(51) International Patent Classification 6 :
G02B 5/18, 5/32, B44F 7/00, 9/04

(11) International Publication Number: WO 97/04339
(43) International Publication Date: 6 February 1997 (06.02.97)

(21) International Application Number: PCT/AU96/00028
(22) International Filing Date: 24 January 1996 (24.01.96)
(30) Priority Data:
PN 0712 24 January 1995 (24.01.95) AU

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Published
With international search report.

(54) Title: SIMULATED OPAL ARTICLES

(57) Abstract

A simulated opal article, including a layer (1) of a reproduction of a surface of an opal applied to the surface of a two-dimensional hologram or diffraction grating (2) formed from two randomized patterned orthogonally embossed holograms or diffraction gratings. The two-dimensional hologram or diffraction grating (2) is formed by embossing a first pattern onto a suitable embossable surface with a second pattern double embossed or superimposed over the first pattern in such a manner that both patterns are visible at similar intensity and become interactive, thereby creating an interactive spectrogram with a three-dimensional effect resembling an opal and being sufficiently flexible so that it may be adhered to a flat, convex, concave, uneven or undulating surface.
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SIMULATED OPAL ARTICLES

Technical Field

The present invention relates to methods of producing simulated opals, such as opal doublets, black opals and decorative articles resembling opals as, or as part of, an article, and so as to exhibit a display of spectral colours resembling opals, opal doublets or black opals.

Whilst Australia produces 90% of the world's genuine opals demand for genuine opals far exceeds those being mined. It is virtually impossible for fashion jewellery designers and manufacturers to create a range of opal jewellery with confidence because they cannot be guaranteed continuity of supply of calibrated opals to fit their settings. Opal is also becoming scarce and, therefore, increasing in value.

It is necessary to understand the principal manufacturing methods of the opal doublet, or triplet, in order to appreciate the full value of the present invention to industry.

Background Art

It has been found that fashion jewellery designers are prepared to use opal simulations providing they have the play of spectral colours characteristic of
genuine opals and providing they can be guaranteed continuity of supply. In a fashion jewellery product price is also a major determining factor on the viability, and profitability, of the finished product. Opal is very expensive and opal cutters developed the opal doublet and opal triplet for two reasons:
1. to enhance the lower quality opal by blackening the back thus making the colours more vivid, and
2. to enable them to get more yield from mined opals, opals with colour bars and of thin material.

Opal doublets are made from thin slices of opal usually blackened on the back to enhance the colour and then adhered to a rigid layer of potch, glass, quartz, obsidian or other suitable material compatible with the opal so that when the opal is adhered to the backing material it does not crack or craze with expansion or contraction due to changes in temperature. Opal is also brittle and therefore it poses a problem to inexperienced jewellers. The heat created when polishing a piece of jewellery may be sufficient to cause the opal to crack. The jewellers, therefore, face a loss of revenue due to breakages.

The main attraction of opal is it’s beautiful and fascinating play of spectral colours. This characteristic of opal is very difficult to simulate and even though other opal synthetics and simulants have been made they are more expensive to make. They are also limited in their applications because of their rigidity.

Disclosure of the Invention

In the simplest form of the invention the article comprises of two random patterned orthogonally engraved interactive holograms or diffraction gratings double embossed or superimposed over each other in such a manner that both patterns are clearly visible at similar intensity and interact to give a three dimensional effect which
resembles an opal.

In another form of the invention the surface reproduction of an opal is overlayed onto holograms or diffraction gratings created by methods known as SPECIAL HOLOGRAPHIC EFFECTS to be later described and so arranged that the effect created by overlaying or overprinting the surface reproduction of an opal onto the INTERACTIVE holograms or diffraction gratings creates an article which stimulates an opal, opal doublet or a black opal. In another method in accordance with the invention a layer or layers of iridescent materials may be overlayed or interposed between other layers to create interference layers within the article.

