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(54) LIQUID CRYSTAL DISPLAY WITHOUT BEZEL

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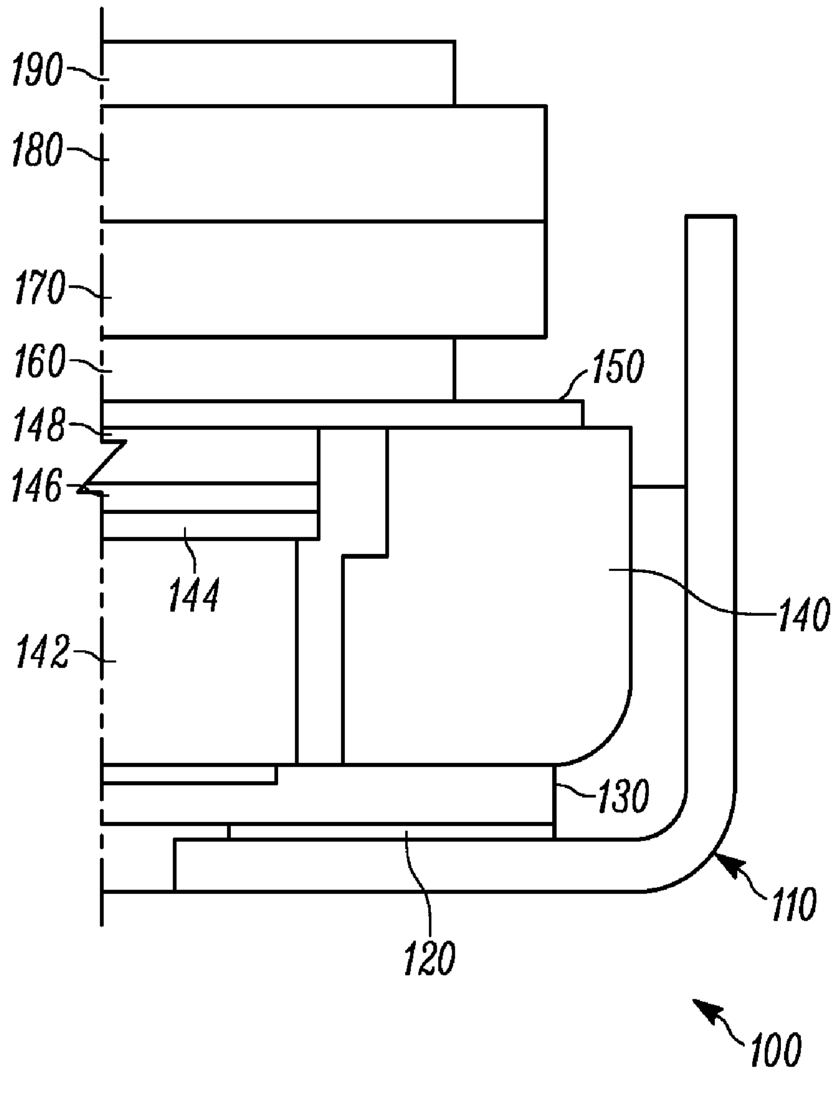
(57) **ABSTRACT**

A device includes a liquid crystal display panel, a compression pad, and a bottom chassis. The bottom chassis supports the liquid crystal display panel. The compression pad has a first surface facing the liquid crystal display panel and a second surface opposite the first surface. The second surface faces away from the liquid crystal display panel. The compression pad substantially fills a volume between the liquid crystal display panel and the bottom chassis. Also, a method of assembling a device includes providing a liquid crystal display panel having a display module reflector, aligning a compression pad assembly with the liquid crystal display panel, and removing a compression pad liner from the compression pad. The compression pad assembly includes the compression pad and the compression pad liner.



