) and a light reflective material (3) which protruding from the surface of the substrate (5). A print roller (75) with a pattern or image in ink or paint transfers said image (76) onto the assembly where the ink or paint bonds to the tops of the stacked elements, leaving an image on the tops of the stacked elements (4). A product similar to the configuration consisting of (5), (2), and (3) can be printed upon using many different methods, including, without limitation, an image transfer method, a stamping method, a platen press, an offset press, or any other painting or printing method capable of transferring an image.

Fig. 55 shows a head-on view of a substrate (71) described in Figs. 50-52. The substrate (71) is printed upon by contact with a roller (75) which prints the desired coatings on the raised surfaces of the substrate. These coatings may be configured for an interior or exterior mounted one-way graphic. The desired coatings may be printed in different orders as desired. As with other assemblies outlined in this document the configurations in Figs. 54 and 55 may have additional adhesive layers, static- cling layers, and/or protective backing layers.

In other embodiments, different levels can be achieved by adhering, bonding, placing, forming, growing or otherwise creating raised sections (125). These raised sections can then be imaged (124) by any suitable means. The raised sections (125) can be created by attracting discs, particles, bits, pieces, or other such matter through the use of electrostatic or magnetic forces. Areas of the substrate (126) are left substantially transparent.

In yet another embodiment, raised areas of the assembly can be a detachable or removable assembly consisting of one or more of the following: substantially transparent substrate, adhesive layer, and an image or pattern formed on one or more areas or levels of the assembly. In this configuration a protective backing assembly is provided to protect the adhesive layer or coating.

In other embodiments, the materials described herein may have different levels as in the configuration of Figs. 32 through 53. In some embodiments, there may be raised sections on both sides of the substrate. This configuration is ideally suited for mass production printing methods where the printed image is in contact with the raised sections of the substrate and the lower sections are substantially transparent.

As with the other configurations described herein the raised sections and or the lower sections may be produced by any means including but not limited to, forming, stamping, molding, growing, nonwoven, bonding, constructing, fabricating, made, etching, developing, ablating, building up, etching, developing, foaming, inflating, expanding, shaving, imprinting, embossing, or otherwise made, formed or constructed so that the product has sections at different levels. As with other methods described herein, the surfaces of each of the different levels may have properties that attract and/or repel subsequent coatings, layers or operations.

One-Way Materials with Internal Light Sources

One-way graphic materials can be created that have internal lighting. Fig. 56 shows a configuration that uses a light source (113) that is transmitted through a substantially transparent material or substrate, a coating, layer or other such material (117) modifies the amount of light transmitted or perceived from side B. Holes, perforations, substantially transparent areas, or other permeable areas (115) allow the passage or modification of light passing through the assembly. The perceived view from side B is substantially through the assembly, through gaps or permeable areas in the coating, layer or other such material of (117). The coating, layer or other such material of (117) may have light reflective or light refractive properties on the side facing the material, or substrate. A coating, layer or other such material (114) may be placed on the side of the assembly, in this case side A. This coating, layer or other such material (114) may be substantially translucent or opaque and may also have a decorative effect. Areas of the substrate that are not permeable (116) may be left uncoated or uncovered by the coating, layer or other such material of (114) to allow the passage of light from the light source (113). Alternately, the non-permeable areas (116) may be tinted, painted, colored or otherwise modified so that the light coming from those areas have the appearance of being different colors.

Fig. 57 illustrates a product similar to that of 56 in that a light source is used to internally light the product. In this embodiment, the substrate is composed of different elements that combine to form a permeable material. This permeable material can be formed from strands, strips, bits, pieces, filaments, monofilaments or other such material that is formed, grown, woven, nonwoven, bonded, constructed, or otherwise made to conform to a dimensional shape. This shows a configuration that uses a light source (113) that is transmitted through a substantially transparent material or substrate (119), a coating, layer or other such material (119) modifies the amount of light transmitted or perceived from side B. Holes, perforations, gaps between strands, strips, bits, pieces, filaments, monofilaments or other such material that is formed, grown, woven, nonwoven, bonded, constructed, or otherwise formed, substantially transparent areas, or other permeable areas allow the passage or modification of light passing through the assembly.

The perceived view from side B is substantially through the assembly, through gaps or permeable areas in the coating, layer or other such material of (120). The coating, layer or other such material of (120) may have light reflective or light refractive properties on the side facing the material, or substrate. A coating, layer or other such material (118) may be placed on the other side of the assembly, in this case side A. This coating, layer or other such material (118) may be substantially translucent or opaque and may also have a decorative effect.