The method of the invention may be used in a variety of ways thus allowing it to be applied to, or used in or on, a wide variety of products to give them a decorative opal effect.

Whilst persons skilled in the art are able to perform the functions of applying images to holographic surfaces it has not been previously contemplated to use the processes to make simulated opal products and, as will be described herein, the invention has more visual impact than other similar products because it actually simulates the characteristic of genuine opals. It has the further advantage over genuine opal in that it may be made as a flexible article for use on contoured or uneven surfaces.

The present invention provides an opal simulation comprising of a two dimensional surface reproduction of the surface of an opal applied to the surface of a hologram thus producing a simulated opal effect for use on a range of products which resemble, and have the play of spectral colour of, genuine opal. For economical reasons the material may, therefore, be made in large sheet form from which sections are cut or formed to any shape or size.

One aspect of the present invention, it's flexibility, allows it to be applied to uneven or contoured
surfaces or to be wrapped around a surface or to be formed into a three dimensional shape, such as a box, for packaging, thereby allowing the fashion designer more scope for use of the product.

It has not previously been contemplated to simulate an opal doublet nor has it been conceived to use opal simulations on packaging or a host of other products that could be enhanced and value added using this type of opal simulation.

It has been discovered that simulated opal doublets may be mass produced at low cost by overlaying a hologram with opal colours, patterns and textures reproduced from genuine opals or applying the image by a variety of methods to a holographic material. Simulated opal doublets are by far the least expensive to manufacture but still exhibit the play of colour which has the essential visual impact of the genuine opal for application in the various industries where genuine opal cannot be used but to which the present invention may be applied. Like genuine opal doublets the opals of the invention display a surface of spectral colours which change as the opal is moved or rotated.

There are several alternative methods of manufacturing the opals of the present each method having advantages over the other, either in quality of the finished product or savings in manufacturing costs. Each manufacturing method can be adapted, within the scope of invention, as later described so that the simulation is created to suit the product for which it is designed.

**Brief Description of the Drawings**

Embodiments of the present invention and the simulated opal effects resulting therefrom, and articles to which the simulated opal effects may be applied, will now be described with reference to the accompanying drawings, in which;

Figure 1 is a cross-sectional side elevational
view of a simulated opal doublet in accordance with one embodiment of the invention,

Figure 2 is a cross-sectional side elevational view of a simulated opal doublet in accordance with another embodiment of the invention,

Figure 3 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 4 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 5 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 6 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 7 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 8 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 9 is a view of the embodiment of Figure 8 having undergone a further manufacturing step,

Figure 10 is a cross-sectional side elevational view of a further embodiment of the invention,

Figure 11 is a cross-sectional side elevational view of the embodiment of Figure 10 having undergone a further manufacturing step,

Figure 12 is a plan view of an article produced utilising the simulated opal of Figures 10 or 11,

Figure 13 is a plan view of an article produced utilising a combination of the simulated opal of Figures 8 and 10,

Figure 14 is a cross-sectional side elevational view of an article in accordance with another embodiment of the invention,

Figure 15 is a plan view of the article of Figure 14,

Figure 16 is a cross-sectional side elevational view of an article produced in accordance with another
embodiment of the invention,

Figure 17 is a cross-sectional side elevational
view of an article produced in accordance with still
another embodiment of the invention,

Figure 18 is a cross-sectional side elevational
view of an article produced in accordance with still
another embodiment of the invention,

Figure 19 is a plan view of the article of Figure
18,

Figure 20 is a plan view of a pattern effect
which can be produced utilising the method of a preferred
embodiment of the invention,

Figure 21 is a plan view of a second pattern
effect utilising the method of the preferred embodiment of
the invention described with reference to Figure 20, and

Figure 22 is a plan view of a pattern effect
resulting from the superimposing the pattern effects of
Figure 21 on the pattern effect of Figure 20.