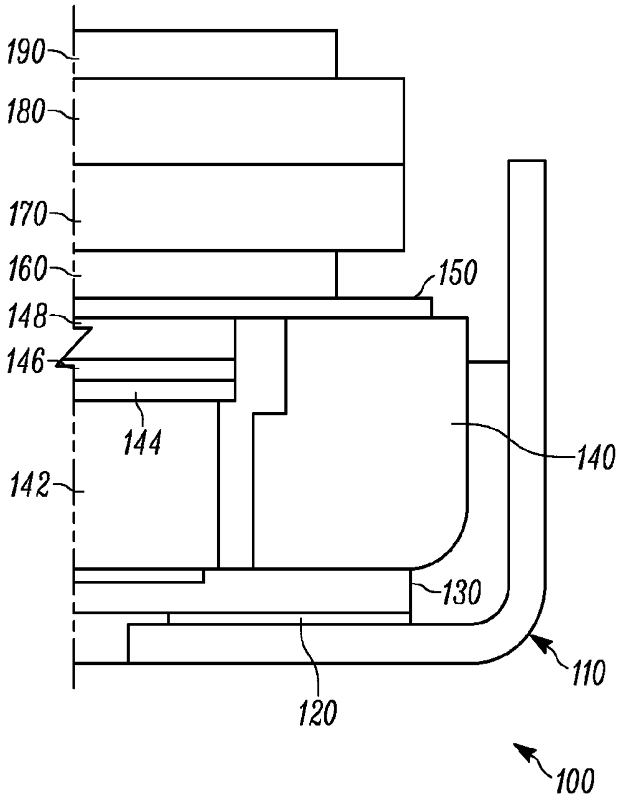

190
180
170
160
150
148
146
144
142
140
130
110
120
100

FIG. 1

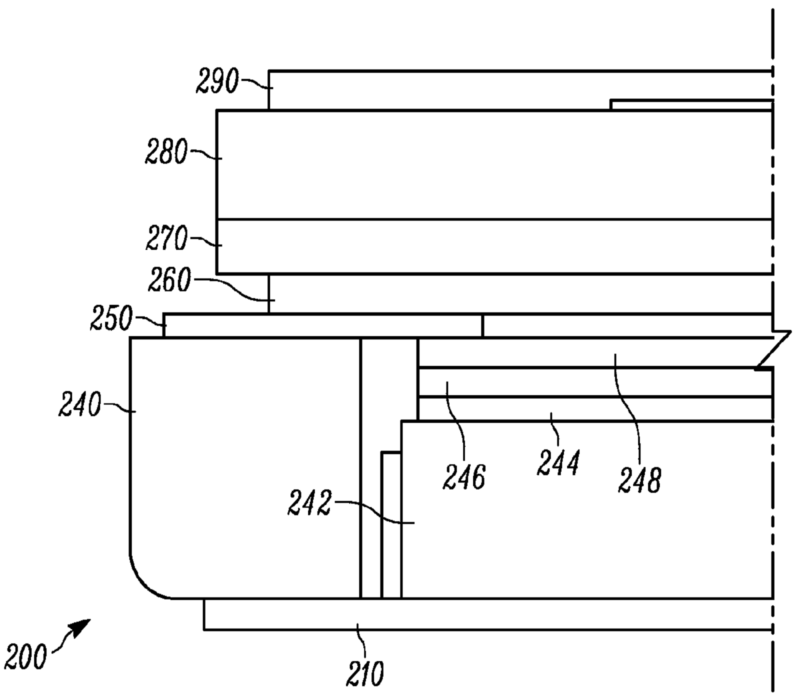

290
280
270
260
250
240
246
244
248
242
200
210

FIG. 2

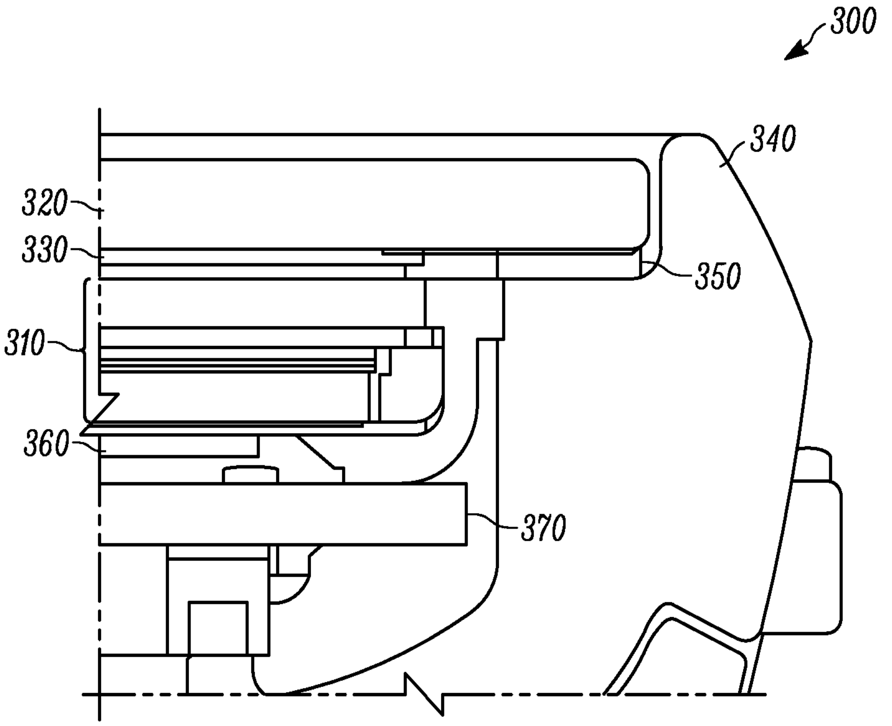

300
340
320
330
350
310
360
370

FIG. 3

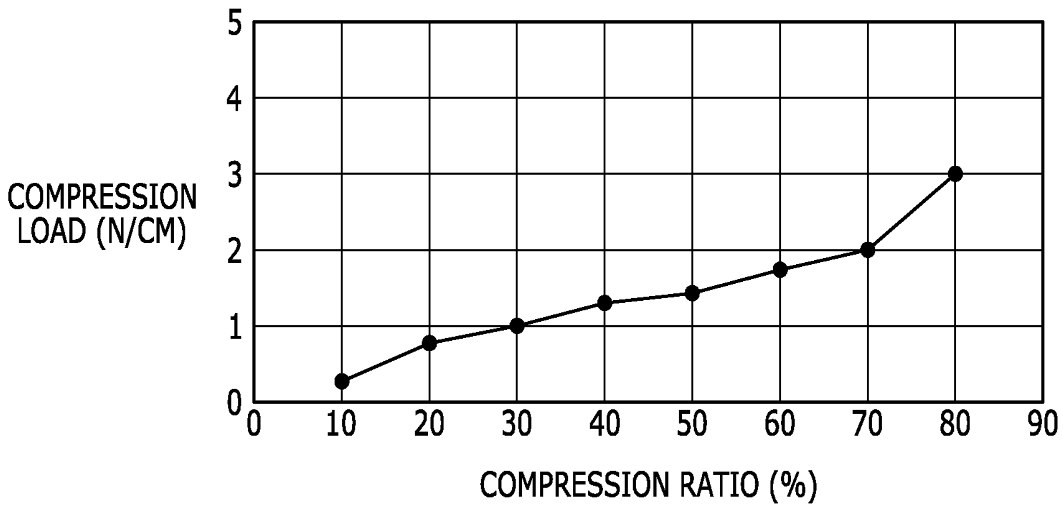

5
4
3
2
1
0
COMPRESSION
LOAD (N/CM)
0
10
20
30
40
50
60
70
80
90
COMPRESSION RATIO (%)

