

316. Specifically, the bottom of the button assembly disclosed by *Meyers* consists of a button support plate which functions as a retainer positioned inward from the input surface. *Meyers* teaches that “[t]he tactile dome switch 118 is disposed above and coupled to a switch gasket 120, which holds the tactile dome switch 118, and which is held in place by a button support plate 122. The button support plate 122 is coupled to the base plate, and held in place by one or more vertical screws” (Ex-1007, ¶[0052]). The button support plate 122 (*i.e.*, the retainer) is pictured in blue, below, and is positioned inward from the input surface (purple).

317. When the button assembly of *Meyers* is combined with the button housing disclosed by *Jung*, the retainer will define a sealing surface against the seal, green.

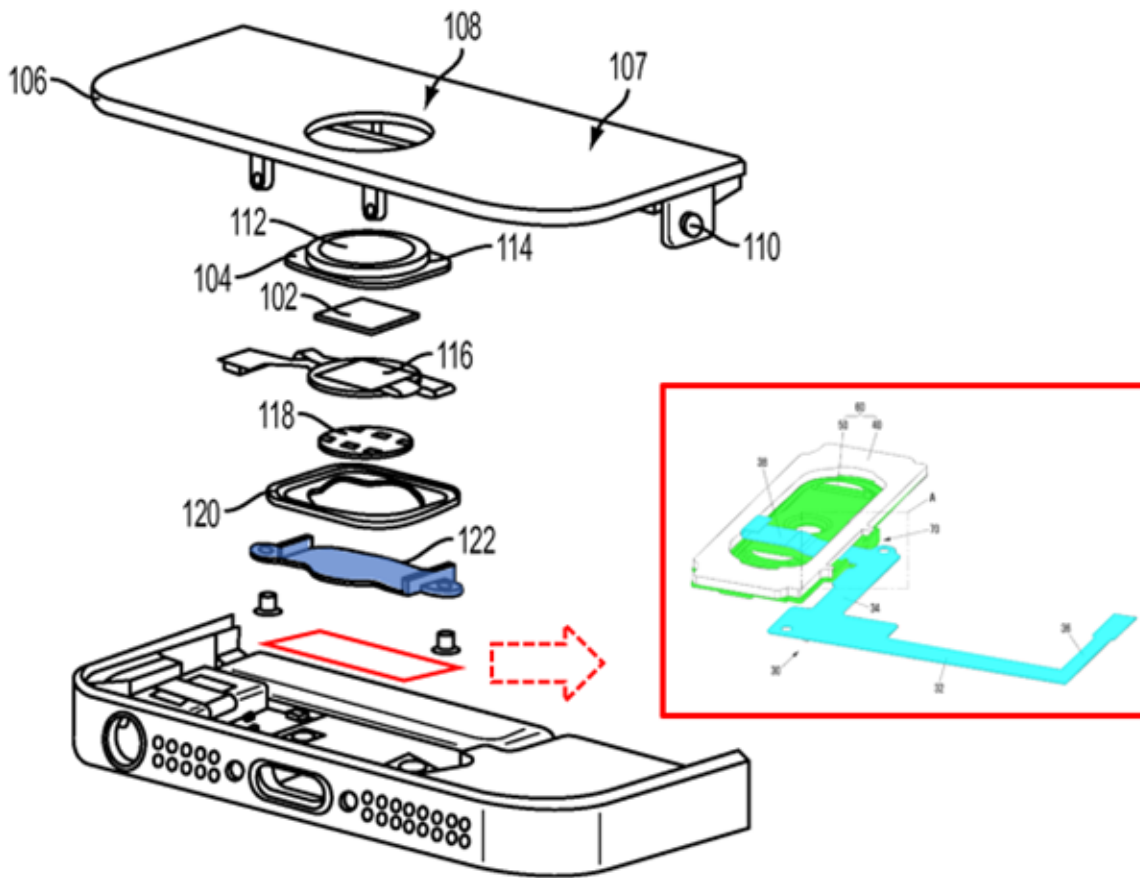


FIG. 1

318. The '619 patent teaches that the retainer provides “a stop to displacement of the button housing” and that multiple “configurations of the retainer 224 are possible” (Ex-1001, 16:54-60). Likewise, the '619 patent explains that “[t]he retainer 224 lower surface forms a sealing surface 225 for the button assembly 310” (Ex-1001, 16:54-60). As depicted above, a person of ordinary skill in the art would

understand that the button support plate 122 of *Meyers* likewise serves as “a stop to the displacement of the button housing” and includes a “lower surface [that] forms a sealing surface ... for the button assembly.” As such, a person of ordinary skill in the art would understand that support fixture 721a constitutes a retainer as envisioned by the ’619 patent.

319. Thus, *Jung* in view of *Meyers* renders obvious claim element [11.c.ii].

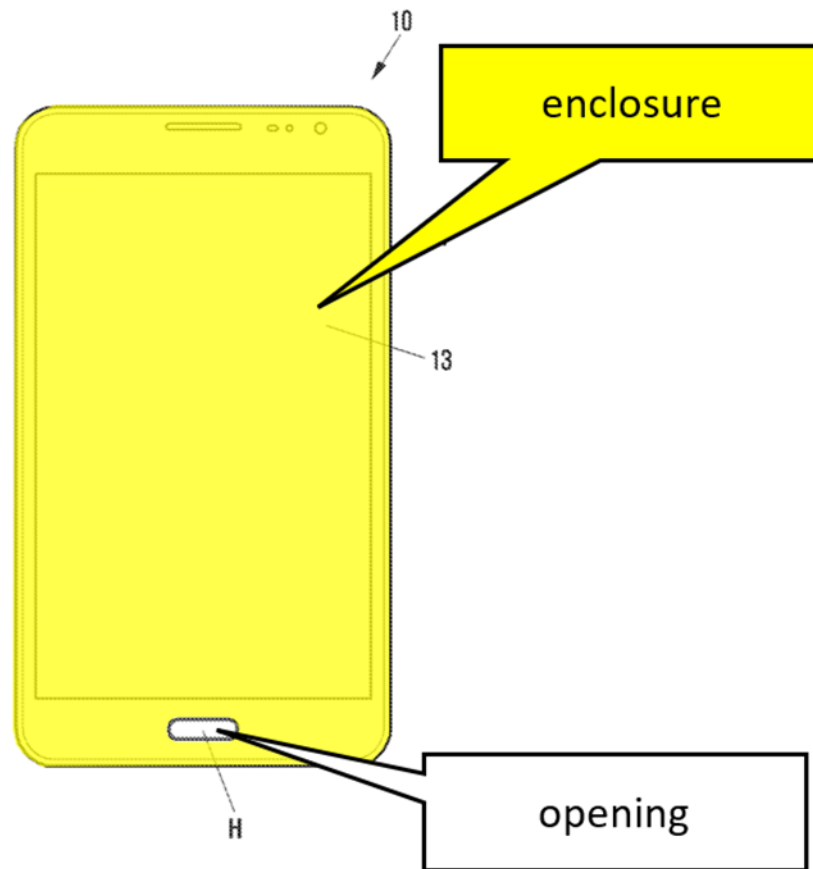
Claim 11, Element [11.d]: a seal disposed between the sealing surface of the retainer and a surface of the opening;

320. *Jung* in view of *Meyers* renders obvious claim element [11.d]. Specifically, *Jung* in view of *Meyers* discloses a seal disposed between the sealing surface of the retainer and a surface of the opening.

321. *Jung* in view of *Meyers* discloses an enclosure defining an enclosed volume and an opening along an exterior surface. *See* claim element [11.a], above.

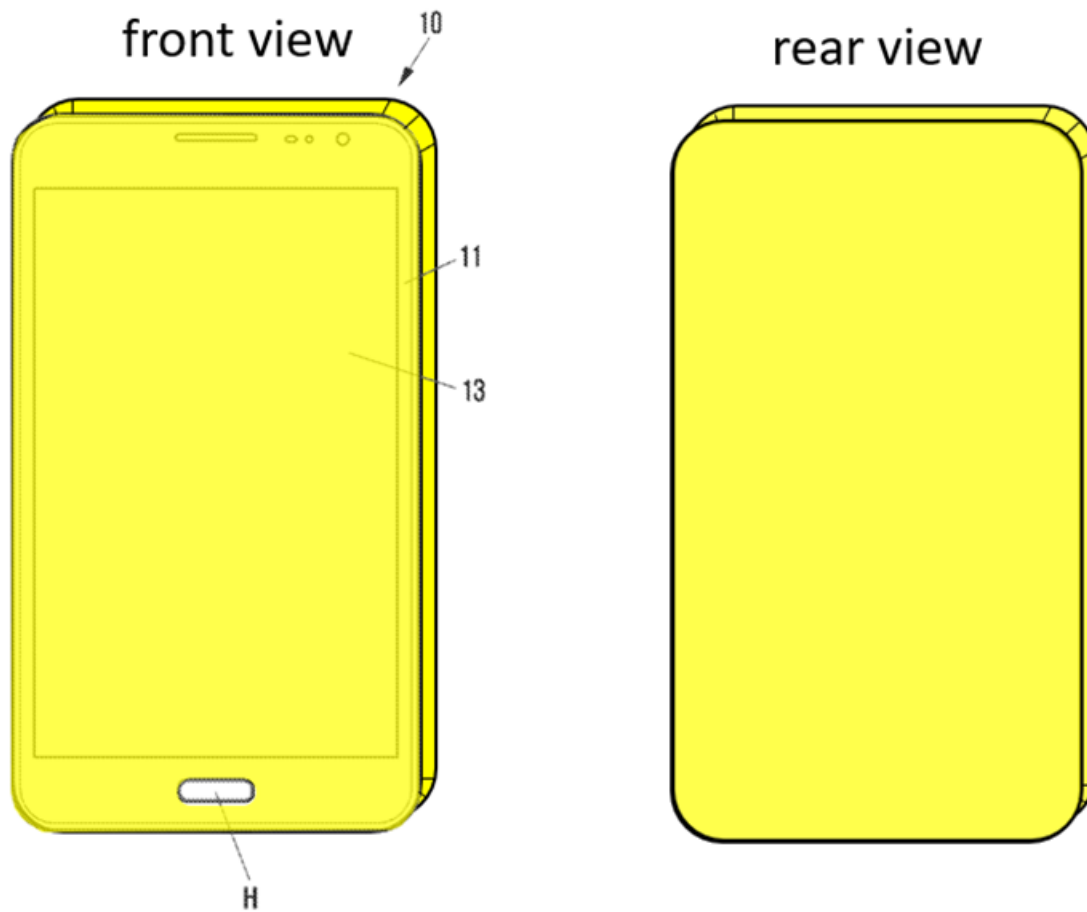
322. As described therein, the opening constitutes a hole in the exterior surface of the enclosure, which is sized so that a button assembly can be inserted therein.

Ex-1005, Fig. 4A



323. Although *Jung* does not explicitly depict the rear of the device, the electronic device is a three-dimensional structure with an enclosed volume, and therefore necessarily has front, side, and rear surfaces. Figure 4A has been annotated, below, to depict the side, and rear surfaces in a three-dimensional orientation:

Ex-1005, Fig. 4A



324. The perimeter of the “opening along an exterior surface” of the enclosure is defined by the perimeter of the opening for home-key “H”, while the depth of the opening is defined by the front and rear surfaces of the enclosure, as depicted above. In other words, a person of ordinary skill in the art would understand that the “opening” is the space that remains in the absence of home-key “H,” bounded by the front and rear surfaces of the electronic device.

325. As discussed above, *Meyers* discloses a button assembly that includes a retainer with a sealing surface (*i.e.*, a button support plate), annotated in blue, below. *See* claim element [11.c.ii], above.

Ex-1007, Fig. 1

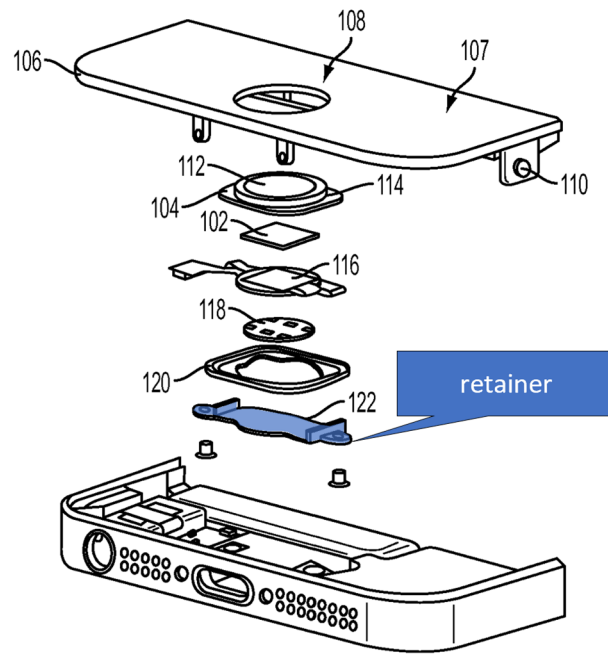
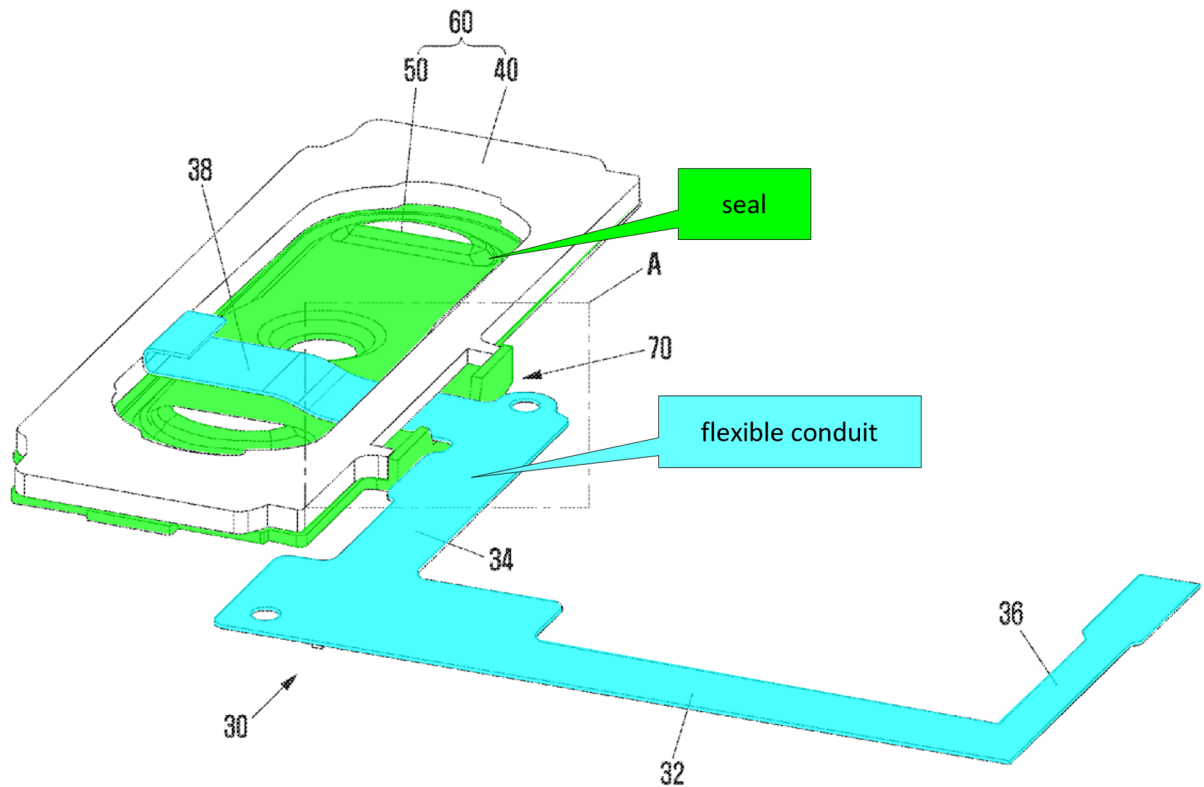


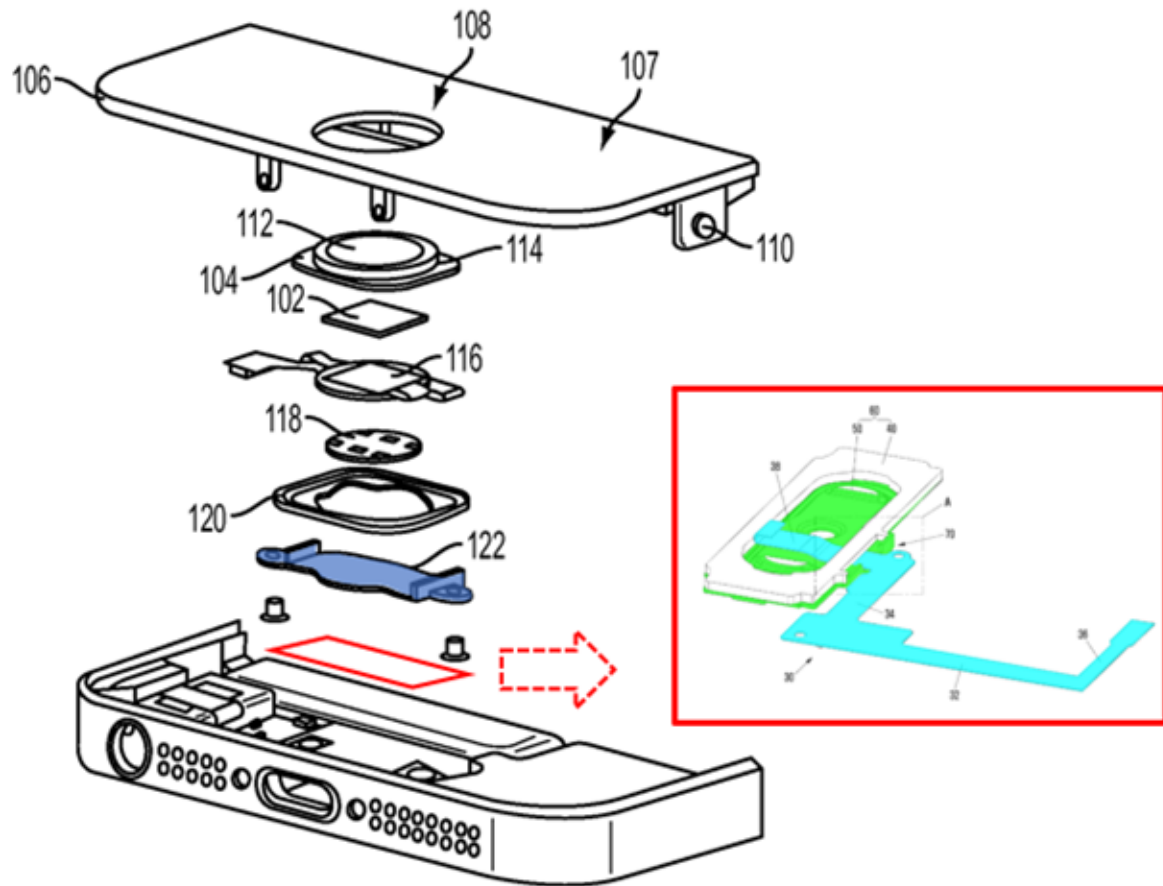
FIG. 1

326. Likewise, *Jung* Figure 10, below, depicts bracket 40 and silicon rubber 50 (the “seal”) in green.

Ex-1005, Fig. 10



327. When assembled, the button assembly of *Meyers* is inserted into the opening of the bracket 40, and rests on top of (1) the key bonding portion 38 of flexible printed circuit board 30 and (2) the silicon rubber 50 (green). In this configuration, the sealing surface button support plate 122 of *Meyers* is adjacent the silicon rubber 50 of *Jung*.