Areas of the substrate that are not permeable (121) may be left uncoated or uncovered by the coating, layer or other such material of (118) to allow the passage of light from the light source (113). Alternately, the non-permeable areas (121) may be tinted, painted, colored or otherwise modified so that the light coming from those areas have the appearance of being different colors.

As shown in Fig. 57, the products of this configuration can be made into three dimensional shapes. Although
not illustrated the lighting source can be behind, in front of, beside, adjacent to, inside, or otherwise near the assembly so that similar effects are achieved. Additionally the light may be transmitted through such means as fiber optics, light pipes or other such means. Additionally one or more of the materials used may be of such a material that gives off light.

[0189] Lenticular and Holographic One-Way Graphics

[0190] As noted above, one-way graphics are generally static, consisting of a single image that looks essentially the same wherever it is visible from. A 3D effect for one way vision can be obtained through the use of lenticular lens graphic assemblies. The lenticular lens assembly acts as a series of tiny prisms where the image visible to one eye is different from the image supplied to the other eye. The graphic image for 3D one way vision can include such methods outlined in this document such as inkjet printing, lithography, web printing, electrostatic micro spheres and the like. The assembly containing a lenticular lens and a corresponding graphic can be perforated and backed with a light-absorbing layer to achieve a one way 3D graphic effect.

[0191] Another configuration calls for a lenticular lens sheet where an area of several lenses alternates with flat transparent areas. The image would then be broken up into stripes and placed behind the areas of lenticular lenses. The backside of the image stripes would have a light absorbing color. The areas between the stacked lenticular lenses and image stripes would be transparent and clear. When one looks through the medium from the reverse he would see through the assembly between the areas of stacked lenses, image and light absorbing material.

[0192] FIG. 58 is a cross-section view of a lenticular type of graphic display that has been modified to create a one-way graphic assembly. The lenticular lens (72) is backed by a segmented graphic (73) that in turn is backed by a light absorbing coating (2). An assembly silhouette pattern, such as holes or perforations, permits the one-way graphic effect. The lenticular lens assembly bends the light so that certain segments of the segmented graphic are visible. As the viewer of a lenticular type of graphic display moves different segments of the segmented graphics are visible. The lenticular effect is enabled by the fact that the segmented graphic (73) consists of at least two interleaved images, each image located at a distinct focal point in relation to the lenticular lens. This is often used to create a three-dimensional effect or movement effect. See, e.g., U.S. Pat. Nos. 6,084,713; 6,227,232; and 6,781,761, which are hereby incorporated by reference.

[0193] FIG. 59 is a face-on view of the assembly of FIG. 59. The lenticular lens assembly (72) and contains a pattern of holes (74) through the assembly. Many different patterns of holes, sizes of holes, shapes of holes are possible. This assembly as with most configurations described herein may have an adhesive layer, a static cling layer and or a protective removable backing layer. These adhesive layers, static cling layers and or protective removable backing layers may be placed on either of the face or the backing as desired.

[0194] FIG. 60 is a cross-section view of a one-way lenticular lens assembly for creation of three-dimensional one-way graphics. FIG. 60 shows an assembly similar to FIG. 58, but instead of physical holes (74) FIG. 60 has windows (56). These windows may be flat concave, convex, or other shapes or cross-sections as desired. The lenticular lens assembly (72) is situated to focus the viewers’ perception on at least two distinct images, each contained within the segmented graphic (73). Although FIG. 60 shows the lens assembly having windows and the segmented graphic having physical gaps, different types of perforation or silhouette patterns could be used to practice the invention.

[0195] The lenticular lens assembly can use many different patterns of windows. FIG. 61 shows a face-on view of one possible configuration of the assembly of FIG. 60, with window elements (56) in strips. The window elements may be round as shown by the hole pattern of FIG. 58. Although FIG. 61 only shows windows in the shape of strips virtually any shape of window is possible.

[0196] In yet another embodiment of the invention, holograms may be perforated and backed with a light-absorbing layer to create one way hologram graphic displays. This assembly may be provided with an adhesive means and a protective backing is so desired.