FIG. 4

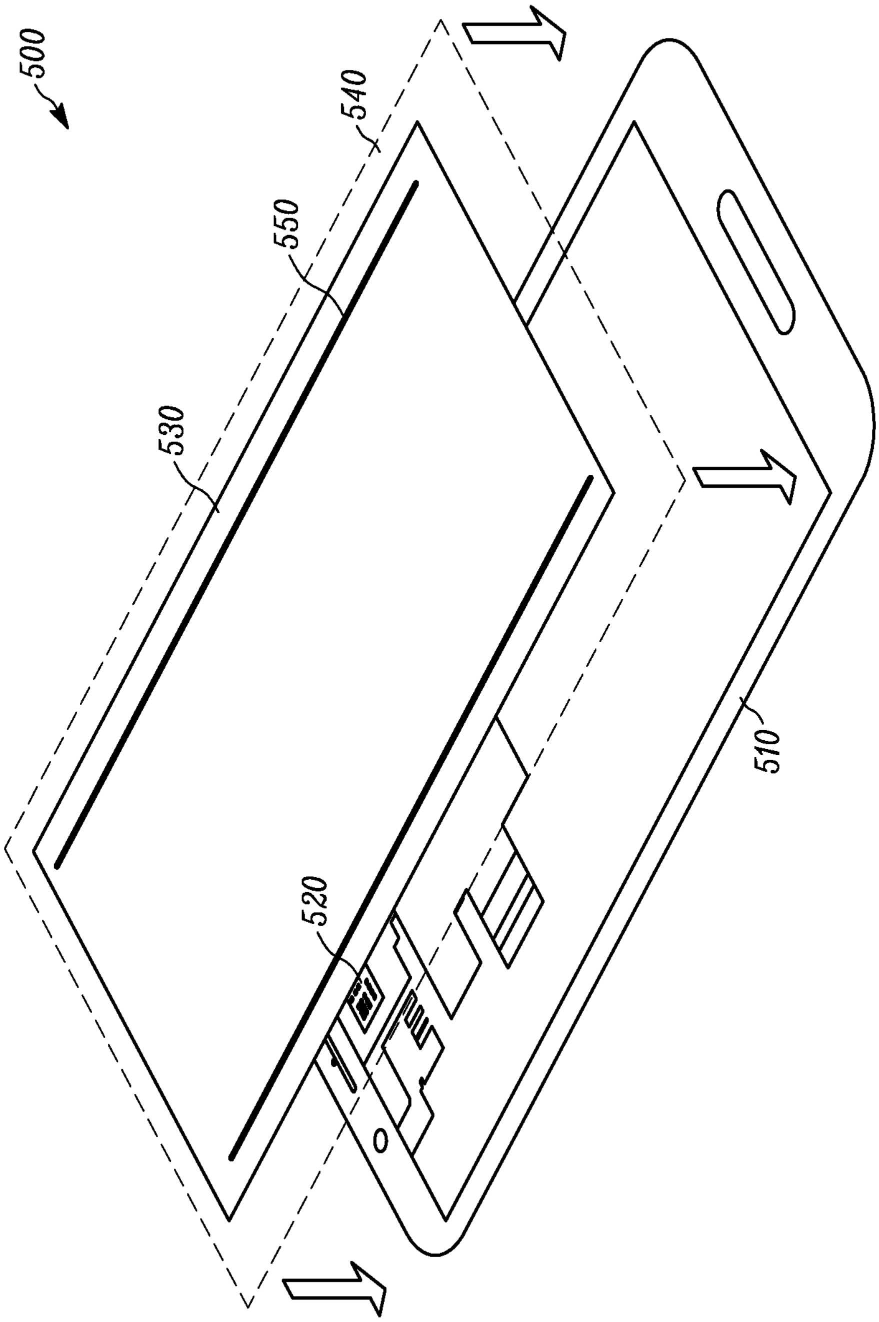


FIG. 5A

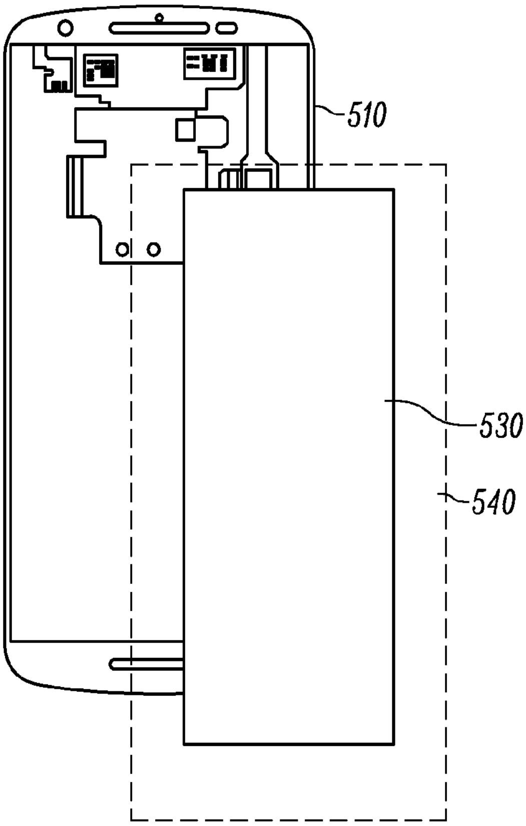


FIG. 5B

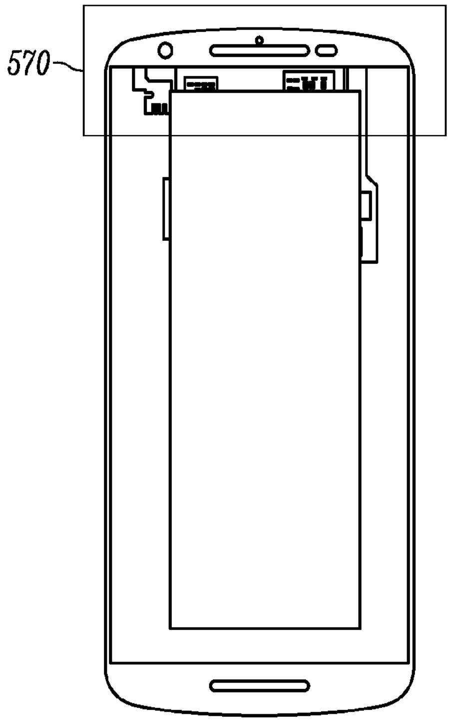


FIG. 5C

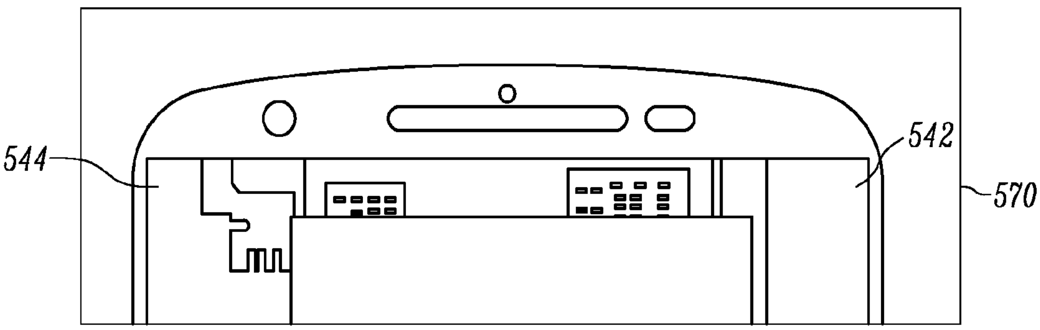


FIG. 5D

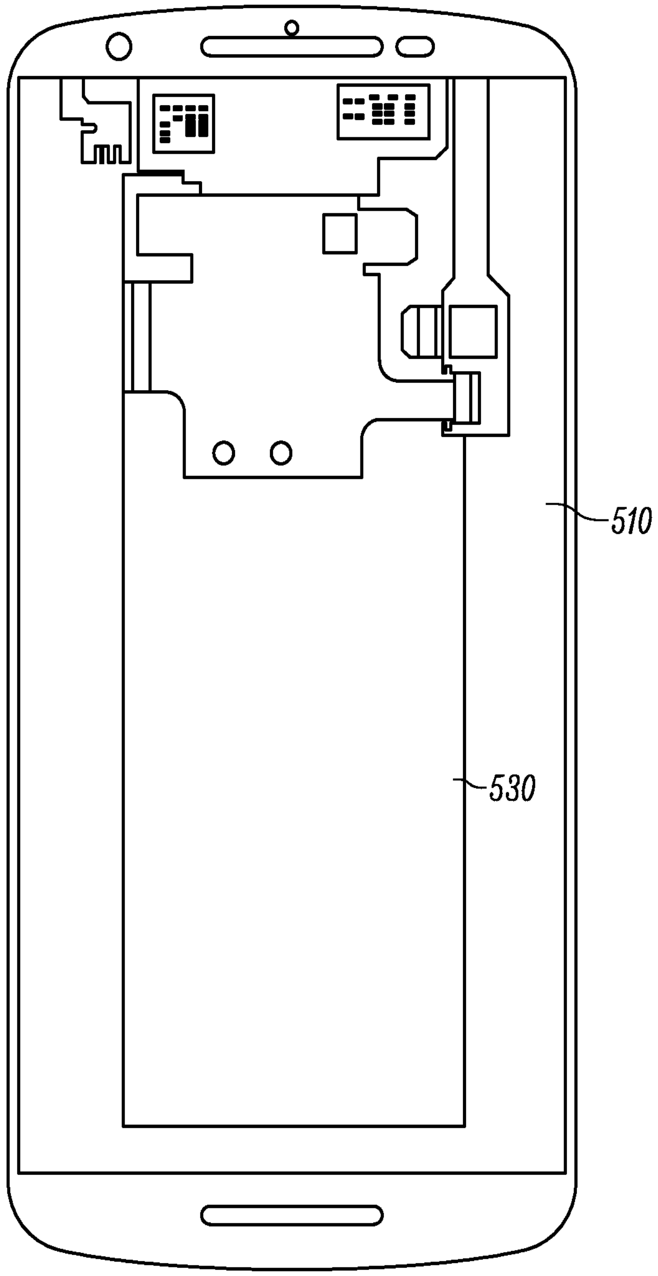


FIG. 5E

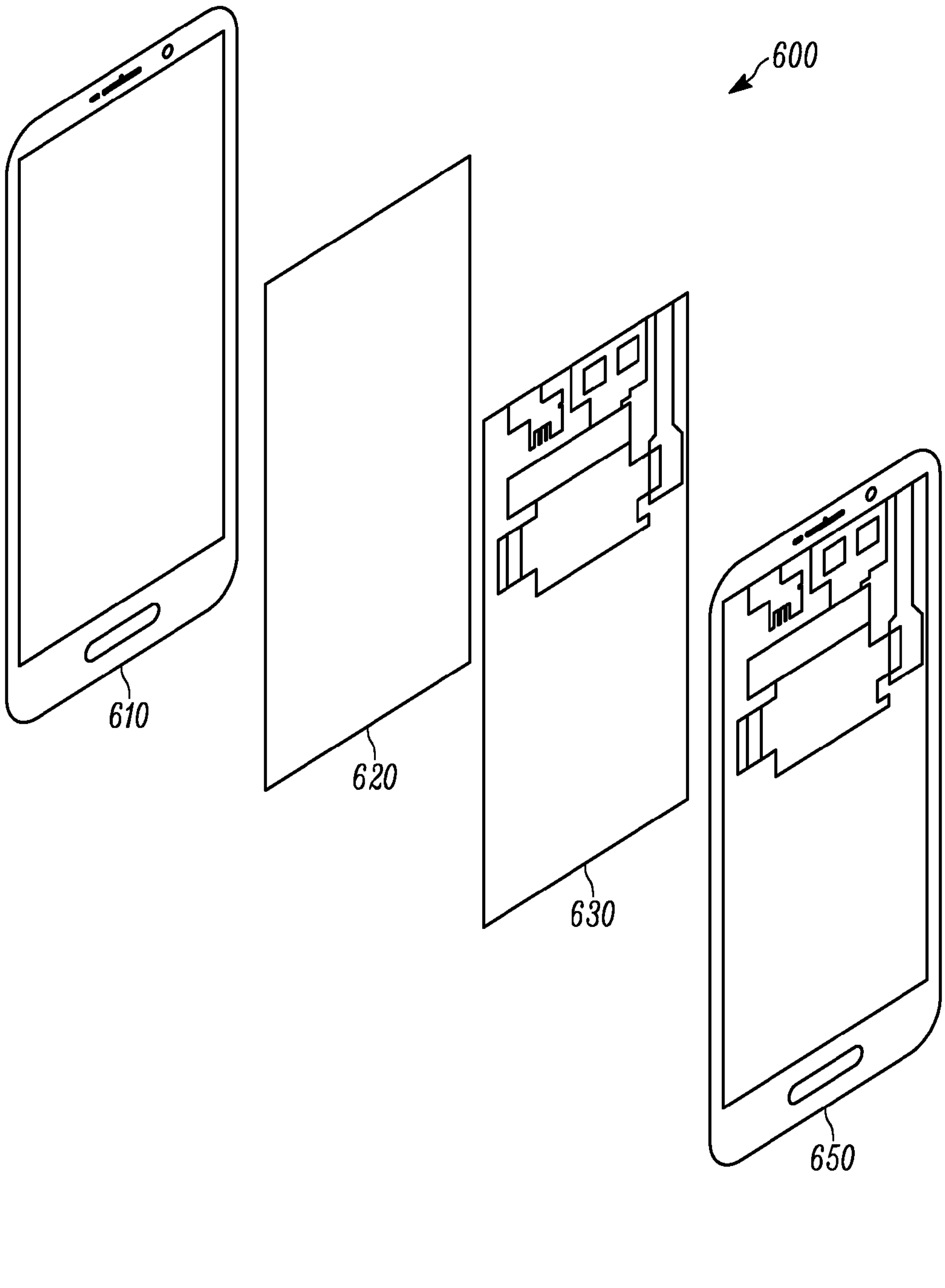


FIG. 6A

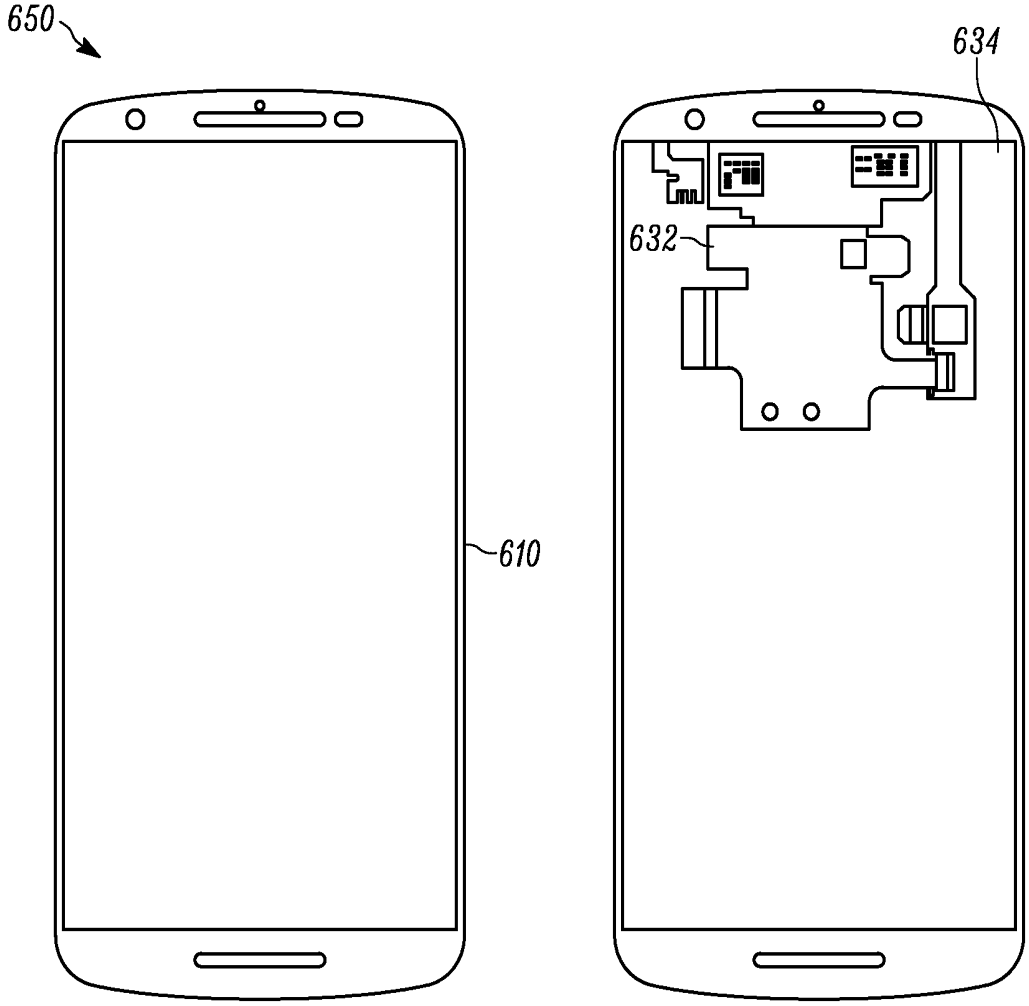


FIG. 6B

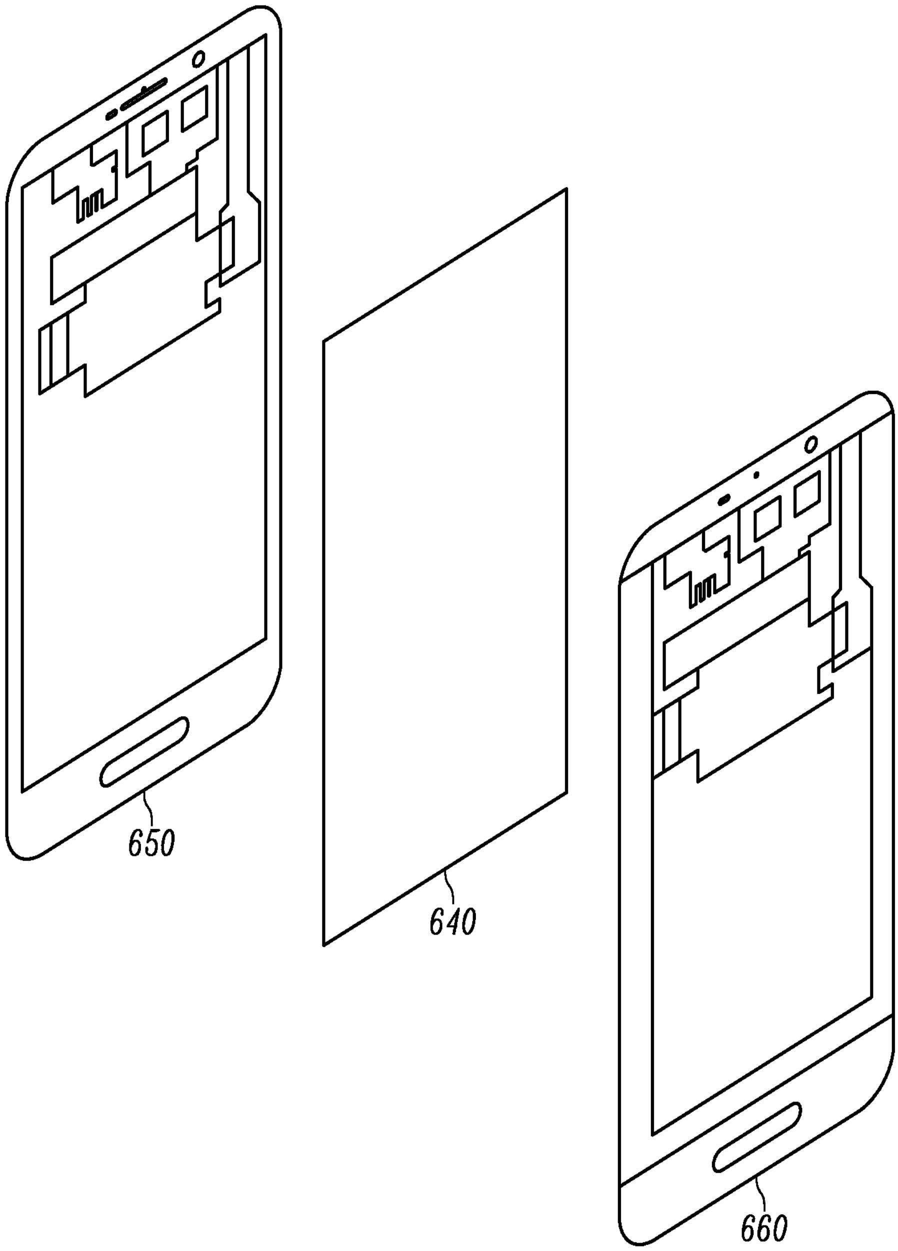