328. Thus, the seal is located between the button support plate (*i.e.*, the sealing surface of the retainer) and the surface of the opening in the enclosure defined by the rear side of the enclosure. Because the entire key waterproofing structure disclosed by *Jung* is located *inside* of the enclosure and the enclosure surrounds the button assembly, the seal is necessarily located between the bracket and the portion of the enclosure defining the rear of the electronic device.

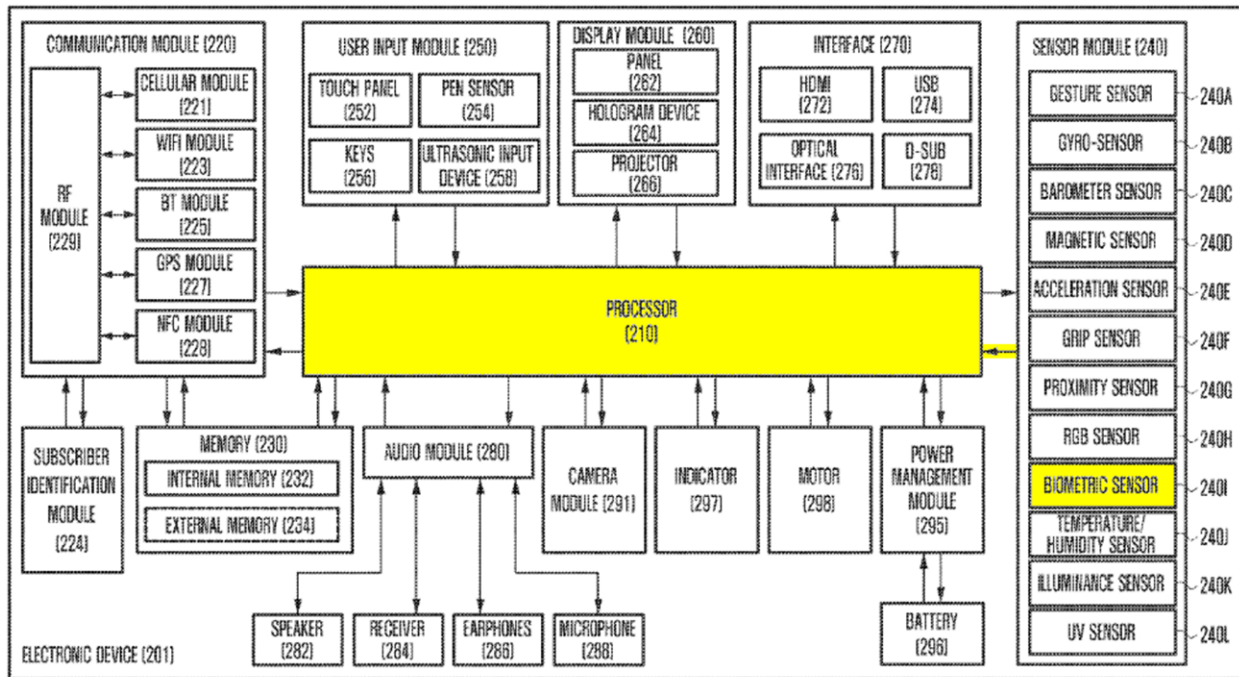
329. Thus, *Jung* in view of *Meyers* renders obvious claim element [11.d].

Claim 11, Element [11.e]: a passage extending from the opening to the enclosed volume;

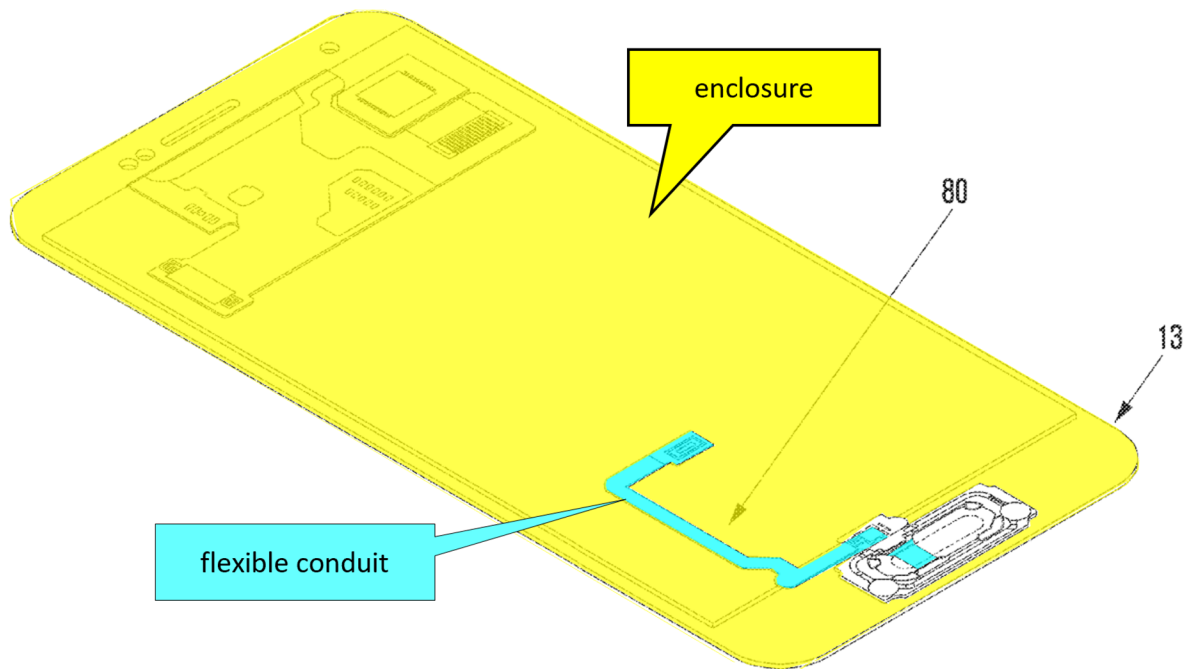
330. *Jung* in view of *Meyers* renders obvious claim element [11.e]. Specifically, *Jung* discloses a passage extending from the opening to the enclosed volume.

331. *Jung* discloses “an enclosure defining an enclosed volume and an opening along an exterior surface.” See claim element [11.a], above. Likewise, *Jung* discloses “a flexible conduit electrically connecting the fingerprint sensor to the processor.” See claim elements [11.b], [11.f]. As explained therein, the processor of *Jung* (located inside of the enclosed volume) is shown to be in communication with the biometric sensor (located in the opening of the enclosed volume). Likewise, *Jung* discloses a “flexible printed circuit board 30” that includes a “key bonding portion 38 ... to which the oval home-key H is bonded” (Ex. 1005, [0098], Fig. 10). Figure 2 of *Jung*, below, also shows the processor in communication with the biometric sensor.

Ex. 1005, Fig. 2



332. Given that the flexible printed circuit board 30 of *Jung* provides for communication between the processor and the biometric sensor, it passes from the opening of the enclosed volume (where the biometric sensor is located) into the enclosed volume (where the processor is located). This configuration is depicted in Figure 12 of *Jung*, below:



333. As depicted in Figure 12, the flexible conduit (teal) extends through a passageway from the opening (uncolored) in the outer wall of the enclosure (yellow) into the enclosed volume of the device.

334. Thus, *Jung* in view of *Meyers* discloses claim element [11.e].

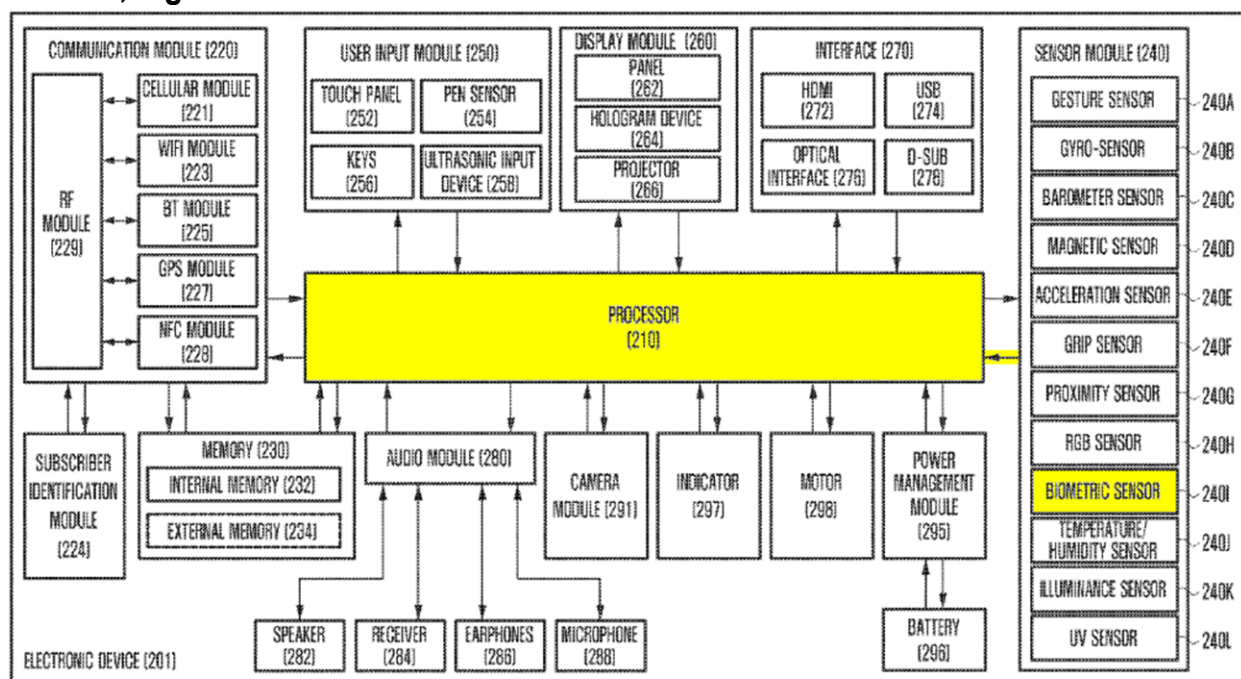
Claim 11, Element [11.f]: a flexible conduit electrically connecting the fingerprint sensor to the processor; wherein:

335. *Jung* in view of *Meyers* renders obvious claim element [11.f]. Specifically, *Jung* discloses a flexible conduit electrically connecting the fingerprint sensor to the processor.

336. *Jung* discloses a “flexible printed circuit board 30 [that] may be shaped into a long and narrow band, and may include a central vertical portion 32, and the first bent portion 34 and the second bent portion 36, which are bent in the same direction at both ends of the vertical portion 32. In addition, a key bonding portion 38 may be attached to a free end of the first bent portion 34 in the vertical direction, to which the oval home-key H is bonded” (Ex-1005, [0098], Fig. 10).

337. Figure 2 of *Jung*, below, also shows the processor in communication with the biometric sensor.

Ex-1005, Fig. 2



338. As such, *Jung* discloses a flexible conduit (*i.e.*, flexible printed circuit board 30) coupled to home-key H and configured to transmit the output signal to the processor. A person of ordinary skill in the art would understand that substituting

the button assembly of *Meyers* in place of home-key H (for the reasons disclosed above with respect to motivation to combine) would result in the flexible conduit being coupled (directly or indirectly) to the biometric sensor disposed in the *Meyers* button assembly, so that the output from the fingerprint sensor can reach the processor. A person of ordinary skill in the art would further understand that Figure 2 depicts an electrical connection, such that the biometric sensor 240I will transmit an output signal to the processor 210. Likewise, a person of ordinary skill in the art would understand that this connection is enabled by flexible PCB 30.

339. Taken together, these disclosures show a flexible conduit coupled to a fingerprint sensor, and configured to transmit to the processor. Furthermore, element [11.f] would have been well known to a person of ordinary skill in the art. As I explained earlier in Section VI.A (which is incorporated by reference), a person of ordinary skill in the art would understand that, in order for the flexible conduit to transmit from the fingerprint sensor to the processor (or vice versa), it must be electrically connected to both components.

340. Thus, *Jung* in view of *Meyers* renders obvious claim element [11.f].

Claim 11, Element [11.g]: a portion of the flexible conduit is sandwiched between the seal and the sealing surface of the retainer or between the seal and the surface of the opening.

341. *Jung* in view of *Meyers* renders obvious claim element [11.g]. Specifically, *Jung* discloses a portion of the flexible conduit is sandwiched between

the seal and the sealing surface of the retainer or between the seal and the surface of the opening. This is illustrated in at least the annotated figure, below, which depicts the discloses a portion of the flexible conduit (teal) sandwiched between the seal (green) and the sealing surface (blue).

Ex-1005, Fig. 10; Ex-1007, Fig. 1

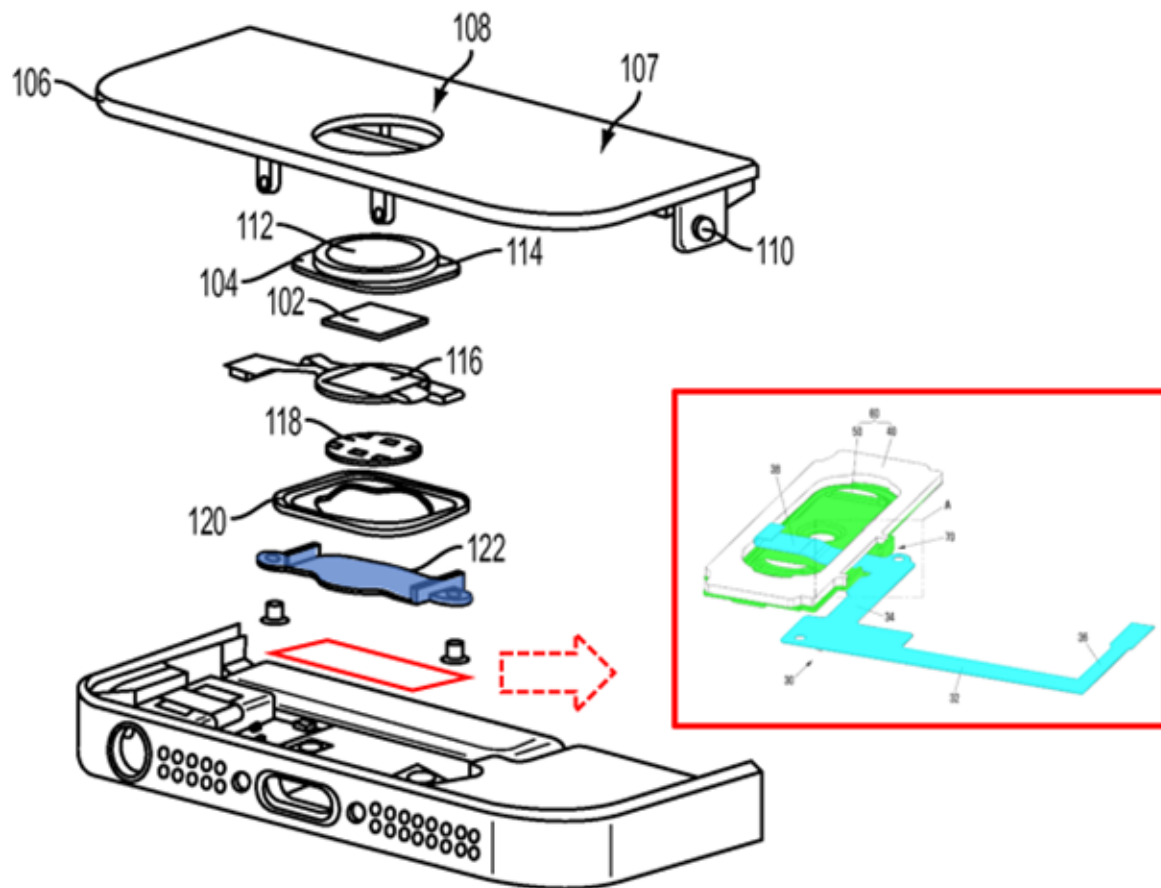


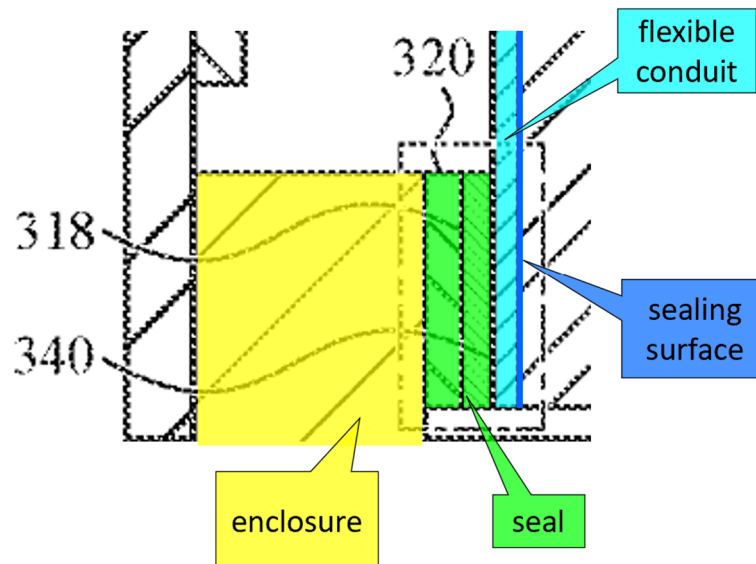
FIG. 1

342. As explained earlier with respect to claim elements [1.a], [1.d], and [1.f] (the discussion of which is incorporated herein), *Jung* discloses the claimed “flexible conduit,” “seal,” and “enclosure.” Furthermore, a person of ordinary skill in the art would understand that when the button assembly of *Meyers* is combined with the waterproof-key assembly of *Jung* (as depicted *Jung*’s Figure 10 and *Meyers*’ Figure 1, annotated above), a portion of the flexible conduit (*i.e.*, *Jung*’s “flexible printed circuit board 30,” teal) is sandwiched between the seal (*i.e.*, *Jung*’s “silicon rubber 50,” green) and the sealing surface (*i.e.*, *Meyers*’ button support plate 122, blue).

343. Indeed, *Jung* in view of *Meyers* discloses “a portion of the flexible conduit is sandwiched between the seal and the sealing surface of the retainer or between the seal and the surface of the opening” the same way as the ’619 patent’s specification. For example, the ’619 patent discloses that “a gasket seal (such as face seal 318) may further be applied below the lower PSA portion, such that ***a sandwich . . . is formed of PSA, flexible conduit 340, PSA, and then the gasket seal***” (Ex-1001, 17:35-46). This is illustrated in at least the ’619 patent’s Figure 3A (excerpted annotated below), which illustrates the “sandwiching.” As another example, the ’619 patent discloses that “sandwiching” includes a “stack” of elements (Ex-1001, 23:39-43 (“In one embodiment, the compressible layer 404 is a heat activated (HAF) silicon sandwich. The HAF silicon sandwich is a stack of the following five

elements: heat activated film, polyimide (PI), silicon, heat activated film and the flexible conduit 440.”)).

Ex-1001, Fig. 3A (excerpted and annotated)



344. Because *Jung* in view of *Meyers* discloses a “stack” of elements including “a portion of the flexible conduit,” a “seal,” and a “sealing surface” of the button assembly, *Jung* in view of *Meyers* discloses “a portion of the flexible conduit is sandwiched between the seal and the sealing surface of the retainer or between the seal and the surface of the opening” the same way as the ’619 patent’s specification.

345. Furthermore, element [11.g] would have been well known to a person of ordinary skill in the art. As I explained earlier in Section VI (which is incorporated by reference), a person of ordinary skill in the art would have known that a common way to electrically connect a biometric sensor (*e.g.*, a fingerprint sensor) and a

processor was with a flexible conduit, such as a flexible printed circuit board (PCB). A person of ordinary skill in the art would also have known that button assemblies and fingerprint sensors in mobile electronic devices should be sealed in order to prevent ingress of potentially damaging moisture and dust. From this, a person of ordinary skill in the art would have been motivated to provide the seal by sandwiching existing, known components, such as a sealing surface of the retainer and flexible conduit. Using these existing, known components would have saved costs and promoted an efficient use of limited space within the mobile device (*see also* Ex. 1015, 12:12-19; Ex. 1011, [0055]; Ex. 1008, 6:67-7:2).