[0197] According to Holography Microsoft Encarta 98 Encyclopedia copyright 1993-1997 Microsoft Corporation:

[0198] “A hologram differs essentially from an ordinary photograph in that it records not only the intensity distribution of reflected light but also the phase distribution. That is, the film distinguishes between waves that reach the light-sensitive surface while they are at maximum wave amplitude, and those that reach the surface at minimum wave amplitude. This ability to discriminate between waves with different phases is obtained by having a so-called reference beam interfere with the reflected waves.

[0199] “Thus, in one method of obtaining a hologram, the object is illuminated by a beam of coherent light—a beam in which all the waves are traveling in phase with one another. Such a beam is produced by a laser. Essentially, the shape of the object determines the form of the wave fronts—that is, the phase at which the reflected light arrives on each point of the photographic plate. Simultaneously, a portion of the same laser beam is reflected by a mirror or prism and directed toward the photographic plate; this beam is called the reference beam. The wave fronts of this latter beam, not having been reflected from the object, remain plane-parallel and produce an interference pattern with the wave fronts of the light reflected by the object. If the object is a point, for example, the wave fronts of the reflected beam will be spherical; the interference pattern produced on the film will then consist of concentric circles, the space between circles decreasing with increasing radius.

[0200] “The interference pattern produced by a more complicated object will be much more complicated, so mere inspection of the resulting hologram will reveal only an intricate pattern of dark and light structures that bear no apparent relationship to the original object. When the hologram is viewed in coherent light, however, the recorded object becomes visible; and when the hologram is viewed from different angles, the object is also seen from different angles. The three-dimensional effect is obtained because the hologram reconstructs in space the wave fronts that originally were produced by the object.

[0201] “How this happens can be understood by again using the example of the hologram of the point. Coherent light arriving at the concentric circles on the hologram is diffracted on a diffraction grating. The diffraction angle of the beam increases with the distance from the center of the concentric rings, thus reconstructing the spherical wave fronts, and the viewer sees the point at
the same relative place where the real point was when the hologram was made. The wave fronts of more complicated objects are reconstructed in the same way. The intensity distribution of the reflected light is recorded in the degree of blackening of the interference patterns on the film.

[0202] In one embodiment of the invention, a hologram is perforated and backed with a light-absorbing layer to create a three dimensional graphic image for a one way effect. The perforations may be done in a number of different patterns, configurations, hole sizes, hole shapes, and percentages of open area versus solid area.

[0203] Additionally, portions of the holographic display may be backed with a light absorbing adhesive coating, or a light absorbing coating that is backed with either a transparent, translucent or a light absorbing adhesive. The portions of the holographic display with the adhesive are adhered to a transparent substrate in a way that leaves voids on the transparent substrate. The transparent substrate may be such materials as glass, ceramic, plastic compounds, composite materials, or the like. This transparent substrate may be coated with an adhesive for adhesion to another transparent substrate such as a window, wind screen, wind break, door, glass unit, plastic unit or the like. The adhesive used could also include such means of adhesion as adhesives, glues, epoxies, compounds(s), mucilage, cements, or static cling. This adhesive may also be protected by means of a removable membrane or cover. Alternately, the adhesive may be applied to either the graphic assembly or the second transparent substrate, namely the window, wind screen, wind break, door, glass unit, plastic unit or the like.

[0204] The portions of the holographic display may be in many different shapes, sizes, patterns and configurations. They may be produced through such well known means as cutting, slitting, molding, die cutting, kiss cutting, or cutting by laser, water jet, or any other method of cutting materials that may apply.

[0205] In yet another embodiment, interesting graphics can be produced with portions of the graphic display containing one-way graphic elements and stereograms or “Magic Eye” graphic effects. Stereograms or “Magic Eye” types of graphics are well known in the prior art. They are created when a pattern has elements or shapes that are “cut out” of the pattern and then shifted or moved horizontally. Typically they are “cut out” through use of computer graphic software. The space or spaces left uncovered after this shift are filled in with additional pattern. When one focuses his eyes beyond the plane of the “Magic Eye” graphic he can see the shapes in a 3D effect. Although interesting and captivating 3D graphics can be created by this method, it is difficult for many people to unfocus their eyes to look beyond the surface to where the elements coalesce into recognizable shapes. When combined with such visual effects as “Magic Eye” 3D graphics, the visual effect can be startling and dramatic. “Magic Eye” type of graphics are created when seemingly random patterns appear on the graphics when looks at the surface, yet when one focuses his eyes beyond the surface, to a point beyond the surface, elements of the seemingly random pattern coalesce into recognizable 3D shapes.