In the following descriptions of the preferred
embodiments it should be understood that reference to a
hologram or diffraction grating is constituted by, in
accordance with the invention, a pair of randomly patterned
orthogonally embossed holograms or diffraction gratings.

Reproductions of the surface of an opal are
obtained by the various methods described hereafter. Opals
are cut into thin slices and placed on a black background
immersed in a fluid having a suitable refractive index to
enhance the play of colour, and photographed, in order to
make a surface reproduction of the opal colours, patterns
and textures. The reproduction may be made by
photographing the slice in the fluid or by blackening the
back of the slice and placing the slice face down on a
colour laser photocopiers with a suitably refractive fluid
between the opal slice and the glass copying surface of the
copier. The reproduced image of an opal, reproduction of
the surface of an opal or the actual surface of an opal may
be scanned directly into a computer, where an array of stored images of the colours, patterns and texture of various opals may be combined, using graphics programmes, into large random patterns allowing for generation of a wide variety of simulated opal effects on a single sheet but, by using the programmes, it also allows for the patterns to be randomly changed so that no two opal simulations are identical. The opal images may be in the form of photographs, prints, paintings or photocopies of opal colours, patterns and textures.

Alternatively an opal doublet may be made and then a surface reproduction be produced by one of the aforementioned methods, thereby making a simulation of the actual doublet. It is preferable that the opal backing be black in order to intensify the colours of the opal. However, the most important requirement is to reproduce an image that has the appearance of the surface of an opal.

Once a selection of opal surface images have been stored it is only necessary to reproduce other opal surface images if new opal features are discovered. When the desired pattern has been selected it is then applied by a variety of methods to the surface of a suitable hologram or diffraction grating or transferred onto a suitable transparent material, such as plastic film, plastic sheet or glass after which a specific holographic material is adhered to the image side of the substrate for protection of the image. The assembly may be cut to any shape or size for use in jewellery or other products.

In another application of the present invention the layer of transparent material bearing the image may be laminated on the toner or printed side with a sheet of transparent material, or laminated between two sheets of transparent material, for further protection of the image and also to further protect the surface of the finished product (the toner surface of a transparency generated from a colour laser copier contains a silicon oil which must be
removed prior to lamination). The lamination of this layer also creates a more rigid laminate.

In considering the desired effect of the finished product it is necessary to develop holograms which had a random pattern with a vivid spectral effect. Holograms and diffraction gratings are usually based on a geometric format for ease of manufacture. Since the play of colour in opal is not visibly geometric these types of holograms are less suitable. This is not to say that they cannot be used but the random pattern or a rolling play of spectral colour is more realistic.

The surface of a simulated opal doublet is usually flat or slightly domed according to the variety of opal used in the manufacture of the simulated opal doublet.

For convenience the simulated opal doublets for jewellery use may be made with a flat surface or with a protective coating of thermosetting resin, or with a preformed plastic cap, but when used on a stationery product the opal image may either be flat or formed into a low dome to give the appearance of a solid opal. The opal images may be generated in a variety of ways as listed below.

1. The image is generated directly from a computer onto a suitable transparent material using a computer system linked to, for example, a colour laser copier;

2. Alternatively the image may be generated or copied onto a material which allows for the transfer of the image onto another surface such as plastic, glass, quartz or similar transparent material, or directly onto the holographic material;

3. Alternatively the image may be photographed onto a transparency which becomes the coloured, textured layer used in the production of the doublet and is then overlayed or adhered to the
holographic layer;

4. Alternatively the image may be printed onto a suitable flat surface made of plastic, glass, quartz or other similar transparent material;

5. Alternatively the opal pattern may be printed directly onto a suitable holographic surface;

6. Alternatively the image may be photocopied onto a suitable transparent material;

7. Alternatively the image may be made by contact exposure from a photographic negative onto a transparent film;

8. Alternatively the image may be painted onto a suitable surface such as a transparent film or painted directly onto the hologram;

9. Alternatively the image may be a photographic slide or an emulsion, similar to that used in making slides, may be coated onto a sheet of plastic or glass and the surface is then exposed to the image of the desired opal pattern.