346. Thus, *Jung* in view of *Meyers* discloses claim element [11.g].

Claim 12: The fingerprint sensing system of claim 11, wherein the flexible conduit extends through the passage.

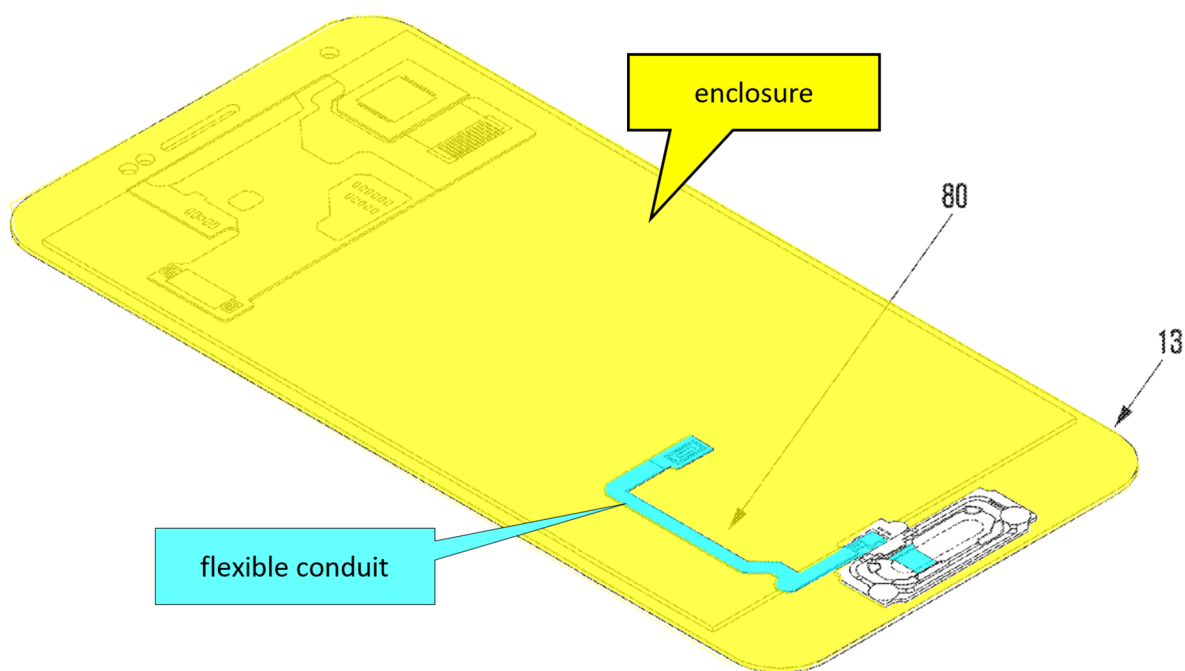
347. *Jung* in view of *Meyers* renders obvious claim 12. Specifically, *Jung* discloses the fingerprint sensing system of claim 11, wherein the flexible conduit extends through the passage.

348. *Jung* in view of *Meyers* renders obvious a passage extending from the opening to the enclosed volume. *See* claim element [11.e].

349. Given that the flexible printed circuit board 30 of *Jung* provides for communication between the processor and the biometric sensor, it passes from the opening of the enclosed volume (where the biometric sensor is located) into the

enclosed volume (where the processor is located). This configuration is depicted in Figure 12 of *Jung*, below:

Ex-1005, Fig. 12



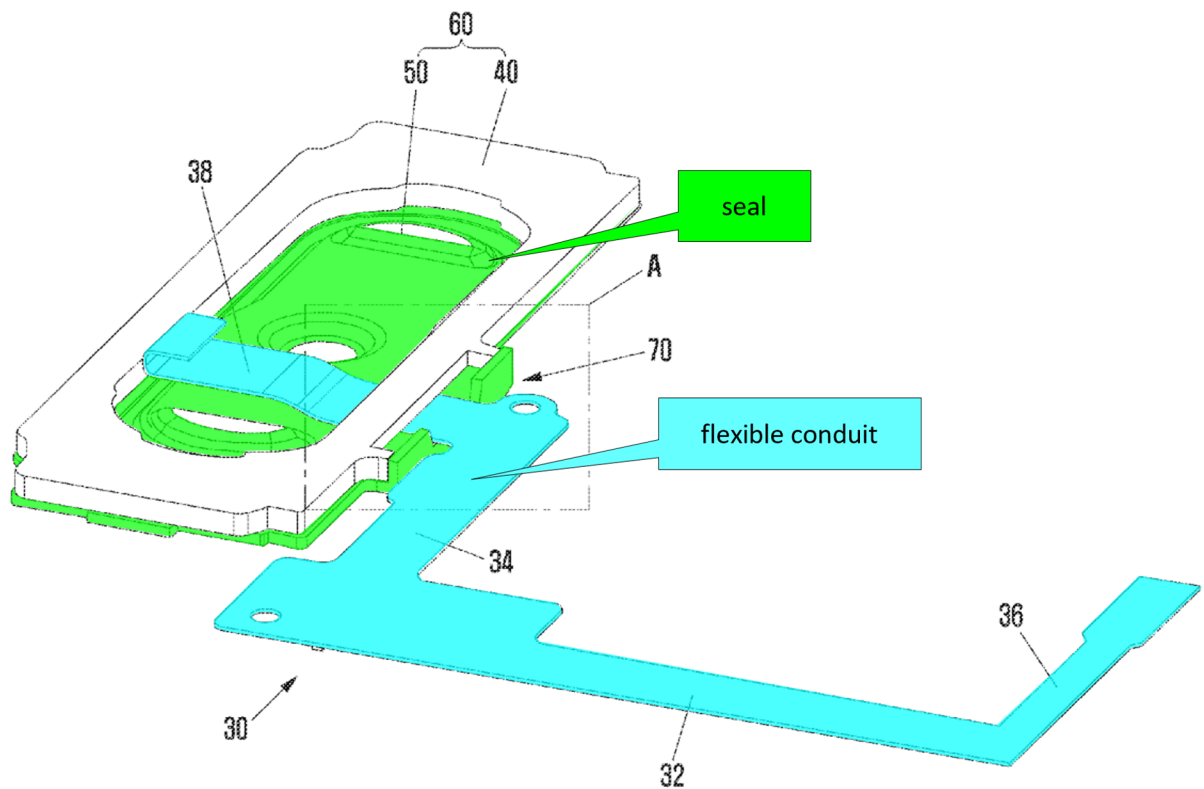
350. The outer wall of the enclosure of *Jung* is depicted in yellow. An opening (uncolored) exists to contain the button assembly. As depicted, the flexible conduit (teal) extends through a passageway from the opening in the outer wall of the enclosure into the enclosed volume of the device.

351. Thus, *Jung* in view of *Meyers* renders obvious claim 12.

Claim 13: The fingerprint sensing system of claim 11, wherein the flexible conduit is coupled to a second flexible conduit that extends through the passage.

352. *Jung* in view of *Meyers* renders obvious claim 13. Specifically, *Jung* in view of *Meyers* discloses the fingerprint sensing system of claim 11, wherein the flexible conduit is coupled to a second flexible conduit that extends through the passage.

353. *Jung* in view of *Meyers* discloses the fingerprint sensing system of claim 11. *See* claim 11. Likewise, *Jung* in view of *Meyers* discloses a flexible conduit that extends through the passage. *See* claim elements [11.f], [12]. The flexible printed circuit board 30 of *Jung* is shown below.



354. *Jung* specifically teaches that the flexible printed circuit board 30 has multiple segments or portions. *Jung* states that “[t]he flexible printed circuit board 30 may be shaped into a long and narrow band, and may include a central vertical portion 32, and the first bent portion 34 and the second bent portion 36, which are bent in the same direction at both ends of the vertical portion 32.” (Ex-1005, [0098]).

355. When discussing the relationship between the various segments of the flexible printed circuit board 30 and the seal, *Jung* explains that “FIG. 10 illustrates the insert-injected product to which the flexible printed circuit board of FIG. 9 has been *assembled* according to an embodiment of the present disclosure” (Ex-1005,

[0113]) (emphasis added). Elsewhere, *Jung* explains that “the key-waterproofing method of the electronic device ... includes the first process of ***assembling the flexible printed circuit board 30 through the silicon-not-attached portion 70*** of the insert-injected product 60” (Ex-1005, [0120]) (emphasis added).

356. Given the disclosures that (1) the flexible PCB contains multiple segments, and (2) the flexible PCB is ***assembled*** through the silicon seal, a person of ordinary skill in the art would understand that *Jung* discloses multiple flexible PCBs which can be combined or assembled together to form the disclosed flexible printed circuit board 30. This combination of multiple flexible PCBs assembled through the silicon seal constitutes a flexible conduit, coupled to a second flexible conduit that extends through the passage.

357. Thus, *Jung* in view of *Meyers* renders obvious claim 13.

Claim 14: The fingerprint sensing system of claim 11, wherein the fingerprint sensor is further configured to detect a touch.

358. *Jung* in view of *Meyers* renders obvious claim 14. Specifically, *Meyers* discloses the fingerprint sensing system of claim 11, wherein the fingerprint sensor is further configured to detect a touch.

359. *Meyers* discloses “the fingerprint sensor is further configured to detect a touch.” For example, *Meyers* discloses:

As described above, while this application primarily describes an assembly in which the fingerprint recognition sensor 102 circuit is

disposed for capacitive coupling to the epidermis of the user's finger, in the context of the invention, there is no particular requirement for any such limitation. For example, the fingerprint recognition sensor 102 circuit might be capacitively coupled, or otherwise electromagnetically coupled, to a subdermal portion of the user's finger. Moreover, the fingerprint recognition sensor 102 circuit might work in combination or conjunction with elements which perform optical sensing, infrared sensing, or other sensing of the user's fingerprint, and which themselves might be coupled either to the epidermis of the user's finger, to a subdermal portion of the user's finger, or to some other feature representative of the user's fingerprint.

(Ex-1007, ¶[0047]).

In one embodiment, the fingerprint recognition sensor 102 includes an integrated circuit, including one or more capacitive plates arranged in a two dimensional (2D) array, each such capacitive plate disposed for collecting at least some fingerprint image information in response to the ridges and valleys of the user's finger at one or more pixels in an array thereof. This has the effect that, while each capacitive plate collects one or more pixels of fingerprint image information in an array thereof, the set of those capacitive plates collectively receives a 2D array of fingerprint image information. For example, a 2D array of fingerprint image information can be used to determine substantial features of the user's fingerprint, which can be used to enroll the user's fingerprint in a database for later use, or which can be compared at a later time against enrolled fingerprint image information to recognize

the user's fingerprint and possibly to authenticate the user in response to that fingerprint image information.

(Ex-1007, ¶[0048]).

360. Notably, *Meyers* explicitly discloses that (1) the fingerprint sensor is a capacitive fingerprint sensor disposed for capacitive coupling to the epidermis of the user's finger, and (2) the fingerprint sensor produces as an output a 2D array of fingerprint information (Ex. 1007, ¶¶[0047]-[0048]). As discussed in section VI.A, above (which is incorporated herein), a person of ordinary skill in the art would understand that a capacitive fingerprint sensor capable of coupling to the epidermis of a user's finger necessarily entails responding to a touch on the input surface. Similarly, a person of ordinary skill in the art would understand that a 2D array of fingerprint information constitutes an output signal corresponding to a biometric characteristic.

361. Thus, *Jung* in view of *Meyers* renders obvious claim 14.

Claim 16, Element [16.pre]: A watch comprising:

362. To the extent that it is found to be limiting, *Jung* in view of *Meyers* renders obvious claim element [16.pre]. Specifically, *Jung* discloses a watch.

363. *Jung* discloses an electronic device, and goes on to explain that:

An electronic device according to the present disclosure may be a device including a communication function. For example, the device corresponds to a combination of at least one of a smartphone, a tablet

personal computer (PC), a mobile phone, a video phone, an e-book reader, a desktop PC, a laptop PC, a netbook computer, a personal digital assistant (PDA), a portable multimedia player (PMP), a digital audio player, a mobile medical device, an electronic bracelet, an electronic necklace, an electronic accessory, a camera, *a wearable device*, an electronic clock, *a wrist watch*, home appliances (for example, an air-conditioner, vacuum, an oven, a microwave, a washing machine, an air cleaner, and the like), an artificial intelligence robot, a television (TV), a digital video disc (DVD) player, an audio device, various medical devices (for example, magnetic resonance angiography (MRA), magnetic resonance imaging (MRI), computed tomography (CT), a scanning machine, a ultrasonic wave device, or the like), a navigation device, a global positioning system (GPS) receiver, an event data recorder (EDR), a flight data recorder (FDR), a set-top box, a TV box (for example, Samsung HomeSync™, Apple TV™, or Google TV™), an electronic dictionary, vehicle infotainment device, an electronic equipment for a ship (for example, navigation equipment for a ship, gyrocompass, or the like), avionics, a security device, *electronic clothes*, an electronic key, a camcorder, game consoles, a head-mounted display (HMD), a flat panel display device, an electronic frame, an electronic album, furniture or a portion of a building/structure that includes a communication function, an electronic board, an electronic signature receiving device, a projector, and the like. It is obvious to those skilled in the art that the electronic device according to the present disclosure is not limited to the aforementioned devices.

(Ex-1005, [0037]) (emphasis added).

364. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.pre].

Claim 16, Element [16.a]: an enclosure defining an enclosed volume and an opening formed in a sidewall;

365. *Jung* in view of *Meyers* renders obvious claim element [16.a]. Specifically, *Jung* discloses an enclosure defining an enclosed volume and an opening formed in a sidewall.

366. This element is substantially similar to claim element [11.a] and [11.c]. As such, I incorporate my analysis with respect to claim element [11.a] and [11.c] herein.

367. *Jung* explicitly acknowledges that the claimed opening may be formed in a sidewall, stating that “[a]lthough the description for the key-waterproof structure of the present disclosure is made of the home-key in the specification, ***other keys for performing various functions rather than the home-key may be applied to the key-waterproof structure of the present disclosure***” (Ex-1005, [0123]) (emphasis added).

368. Furthermore, element [16.a] would have been well known to a person of ordinary skill in the art. As I explained earlier in Section VI.B (which is incorporated by reference), A person of ordinary skill in the art would have understood the key-waterproof structure of *Jung* would be applied to any of the electronic devices disclosed therein (Ex. 1005, [0019], [0037]; claim [11.a]). Therefore, a person of ordinary skill in the art would have understood that the key-

waterproof structure can be applied to one or more keys and/or buttons, including keys located in the sidewall of the electronic device. Indeed, waterproofing keys located in the sidewall of the electronic device was well within the general knowledge of a person of ordinary skill in the art (*see, e.g.*, Ex. 1004, 13:46-53, 17:10-12; Ex. 1022, ¶¶89, 166).

369. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.a].

Claim 16, Element [16.b]: a processor disposed in the enclosed volume;

370. *Jung* in view of *Meyers* renders obvious claim element [16.b]. Specifically, *Jung* discloses a processor disposed in the enclosed volume.

371. This element is substantially similar to claim element [11.b]. As such, I incorporate my analysis with respect to claim element [11.b] herein.

372. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.b].

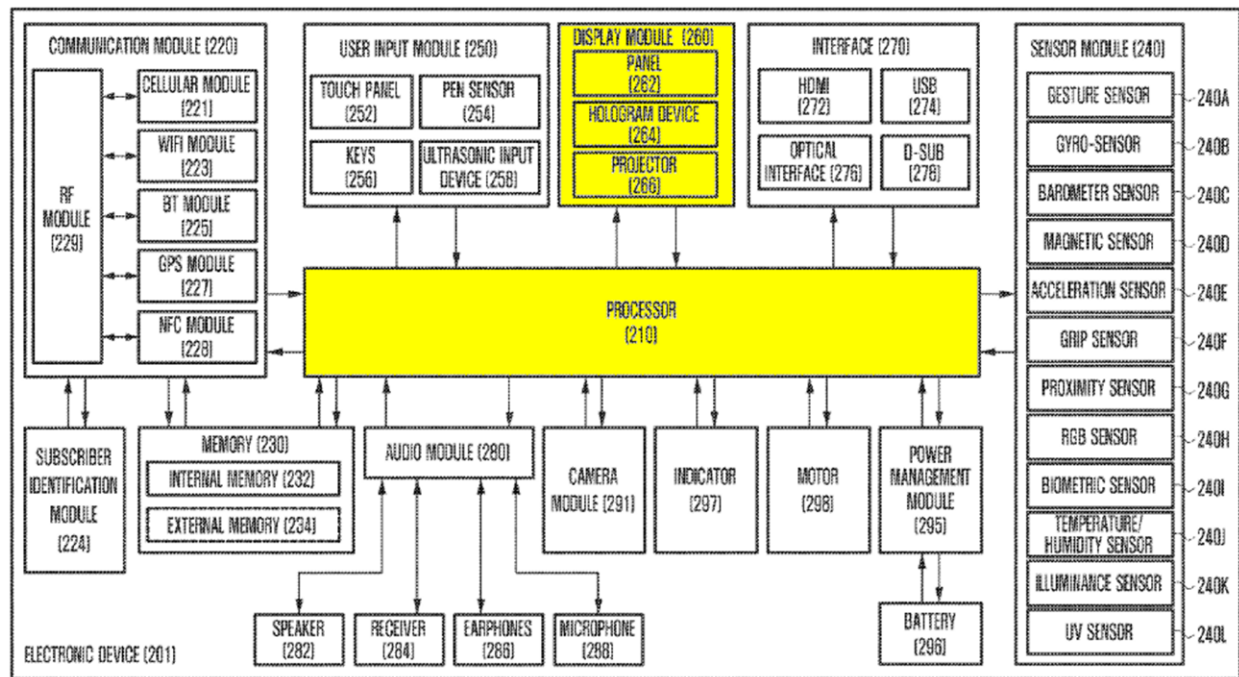
Claim 16, Element [16.c]: a display positioned within the enclosure and operably coupled to the processor;

373. *Jung* in view of *Meyers* renders obvious claim element [16.c]. Specifically, *Jung* discloses a display positioned within the enclosure and operably coupled to the processor.

374. *Jung* discloses a device that “includes a body, [and] a display device disposed in the body” (Ex-1006, [0012]).

375. *Jung* also teaches that the display is operably coupled to the processor.

Ex-1005, Fig. 2



376. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.c].

Claim 16, Element [16.d]: a watchband attached to the enclosure and configured to couple the watch to a user;

377. *Jung* in view of *Meyers* renders obvious claim element [16.d]. Specifically, *Jung* discloses a watchband attached to the enclosure and configured to couple the watch to a user.

378. *Jung* discloses an electronic device, wherein the electronic device is a smart watch. See claim element [16.pre], above. A person of ordinary skill in the art would understand that a smart watch necessarily includes a watchband attached to the outer surface of the watch (*i.e.*, the “enclosure”) and configured to couple the watch to the user.

379. Moreover, a person of ordinary skill in the art would have understood that a watch includes a watchband. Given that the claimed enclosure constitutes the outer surface of the electronic device, it would be obvious to one of ordinary skill in the art to connect the watchband of the disclosed watch to the enclosure of the electronic device. Likewise, a person of ordinary skill in the art would understand that the purpose of a watchband is to couple the watch to the user.

380. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.d].

Claim 16, Element [16.e]: a button assembly disposed within the opening, the button assembly comprising: a button housing; an input member with an input surface; a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint; a touch sensor configured to detect the touch; a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor; and

381. *Jung* in view of *Meyers* renders obvious claim element [16.e]. Specifically, *Meyers* discloses a button assembly disposed within the opening.

382. This element is substantially similar to claim element [11.c]. As such, I incorporate my analysis with respect to claim element [11.c] herein.

383. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e]

384. Claim element [16.e] contains five sub-elements, discussed in turn below.

(i) Claim 16, Element [16.e.i]: a button assembly disposed within the opening, the button assembly comprising: . . . a button housing;

385. *Jung* in view of *Meyers* renders obvious claim element [16.e.i]. Specifically, *Meyers* discloses a button housing.

386. The button housing of *Meyers* is depicted in an expanded view, below. The exterior of the housing is comprised in large part by button 104, lens 112, ground ring 114, and button support plate 122. *Meyers* teaches “[t]he button 104 includes a lens 112, at least a portion of the lens 112 helping to form a recessed shape, with the effect of guiding the user’s finger onto the button 104” (Ex-1007, ¶[0044]).

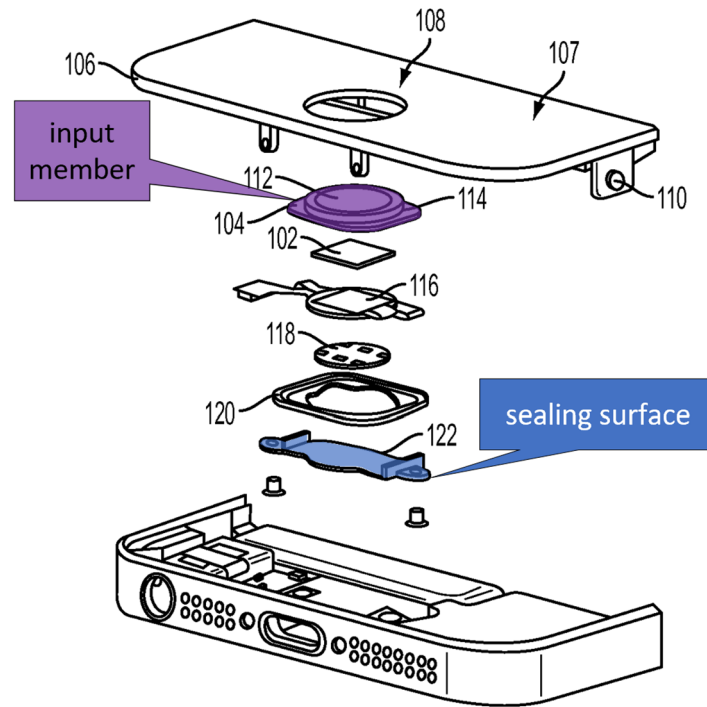


FIG. 1

387. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e.1]

- (ii) **Claim 16, Element [16.e.ii]: a button assembly disposed within the opening, the button assembly comprising: . . . an input member with an input surface;**

388. *Jung* in view of *Meyers* renders obvious claim element [16.e.ii].

Specifically, *Meyers* discloses an input member with an input surface.

389. This element is substantially similar to claim element [11.c]. As such, I incorporate my analysis with respect to claim element [11.c] herein.

390. The button assembly of *Meyers* includes a button 104 (*i.e.*, an input member) that includes a lens 112 (*i.e.*, an input surface) that helps to guide the user's finger onto the button 104. The input member having an input surface of *Meyers* is depicted in purple in annotated Figure 1, below.

Ex-1007, Fig. 1

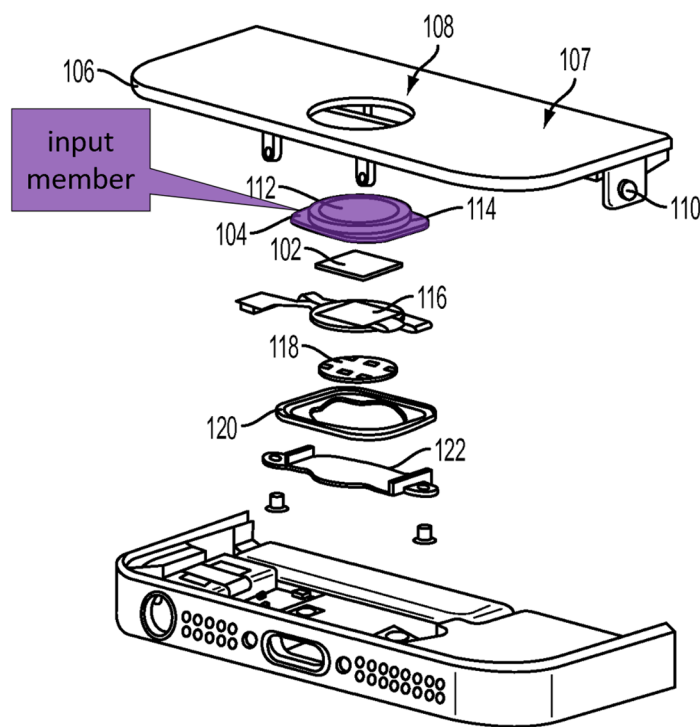


FIG. 1

391. Specifically, *Meyers* teaches that “[t]he button hole 108 in the cover glass frame 106 is disposed to hold a button 104 (which can form a top element of a push button, as described below), as shown in the figure. The button 104 is disposed to fit into the button hole 108. The button 104 includes a lens 112, at least a portion

of the lens 112 helping to form a recessed shape, with the effect of guiding the user's finger onto the button 104" (Ex-1007, ¶[0044]).

392. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e.ii].

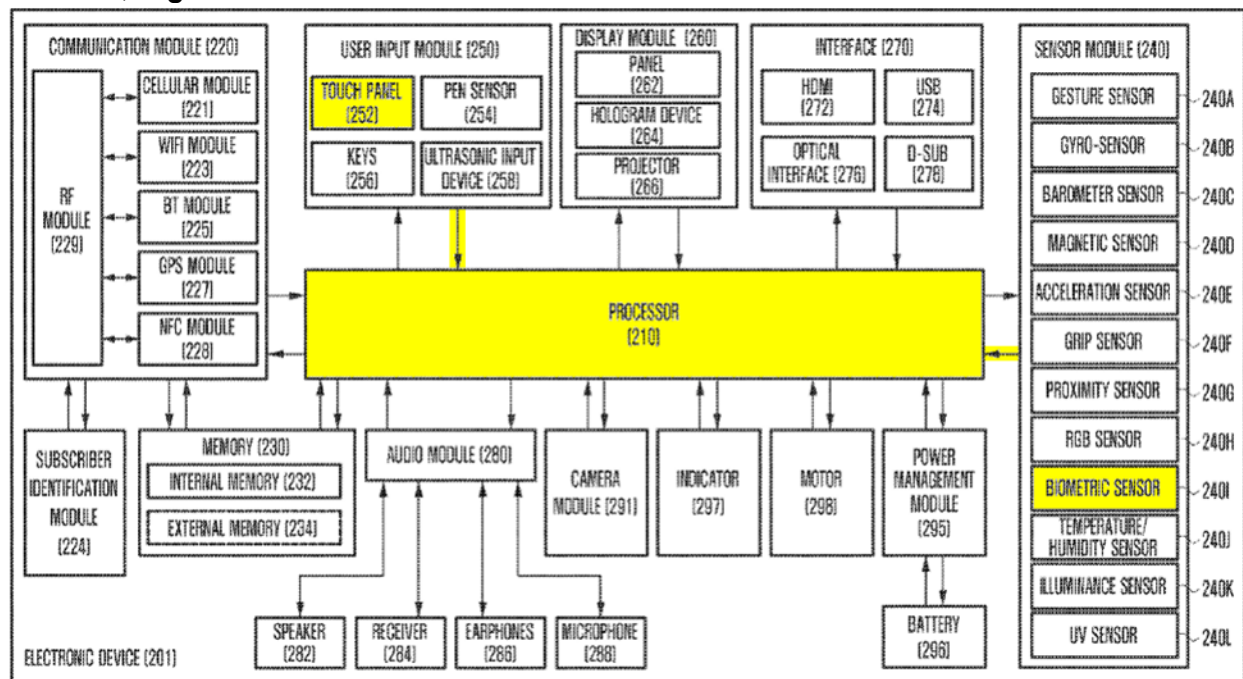
(iii) Claim 16, Element [16.e.iii]: a button assembly disposed within the opening, the button assembly comprising: . . . a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint;

393. *Jung* in view of *Meyers* renders obvious claim element [16.e.iii]. Specifically, *Meyers* discloses a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint.

394. This element is substantially similar to claim elements [11.c.i] and 14. As such, I incorporate my analysis with respect to claim elements [11.c.i] and 14 herein.

395. *Jung*, meanwhile, discloses a biometric sensor connected to a processor. Specifically, annotated Figure 2, below, shows that the biometric sensor is connected to a processor (Ex-1005, Fig. 2). In turn, it further discloses that user input to the biometric sensor may be provided via a touch panel.

Ex-1005, Fig 2



396. *Jung* explains that:

The sensor module 240 may include, for example, at least one of a gesture sensor 240A, a gyro sensor 240B, a barometer sensor 240C, a magnetic sensor 240D, an acceleration sensor 240E, a grip sensor 240F, a proximity sensor 240G, a red, green and blue (RGB) sensor 240H, a biometric sensor 240I, a temperature/humidity sensor 240J, an illuminance sensor 240K, and a ultra violet (UV) sensor 240L. The sensor module 240 may measure a physical quantity or may sense an operating state of the electronic device 101, and may convert the measured or sensed information to an electrical signal. Additionally/alternatively, the sensor module 240 may include, for example, an E-nose sensor (not illustrated), an electromyography (EMG) sensor (not illustrated), an electroencephalogram (EEG) sensor

(not illustrated), an electrocardiogram (ECG) sensor (not illustrated), *a fingerprint sensor (not illustrated)*, and the like. Additionally or alternatively, the sensor module 240 may include, for example, an E-nose sensor (not illustrated), an EMG sensor (not illustrated), an EEG sensor (not illustrated), an ECG sensor (not illustrated), a fingerprint sensor, and the like. The sensor module 240 may further include a control circuit (not illustrated) for controlling one or more sensors included therein.

(Ex-1005, [0060]).

397. Elsewhere, *Jung* explicitly discloses that “[t]he processor 210 may control the sensor module 240” (Ex-1005, [0070]).

398. Indeed, *Jung* in view of *Meyers* discloses “a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface” the same way as the ’619 patent’s specification. For example, the ’619 patent discloses that the “biometric sensor” includes a “fingerprint” sensor, and “biometric characteristic” includes a “fingerprint”:

“Biometric sensor,” as used herein, may be used to refer to a sensor that can identify or determine a human physical characteristic. The sensed human physical characteristic may vary widely, but may include fingerprint, palm veins, DNA, heart rate, and blood pressure. A capacitive biometric sensor may sense fingerprint characteristics of a

user touch that may be used to provide a fingerprint identification of the user. . . .

A “biometric characteristic” or a “biometric identifier,” as used herein, may refer to a human characteristic that is so distinctive and measureable that a particular human individual may be identified.

Fingerprints and DNA are example biometric characteristics.

(Ex-1001, 4:51-5:14 (emphasis added)).

399. Because *Jung* in view of *Meyers* discloses a capacitive fingerprint sensor that can sense a fingerprint, *Jung* in view of *Meyers* discloses “a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface” the same way as the ’619 patent’s specification.

400. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e.iii].

(iv) Claim 16, Element [16.e.iv]: a button assembly disposed within the opening, the button assembly comprising: . . . a touch sensor configured to detect the touch;

401. *Jung* in view of *Meyers* renders obvious claim element [16.e.iv]. Specifically, *Meyers* discloses a touch sensor configured to detect the touch.

402. *Jung* in view of *Meyers* discloses a capacitive fingerprint sensor embedded into the button assembly, wherein the fingerprint sensor is further configured to detect a touch. *See, e.g.*, claim elements [11.c.i], 14, above. As such, I incorporate my analysis with respect to claim elements [11.c.i], 14 herein. Because

a capacitive fingerprint sensor functions by detecting minor electrical changes when the ridges of a fingerprint contact the sensor, a person of ordinary skill in the art would understand that the implementation of a capacitive fingerprint sensor necessarily entails a touch sensor configured to detect the touch.

403. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e.iv].

(v) **Claim 16, Element [16.e.v]: a button assembly disposed within the opening, the button assembly comprising: . . . a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor;**

404. *Jung* in view of *Meyers* renders obvious claim element [16.e.v]. Specifically, *Jung* discloses a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor.

405. This element is substantially similar to claim element [11.f]. As such, I incorporate my analysis with respect to claim element [11.f] herein. A person of ordinary skill in the art would further understand that *Jung*'s Figure 2 depicts an electrical connection, such that the biometric sensor 240I will transmit an output signal to the processor 210. Likewise, a person of ordinary skill in the art would understand that this connection is enabled by flexible PCB 30.

406. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.e.v].

Claim 16, Element [16.f]: a seal positioned between the button housing and a surface of the opening;

407. *Jung* in view of *Meyers* renders obvious claim element [16.f]. Specifically, *Jung* in view of *Meyers* discloses a seal disposed between the sealing surface of the retainer and a surface of the opening.

408. As discussed above, the “button housing” constitutes the exterior structure of the button assembly discussed in claim element [16.e.iv]. Moreover, as described with respect to previous claims, *Jung* in view of *Meyers* explicitly discloses a seal positioned between the lower surface of the button housing (*i.e.*, the retainer), and the portion of the enclosure defining a surface of the opening. *See*, claim element [11.d].

409. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.f].

Claim 16, Element [16.g]: wherein a portion of the flexible conduit is sandwiched between the seal and the button housing or between the seal and the surface of the opening.

410. *Jung* in view of *Meyers* renders obvious claim element [16.g]. Specifically, *Jung* discloses wherein a portion of the flexible conduit is sandwiched between the seal and the button housing or between the seal and the surface of the opening.

411. As discussed above, the “button housing” constitutes the exterior structure of the button assembly discussed in claim element [16.e.iv]. As shown above, *Jung* in view of *Meyers* explicitly discloses a portion of the flexible conduit

sandwiched between the seal and the lower surface of the button housing (*i.e.*, the retainer). This element is substantially similar to claim element [11.g]. As such, I incorporate my analysis with respect to claim element [11.g] herein.

412. Thus, *Jung* in view of *Meyers* renders obvious claim element [16.g].

Claim 17, Element [17.pre]: The watch of claim 16, further comprising:

413. *Jung* in view of *Meyers* renders obvious claim element [17.pre].

Specifically, *Jung* discloses the watch of claim 16. *See* claim 16, above.

Claim 17, Element [17.a]: a passage extending from the opening to the enclosed volume; wherein

414. *Jung* in view of *Meyers* renders obvious claim element [17.a].

Specifically, *Jung* discloses a passage extending from the opening to the enclosed volume.

415. This element is substantially similar to claim element [11.e]. As such, I incorporate my analysis with respect to claim [11.e] herein.

416. Thus, *Jung* in view of *Meyers* renders obvious claim element [17.a].

Claim 17, Element [17.b]: the flexible conduit extends from the opening to the enclosed volume through the passage.

417. *Jung* in view of *Meyers* renders obvious claim element [17.b].

Specifically, *Jung* discloses the flexible conduit extends from the opening to the enclosed volume through the passage.

418. This element is substantially similar to claim 12. As such, I incorporate my analysis with respect to claim 12 herein.

419. Thus, *Jung* in view of *Meyers* renders obvious claim element [17.b].

Claim 19: The watch of claim 16, further comprising a compressible layer disposed below the fingerprint sensor, the compressible layer compressing to receive a displacement or a deflection of the input member upon receipt of a user force to the input surface.

420. *Jung* in view of *Meyers* renders obvious claim 19. Specifically, *Meyers* discloses the watch of claim 16, further comprising a compressible layer disposed below the fingerprint sensor, the compressible layer compressing to receive a displacement or a deflection of the input member upon receipt of a user force to the input surface.

421. *Meyers* teaches that “the fingerprint recognition circuit is disposed above and coupled to a flexible element 116, ***the flexible element 116 being disposed both to receive any force imposed by the user’s finger on the button 104, and to transmit that force to a tactile dome switch 118***” (Ex-1007, ¶[0049]) (emphasis added). Flexible element 116 (*i.e.*, the compressible layer) is identified by the red box, below, and is depicted below fingerprint sensor 102 (red):

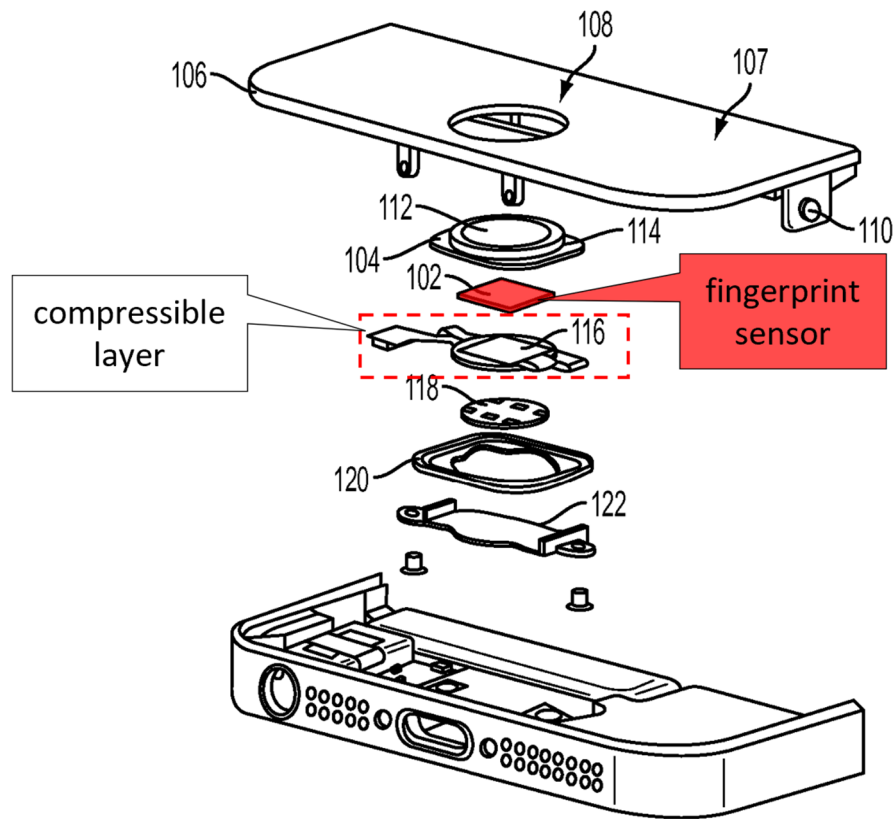


FIG. 1

422. A person of ordinary skill in the art would understand that when a user places a force on the input member, it causes flexible element 116 to be compressed and transmit that force to the tactile dome switch 118.

423. Thus, *Jung* in view of *Meyers* renders obvious claim 19.

Claim 20: The watch of claim 16, further comprising an electrical isolation sheet disposed between the button housing and the enclosure.

424. *Jung* in view of *Meyers* renders obvious claim 20. Specifically, *Jung* discloses the watch of claim 16, further comprising an electrical isolation sheet disposed between the button housing and the enclosure.

425. *Meyers* teaches the use of a ground ring 114 that can be used to shield electromagnetic effects, and provide capacitance isolation or other electromagnetic isolation. Specifically, *Meyers* states that:

The button 104 is disposed to fit into the button hole 108. The button 104 includes a lens 112, at least a portion of the lens 112 helping to form a recessed shape, with the effect of guiding the user's finger onto the button 104. The recessed shape may likewise be at least partially formed by a chamfer in the ground ring. ... The lens 112 is disposed within a ground ring 114. In one embodiment, ***the ground ring 114 can be used to shield electromagnetic effects, with the effect of providing capacitance isolation or other electromagnetic isolation.*** The ground ring 114 is shown in the figure as having a cylindrical edge which holds the lens 112, and a base plate which can be aligned or oriented within the device 100 when the assembly is constructed"

(Ex-1007, ¶[0044]) (emphasis added).

