

- [0055] Optical cement;
- [0056] Diffusive film;
- [0057] Holographic diffusion film; and
- [0058] any other filter for removing moiré interference

[0059] Thus, there is the combined need to cost-effectively re-align the polarisation between successive LCD panels, whilst avoid chromatic aberrations such as coloured interference fringes present with the use of existing retarder such as polycarbonate.

[0060] All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

[0061] It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning—i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

[0062] It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

[0063] Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

[0064] According to one aspect of the present invention there is provided a multi-focal plane display including at least two at least partially overlapping display surfaces having a first order optical retarder interposed between at least two said screens.

[0065] A first order optical retarder produces a phase angle displacement or retardation of less than or equal to that of the incident wavelength. Furthermore, it has been found that a first order retarder does not produce discernible coloured interference fringes when used in said displays.

[0066] Suitable materials for production of first order retarders have hitherto suffered from significant drawbacks such as instability underexposure to bright lights and/or ageing, discoloration over time, manufacturing expense, brittleness and so forth.

[0067] Thus, according to a further aspect of the present invention, there is provided a display as hereinbefore described, wherein said first order retarder is a material with the optical properties of a biaxial polypropylene.

[0068] Preferably, the said optical properties include those of a diffuser.

[0069] The diffuser may be either formed as a separate layer distinct from said retarder or diffusive properties may be applied to the surface of the retarder itself.

[0070] According to a further embodiment, said diffusive effects of the diffuser are formed by a means selected from the group comprising chemical etching; embossing; impressing; or calendering a random, non-periodic surface structure onto the diffuser surface.

[0071] The ideal separation of the said diffuser from the surface of the display surface is a trade off between image clarity (decrease with separation) and diffusion of the moiré effects. The separation of the diffusive layer from the display surface can be controlled by using adhesive of various thickness, to attach the diffuser to the display surface. This is applicable for both the use of a separate distinct diffuser or one integrally formed with, or attached to the said retarder.

[0072] Thus, according to a further aspect of the present invention, the said diffuser is adhered to said display by adhesive of a predetermined thickness.

[0073] In a display as described herein, used with visible light with a mean wavelength of 560 nm, said first order retarder has a phase difference of less than or equal to 560 nm.

[0074] Thus, according to a further aspect of the present invention, said retarder causes a phase angle retardation of less than or equal to one wavelength of light incident on said display. This is may be alternatively expressed as a linear displacement of less than or equal to 560 nm of said incident light.

[0075] The biaxial polypropylene is preferably formed as clear flexible film, though may conceivably be formed as a film, lacquer or coating.

[0076] According to another aspect of the present invention there is provided a method of manufacturing a multi-focal plane display including positioning a first order optical retarder between at least two partially overlapping display surfaces.

[0077] According to another aspect of the present invention there is provided a biaxial polypropylene layer adapted for use in an optical system.

[0078] Said optical system need not be restricted to multi-focal plane displays as described above, but includes any optical system capable of utilising the said optical properties of biaxial polypropylene, and in particular, those of a retarder.

[0079] However, to date, biaxial polypropylene has not been employed for its optical properties, and in particular those of retardation. It has been found that replacing known retarders—such as polycarbonate in multi-layer displays by film of biaxial polypropylene that unexpectedly advantageous results are obtained in comparison to the prior art.

[0080] The multi focal plane displays are preferably formed from liquid crystal panels, though it will be appreciated that other forms of optically active display elements may be used and are thus incorporated within the scope of the present invention.