Colour images can be applied directly onto holograms or diffraction gratings but it has not been previously contemplated to create a simulated opal doublet or a simulated opal product using the methods described herein. The present invention allows for the creation within the industry for more effective display and promotional material, packaging materials as well as souvenir and gift products where a simulated opal effect would have greater visual impact than the current designs.

In another product the method of manufacture in accordance with the present invention requires the surface reproduction of an opal to be generated onto a sheet of clear plastic film and a double sided optically clear transfer tape is laminated to the toner, or emulsion, surface of the transparency, the protective coating is peeled away and a hologram or diffraction grating is then adhered. A rigid backing member is then adhered to the
back of the hologram to form a complete assembly from which simulated opal doublets may then be cut into the desired shape or size. For simplicity an adhesive layer may be applied to the rear of the rigid surface of the assembly with a protective coating of release paper. The release paper being removed when it is necessary to adhere the simulated gem to another surface or product. In another form of the invention the rigid layer and adhesive backing layer are replaced by a magnetic material.

It is possible, using this process, to generate opal doublet simulations in many and varied shapes using simple computer software to mix patterns and textures in order that, like genuine opal, each simulated opal doublet is slightly different. It is also possible to make mosaic patterns or simulated intarsias by combining a variety of images or to incorporate an initial, logo, or other featured image, upon the surface of the opal pattern. This is created by using computer graphics, hot foil stamping or by overprinting onto the opal image.

Although the rigid backing method of production is desirable for jewellery applications it will be necessary, in some applications of the method, to print a reproduction of the surface of an opal directly onto the holographic material, with or without an adhesive backing. The advantage of this being for use on large objects or objects with an uneven surface. Whilst this will not give the unlimited patterns, textures, and colours, possible with computer generated images it provides a much less expensive means of manufacture and allows the methods of the invention to be used in, or on, a far greater range of products. By printing the opal patterns onto a holographic surface there is a huge saving in labour and materials. The resulting image may then be cut to any shape or size to suit a jewellery setting or other product as required. Because the material is flexible the simulations may be wrapped around a product overcoming the limitations of
rigid varieties produce by the methods of the invention. However, a rigid backing may also be adhered in
certain uses of the product such as place mats where the
surface of the print is also protected by a layer of
durable transparent material.

Industry demands high quality products but also
competitive prices and the methods of the present
invention, and the products resulting therefrom meet the
demands of the industry.

In the case of an opal surface reproduction being
printed onto a holographic material, cutting the simulated
gem for use on a variety of small products may be performed
by form cutting methods. Using an overprinted pattern
allows larger sheets of simulated opals to be made again
lowering production costs. A protective coating may also
be added to the printed surface, or the entire sheet of
material may be adhered to the underside of a sheet of
plastic, glass or other durable transparent material for
use on such items, for example, table tops, wall and door
panels.

In an alternative method the hologram may be
embossed or hot stamped onto a sheet of material and then
overprinted with the opal pattern. An image of a person,
place, scene or object, or the like may first be printed
onto a suitable surface and then a hologram embossed or hot
stamped onto the print. The holographic area of the
surface of the printed object is then overprinted with an
opal reproduction. In the case of embossing a hologram
onto a product, for example a stationery product, it may
only be necessary for a section of the product to be
embossed with the hologram. When the article is printed
the hologram becomes a simulated opal within a picture.
This picture may be an opal mining scene with the simulated
opal depicting a seam of opal running through a rock, piece
of rough opal being held by a miner or, in another case,
the picture or graphic rendition may be of a person wearing
an opal. In each case the opal portion being the embossed hologram overprinted with opal patterns to simulate an opal whilst the rest of the picture is normal graphic printing without the holographic effect and being printed by any suitable printing, hot stamping, painting, photographic or other technique for laying down graphic images. The holographic pattern may also be embossed onto metallised paper or tapes and then overprinted with an opal pattern for use on products such as wall paper, adhesive tapes, labels, posters, point of sales promotional materials, signs, wrapping paper or decorative opal effect packaging.