[0206] When “Magic Eye” type graphics are combined with one-way graphics, one’s visual perception can be drawn through the graphic to elements behind the one-way stereogram or “Magic Eye” graphic. When the eyes focus on the elements beyond the surface of the graphic the eyes also focus on the elements of the “Magic Eye” graphic. The effect can be quite startling and dramatic; the 3D “Magic Eye” image seems to pop out of nowhere.

[0207] This effect can be used for any number of applications such as storefronts, windows, display cases, and packaging. When used for packaging, the “Magic Eye” elements can be placed around a window, opening or viewing port. When one looks through said opening to look at the product displayed, the eyes focus on the “Magic Eye” elements. Variable lighting effect can intensify this type of display.

[0208] Often a greater degree of one way effect is desired, for greater security. Or, the application may require installation where the image side of the graphic has a lower light level than the see through side of the one way graphic. One way graphics with a transparent substrate allow too much light through for the one way effect to be properly perceived. In installations such as these a tinted or a semi-reflective substrate material may be substituted for the transparent substrate. A tinted or a semi-reflective substrate may be used for all embodiments where there is a transparent substrate.

1. A method of making a one-way graphic panel comprising:
   - selecting an image medium;
   - applying a layer of substantially transparent image-medium-repellent material to a substantially transparent image-medium-receptive substrate to create a non-printable area, wherein said image-medium-receptive substrate is capable of forming a durable bond to the selected image medium, and wherein the image-medium-repellent material prevents the image-medium-receptive substrate from durably bonding to the image medium within the non-printable area.

2. The method of claim 1, further comprising applying a layer of light-absorbing image medium to the image-medium-receptive substrate.

3. The method of claim 2, further comprising applying a layer of light-absorbing image medium to the image-medium-receptive substrate;

4. The method of claim 3, further comprising applying a layer of light-reflective image medium to the image-medium-receptive substrate;

5. The method of claim 4, further comprising applying image medium to said image-medium-receptive substrate to create an image layer, and allowing the image medium to form a durable bond to the non-perforated substrate; and
   - removing non-bonded image medium that may have been introduced to the non-printable area from the non-printable area.

6. The method of claim 6, wherein the image medium is applied using a method of printing selected from the group consisting of screen printing, offset printing, lithography, linotype, rotogravure, inkjet, electrostatic printing, xerography, letter press, web, flexographic, and intaglio.

7. The method of claim 1, further comprising applying an electrostatic charge to control printing of image medium, wherein the image-medium-receptive substrate is conductive and the image-medium-repellent material is non-conductive, wherein the differential conductivity is used to define non-printable areas and printable areas.

8. A method of making a one-way graphic panel comprising:
   - selecting an image medium;
   - presenting a substrate to a printing apparatus for application of the image medium, wherein the substrate is sub-
stantially transparent and receptive to the selected image medium, and wherein the substrate contains conductive elements capable of generating an electromagnetic force,
creating an electromagnetic force using the conductive elements, and using said electromagnetic force to define printable and non-printable areas of said substrate during electrostatic application of the image medium to the substrate,
wherein the non-printable areas defined by said electromagnetic force are distributed across the area of the substrate such that the non-printable areas allow substantially clear visibility through the substrate from at least one side after image medium has been applied.

9. An apparatus for use as a display panel, said display panel comprising:
a layer of substantially transparent image-medium-receptive substrate;
a layer of substantially transparent image-medium-repellent material in contact with the layer of image-medium-repellent substrate, wherein the layer of image-medium-repellent material forms a non-printable area over the image-medium-receptive substrate,
wherein the non-printable area defines a complementary printable area, arranged so that the non-printable area is capable of providing a substantially clear view through the display panel when the printable area is made non-transparent.

10. The apparatus of claim 9, further comprising a layer of light-absorbing image medium attached to the printable area of the image-medium-receptive substrate.

11. The apparatus of claim 10, further comprising a layer of light-reflective image medium attached to the layer of light-absorbing image medium, wherein the light-reflective image medium creates an image layer.

12. The apparatus of claim 10, further comprising a layer of adhesive covering attached to the image-medium-receptive substrate, wherein the adhesive layer is situated on the opposite side of said substrate from the non-printable area, and a removable layer of non-adhesive backing material attached to the adhesive layer, wherein the removable layer of non-adhesive backing material is attached to the substrate by the adhesive layer.