426. *Meyers* explicitly teaches that the ground ring 114 has a base plate (or sheet) that can be aligned with the electrical device. Thus, *Jung* in view of *Meyers* discloses claim 20.

427. Furthermore, claim 20 would have been well known to a person of ordinary skill in the art. As I explained earlier in Section VI (which is incorporated by reference), a person of ordinary skill in the art would have understood that use of electrical isolation techniques are beneficial to prevent interference with the sensitive electronic components disposed in the button assembly of *Meyers*. Likewise, a person of ordinary skill in the art would have understood that installing an electrical isolation sheet in place of (or in addition to) the ground ring 114 of *Meyers* would increase the effectiveness of the ground ring's electrical isolation capabilities.

428. Thus, *Jung* in view of *Meyers* renders obvious claim 20.

D. Ground 4: *Chang* Anticipates and/or Renders Obvious Claims 11-17, 19 of the '619 patent.

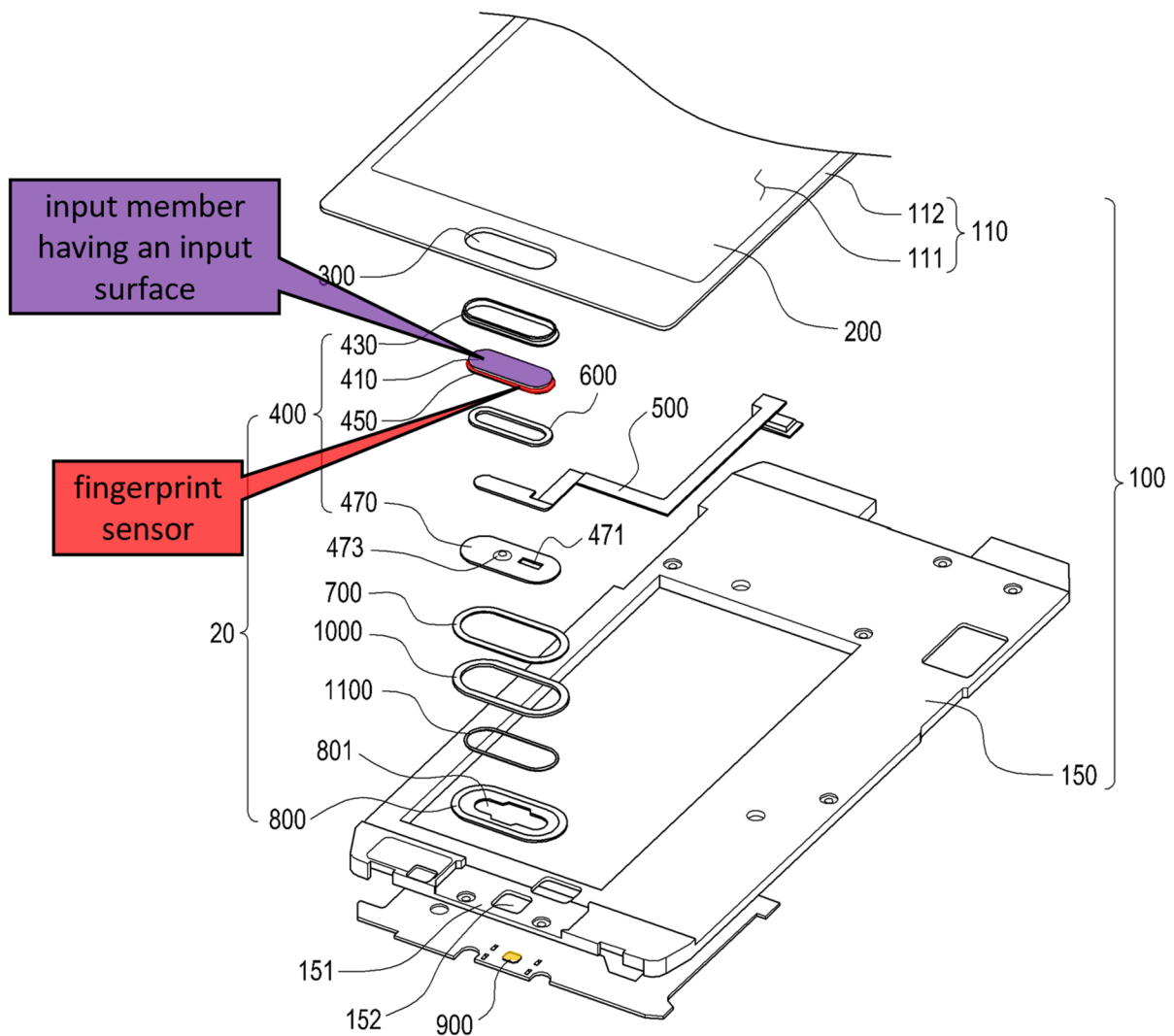
429. *Chang* anticipates and/or renders obvious claims 11-17, 19 of the '619 patent.

Claim 11, Element [11.pre]: A fingerprint sensing system for a wearable device comprising:

430. To the extent that it is found to be limiting, *Chang* discloses claim element [11.pre]. Specifically, *Chang* discloses a fingerprint sensing system for a wearable device.

431. *Chang* discloses that the “button structure 400” includes a fingerprint sensor (red) positioned below the input member (purple). This is illustrated in at least *Chang’s* Figure 3 (annotated below) and is described in further detail as follows.

Ex-1015, Fig. 3



432. *Chang* discloses “a fingerprint sensor.” For example, *Chang* teaches that the disclosed button assembly “may include a fingerprint recognizing member

450” (Ex-1015, 9:59-63). Likewise, *Chang* discloses a fingerprint recognizing member 450 (*i.e.* “biometric sensor”) comprising “a fingerprint recognizing pad including a plurality of conductive lines formed ***to recognize a fingerprint***” (*i.e.*, “biometric characteristic”) (Ex-1015, 1:58-2:24) (emphasis added). *Chang* further discloses that the fingerprint recognizing member is configured to produce an output signal, stating that: “[w]ith this bonding, the flexible conductive member 500 and the circuit region 453 may be electrically connected to each other, and ***may transfer a signal or a pressure, which is transferred from the fingerprint recognizing member 450, to the inside of the electronic device 10***” (Ex-1015, 13:1-10). A person of ordinary skill in the art would have understood that the “signal” discussed herein is an electrical signal that represents the fingerprint recognized by the fingerprint recognizing pad. *Chang* also discloses that the fingerprint recognizing member responds to a touch, stating that: “***[i]n order to recognize only a fingerprint, the operation of the electronic device 10 may be performed merely by a touch*** without transferring a pressure to the button structure 400 by the user” (Ex-1015, 11:43-59 (emphasis added)).

433. *Chang* further discloses that its fingerprint sensing system is suitable for various electronic devices, including but not limited to a wearable device such as a watch:

An electronic device according to various embodiments of the present disclosure may include at least one of, for example, a smart phone, a tablet Personal Computer (PC), a mobile phone, a video phone, an electronic book reader (e-book reader), a desktop PC, a laptop PC, a netbook computer, a workstation, a server, a Personal Digital Assistant (PDA), a Portable Multimedia Player (PMP), a MPEG-1 audio layer-3 (MP3) player, a mobile medical device, a camera, and a wearable device. According to various embodiments, *the wearable device may include at least one of an accessory type (e.g., a watch, a ring, a bracelet, an anklet, a necklace, a glasses, a contact lens, or a Head-Mounted Device (HMD)), a fabric or clothing integrated type (e.g., an electronic clothing), a body-mounted type (e.g., a skin pad, or tattoo), and a bio-implantable type (e.g., an implantable circuit), or the like, but is not limited thereto.*

(Ex-1015, 5:5-20) (emphasis added).

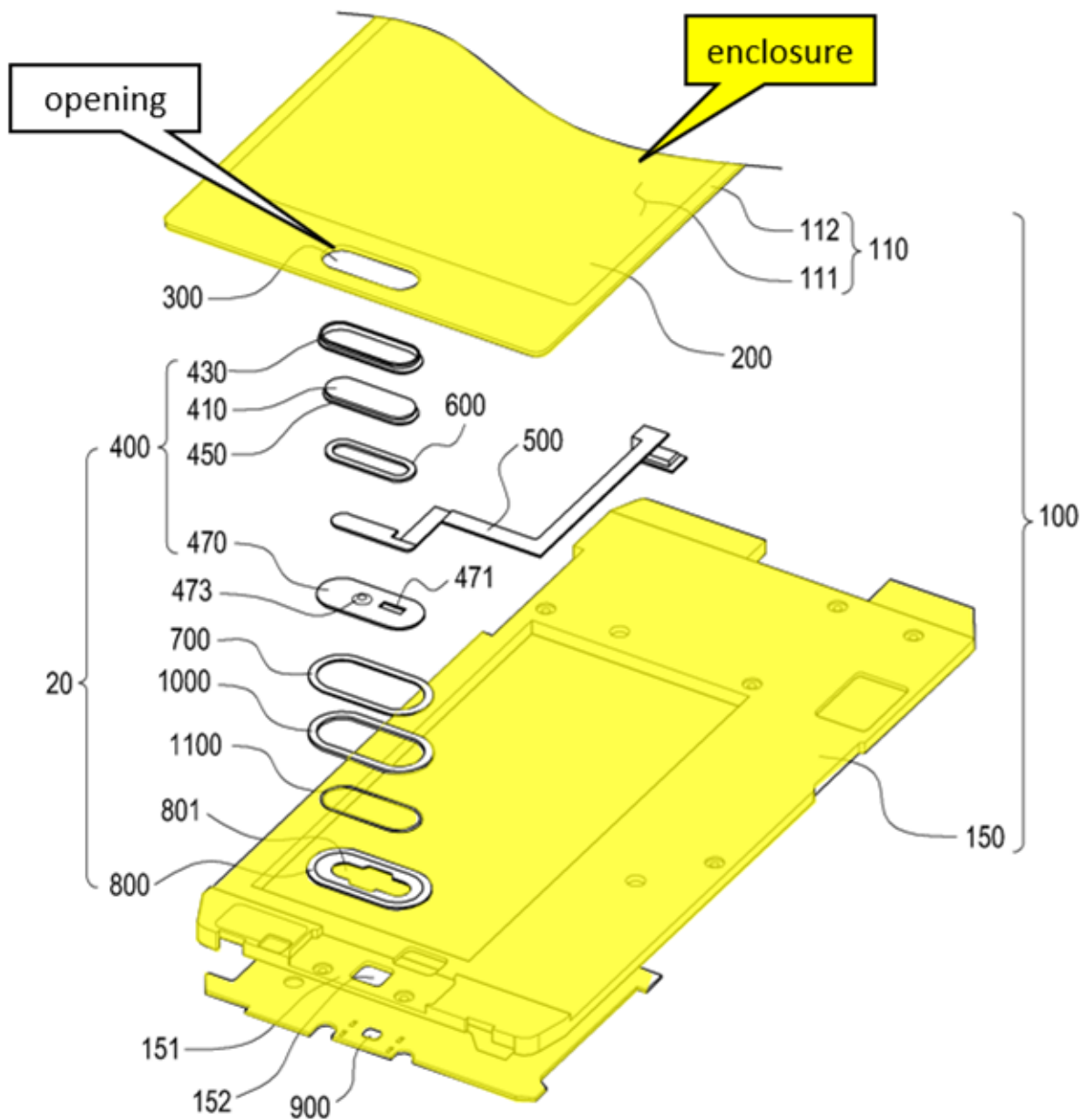
434. Thus, *Chang* discloses claim element [11.pre].

Claim 11, Element [11.a]: an enclosure defining an enclosed volume and an opening along an exterior surface:

435. *Chang* discloses claim element [11.a]. Specifically, *Chang* discloses an enclosure defining an enclosed volume and an opening along an exterior surface.

436. *Chang's* Figure 3, (annotated below) depicts an enclosure defining an enclosed volume and an opening along an exterior surface.

Ex-1015, Fig. 3



437. First, *Chang* discloses an enclosure having an enclosed volume and an opening. For example, *Chang* recites “[a]s illustrated in FIGS. 1 to 3, the electronic device 10 of the present disclosure may include a housing 100, a display 200, a first

opening 300, and a key module 20” located in the first opening 300 (Ex-1015, 7:35-40).

438. *Chang* explicitly teaches that the housing 100 constitutes an enclosure defining an enclosed volume:

According to an example embodiment, the housing 100 may include a first plate 110 disposed to face in a first direction, a second plate 130 disposed to face in a second direction that is opposite to the first direction, and a side member 150 disposed between the first plate 110 and the second plate 130.

For example, the first plate 110 may form the front cover of the electronic device 10, and the second plate 130 may form the rear cover of the electronic device 10. In addition, the side member 150 may be configured to enclose at least a portion formed between the first plate 110 and the second plate 130.

(Ex-1015, 7:41-52).

439. A person of ordinary skill in the art would understand that the “enclosure” would also include the display of *Chang*, insofar as *Chang* teaches that the face of the device includes an opening for a screen region of the display 200. Specifically, *Chang* explains that “the display 200 may be disposed in the space formed between the first plate 110 and the second plate 130 and may be configured to include *a screen region exposed through the first region 111 of the first plate 110*” (Ex-1015, 8:10-16).

440. Thus, *Chang* discloses claim element [11.a].

Claim 11, Element [11.b]: a processor disposed in the enclosed volume;

441. *Chang* discloses claim element [11.b]. Specifically, *Chang* discloses a processor disposed in the enclosed volume.

442. This is illustrated in at least *Chang*'s Figure 1 (annotated below) and is described in further detail as follows.

Ex-1015, Fig. 13

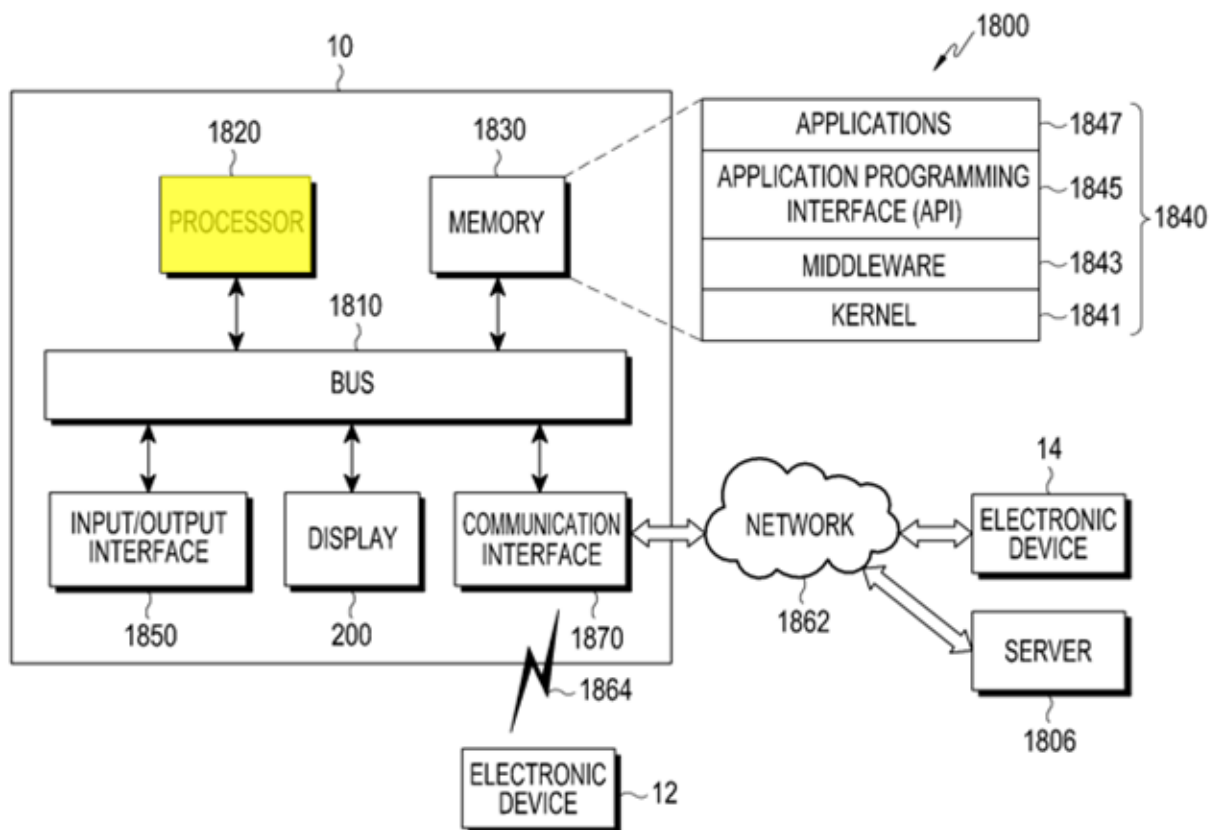


FIG.13

443. *Chang* discloses that “[t]he electronic device 10 may include a bus 1810, ***a processor (e.g., including processing circuitry) 1820***, a memory 1830, an input/output interface (e.g., including input/output circuitry) 1850, a display 200, and a communication interface (e.g., including communication circuitry) 1870” (Ex-1015, 18:64-19:7; *see also* Ex-1015, Figs. 13-15, 21:46-61, 22:59-23:16). Moreover, *Chang* explicitly discloses that “inner electronic components” such as the processor are located in “a space” bounded by side member 150, first plate 110, and second plate 130 (Ex-1015, 7:62-8:9).

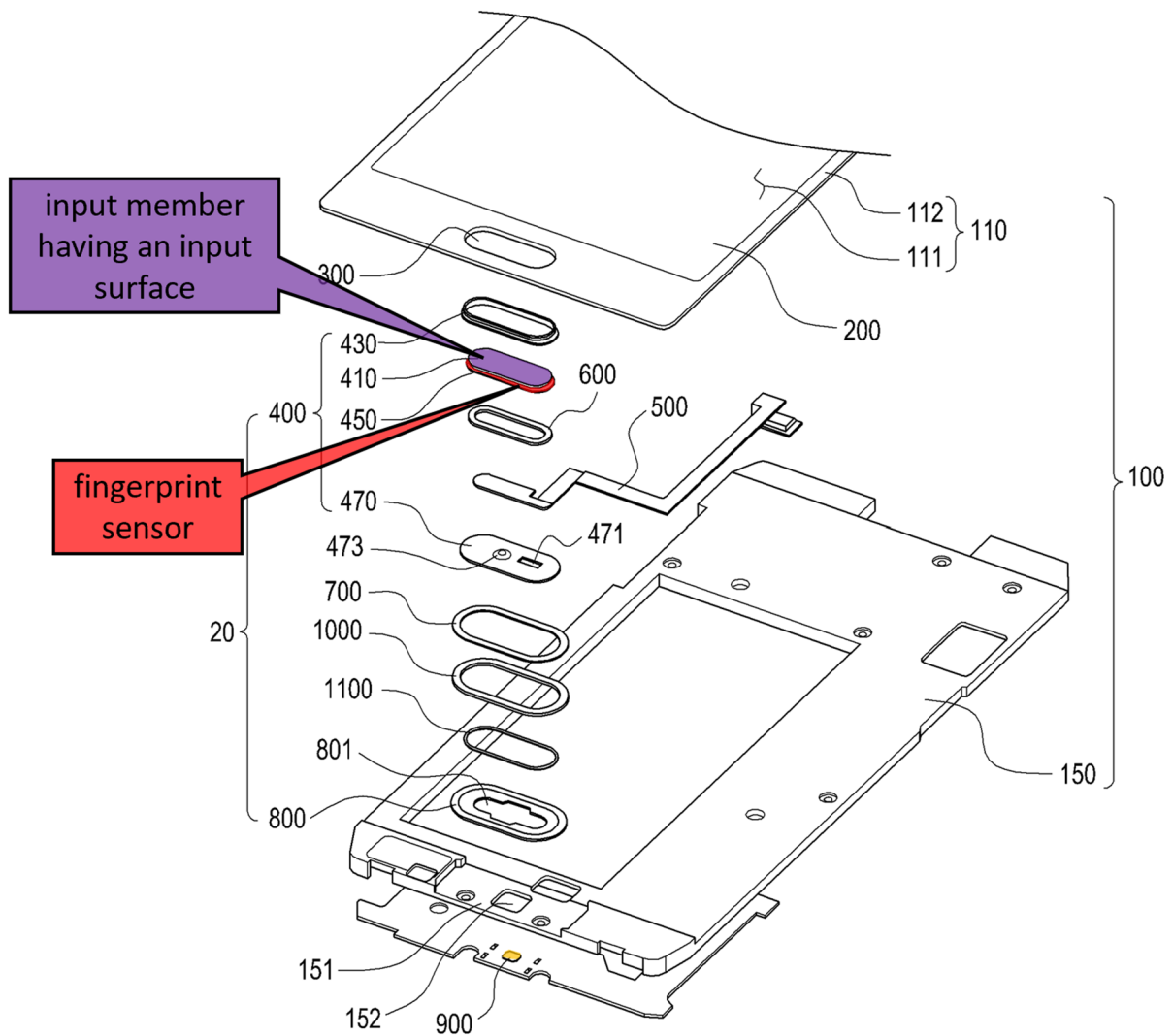
444. Thus, *Chang* discloses claim element [11.b].