The method of the present invention may also be applied to a variety of surfaces such as post cards, envelopes, business cards, packaging, letterheads, wrapping materials, badges, pens, pencils, salt and pepper shakers, spoon and cutlery handles, plates, cups, table tops, watches, clocks or any surface where the product would be enhanced by an opal simulated effect as opposed to the usual holographic graphics presently in vogue. The method may be applied to make a simulated opal postage stamp. In another application opal dealers, for example, could have an embossed overprinted opal logo on their letterheads, business cards or stationery products for promotional purposes or for reproduction of a rare opal from their collection for use on a variety of corporate or personal stationery products.

In another aspect of the invention a preformed sheet of plastic, glass, quartz or similar transparent material with a flat top surface being of any shape or size with a peripheral lip on the back is placed face down on a flat surface; a small amount of a thermosetting resin is applied to the inside surface of the preform and a precut laminate of the opal pattern and hologram, such as later described with reference to Figures 1, 2, 4, 5 or 6 of the drawings, is inserted into the cavity ensuring that all air
bubble are eliminated from between the inner surface of the preform and the patterned surface of the laminate. In this case the laminate consists of a reproduction of the surface of an opal printed upon the surface of a hologram or a surface reproduction of an opal a layer of adhesive, which may be in the form of an optically clear double sided transfer tape, a holographic material, and an opaque backing material to fill the back of the preform. In an alternative to this method the laminated section, as later described with reference to Figures 1, 2, 4, 5 and 6, may be adhered to a sheet of suitable transparent material which is flat on both sides.

By using this technique it is, therefore, possible to make very large simulated opal products with a flat surface either by printing the reproduction of opal surface onto a desired substrate or by adhering the reproduced opal image to a transparent substrate or transferring the image onto the internal surface of the product. Once the image is applied to the transparent inside surface a hologram is applied to the image and then a backing member is added thus making the assembled components ready for use in another product for example a table top. In the case of large products such as table tops, trays, bar tops, wall plaques, door or wall panels the opal pattern may be printed onto the inner surface of, for example a sheet of clear plastic, glass or similar transparent material, and a holographic pattern is then applied to the surface of the print. The opal pattern may also be laminated between two sheets of clear material to give more depth of colour when the hologram is added to the rear of the assembly. The materials may be varieties of plastic, glass or quartz, or combinations thereof, according to the product.

Another method is to use a thermosetting resin to apply a toner surface to another surface allowing the image to migrate into the resin and when the resin is cured
remove the substrate leaving the image embedded in the resin attached to the new surface.

In special cases where a large opal reproduction is required then the opal patterns and textures may be enlarged to suit the purpose for which the product is designed. In this case the holographic material may be made from precut sections of holographic material and then randomly adhered to the surface of the reproduced image.

SPECIAL HOLOGRAPHIC EFFECTS

The holograms used in the manufacturing methods of the present invention are new in that they involve the process of embossing one holographic pattern over the top of another holographic pattern. A semi metallised hologram may be used to reduce the metal effect which may also be double embossed. Not all holograms are suitable for this purpose so the method of the present invention enables the production of a hologram which is used to create a realistic opal effect when overprinted with opal patterns, colours or textures. Most of the holograms readily available are made on a geometric pattern and they are not realistic to the discerning eye. There are several ways to overcome the problem and this has been achieved by designing specific holograms with totally random patterns based on the patterns and play of colour characteristic of genuine opal. The other problem with normal holograms is the metallic appearance of the hologram itself, because of the material upon which it is embossed. To overcome this problem we have used a technique of double embossing one holographic pattern over the top of another pattern. This is achieved by raising or lowering the temperature of each embossing roller until both patterns are visible at the optimum level of diffraction. In doing this more play of spectral colour with spectral colour patterns appearing and disappearing, as the hologram is moved or rotated, is created. The spectral effect of the hologram is created when rays of white light are split into the colours of the
spectrum when they hit the surface of the material. This effect is caused because the surface is embossed with a minimum of 14,000 lines per inch. By double embossing the material, the metallic reflective nature of the material normally used in the manufacture of holograms and diffraction gratings by embossing more information onto the material, is overcome to a certain extent.