FIG. 6C

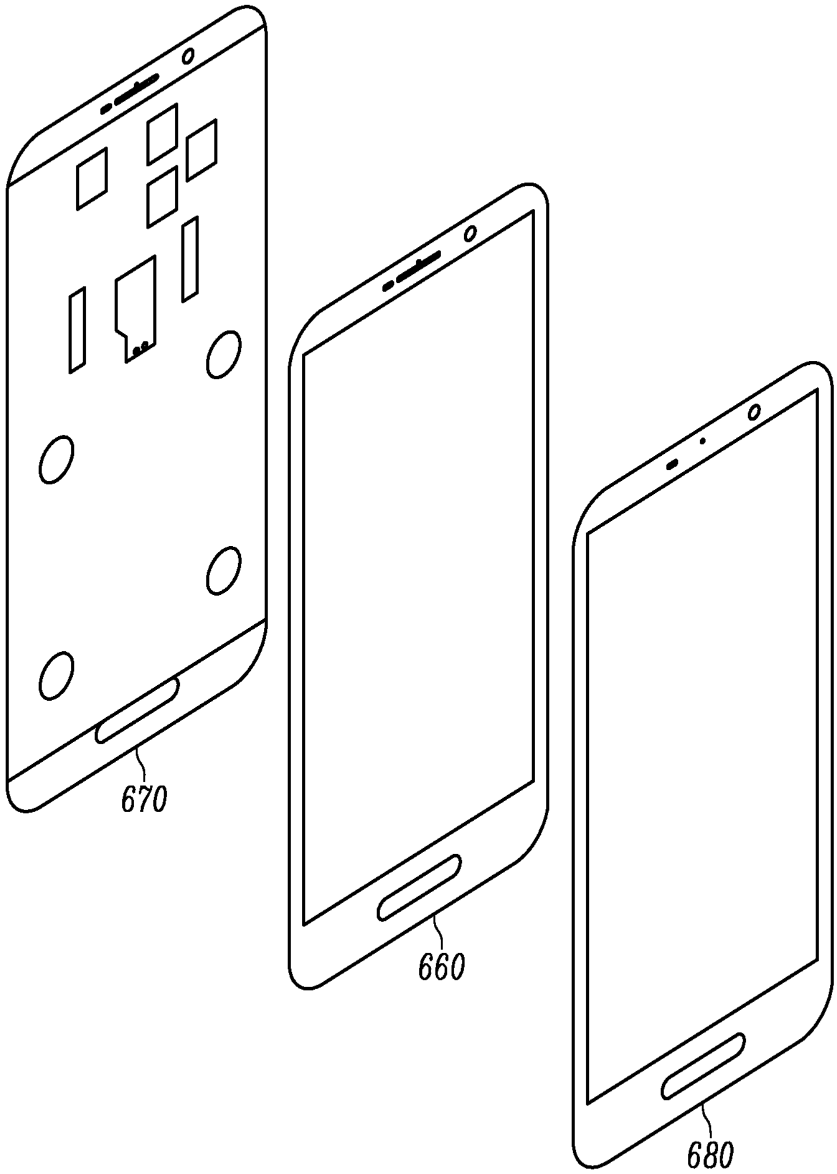


FIG. 6D

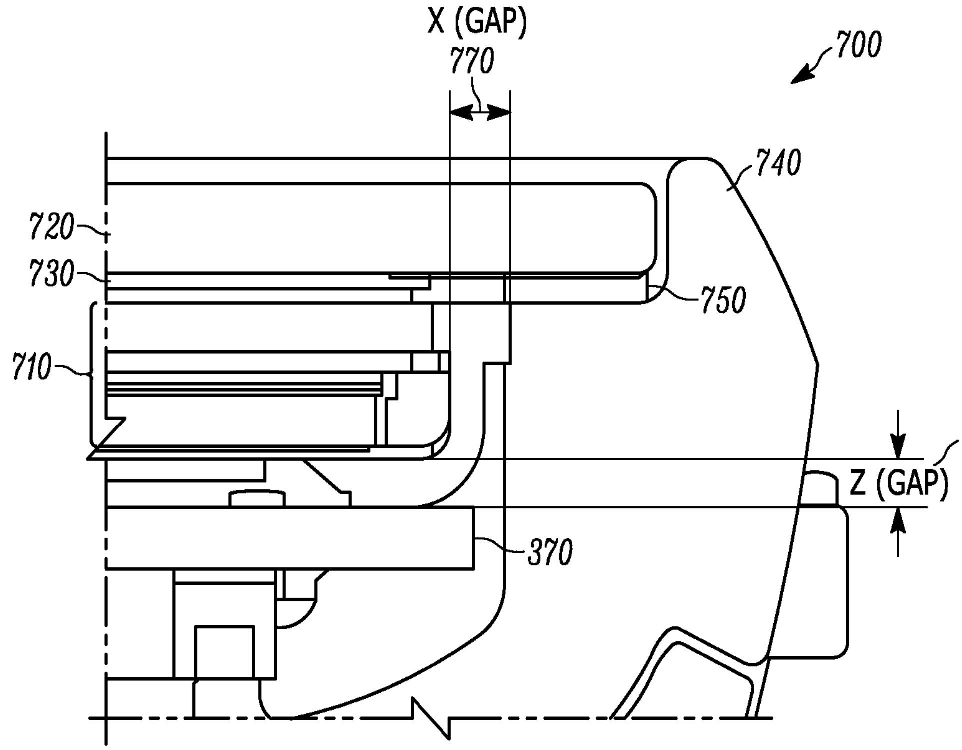


FIG. 7

LIQUID CRYSTAL DISPLAY WITHOUT BEZEL

FIELD

[0001] The disclosure relates generally to the liquid crystal displays (LCDs) for mobile devices, and more specifically to devices and methods for LCDs that do not include a bezel.

BACKGROUND

[0002] In the world of smartphones, the bezel functions acts as a shield and protects the back of the phone display. In the early days, cellphones were almost entirely bezel—screens were tiny, and because they lacked touchscreen interaction, that was fine. Once we began to poke and swipe at our screens, though, they got bigger—and the frame that was structurally necessary to keep them stable began to get smaller and smaller.