Claim 11, Element [11.c]: a button assembly positioned in the opening and defining an input surface, the button assembly comprising: a fingerprint sensor positioned inward from the input surface; and a retainer positioned inward from the input surface and defining a sealing surface;

445. *Chang* discloses claim element [11.c]. Specifically, *Chang* discloses a button assembly positioned in the opening and defining an input surface.

446. This is illustrated in at least *Chang*’s Figure 3 (annotated below) and is described in further detail as follows.

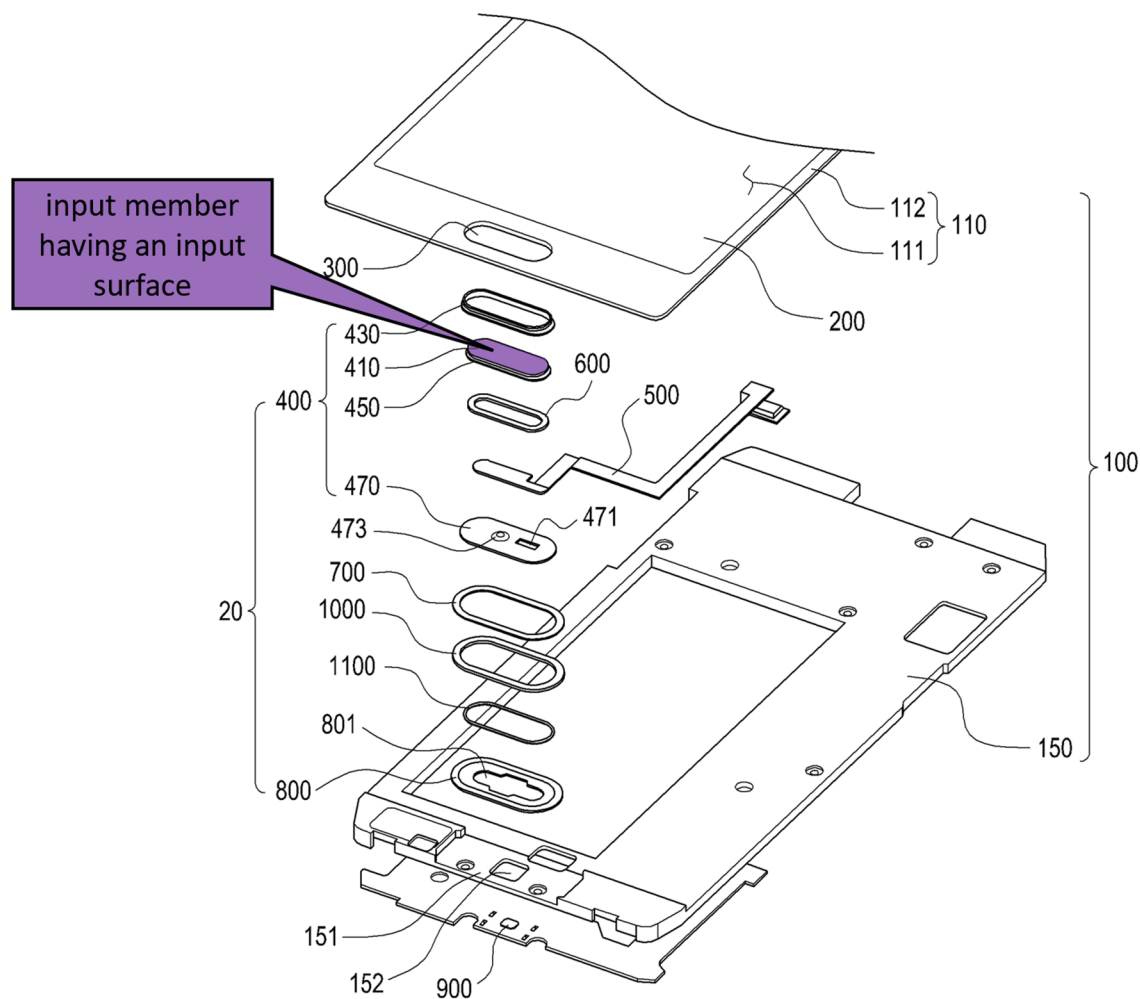
Ex-1015, Fig. 3



447. *Chang* teaches that the button assembly (*i.e.*, the “key module 20”) “may include a button structure 400 that is partially exposed to the first opening 300, a flexible conductive member 500 at least partially disposed in the button structure 400 to transmit an electric signal, and sealing members 600, 700, and 1100 provided for the waterproof function of the key module, and may include an elastic member

800 and a bracket 1000 that protect the button structure 400” (Ex-1015, 8:31-74). The button assembly also includes an input member having an input surface (*i.e.*, cover layer 410). The input member having an input surface is depicted in purple in annotated Figure 3, below.

Ex-1015, Fig. 3



448. As discussed above, *Chang* teaches that “the key module 20 may include a button structure 400 that is partially exposed to the first opening 300” (Ex-1015, 9:59-63). When discussing the makeup of button structure 400, *Chang*

explains that “*the cover layer 410*, the annular structure 430, the fingerprint recognizing member 450, and the lower plate 470 of the key module 20 may be described as a button structure 400” (Ex-1015, 9:64-67) (emphasis added).

449. A person of ordinary skill in the art would understand that cover layer 410 is responsible for user input, insofar as it is the portion of the button structure 400 that is in direct contact with the user. Likewise, a person of ordinary skill in the art would understand that the cover layer 410 has an upper face or surface that is used for input. *Chang* supports this interpretation, explaining that “[t]he cover layer 410 may be a portion that is exposed to the outside of the housing 100, and is to come in direct contact with the user’s fingerprint” (Ex-1015, 10:22-31).

450. Thus, *Chang* discloses claim element [11.c].

451. Claim element 11.c contains two sub-elements, discussed in turn below.

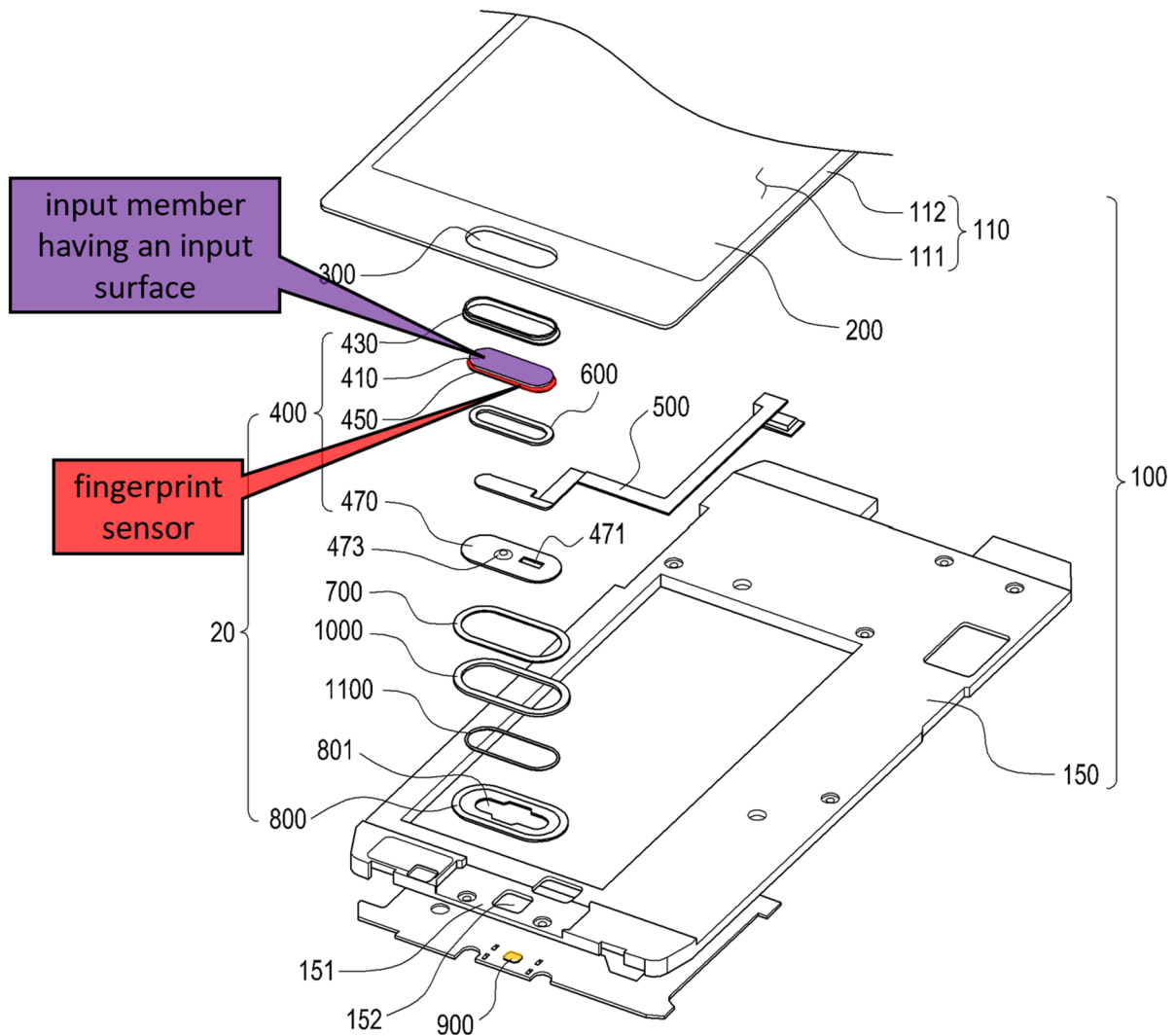
- (i) **Claim 11, Element [11.c.i]: a button assembly positioned in the opening and defining an input surface, the button assembly comprising: a fingerprint sensor positioned inward from the input surface;**

452. *Chang* discloses claim element [11.c.i]. Specifically, *Chang* discloses an input member having an input surface.

453. As explained earlier for claim element [1.c], *Chang* discloses a “button structure 400” with an input member. Furthermore, *Chang* discloses that the “button structure 400” includes a fingerprint sensor (red) positioned inward from the input

surface of the input member (purple). This is illustrated in at least *Chang*'s Figure 3 (annotated below) and is described in further detail as follows.

Ex-1015, Fig. 3



454. First, *Chang* discloses “a button assembly positioned in the opening and defining an input surface, the button assembly comprising: a fingerprint sensor.” For example, *Chang* teaches that the disclosed button assembly “may include a

fingerprint recognizing member 450” (Ex-1015, 9:59-63). Likewise, *Chang* discloses a fingerprint recognizing member 450 comprising “a fingerprint recognizing pad including a plurality of conductive lines formed *to recognize a fingerprint*” (Ex-1015, 1:58-2:24) (emphasis added). *Chang* further discloses that the fingerprint recognizing member is configured to produce an output signal, stating that: “[w]ith this bonding, the flexible conductive member 500 and the circuit region 453 may be electrically connected to each other, and *may transfer a signal or a pressure, which is transferred from the fingerprint recognizing member 450, to the inside of the electronic device 10*” (Ex-1015, 13:1-10). A person of ordinary skill in the art would have understood that the “signal” discussed herein is an electrical signal that represents the fingerprint recognized by the fingerprint recognizing pad. *Chang* also discloses that the fingerprint recognizing member responds to a touch, stating that: “[i]n order to recognize only a fingerprint, the operation of the electronic device 10 may be performed merely by a touch without transferring a pressure to the button structure 400 by the user” (Ex-1015, 11:43-59

455. Second, *Chang* discloses that the fingerprint sensor is “positioned inward from the input surface.” For example, *Chang* explains that the cover layer 410 (*i.e.*, the input surface) “may be formed above the fingerprint recognizing member 450” (Ex-1015, 10:22-31). A person of ordinary skill in the art would have understood that because the cover layer is formed “above” the fingerprint

recognizing member, the fingerprint recognizing member is “positioned inward from” the input surface. This configuration is likewise depicted in Figure 3, above.

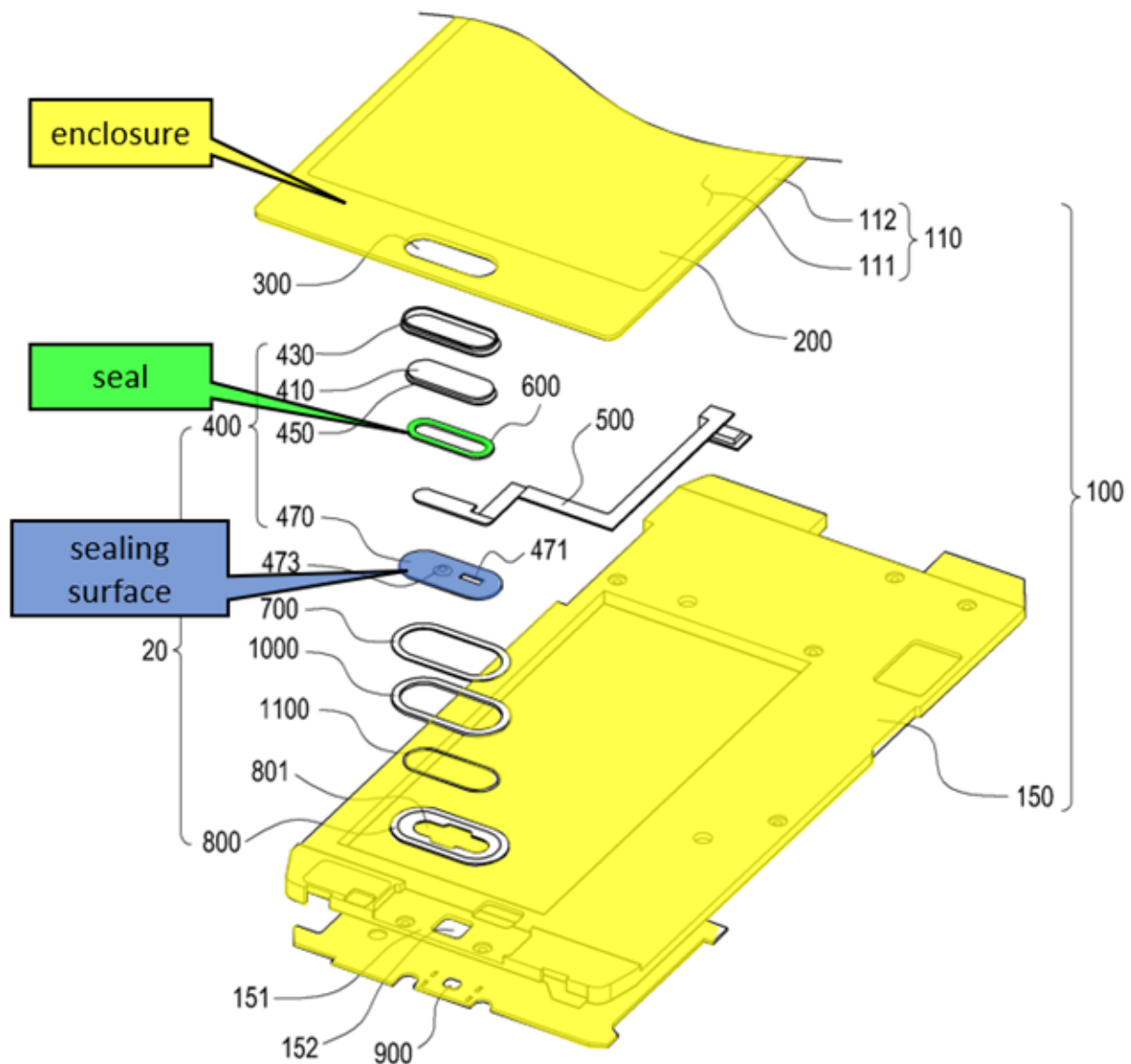
456. Thus, *Chang* discloses claim element [11.c.i].

(ii) **Claim 11, Element [11.c.ii]: a button assembly positioned in the opening and defining an input surface, the button assembly comprising: . . . a retainer positioned inward from the input surface and defining a sealing surface;**

457. *Chang* discloses claim element [11.c.ii]. Specifically, *Chang* discloses a retainer positioned inward from the input surface and defining a sealing surface.

458. This is illustrated in at least *Chang*’s Figure 3 (annotated below) and is described in further detail as follows.

Ex-1015, Fig. 3



459. First, *Chang* discloses a seal. For example, *Chang* discloses that “[t]he key module 20 may include a button structure 400, a flexible 30 conductive member 500, *sealing members* 600, 700, and 1100, an elastic member 800, and a bracket 1000” (Ex-1015, 7:35-40). *Chang* explains that “sealing members 600, 700, and 1100 [are] provided for the waterproof function of the key module” (Ex-1015, 8:31-

41; *see also* Ex-1015, 12:9-23, 14:16-19). A person of ordinary skill in the art would have understood sealing member 600 to be the claimed “seal” of claim element [11.d], below.