The random effect of the hologram is created by rotating the image in increments of 10 degrees through 90 degrees as the master plate is exposed for each section of the pattern and then turning the image through 90 degrees and re-exposing the master plate thereby creating an orthogonal embossing which results in a display of spectral colours when the image is moved at right angles as opposed to normal holograms which are only visible when viewed at one specific angle. The new technique displays colour at various angles when the hologram is rotated through various degrees of rotation. This is an advantage over current holograms, and combined with the double embossing technique, a more effective holographic opal effect is thereby created.

A further method is to use a semi-metallisation technique which does not give such a vivid metal reflection, or mirroring, from the surface of the holographic material. The hologram may be transparent to translucent whilst still reflecting spectral colours. Also the more information that is embossed onto the material the less the metallic reflection.

The holograms used may have an adhesive backing, may be embossed onto a hot stamping material, or may be embossed onto a suitable material that will allow the transfer of the hologram to another surface for overprinting with the reproduced surface of an opal as previously stated.

Turning to the embodiments of the present invention described with reference to the accompanying
drawings, Figure 1 is a cross-sectional side elevational view of a simulated opal doublet produced according to one embodiment comprising a printed layer 1 of a reproduction of the surface of an opal on the surface of a specially designed two dimensional hologram 2 formed from two random patterned orthogonally embossed holograms.

Figure 2 is a cross-sectional side elevational view of simulated opal doublet of another embodiment comprising a reproduction of the surface of an opal on a transparent film 3, with an adhesive layer 4, a hologram 2, a layer of adhesive 4, and a layer of protective release material 5 to be peeled from the assembly prior to adhering to a product.

Figure 3 is a cross-sectional side elevational view of another embodiment of the invention comprising an assembly of a hologram 2 formed from a layer of transparent material bearing the reproduction of the surface of an opal and laminated between layers of transparent protective film 3. This assembly may be used to replace the layer bearing the reproduction of the surface of an opal wherein that reproduction is generated onto the surface of a transparent film either by hot stamping, photographing, photocopying, migration of the image using thermosetting resin techniques, heat transfer, embossing, printing, painting or by computer generating methods, in order to protect the surface of the image.

Figure 4 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a transparent film 3 bearing the reproduction of the surface of an opal, a layer of adhesive 4, a hologram 2, a layer of adhesive 4 and a rigid backing 6.

Figure 5 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a printed image 7 of the surface reproduction of an opal on a hologram 2, an
adhesive layer 4, and a layer of release paper 5. A rigid layer may be inserted between layers 2 and 4, but this is optional according to the purpose of the assembly.

Figure 6 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a transparent material 8 such as plastic, glass, quartz or other suitable transparent material bearing a printed image of the surface reproduction of an opal 7, a layer of adhesive 4, an adhesive backed hologram 2, and a release paper 5. A rigid layer between layers 2 and 5 is optional according to the purpose of the assembly whilst a further layer of double sided adhesive is also optional.

Figure 7 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a layer 8 of transparent material such as plastic, glass, quartz or other suitable material, an adhesive layer 4, a transparent film 3 bearing the image of the reproduction of the surface of an opal, a layer of adhesive 4, a hologram 2 and a backing layer 6 (the backing layer is optional).

