colour gamut and hence a addressable object with a larger area can addressable object a greater variation in colour and has a greater colour gamut.

[0013] Displays employ several variations of liquid crystal technology, including super twisted nematics, dual scan twisted nematics, ferroelectric liquid crystal and surface stabilized ferroelectric liquid crystal. They can be lit using ambient light in which case they are termed as reflective, or backlit and termed transmissive. There are also emissive technologies and reflective technologies such as Organic Light Emitting Diodes and electronic ink which are addressed in the same manner as Liquid Crystal displays.

[0014] At present there exist displays that by various means enable the stacking of addressable object planes at set distances. As well as the binocular depth cue, they feature intrinsic motion parallax, where the x and y distance changes between objects displayed on different planes depending on viewing angle. Additionally separate focal planes may be literally be brought in and out of focus depending on the focal length of the lens in the viewers eye. These displays consist of a high-brightened backlight, a rear image panel which is usually an active matrix, colour liquid crystal display, a diffuser, a refractor and a front image plane which are laminated to form a stack. There are generally colour filter stripes as mentioned above, and a black matrix on each display which defines the borders of the pixels. However it should be appreciated that the following discussion applies to all addressable object planes that are addressed by passive or active matrices or have colour filters arranged in any periodic pattern, or any optically active periodic pattern. The displays are close to each other, as far as the viewer is concerned they form two similar, but not identical periodic patterns on the retina. This is because the solid angle subtended by the repeating patterns is different, which causes the colour stripes and black matrix boundaries to have slightly different pitches when projected onto the retina.

[0015] These conditions are sufficient to cause a phenomenon called moiré interference, which is characterized by large, annoying vertical red, green and blue stripes. The diffuser combats the interference by spreading the intensity distribution of the image formed by the colour filters. However while this may help remove moiré it has the effect of changing the bidirectional scattering transmission function of the sub-pixels, smearing them to a point spread function thus effectively reducing the resolution of the display. Therefore to make a good display or optical system where the image remains sharp and the amplitude of the moiré interference is hardly noticeable, these two conflicting factors must be carefully controlled.

[0016] Typically the diffuser is of the form of a chemically etched series of surface features on a thin (0.000115 meter), birefingent substrate such polyester. If the pattern was viewed under a microscope at 1000× magnification it would be undulating in topology. Because of the polarised nature of the displays this can cause the total luminance, which is evaluated at the front display by the viewer, to be reduced because it changes the degree and polarization orientation from the optimum. A similar pattern is available on a non-birefringent surface such as acrylic but this substrate cannot be made thin enough as not over-blur the rear most pixels. In general one cannot easily control the angular distribution of the light as it exits a typical diffuser. Also because there is an extra layer in the optical stack, extra air-plastic or air-glass interfaces are formed causing back reflections. These decrease the brightness of the display because at least 4% of the light is directed towards the backlight, as opposed, to the viewing direction. The ratio of the reflected and transmitted radiation is given by Fresnel's equations which are well known in the art. Note that if a ray is at some angle from the normal significantly more than 4% of light may be reflected. This reflected light may also be re-reflected out to the viewer, but may not appear to come from the correct origin, reducing the contrast of the display. Also because the film is on a separate sheet it has the tendency to deform due to the heat from the high-brightness backlight which is visible to the viewer and can exasperate the sharpness problem described above. Point spread functions for typical, commercially available diffusers are circularly symmetric, that is their gain is constant for a given radius.

[0017] A holographic diffuser is a transparent or translucent structure having an entrance surface, an exit surface, and light shaping structures formed on its entrance surface and/or in its interior. These light shaping structures are random, disordered, and non-planar micro sculpted structures.

[0018] These structures are created during recording of the medium by illuminating the medium with a speckle pattern produced in conjunction with coherent light or the combination of incoherent light and a computer-generated mask which simulates speckle. The speckle produced changes in the refractive index of the medium which, when developed, are the micro-sculpted structures. These light shaping structures diffract light passing through the holographic diffuser so that the beam of light emitted from the holographic diffuser's exit surface exhibits a precisely controlled energy distribution along horizontal and vertical axes. Holographic diffusers can be used to shape a light beam so that over 90% (and up to 95%-98%) of the light beam entering the holographic diffuser is directed towards and into contact with a target located downstream of the holographic diffuser. A holographic diffuser can be made to collect incoming light and either (1) distribute it over a circular area from a fraction of a degree to over 100 degrees, or (2) send it into an almost unlimited range of elliptical angles. For example, a 2 degree×50 degree. holographic diffuser will produce a line when illuminated by a LED or laser and a 35 degree×0.90 degree. Thus a holographic diffuser is not a typical example of a diffuser, since it may send most of the incoming light out at elliptical angles and these particular angles may be finely controlled.

[0019] The following discussion describes pixel patterns used in the imaging industry. For the purposes of illustration it is assumed a sub-pixel is a 0.1 mm×0.3 mm rectangle, with the long axis of the rectangle in the y direction and a pixel is a 0.3 mm×0.3 mm square, however it should be appreciated that a pixel can be any shape that is possible to tessellate and a sub pixel can be any one of a set of shapes which are possible to tessellate in combination. To define this rigorously consider a set of regular points in 2D space forming a lattice and the same collection of pixels or sub-pixels at these points. Then the pixel pattern is wholly described by the lattice and the collection of sub-pixels or pixels at that point which are called a basis. The lattice can in turn be