460. Second, *Chang* discloses a “sealing surface” of the button assembly. As discussed above, with respect to the makeup of button structure 400, *Chang* explains that “the cover layer 410, the annular structure 430, the fingerprint recognizing member 450, ***and the lower plate 470*** of the key module 20 may be described as a button structure 400” (Ex-1015, 9:64-67) (emphasis added). A person of ordinary skill in the art would have understood that “lower plate 470” constitutes a sealing surface of the retainer, because *Chang* teaches that:

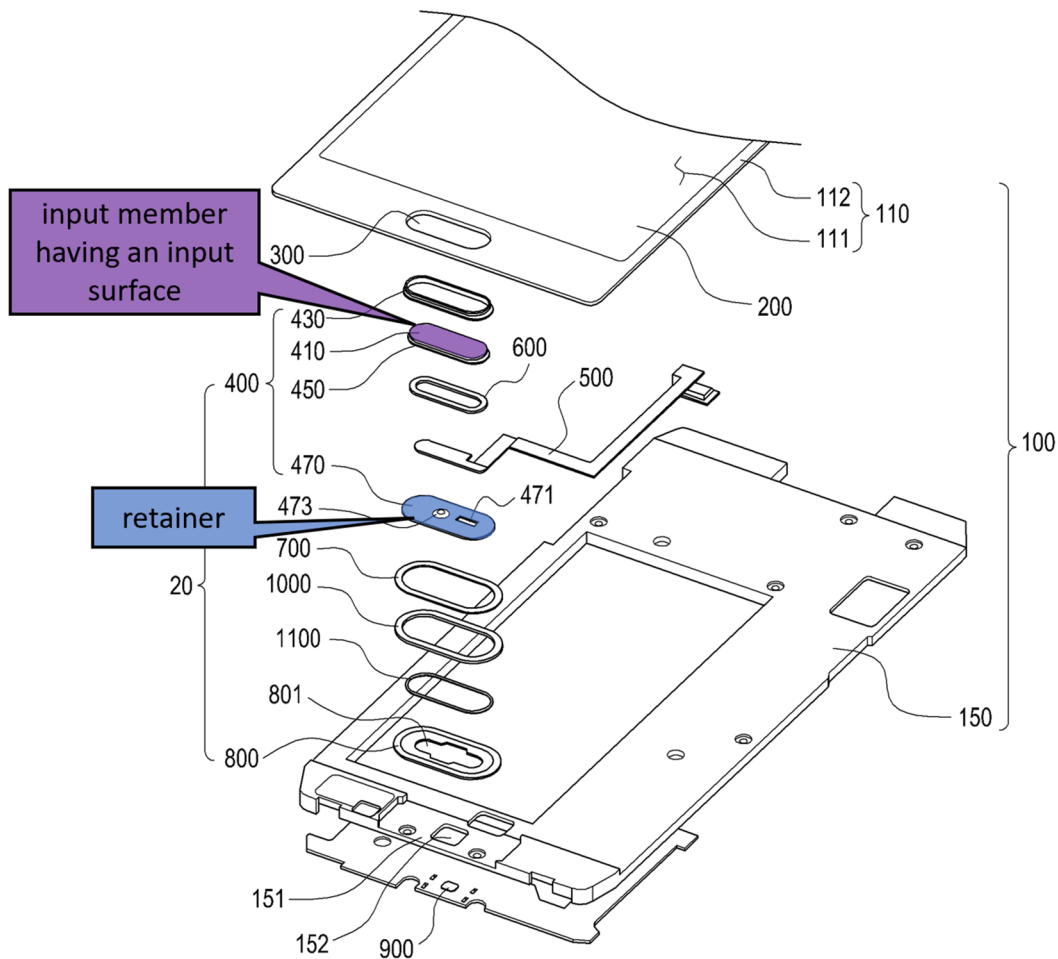
The first sealing member 600 may be interposed between the lower plate 470 and the fingerprint recognizing member 450 in order to block external foreign matter (e.g., a fluid, such as moisture), and ***the opposite end faces of the first sealing member 600 may be respectively attached to the top face of the lower plate 470*** and the bottom face of the fingerprint recognizing member 450 via taping.

(Ex-1015, 12:9-19 (emphasis added)).

461. The ’619 patent teaches that the retainer provides “a stop to displacement of the button housing” and that multiple “configurations of the retainer 224 are possible” (Ex-1001, 16:54-60). Likewise, the ’619 patent explains that “[t]he retainer 224 lower surface forms a sealing surface 225 for the button assembly 310”

(Ex-1001, 16:54-60). As depicted below, a person of ordinary skill in the art would understand that the lower plate 470 of *Chang* likewise serves as “a stop to the displacement of the button housing” and includes a “lower surface [that] forms a sealing surface ... for the button assembly.” As such, a person of ordinary skill in the art would understand that lower plate 470 constitutes a retainer as envisioned by the '619 patent.

462. As discussed above, the top surface of lower plate 470 constitutes the claimed “sealing surface” (*see also* claim element [11.d]). Likewise, the bottom surface of lower plate 470 constitutes the claimed “retainer.” Likewise, and as depicted in at least annotated Figure 3 below, *Chang* discloses that the retainer is positioned inward from the input surface.



463. Furthermore, element [11.c.ii] would have been well known to a person of ordinary skill in the art. As I explained earlier in Section VI (which is incorporated by reference), a person of ordinary skill in the art would have understood that because the lower plate 470 defines an aperture housing the plunger, that retainer should be formed of a rigid, durable material that would withstand repeated user presses on the input surface. A person of ordinary skill in the art would further have

understood that a rigid, durable retainer would be one of a limited number of surfaces that could be used as a sealing surface. Thus, a person of ordinary skill in the art would understand that the top surface of the “retainer” defines the claimed sealing surface, and is depicted in annotated Figure 3, above, in blue.

464. Thus, *Chang* renders obvious claim element [11.c.ii].

Claim 11, Element [11.d]: a seal disposed between the sealing surface of the retainer and a surface of the opening;

465. *Chang* discloses claim element [11.d]. Specifically, *Chang* discloses a seal disposed between the sealing surface of the retainer and a surface of the opening.

466. This is illustrated in at least *Chang*’s Figure 3 (annotated below) and is described in further detail as follows.

186

41; *see also* Ex-1015, 12:9-23, 14:16-19). A person of ordinary skill in the art would have understood sealing member 600 to be the claimed “seal” of claim element [1.d].

468. Second, *Chang* discloses a “sealing surface” of the button assembly. As discussed above, with respect to the makeup of button structure 400, *Chang* explains that “the cover layer 410, the annular structure 430, the fingerprint recognizing member 450, **and the lower plate 470** of the key module 20 may be described as a button structure 400” (Ex-1015, 9:64-67) (emphasis added). A person of ordinary skill in the art would have understood that “lower plate 470” constitutes a sealing surface of the retainer, because *Chang* teaches that:

The first sealing member 600 may be interposed between the lower plate 470 and the fingerprint recognizing member 450 in order to block external foreign matter (e.g., a fluid, such as moisture), and ***the opposite end faces of the first sealing member 600 may be respectively attached to the top face of the lower plate 470*** and the bottom face of the fingerprint recognizing member 450 via taping.

(Ex-1015, 12:9-19 (emphasis added)).

469. Finally, as depicted in annotated Figure 3, above, *Chang* discloses that the seal (green) is positioned between a sealing surface of the retainer (blue) and the enclosure (yellow).

470. Likewise, the top surface of the opening for the button assembly is coplanar with the face of the enclosure (*see, e.g.*, Figs. 1, 3, 4A, 5A). As such, a

person of ordinary skill in the art would understand that a seal located between the sealing surface of the retainer and the enclosure is also located between the sealing surface of the retainer and a surface of the opening.

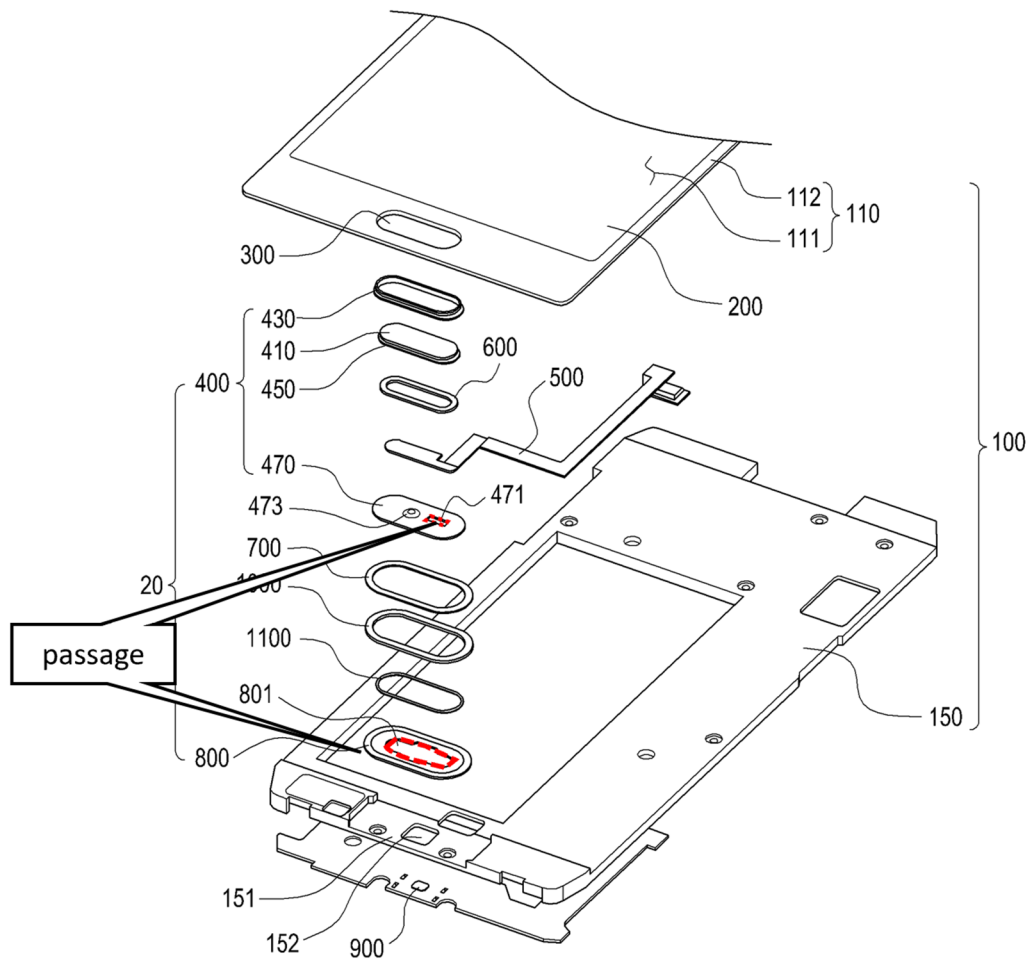
471. Thus, *Chang* discloses claim element [11.d].

Claim 11, Element [11.e]: a passage extending from the opening to the enclosed volume;

472. *Chang* discloses claim element [11.e]. Specifically, *Kim* discloses a passage extending from the opening to the enclosed volume.

473. *Chang* likewise discloses a passage extending from the opening to the enclosed volume. The disclosed passage extends from the “second opening 471” of the lower plate 470, passes through sealing member 700, bracket 1000, sealing member 1100, and finally culminates with the “third opening 801” of the elastic member 800 (Ex-1015, 9:20-28). The beginning and end points of the passage are depicted in annotated Figure 3, below. As shown, the passage begins in the opening of the enclosure (which houses the button assembly), and extends to the enclosed volume.

Ex-1015, Fig. 3



474. This configuration is further depicted in Figure 4B:

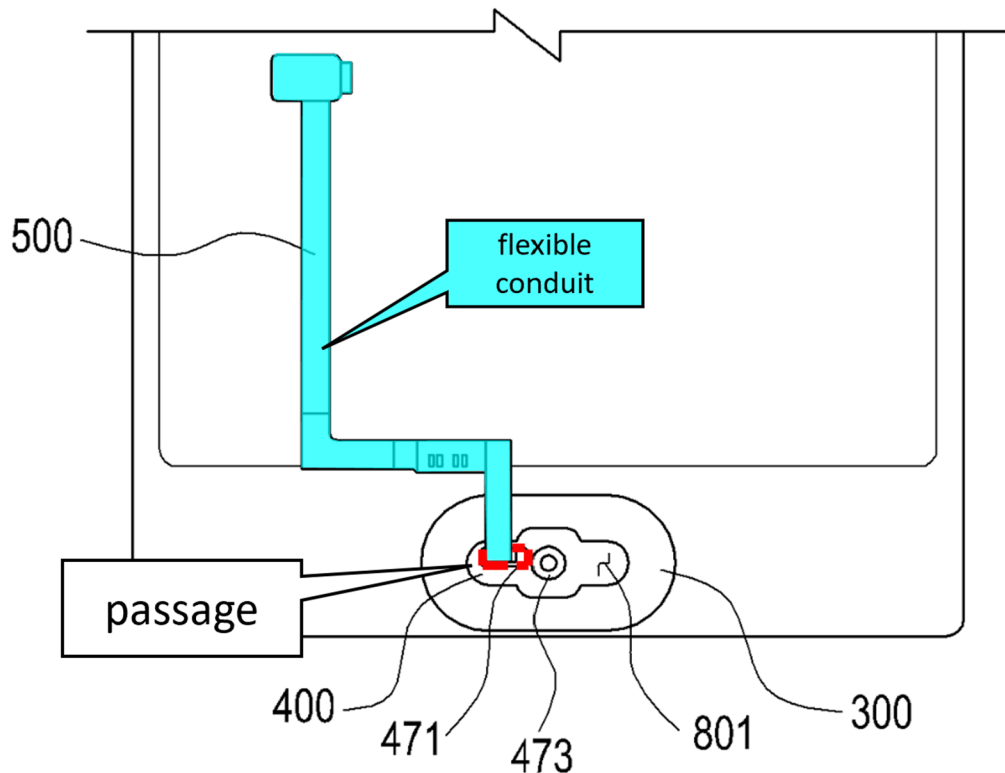


FIG.4B

475. Thus, *Chang* discloses claim element [11.e].

Claim 11, Element [11.f]: a flexible conduit electrically connecting the fingerprint sensor to the processor; wherein:

476. *Chang* discloses claim element [11.f]. Specifically, *Chang* discloses a flexible conduit electrically connecting the fingerprint sensor to the processor.

477. First, *Chang* discloses a flexible conductive member 500 (*i.e.*, a flexible conduit). *Chang* explicitly teaches that the flexible conduit is connected to the

fingerprint sensor, stating that “[t]he flexible conductive member 500 [is] connected with the fingerprint recognizing member 450” (Ex-1015, 11:28-35).

478. Likewise, *Chang* teaches that the flexible conduit is configured to transmit the output signal (described in claim element [1.c.ii], above) to the processor. *Chang* explains that the flexible conductive member 500 “is electrically connectable to other electronic components” (Ex-1015, 11:28-35). A person of ordinary skill in the art would have understood this disclosure to mean that the flexible conduit taught by *Chang* is electrically connected to the processor.

479. *Chang* also explains that “the flexible conductive member 500 and the circuit region 453 may be electrically connected to each other, and ***may transfer a signal or a pressure***, which is transferred from the fingerprint recognizing member 450, ***to the inside of the electronic device 10***” (Ex-1015, 13:1-10 (emphasis added)). Again, a person of ordinary skill in the art would understand this disclosure to mean that the flexible conduit taught by *Chang* would be electrically connected to both the fingerprint sensor and the processor located in the inside of the electronic device.

480. *Chang*’s Figure 14, below, further depicts the relationship between the biometric sensor and the processor.

Ex-1015, Fig. 14

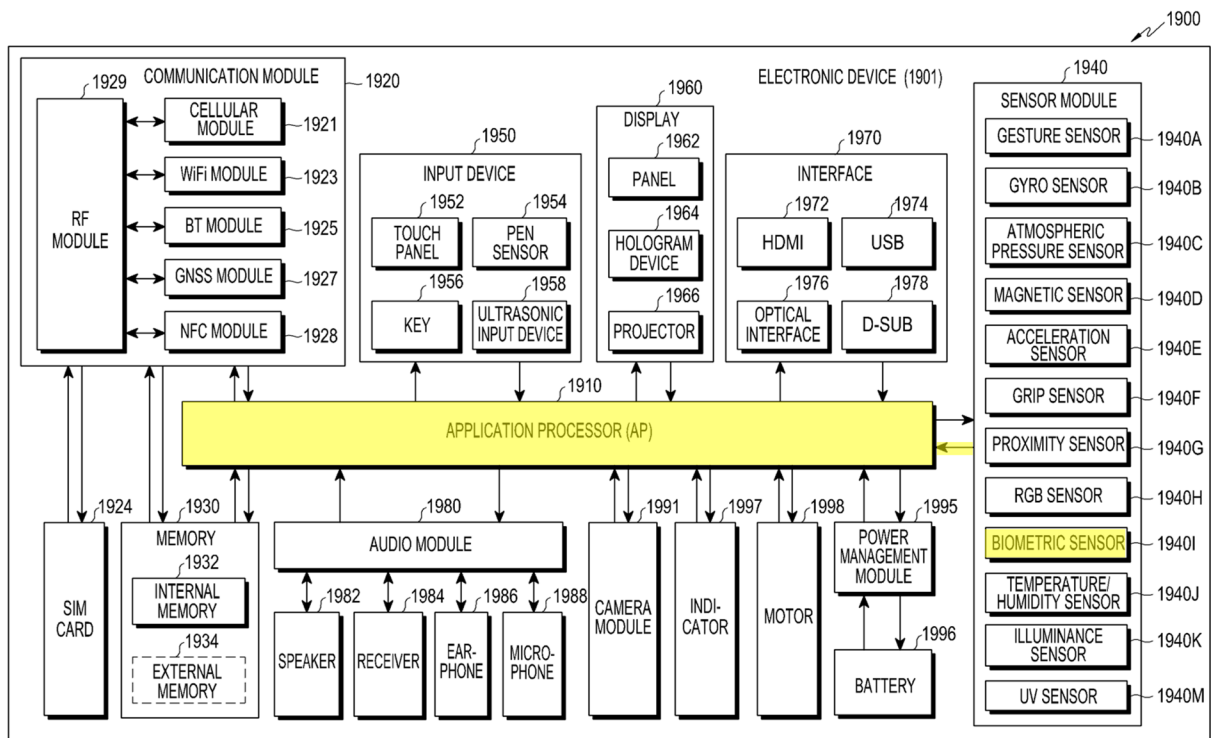


FIG.14

481. As depicted therein, the sensor module (including the biometric sensor) is configured to communicate with the application processor.

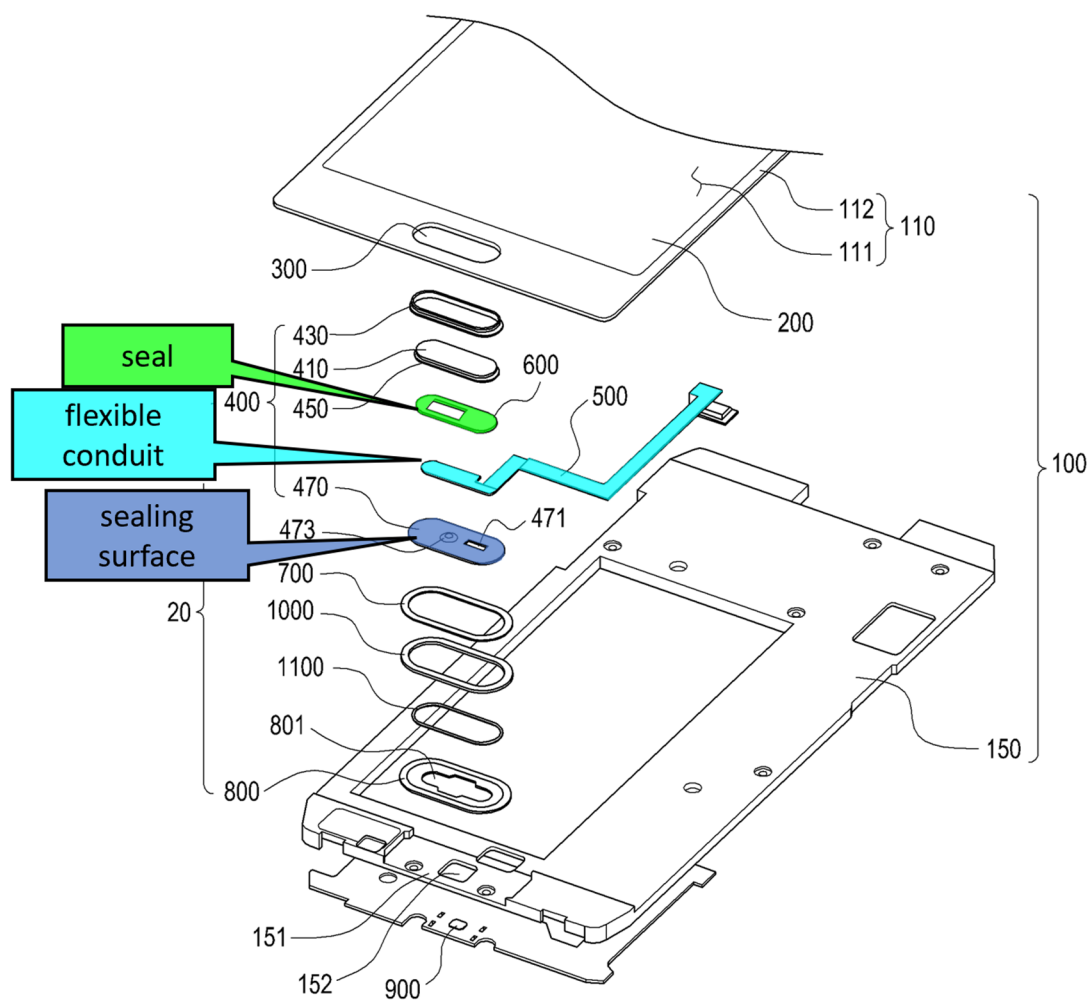
482. Thus, *Chang* discloses claim element [11.f].