Figure 8 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a layer 9 of suitable material capable of being printed upon a printed layer or an adhered or embossed layer 10 bearing graphic design, photocopy, photograph, print or painting, a hologram 2 applied by hot stamping, embossing or adhering to the surface of the previously printed layer, and a printed image of the reproduction of the surface of an opal 7 overprinted on all or part of the hologram. That part of the hologram not overprinted with the opal image is overprinted with an opaque design, colour or is over embossed to depict the opal.

Figure 9 is a view of the embodiment of Figure 8 wherein the area depicting the simulated opal has been
formed into a low dome creating the effect of a three dimensional opal on the surface of the product.

Figure 10 is a cross-sectional side elevational view of an assembly produced according to another embodiment of the invention comprising a suitable material such as, but not limited to, card, plastic, foil, or paper, an embossed or hot stamped hologram 2, and a printed layer 1 featuring a composed scene incorporating an image of the surface reproduction of an opal 7 covering the embossed hologram, whilst the remaining area of the picture being of a subject, place, object, text or other article with which opals may be associated.

Figure 11 is a view of the embodiment of Figure 10 wherein the area covered by the simulated opal is formed with a low dome to create a three dimension effect.

Figure 12 is a plan view of an article produced according to the embodiments of Figures 10 and 11 comprising a surface 1 printed with an image or text 12 with an embossed hologram as shown in Figure 10 overprinted with the image of a surface reproduction of an opal 7 which may be formed into a low dome.

Figure 13 is a plan view of an article comprising a surface 1 as described in Figure 8, with an embossed hologram as described in Figure 10 overprinted in part with the image of the reproduction of the surface of an opal 7 and an opaque print 13 covering the remaining surface of the hologram contained within the boundary 14 so as to depict a seam of opal running through a rock.

Figure 14 represents a cross-sectional view of an article in accordance with another embodiment of the invention comprising a preformed component 15 of plastic, glass or other transparent material having a peripheral lip to provide a cavity also having a peripheral lip 16 allowing for the insertion of a further component such as, in this example, a clock 17, a layer of adhesive 4, a precut assembly of the image of a surface reproduction of
an opal 7, a layer of adhesive 4, a hologram 2, and a backing 6.

Figure 15 is a plan view of the article of Figure 9 showing a clock 17 within the cavity defined by lip 16 in Figure 14. The clock may be replaced by other such functional products such as a calendar, egg timer or a thermometer.

Figure 16 is a cross-sectional side elevational view of an article produced in accordance with another embodiment of the invention comprising a preformed component 15 of plastic, glass or other transparent material with a peripheral lip, and which receive a layer of adhesive 4, a transparent material bearing the image of a reproduction of the surface of an opal 7, a layer of adhesive 4, a hologram 2, and a backing member 6.

Figure 17 is a cross-sectional side elevational view of an article produced in accordance with another embodiment of the invention comprising a sheet 8 of glass, plastic or other transparent material, a surface reproduction of an opal 7, a sheet of glass, plastic or other transparent material 8, a hologram 2, and optional layers of adhesive 4 and a backing 6.

Figure 18 is a cross-sectional view of an article produced in accordance with another embodiment of the invention comprising a sheet 8 of transparent material, a reproduction of a surface of an opal 7, a layer of adhesive 3, and precut sections of a hologram 2.

Figure 19 is a plan view of the holographic layer of Figure 18 where the holographic layer 2 is composed of sections of a hologram cut into random shapes and adhered to the back of the reproduced surface of an opal 7. This method is suitable for manufacture of large simulated opal effects for displays and table tops, tiles, wall panels, and the like.

Figure 20 is a plan view depicting an orthogonally exposed hologram 2 and areas such as 22, 23
and 24 depicting the orientation of the patterns necessary to create a realistic opal effect. The pattern, shapes and positioning of one colour section in relation to another colour section may vary and the design portrayed is only described by way of an example of a few possibilities for patterns which can be used in this invention.