13. The apparatus of claim 10, further comprising a layer of adhesive covering attached to the image-medium-receptive substrate, wherein the adhesive layer is situated on the opposite side of said substrate from the non-printable area.

14. A one-way vision panel assembly comprising:
an image substrate;
a light-absorbing backing layer, comprising at least one area of light-absorbing material;
at least two image layers, each comprising a plurality of areas of an image medium applied to the light-absorbing backing layer, each said image layer being perceptible under conditions of appropriate illumination to convey an image;
a lenticular lens layer, situated parallel to each of the at least two image layers, such that distinct images of each image layer are perceptible from different locations relative to the viewing side of the at least two image layers; a pattern of transparent areas, wherein the transparent areas extend through one-way vision panel assembly, and wherein the pattern of transparent areas is distributed such that the panel assembly is substantially transparent when viewed from an area of relatively low illumination looking toward an area of relatively bright illumination,

15. A panel assembly comprising:
an image substrate, comprising a holographic image; a light-absorbing backing layer, comprising at least one area of light-absorbing material; a perforation pattern comprising at least one area of transparency, wherein the perforation pattern extends through the one-way vision panel assembly, and wherein the perforation pattern is configured such that the panel assembly is substantially transparent when viewed from an area of relatively low illumination looking toward an area of relatively bright illumination.

16. The panel assembly of claim 15, wherein the perforation pattern constitutes between 25% and 75% of the area of the one-way vision panel assembly.

17. The panel assembly of claim 16, wherein the perforation pattern constitutes approximately 50% of the area of the one-way vision panel assembly.

18. The panel assembly of claim 15, wherein the perforation pattern comprises a plurality of physical gaps in the structure of the one-way

19. The panel assembly of claim 15, wherein the perforation pattern comprises a transparent solid substrate that forms part of the structure of the panel assembly.

20. The panel assembly of claim 15, wherein the holographic image is an embossed hologram.

21. An apparatus for use as a display panel, said display panel comprising:
a layer of substantially transparent substrate;
an image layer bonded to the layer of substantially transparent substrate and a backing layer comprising a light-absorbing material;
wherein said image layer and said backing layer share an identical perforation pattern;
a light source connected to the layer of substantially transparent substrate.

22. The apparatus of claim 21, wherein the light source comprises fiber optics embedded within the substantially transparent substrate, said fiber optics distributed throughout the substantially transparent substrate to deliver light to select portions of the display panel.

23. A method of making a one-way graphic panel comprising:
presenting a printing substrate having a pattern of raised areas and a pattern of depressed areas to an image medium transfer unit, wherein the surface area said pattern of depressed areas comprises between 25% and 75% of the total surface area of the printing substrate; wherein said image medium transfer unit is configured to apply an image medium selectively to the raised portions of the substantially transparent printing substrate; applying image medium selectively to the pattern of raised areas on the printing substrate using the image medium transfer unit to create an image pattern.

24. The method of claim 23, further comprising applying a layer of light-absorbing image medium selectively to the raised portions of the substantially transparent printing substrate using a second image medium transfer unit.

25. The method of claim 24, further comprising applying a layer of light-reflective image medium selectively to the raised portions of the substantially transparent printing substrate using a third image medium transfer unit.
26. A method of making a one-way graphic panel comprising:
   presenting a printing substrate having a pattern of raised areas and a pattern of depressed areas to an image medium transfer unit, wherein the surface area said pattern of depressed areas comprises between 25% and 75% of the total surface area of the printing substrate;
   applying a layer of light-absorbing material to the printing substrate and allowing the light-absorbing material to collect within the pattern of depressed areas and allowing the light-absorbing material to cure to form;
   applying a layer of light-reflective material to the printing substrate and allowing the light-reflective material to collect within the pattern of depressed areas to form a second layer over the layer of light-absorbing material and allowing the light-reflective material to cure;
   applying at least one image layer to the printing substrate and allowing the image layer to collect within the pattern of depressed areas over the layer of light-reflective material and allowing the light-reflective material to cure;
   wherein the pattern of raised areas is left substantially transparent and allows substantially unobstructed vision through the one-way graphic panel.
27. The method of claim 26, further comprising physically removing any image medium that may have collected on the pattern of raised areas of the transparent substrate between each application of image medium.
29. The product of the method of claim 27.

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