[0003] It follows, by some logic, that the next evolutionary step would be to get rid of the bezel altogether. However, removing a bezel is not without difficulties. As provided above, the bezel offers structural support to smartphones. The bezel is often form fitted to the display screen of a phone, wrapping around the edge and extending beneath the display screen or main lens of the phone. Without bezel protection, the display is more susceptible to any point load or line load to the backside of the display screen, causing visual defects. These permanent and dynamic visual defects are often referred to as dynamic bloom, white/dark/blue spots and edge glow, but may be referred to collectively as "pressure marks."

SUMMARY

[0004] Accordingly, there are provided herein devices and methods that allow for bloom or pressure mark protection for a thin liquid crystal display (LCD) product without a formed metal bezel.

[0005] In a first aspect, a device is disclosed. The device includes: a liquid crystal display panel; a compression pad having a first surface facing the liquid crystal display panel and a second surface opposite the first surface, the second surface facing away from the liquid crystal display panel, the compression pad substantially filling a volume between the liquid crystal display panel and a bottom chassis; and a bottom chassis that supports the liquid crystal display panel.

[0006] In a second aspect, a method of assembling a device is disclosed. The method includes: providing a liquid crystal display panel having a display module reflector; aligning a compression pad assembly with the liquid crystal display panel, the compression pad assembly including a compression pad and a compression pad liner; and removing the compression pad liner from the compression pad.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The details of the present disclosure, both as to its structure and operation, may be understood in part by study of the accompanying drawings, in which like reference numerals refer to like parts. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the disclosure.

[0008] FIG. **1** is a perspective view of an example mobile device with a display bezel.

[0009] FIG. **2** is a perspective view of an example mobile device without a display bezel.

[0010] FIG. **3** is a perspective view an example mobile device with a compression pad in accordance with an embodiment.

[0011] FIG. **4** is an example graph showing the compression load (N/cm^2) versus the compression ratio (%) for a compression pad in accordance with an embodiment.

[0012] FIG. **5**A is a perspective exploded view of an example mobile device with a compression pad in accordance with an embodiment.

[0013] FIG. **5**B is a front top view of an example mobile device in a first assembly position in accordance with an embodiment.

[0014] FIG. **5**C is a front top view of an example mobile device in a second assembly position in accordance with an embodiment.

[0015] FIG. **5**D is a close up of a top portion of FIG. **5**C.

[0016] FIG. **5**E is a front top view of an example mobile device in a third assembly position in accordance with an embodiment.

[0017] FIG. **6**A is a perspective exploded view of an example mobile device in a first assembly position in accordance with an embodiment.

[0018] FIG. **6**B is a top view showing a general front side and backside of an LCD module for the example mobile device of FIG. **6**A.

[0019] FIG. **6**C is a perspective exploded view of an example mobile device in a second assembly position in accordance with an embodiment.

[0020] FIG. **6**D is a perspective exploded view of an example mobile device in a third assembly position in accordance with an embodiment.

[0021] FIG. **7** is a perspective view of an example mobile device showing gaps in the mobile device.

DETAILED DESCRIPTION

[0022] The present disclosure describes methods and systems for that allow for bloom or pressure mark protection for a thin LCD product without a formed metal bezel. In some embodiments, the LCD product includes a low compression force pad proximate to the back of a display module reflector, between the display and chassis, to distribute point loads, thereby reducing the occurrence of pressure marks.

[0023] FIG. **1** is a perspective view of an example mobile device with a display bezel. As shown, mobile device is not an entire mobile device, but rather a liquid crystal display (LCD) module **100**. LCD module **100** includes a metal bezel **110**, a reflector **130** and a light guide frame (LGF) **140**. Metal bezel **110** is connected to reflector **130** via adhesive **120**. LGF **140** is configured to hold LCD module **100** together by means of mechanical features and adhesives. Adhesive **120** may be made of any suitable adhesive material, including for example, glues and/or epoxies. Reflector **130** may be a multilayered plastic film that functions as a mirror.

[0024] In some embodiments, the metal bezel **110** has a thickness of approximately 0.150 mm. Reflector **130** may have a thickness of around 0.082 mm. Adhesive **120** has a thickness of approximately 0.03 mm to approximately 0.08 mm.

[0025] As shown, metal bezel **110** does not effectively solve bloom issues or pressure marks associated with LCD module **100**. This is because point or edge loads translate through the thin metal bezel **110** and into the LCD module **100** with minimal load distribution. When the load is minimally distributed, the applied pressure is higher through the LCD module **100** (e.g., Pressure=Force/Area). The higher pressure results in more deflection through the layers of the LCD module **100** and reduces the gap between the front and back glass prisms **146**, **148** containing the liquid crystal. The effect is bloom.

[0026] LCD module **100** also includes a light guide **142**, a diffuser film **144**, a lower prism **146**, and an upper prism **148**. In some embodiments, the light guide **142** is constructed from plastic and distributes light from light emitting diodes (LEDs) throughout LCD module **100**. In some embodiments, diffuser film **144** is constructed from plastic and spreads light throughout the display. In some embodiments, the lower prism **146** and upper prism **148** are constructed from plastic and are brightness enhancement films that focus light. One prism **146** or **148** focuses light in the horizontal direction and the other prism **146** or **148** focuses light in the vertical direction. Also shown is a rim adhesive **150** that allows the prisms **146**, **148** to be secured to LFG **140**.

[0027] In some embodiments, light guide **142** has a thickness of approximately 0.45 to 0.56 mm. Diffuser film **144** may have a thickness of around 0.05 mm. Lower prism **146** may have a thickness of approximately 0.065 mm and upper prism **148** may have a thickness of approximately 0.095 mm.

[0028] LCD module **100** also includes a back polarizer **160**, a lower prism **170**, an upper prism **180**, and a front polarizer **190**. In some embodiments, the back polarizer **160** is constructed from plastic and allows light to pass at a specific polarization. In some embodiments, lower prism **170** is constructed from glass and holds a thin film transistor (TFT), which carries electrical current to the liquid crystal and forces it to either block or omit light. In some embodiments, the liquid crystal (not shown) is located between lower prism **170** and upper prism **180**. In some embodiments, upper prism **180** is constructed from glass and includes a color filter for red, green, and blue (RGB). Each RGB filter is associated with a transistor that defines the color that will be visible (e.g., a pixel). In some embodiments, front polarizer **190** is constructed from plastic and allows light to pass at a specific polarization.

[0029] FIG. **2** is a perspective view of an example mobile device without a display bezel. As shown, mobile device is not an entire mobile device, but rather an LCD module **200**. LCD module **200** includes a reflector **210** and a light guide frame (LGF) **240**. LGF **240** is configured to hold LCD module **200** together by means of mechanical features and adhesives. Reflector **210** may be a multilayered plastic film that functions as a mirror.

[0030] LCD module **200** also includes a light guide **242**, a diffuser film **244**, a lower prism **246**, and an upper prism **248**. In some embodiments, the light guide **242** is constructed from plastic and distributes light from light emitting diodes (LEDs) throughout LCD module **200**. In some embodiments, diffuser film **244** is constructed from plastic and spreads light throughout the display. In some embodiments, the lower prism **246** and upper prism **248** are constructed from plastic and are brightness enhancement films that focus light. One prism **246** or **248** focuses light in the horizontal direction and the other prism **246** or **248** focuses light in the vertical direction. Also shown is a rim adhesive **250** that allows the prisms **246**, **248** to be secured to LFG **240**.

[0031] LCD module **200** also includes a back polarizer **260**, a lower prism **270**, an upper prism **280**, and a front polarizer **290**. In some embodiments, the back polarizer **260** is constructed from plastic and allows light to pass at a specific polarization. In some embodiments, lower prism **270** is constructed from glass and holds a thin film transistor (TFT), which carries electrical current to the liquid crystal and forces it to either block or omit light. In some embodiments, the liquid crystal (not shown) is located between lower prism **270** and upper prism **280**. In some embodiments, upper prism **280** is constructed from glass and includes a color filter for red, green, and blue (RGB). Each RGB filter is associated with a transistor that defines the color that will be visible (e.g., a pixel). In some embodiments, front polarizer **290** is constructed from plastic and allows light to pass at a specific polarization.