Figure 21 is a plan view of a second orthogonally exposed hologram 2 with differing orientational pattern areas 22, 23 and 24 that of Figure 20 whereby, when the hologram of Figure 22 is overlayed onto the hologram in Figure 21, the pattern effect in Figure 23 is produced.
CLAIMS:
1. A simulated opal article, including two random patterned orthogonally embossed holograms or diffraction gratings formed by embossing a first pattern onto a suitable embossable surface, and a second pattern double embossed or superimposed over the first pattern in such a manner that both patterns are visible at similar intensity, and become interactive, thereby creating an interactive spectrogram with a three dimensional effect resembling an opal and being sufficiently flexible so that it may be adhered to a flat, convex, concave, uneven or undulating surface.

2. An article comprising a spectrogram as claimed in Claim 1, wherein the spectrogram is overlayed with coloured patterns of opal which have been reproduced by normal photographic methods and result in the image having the effect of an opal.

3. A method of making an interactive master hologram or diffraction grating as described in Claim 1 or 2, wherein two separate orthogonally embossed patterns are created by known methods and double embossed onto a suitable embossable material from which a master plate is made for the purpose of mass producing copies of the interactive hologram.

4. An article according to any one of claims 1 to 2, wherein the two patterns are embossed onto separate materials one being a semi-metallised material and the other being a material with a reflective backing interposed with a layer of adhesive material and so arranged that the patterns become interactive.

5. An article according to Claim 4, wherein a coloured opal pattern is overlayed onto the upper surface of the article so that the resulting image has the effect of an opal.

6. An article according to any one of Claims 1 to 5, wherein a protective layer is added to the overlayed opal
7. An article in accordance with any one of Claims 1 to 6, wherein the coloured opal pattern or texture is printed onto one of the layers of interactive hologram or diffraction grating by known printing methods and having a surface which resembles an opal or an opal doublet.

8. An article according to any one of Claims 1 to 7, wherein a rigid backing is applied to the back surface of the assembly by means of an adhesive.

9. An article according to any one of Claims 1 to 8, wherein the interactive hologram is applied to the surface of an object by hot stamping or other suitable embossing process giving the object the appearance of an opal.

10. An article according to Claim 11, wherein a coloured opal pattern or texture is applied to the upper surface of the object by printing, transfer, hot stamping, or other suitable method, to create a surface which resembles an opal or opal doublet.

11. An article according to Claim 8, wherein the rigid layer is a magnet.

12. An article according to Claim 8, wherein the rigid layer is a material suitable for forming into a package.

13. An article according to Claim 12, wherein the package is a box.

14. An article according to Claim 8, wherein the rigid layer is a sheet of plastic.

15. An article according to Claim 1, wherein the interactive hologram or diffraction grating is embossed onto metallised paper, plastic or card and overprinted with the surface reproduction of an opal in such a manner that the object has the appearance of an opal or an opal doublet.

16. An article according to any one of the preceding claims, wherein the coloured opal pattern or texture is hot stamped onto the hologram or diffraction grating.
INTERNATIONAL SEARCH REPORT

INTERNATIONAL APPLICATION

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl ⇒ G02B 5/18, 5/32, B44F 7/00, 9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC : G02B 5/18 5/32 B44F 7/00 9/04 B44C 3/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DERWENT : (opal: or gem.) and (G02B 5/ or B44F or B44C 3/02)

JAPIO : (opal: or gem.) and (G02B 5/ or B44F or B44C 3/02)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Relevant to claim No.</th>
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<td>AU 42994/93,A, (HI TEK ILLUSIONS AUSTRALIA PTY LTD) 6 January 1994 page 11 lines 14-23</td>
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<td>1-3, 6, 7, 9, 10, 15, 16</td>
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See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search

28 March 1996

Date of mailing of the international search report

9th April 1996

Name and mailing address of the ISA/AU

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