curable adhesive. The pixels of the green, red layer **104** are first aligned with the broad-band CLC reflective matrix **101**. Then a strong UV light at 20 mW/cm$^2$ is used to cure the glue for approximately 60 seconds. Then heat layer **104** and reflective matrix **111** for approximately 30 seconds at 65° C., peel off the glass substrate **220** of the green-red reflecting layer **104** and apply a UV curable adhesive to the top of layer **104** to attached layer **102** thereto. Align the pixels and cure the glue with UV light at 20 mW/cm$^2$ for approximately 60 seconds.

[**0305**] There are several alternative ways of realizing the basic CLC spectral filtering structure depicted in FIGS. **5**B through **5**B2. These alternative ways will be considered below.

[**0306**] In **FIG. 8C, a** second alternative method of fabricating the CLC-based spectral filtering structure shown in **FIG. 5**B, wherein the subpixel structures of each pixel structure therein are arranged in a 3×1 array, and the order of the subpixel structures in neighboring pixel structures are periodically reversed to enable manufacturer of CLC layers having double-sized color-band reflection regions.

[**0307**] **FIG. 8C** shows an embodiment of the method for patterning the color filter in each layer associated with **FIG. 5**B1. Instead of patterning "green", "green", and "red" (R, R, G) in layer **40** in **FIG. 5**B1 it can be patterned into G, G, R, R, R, R, G, G, R, R, R, R, G, G,. Similarly, layer **50** can be patterned to be B, B, B, B, G, G, B, B, B, B, G, G . . . , where "R", "G" and "B" refer to the filter layer portion reflecting red, green, and blue light, respectively. If the two layers are aligned in the way as shown in **FIG. 16**, color filter pixels consist of sub-pixels ($R_t$, $G_t$, $B_t$) and ($B_t$, $G_t$, $R_t$) will be formed, where "$R_t$", "$G_t$", and "$B_t$" refer to the red, green, and blue sub-pixels in transmission. This method for patterning has the advantage of creating the patterned color portion on each layer with a size twice and four times larger than the display sub-pixel ($R_tG_tB_t$) size. The sub-pixels of red (R) can then be made as one large pixel instead of **4** small separate sub-pixels making it easier to fabricate the display. Similarly 4 blue(B) sub-pixels are made as one large pixel and two sub-pixels of green G are made as one pixel.

[**0308**] As shown in **FIG. 5**B1 a black matrix is automatically formed around the pixels and sub-pixels in **FIG. 8C** with the addition of a green blue GB **86**, red, green RG **87**, blue B **88** and red R **89** reflective portions in a black matrix layer.

[**0309**] In FIGS. **8**D1 through **8**D4 show a third alternative method of fabricating the CLC-based spectral filtering structure shown in **FIG. 5**B, wherein the subpixel structures of each pixel structure therein are arranged in a 2×2 array.

[**0310**] In order to eliminate all reflection at the interfaces between the various parts, index matching techniques should be used. In some cases, this can be simply achieved by gluing the parts together. This by itself will reduce the amount of reflection by a factor of almost 100. Alternatively, a transparent fluid (glycerol) can be disposed between the component parts for index matching. If even greater attenuation of such reflections is required the index of refraction (n) of the fluid or glue should be intermediate between the index values of the adjacent materials For example: if $n_{BBP}$=1.6 and $n_{GLASS}$=1.5 the least reflection will occur for a glue/fluid of index: $n=\sqrt{n_{BBP}n_{Glass}}=1.549$.

[**0311**] Alternative Embodiments Of CLC-Based Spectral Filtering Structures For Use In The First Generalized LCD Panel Of The Present Invention

[**0312**] Having described how to make CLC spectral filters for use in the LCD panel assemblies, such as shown in FIGS. **5** though **5**B2, a number of alternative embodiments come to mind.

[**0313**] To improve the quality of the transmitted light for a display, each color section reflecting red green and blue used in layers **40** and **50** is made with cholesteric liquid crystals which have sharply defined bands of color matched to the colors produced in the light source **100**. With a narrow band of color transmitted, color images with improved color purity and better contrast are produced. **FIG. 6J** shows that cholesteric liquid crystals can be made for tuning the color around a narrow band from a central wavelength. Details of how to make such cholesteric liquid crystals are disclosed in copending patent application Attorney Docket Number PA1101 entitled "Cholesteric Liquid Crystal Reflective Color Filters and the Methods of Fabrication" which is hereby made a part hereof and incorporated herein by reference. In order to cover the correct bandwidth, the CLC bandwidth needs to be appropriately broadened. For example, in order to reflect the red portion of the light from 600 to 750 nm, a CLC with a bandwidth of 150 nm is required. However, a natural CLC can cover only 100 nm at the most. Such broadband reflective cholesteric liquid crystals are made by the method as shown in copending patent application Ser. No. 08/739,467 entitled "Circularly Polarizing Reflective Material Having Super Broad-Band Reflection And Transmission Characteristics And Method of Fabricating And Using Same In Diverse Applications" filed Oct. 29, 1996, which is hereby made a part hereof and incorporated herein by reference.

[**0314**] Although this spectral filtering device **10A** is shown with left handed CLC polymers, it is understood that right handed polymers could also be used to produce a device with opposite handedness light being transmitted. In another embodiment of the present invention, the blue, green and red, green layers **102** and **104** respectively may be used in reverse order and the display will still function in the same way.

[**0315**] In addition to the above separate layers of cholesteric liquid crystal materials glued together, a single layer of cholesteric liquid crystal material with a top portion reflecting one color and a bottom portion reflecting another color, or multiple portions of cholesteric liquid crystal materials polymerized for different functions, can be all stacked in one layer. Pitch gradient CLC materials for use in making the spectral filters hereof are disclosed in copending application Ser. No. 08/739,467 entitled Circularly Polarizing Reflective Material Having Super Broad-Band Reflecting & Transmission Characteristics & Method of Fabricating & Using Same in Diverse Applications, is incorporated herein by reference in its entirety.

[**0316**] By polymerizing different portions of layers by depth of penetration of UV radiation at different temperatures, discrete portions of a linear stack in a layer of CLC materials can be formed with different optical properties. With a continuous change in temperature and a continuous change in frequency of UV light to change the depth of penetration of UV light, broadband reflective cholesteric liquid crystal color filters can be formed.