[0032] A main difference between FIG. **1** and FIG. **2** is that FIG. **1** includes a bezel **110** and adhesive **120** to secure it to the LCD module **110**. Generally, the sizes (e.g., thicknesses) of like components are similar. However, the overall thickness of mobile device **100** is greater than mobile device **200** due to including the bezel **110**.

[0033] FIG. **3** is a perspective view an example mobile device **300** with a compression pad in accordance with an embodiment. Unlike in FIG. **1** and FIG. **2**, FIG. **3** shows a mobile device **300** including an LCD module **310** and additional components, making a more complete phone. It should be appreciated that for purposes of discussion, LCD module **310** may include similar components to LCD module **200**.

[0034] Mobile device **300** also includes a main lens **320**, which may be constructed of a transparent material such as glass. Main lens **320** may be secured to the LCD module **310** via an optically clear adhesive (OCA) **330**. OCA **330** may be approximately 0.15 thick and made from any suitable adhesive.

[0035] Also shown are front housing **340**, which is secured to main lens **320** via main lens adhesive **350**. In some embodiments, front housing is constructed from aluminum die cast and over-molded PC plastic. Main lens adhesive **350** may be any suitable adhesive and is approximately 0.25 mm thick. Proximate to and beneath LCD module **310** is compression pad **360**. As shown, compression pad **360** is in contact with a reflector or reflector film (not shown) of LCD module **360**. Beneath compression pad **360** is a chassis **370**. As shown, chassis **370** is generally a bottom structure of mobile device **300**, however in some embodiments, it may be a printed circuit board (not shown) of other internal phone component that is located beneath the LCD module **310**.

[0036] In some embodiments, compression pad **360** substantially fills a volume between the LCD module **310** and chassis **370**. In some embodiments, compression pad **360** effectively minimizes or removes any gaps in mobile device **300** between LCD module **310** and chassis **370**. Thus, compression pad **360** is at least partially compressed between LCD module **310** and chassis **370**.

[0037] The compression force on the compression pad **360** is important, because if compression force is too high, it may overstress the lens bond between main lens **320** and LCD module **330**. Too much force from the compression pad **360** may force the main lens **320** to detach from the phone. If compression force is too low, the compression pad **360** may not be effective to distribute point and/or line loads.

[0038] Material properties for suitable compression pads **360** are provided in Tables 1 and 2. In some embodiments, compression pad **360** has a thickness of approximately 0.3 mm to 0.4 mm. However, it is appreciated that the thickness of the compression pad **360** may vary, depending on the size of a gap between the LCD module **310** and chassis **370**. Additionally, the width and length of compression pad **360** will vary according to the display size.

TABLE 1

Compression Pad Dimensions		
Thickness (mm)	Width (mm)	Length (mm)
0.3-0.4	36	117

TABLE 2

Compression Pad General Properties			
Property	Unit	Values	Test Method
Density	g/cm^3	0.045	JIS K 6767
50% Compression Load	N/cm^2	1.4	JIS K 6767

[0039] In some embodiments, compression pad **360** is constructed from a compressible or pliable material such as polypropylene, polyethylene terephthalate, silicone, thermoplastic urethane, or other suitable porous materials. In some embodiments, compression pad **360** has a density of approximately 0.02 to 2.3 g/cm^3. The range of densities may be dependent on the material of compression pad **360**. For example, a compression pad **360** having a density of 0.02 g/cm^3 to 1 g/cm^3 is a highly porous compressible pad **360** and a compression pad **360** having a density of 1 g/cm^3 to 2.3 g/cm^3 is a nonporous compressible pad **360** such as silicone rubber. In some embodiments, compression pad **360** has a 50% compression load of approximately 0.5 to 5 N/cm^2.

[0040] FIG. **4** is an example graph showing the compression load (N/cm^2) versus the compression ratio (%) for a suitable compression pad material.

[0041] FIG. **5**A is a perspective exploded view of an example mobile device with a compression pad in accordance with an embodiment. In FIG. **5**A, mobile device **500** includes a main lens and a display assembly **510** or LCD module. Also included in display assembly **510** is a display flex **520**, which includes a processor chip and supporting circuitry. The display flex **520** connects to the phone's main printed circuit board (PCB).

[0042] Also shown in FIG. **5**A are a compression pad **530** and a compression pad liner **540**. Compression pad **530** includes one or more adhesive strips **550** that run the length of the compression pad **530**. The adhesive strips **550** are located on the underside of compression pad **530**, proximate to display assembly **510**, and are used to secure the compression pad **530** to the display assembly **510**.

[0043] FIG. **5**B is a front top view of an example mobile device in a first assembly position in accordance with an embodiment. In FIG. **5**B, mobile device **500** is shown with compression pad liner **540** and compression pad **530** unattached to display assembly **510**.

[0044] FIG. **5**C is a front top view of an example mobile device in a second assembly position in accordance with an embodiment. In FIG. **5**C, mobile device **500** is shown with compression pad liner **540** and compression pad **530** placed on top of display assembly **510**. A top portion **570** of mobile device **500** is also shown, where the compression pad liner **540** is aligned to a top edge of the display assembly **510** in order to properly position the compression pad **530** on the display assembly **510**.

[0045] FIG. **5**D is a close up of a top portion of FIG. **5**C. In top portion **570**, two corners **542**, **544** of compression pad liner **540** are shown which align with two corners of the display assembly **510**. In some embodiments, the compression pad liner **540** aligns with the display reflector of display assembly **510**.

[0046] FIG. **5**E is a front top view of an example mobile device in a third assembly position in accordance with an embodiment. In FIG. **5**E, the compression pad liner **540** has been removed after placing the compression pad **530** in its correct position. As provided above, the compression pad **530** is secured to display assembly **510** with adhesive strips **550**.

[0047] FIG. **6**A is a perspective exploded view of an example mobile device in a first assembly position in accordance with an embodiment. In FIG. **6**A, an example mobile device **600** includes a main lens **610**, OCA **620** and LCD module **630**, which when placed together form partial device **650**. Main lens **610** bonds to the LCD module **630** via OCA **620**.

[0048] FIG. **6**B is a top view showing a general front side and backside of an LCD module for the example mobile device of FIG. **6**A. Partial device **650** is shown with a front side showing main lens **610** and backside showing LCD module **630**. On LCD module **630** is a display flex **632** and touch flex **634**. In some embodiments, the display flex **632** connects to the touch flex **634**, which controls the capacitive touch on module **634**. The display flex **632** connects to the mobile device's **600** main printed circuit board (PCB) (not shown).

[0049] FIG. **6**C is a perspective exploded view of an example mobile device in a second assembly position in accordance with an embodiment. A compression pad **640** is shown as assembled to the back of partial device **650** (which is LCD module **630** from FIG. **6**B), resulting in main lens assembly **660**. In some embodiments, fixtures can be used during assembly to ensure proper alignment.

[0050] FIG. **6**D is a perspective exploded view of an example mobile device in a third assembly position in accordance with an embodiment. As provided, main lens assembly **660** is secured to front housing **670** to form a top half **680** of a mobile device.

[0051] FIG. **7** is a perspective view of an example mobile device without a compression pad or display bezel. A mobile device **700** is shown having a LCD module **710**, main lens **720**, OCA **730**, front housing **740** and mains lens adhesive **750**. Also shown are an X-gap **770** and a Z-gap **760**. A Y-gap is also present and identical to the X-gap, but is not shown. In some embodiments, using a compression pad reduces the X-gap **770** and Z-gap **760** and Y-gap (not shown). For example, the X-gap **770** may be reduced by approximately 0.27 mm for each side of the mobile device, the Y-gap (not shown) may be reduced by approximately 0.27 mm for each side of the mobile device, and the Z-gap **760** may be reduced by approximately 0.25 mm.

[0052] The reduction in mobile device thickness is provided in Tables 3-5. In Table 3, the mobile device thickness for a device with a display bezel is shown. Gap **2** in Table 3 provides a minimum distance used to prevent bloom or pressure marks in the mobile device using a bezel. Table 4 provides the mobile device thickness for a device without a bezel or compression pad. The Gap in Table 4 provides a minimum distance used to prevent bloom or pressure marks in the mobile device without a bezel or compression pad. Table 5 provides the mobile device thickness for a device with a compression pad.

TABLE 3

Mobile Device Thickness for Device with Display Bezel Stack Through Display

Description of Layer	Size (mm)
Main Lens	0.600
OCA	0.150
Display	1.400
Gap 1	0.050
Display Bezel	0.150
Gap 2	0.250
Chassis	0.500
Total Thickness	3.100

TABLE 4

Mobile Device Thickness for Device without Bezel Stack Through Display

Description of Layer	Size (mm)
Main Lens	0.600
OCA	0.150
Display	1.400
Gap	0.350
Chassis	0.500
Total Thickness	3.000

TABLE 5

Mobile Device Thickness for Device with Compression Pad Stack Through Display

Description of Layer	Size (mm)
Main Lens	0.600
OCA	0.150
Display	1.400
Gap	0.200
Chassis	0.500
Total Thickness	2.850

[0053] In some embodiments, adding a pad behind a display distributes point or edge loads over an area, which results in less pressure translating through the liquid crystal layer. As the equation (Pressure=Force/Area) shows, at constant force pressure decreased if the area of applied force is increased. The reduction in pressure reduces the deflection between films and the liquid crystal layer between the two glass prisms. By reducing the deflections, light paths are less interrupted resulting in less cosmetic defects such as bloom.

[0054] Benefits associated with using a compression pad in a mobile device assembly may include:

[0055] The compression pad distributes point and line load and conforms to a gap between an LCD module display reflector and device housing.

[0056] The compression pad reduces the x-y-z device package, allowing thinner devices with a greater screen to size ratio.

[0057] For example, using a compression pad may reduce the device by approximately 0.5 mm in both x and y directions, and may reduce the device by approximately 0.2 mm in the z direction.

[0058] The compression pad allows the use of an LCD panel without a protective bezel while maintaining visual performance. This translates into opportunities in cost and weight savings for the device.

[0059] For example, the device weight may be reduced by approximately 5 g by using a compression pad.

[0060] The aspect ratio of the display active area to the size of the screen may be improved because the compression pad sits behind the display, whereas the metal bezel wraps around the display.

[0061] Accordingly, the present disclosure is not limited to only those implementations described above. Those of skill in the art will appreciate that the various illustrative modules and method steps described in connection with the above described figures and the implementations disclosed herein can often be implemented as electronic hardware, software, firmware or combinations of the foregoing. To clearly illustrate this interchangeability of hardware and software, various illustrative modules and method steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled persons can implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the disclosure. In addition, the grouping of functions within a module or step is for ease of description. Specific functions can be moved from one module or step to another without departing from the disclosure.

[0062] The various illustrative modules and method steps described in connection with the implementations disclosed herein can be implemented or performed with a general purpose processor, a digital signal processor ("DSP"), an application specific integrated circuit ("ASIC"), a field programmable gate array ("FPGA") or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor can be a microprocessor, but in the alternative, the processor can be any processor, controller, or microcontroller. A processor can also be implemented as a combination of computing devices, for example, a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0063] Additionally, the steps of a method or algorithm described in connection with the implementations disclosed herein can be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module can reside in computer or machine-readable storage media such as RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium including a network storage medium. An example storage medium can be coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium can be integral to the processor. The processor and the storage medium can also reside in an ASIC.

We claim:

1. A device comprising:

a liquid crystal display panel;

a bottom chassis that supports the liquid crystal display panel; and

a compression pad having a first surface facing the liquid crystal display panel and a second surface opposite the first surface, the second surface facing away from the liquid crystal display panel, the compression pad substantially filling a volume between the liquid crystal display panel and the bottom chassis.

2. The device of claim **1**, wherein the liquid crystal display panel comprises a display module reflector, the display module reflector proximate to the compression pad.

3. The device of claim **1**, wherein the compression pad is configured to distribute point loads in the device.

4. The device of claim **1**, wherein the compression pad comprises adhesive strips configured to adhere the compression pad to the liquid crystal display panel.

5. The device of claim **1**, wherein the compression pad comprises polypropylene, polyethylene terephthalate, silicone, thermoplastic urethane, or combinations thereof.

6. The device of claim **1**, wherein the compression pad has a density of approximately 0.02 to 2.3 g/cm^3.

7. The device of claim **1**, wherein the compression pad has a 50% compression load of approximately 0.5 to 5 N/cm^2.

8. The device of claim **1**, wherein the thickness of the compression pad is approximately 0.1 mm to 0.6 mm, and wherein the compression pad substantially fills the volume between the liquid crystal display panel and the bottom chassis.

9. The device of claim **1**, further comprising:

a compression pad liner adhered to the second surface of the compression pad, the compression pad liner configured to align the compression pad with the liquid crystal display.

10. The device of claim **9**, wherein the compression pad liner comprises two corners that align with two corners of the liquid crystal display panel.

11. The device of claim **9**, wherein the compression pad liner is configured to be removed from the compression pad during device assembly.

12. The device of claim **1**, wherein a thickness of the device is reduced by approximately 0.1 to 0.4 mm by using the compression pad.

13. The device of claim **1**, wherein a length and width of the device is reduced by approximately 0.5 mm in each direction.

14. The device of claim **1**, wherein the liquid crystal display panel comprises an upper prism, lower prism, back polarizer, rim adhesive, light guide frame, two brightness enhancement prisms, a light guide and reflector film.

15. The device of claim **1**, wherein the bottom chassis comprises a metal floor, a printed circuit board or solid composite housing.

16. The device of claim **1**, wherein a length and width of the compression pad is less than a length and width of the liquid crystal display panel.

17. A method of assembling a device comprising:

providing a liquid crystal display panel having a display module reflector;

aligning a compression pad assembly with the liquid crystal display panel, the compression pad assembly including a compression pad and a compression pad liner; and

removing the compression pad liner from the compression pad.

18. The method of claim **17**, further comprising:

adhering the compression pad to the display reflector module with adhesive strips.

19. The method of claim **17**, further comprising:

placing a bottom chassis proximate to the compression pad, the bottom chassis configured to support the liquid crystal display panel.

20. The method of claim **19**, wherein the compression pad is compressed approximately 5% to 80% when engaged between the liquid crystal display panel and bottom chassis.

21. The method of claim **20**, wherein the compression pad is compressed approximately 50% when engaged between the liquid crystal display panel and bottom chassis.

22. The method of claim **17**, wherein the device comprises a device selected from the group consisting of: mobile phones, tablets, watches, laptops, and televisions.

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专利名称(译)	没有挡板的液晶显示器		
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摘要(译)

一种装置包括液晶显示面板，压缩垫和底架。底架支撑液晶显示面板。压缩垫具有面向液晶显示面板的第一表面和与第一表面相对的第二表面。第二表面背向液晶显示面板。压缩垫基本上填充液晶显示面板和底架之间的体积。此外，组装装置的方法包括提供具有显示模块反射器的液晶显示面板，将压缩垫组件与液晶显示面板对准，以及从压缩垫移除压缩垫衬垫。压缩垫组件包括压缩垫和压缩垫衬垫。