Claim 11, Element [11.g]: a portion of the flexible conduit is sandwiched between the seal and the sealing surface of the retainer or between the seal and the surface of the opening.

483. *Chang* renders obvious claim element [11.g]. Specifically, *Chang* discloses a portion of the flexible conduit is sandwiched between the seal and the sealing surface of the retainer or between the seal and the surface of the opening.

Here, a portion of the flexible conduit is sandwiched between the seal and the sealing surface, as depicted in *Chang*'s Figure 3 (altered and annotated below).

Ex-1015, Fig. 3 (altered and annotated)



484. As explained earlier with respect to claim elements [1.a], [1.d], and [1.f] (the discussion of which is incorporated herein), *Chang* discloses the claimed “flexible conduit,” “seal,” and “sealing surface.” Furthermore, *Chang*'s Figure 3 discloses that a portion of the flexible conduit (*i.e.*, *Chang*'s “flexible conductive

member 500,” highlighted in teal) is sandwiched between the seal (*i.e.*, *Chang’s* “sealing member 600,” green) and the sealing surface (*i.e.*, *Chang’s* “lower plate 470,” blue).

485. *Chang* describes the purpose and structure of sealing member 600 at length. Initially, it states that “key module 20 may include a button structure 400, a flexible 30 conductive member 500, **sealing members 600**, 700, and 1100, an elastic member 800, and a bracket 1000” (Ex-1015, 7:35-40) (emphasis added). *Chang* then explains that “sealing members 600, 700, and 1100 [are] provided for the waterproof function of the key module” (Ex-1015, 8:31-41) and that “[e]ach of the sealing members 600, 700, and 1100 may block moisture that flows in from the outside” (Ex-1015, 14:16-19).

486. *Chang* also discloses the location and structure of sealing member 600.

487. First, *Chang* discloses that sealing member 600 is located between (1) the lower plate 470 and (2) the fingerprint recognizing member 450 (Ex-1015, Fig. 3). Specifically, sealing member 600 “may be interposed between the lower plate 470 and the fingerprint recognizing member 450 in order to block external foreign matter (*e.g.*, a fluid, such as moisture)” (Ex-1015, 12:12-19). Likewise, “[a]ccording to an example embodiment, the first sealing member 600 may be disposed between the fingerprint recognizing member 450 and the lower plate 470” (Ex-1015, 14:20-24).

488. Second, *Chang* teaches that the sealing member 600 is described as having two faces (Ex-1015, Fig. 3). *Chang* states: “the opposite end faces of the first sealing member 600 may be respectively attached to the top face of the lower plate 470 and the bottom face of the fingerprint recognizing member 450 via taping” (Ex-1015, 12:12-19). The first face is attached to the top face of lower plate 470, while the second face is attached to the bottom face of fingerprint recognizing member 450. *Chang* also teaches that the respective faces are attached via taping.

489. Third, *Chang* teaches that fingerprint sensor includes a “circuit region 453,” which “may be a printed circuit board (PCB), and may include a plurality of contact points formed on the lower portion thereof to be electrically contacted with another printed circuit board” (Ex-1015, 10:13-21). Likewise, “the circuit board used inside the fingerprint recognizing member may be designed in such a manner in which a printed circuit board is used and a contact point is disposed on the circuit board to be electrically connected to the flexible printed circuit board” (Ex-1015, 12:44-49).

490. Thus, based on the teachings of *Chang*, a person of ordinary skill in the art would have understood that sealing member 600 is (1) located between lower plate 470 and fingerprint recognizing member 450, (2) has at least two planar faces, wherein the first face is attached to lower plate 470 and the second face is attached to fingerprint recognizing member 450, and (3) contains an opening to allow

fingerprint recognizing member 450 to be connected to flexible conductive member 500.

491. After describing both the purpose and structural characteristics of sealing member 600, *Chang* teaches that the sealing member 600 may be constructed in a ring shape:

Alternatively, the first sealing member 600 may be designed in an *annular shape (e.g., a loop or ring shape)*, which corresponds to the entire shape of the key module 20 and includes an opening so as to allow the flexible conductive member 500 to extend therethrough.

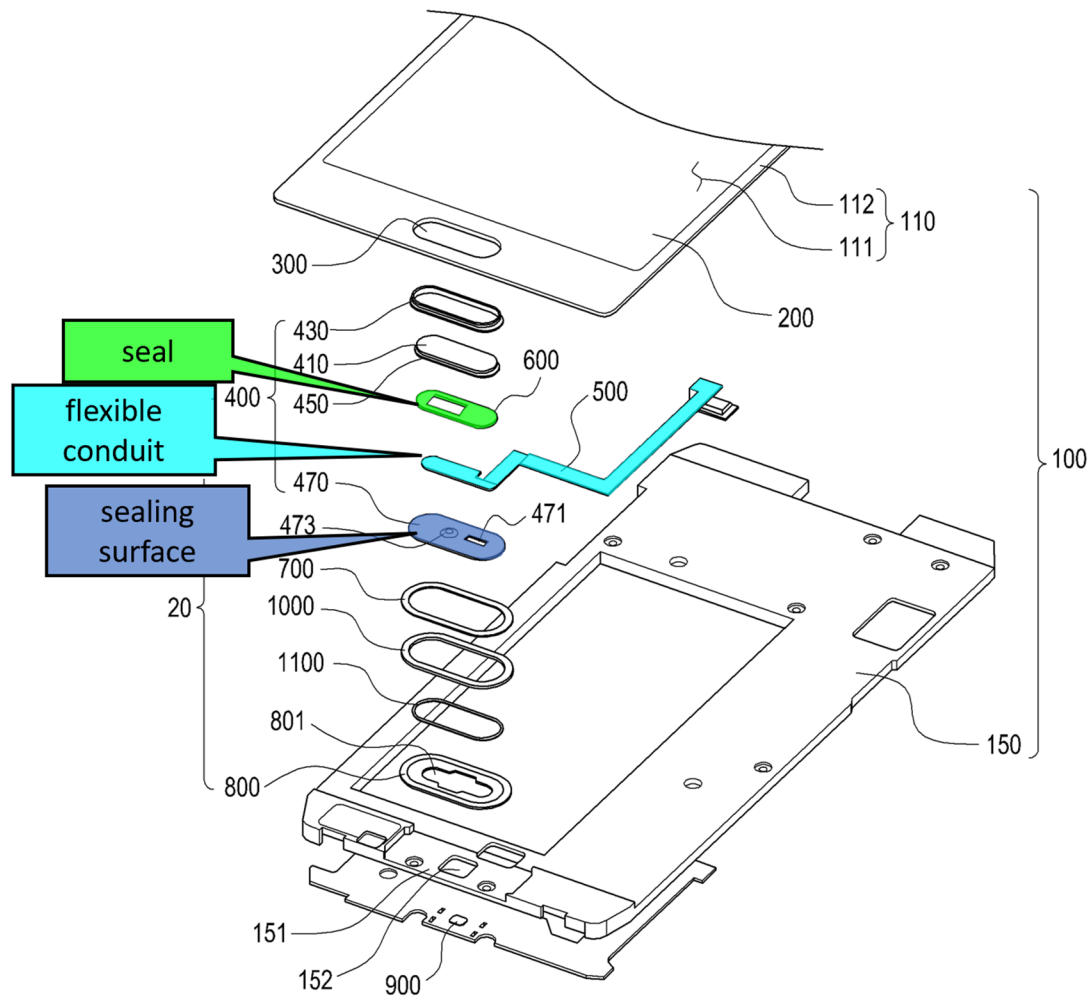
(Ex-1015, 14:24-29 (emphasis added)).

492. This alternative configuration of sealing member 600 is illustrated in Figure 3. But because *Chang* discloses this as an “[a]lternative” embodiment, a person of ordinary skill in the art would have understood that *Chang* also teaches a sealing member 600 that *is not* designed in an “annular shape (*e.g., a loop or ring shape*).”

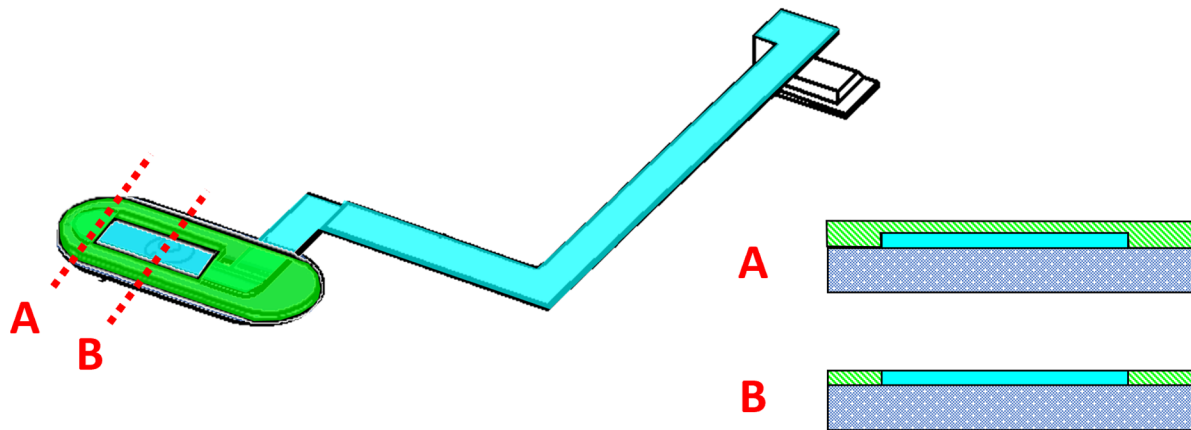
493. From this, a person of ordinary skill in the art would have understood that sealing member 600 would be constructed as depicted below, such that the planar faces are adjacent to both lower plate 470 and fingerprint recognizing member 450, and the opening is in the shape of the “contact points formed on the lower portion [of the fingerprint recognizing member 450] to be electrically contacted with

another printed circuit board” such as the flexible conductive member 500 (Ex-1015, 10:13-21).

494. For example, *Chang* teaches its button structure “may be variously modified and designed according to the structural shape or design of the electronic device 10 and the user’s convenience” (Ex. 1015, 10:32-42). In addressing the design characteristics which should be considered while adapting the depicted configuration, *Chang* teaches the disclosed design is “not limited to the ring shape, and may be subjected to a design change to various shapes as long as they may prevent respective components from being separated to the outside and safely fix the respective components” (Ex. 1015, 10:59-11:3). Of particular relevance, *Chang* teaches the “second opening 471 is provided in a rectangular shape having a size that allows the flexible conductive member 500 to pass therethrough, but may be implemented in various shapes such that ***various shapes of conductive members 500 may pass therethrough***” (Ex. 1015, 11:36-42). The configuration depicted below would allow for the maximum sealing surface, while still providing an open in the size and shape of “circuit region 453” located on fingerprint recognizing member 450 (*see, e.g.*, Ex. 1015, Fig. 7A).



495. The seal (green), flexible conduit (teal), and sealing surface (blue) are depicted in a condensed configuration, below left. Section cuts along the red dashed lines “A” and “B” are depicted below right:

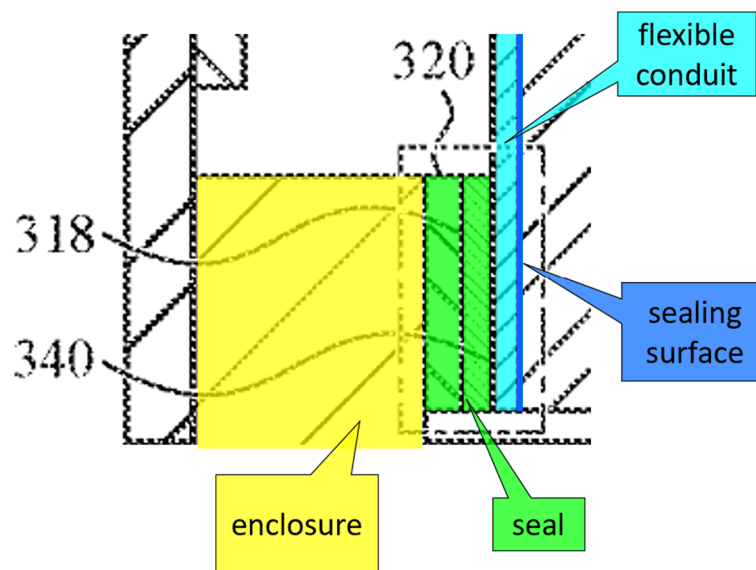


496. As shown in section cut A, at least a portion of the flexible conduit (teal) is sandwiched between the seal (green) and the sealing surface (blue). A person of ordinary skill in the art would have understood that this embodiment of *Chang*'s sealing member would have included additional "sealing" material and, therefore, further promoted *Chang*'s stated goal of providing a "waterproof structure in order to prevent a fluid from infiltrating into the interior of the portable terminals" (Ex-1015, 1:23-50, *see also* Ex-1015, 2:53-67, 12:62-67).

497. Indeed, *Chang* discloses "a portion of the flexible conduit is sandwiched between the seal and the sealing surface or between the seal and the enclosure" the same way as the '619 patent's specification. For example, the '619 patent discloses that "a gasket seal (such as face seal 318) may further be applied below the lower PSA portion, such that *a sandwich . . . is formed of PSA, flexible*

conduit 340, PSA, and then the gasket seal” (Ex-1001, 17:35-46). This is illustrated in at least the ’619 patent’s Figure 3A (excerpted annotated below), which illustrates the “sandwiching.” As another example, the ’619 patent discloses that “sandwiching” includes a “stack” of elements (Ex-1001, 23:39-43 (“In one embodiment, the compressible layer 404 is a heat activated (HAF) silicon sandwich. The HAF silicon sandwich is a stack of the following five elements: heat activated film, polyimide (PI), silicon, heat activated film and the flexible conduit 440.”)).

Ex-1001, Fig. 3A (excerpted and annotated)



498. Because *Chang* discloses a “stack” of elements including “a portion of the flexible conduit,” a “seal,” and a “sealing surface,” *Chang* discloses “a portion of the flexible conduit is sandwiched between the seal and the sealing surface or between the seal and the enclosure” the same way as the ’619 patent’s specification.

499. To the extent that a person of ordinary skill in the art would not find claim element [11.g] to be explicitly disclosed by *Chang*, it is nevertheless rendered obvious by *Chang*. In summary, a person of ordinary skill in the art would understand that *Chang* discloses a button assembly that, while depicted in an oval or ring shape, would be modified to fit the structural shape or design of the electronic device in question. Modification of the button assembly would include modification of the size and shape of both the fingerprint sensor, and the flexible conductive member attached thereto, among other things. In order to meet the stated purpose of ensuring that the electronic components are separated to the outside and safely affixed, and as I explained in Section VI.B (which is incorporated herein) a person of ordinary skill in the art would understand that the seal would need to be modified in accordance with the button assembly. In making these modifications, a person of ordinary skill in the art would choose the sandwiching configuration depicted in the annotated figures, above, in order to ensure that the electrical connection between the flexible conductive member and the fingerprint sensor is sufficiently sealed.

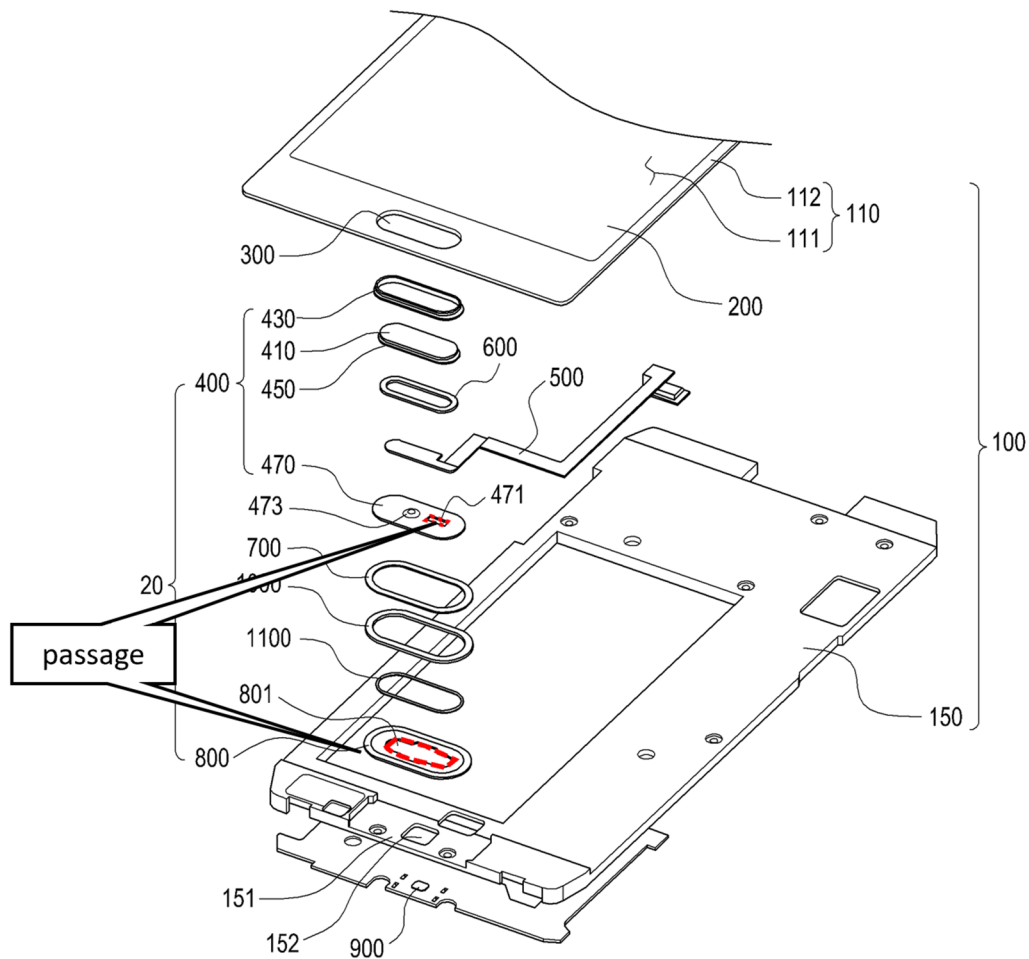
500. Thus, *Chang* renders claim element [11.g] obvious.

Claim 12: The fingerprint sensing system of claim 11, wherein the flexible conduit extends through the passage.

501. *Chang* discloses claim 12. Specifically, *Chang* discloses the fingerprint sensing system of claim 11, wherein the flexible conduit extends through the passage.

502. *Chang* discloses the electronic device of claim 11. *See* claim 11, above.

503. *Chang* likewise discloses a passage extending from the opening to the enclosed volume. The disclosed passage extends from the “second opening 471” of the lower plate 470, passes through sealing member 700, bracket 1000, sealing member 1100, and finally culminates with the “third opening 801” of the elastic member 800 (Ex-1015, 9:20-28). The beginning and end points of the passage are depicted in annotated Figure 3, below. As shown, the passage begins in the opening of the enclosure (which houses the button assembly), and extends to the enclosed volume.



504. *Chang* also teaches that the flexible conduit passes through the passage. Specifically, it explains that “after passing through various openings, the flexible conductive member 500 may finally extend *to the inside of the electronic device 10 via a second opening 471 of a lower plate 470 and a third opening 801 of an elastic member 800*” (Ex-1015, 9:20-28) (emphasis added).

505. This configuration is further depicted in annotated Figure 4B, below.

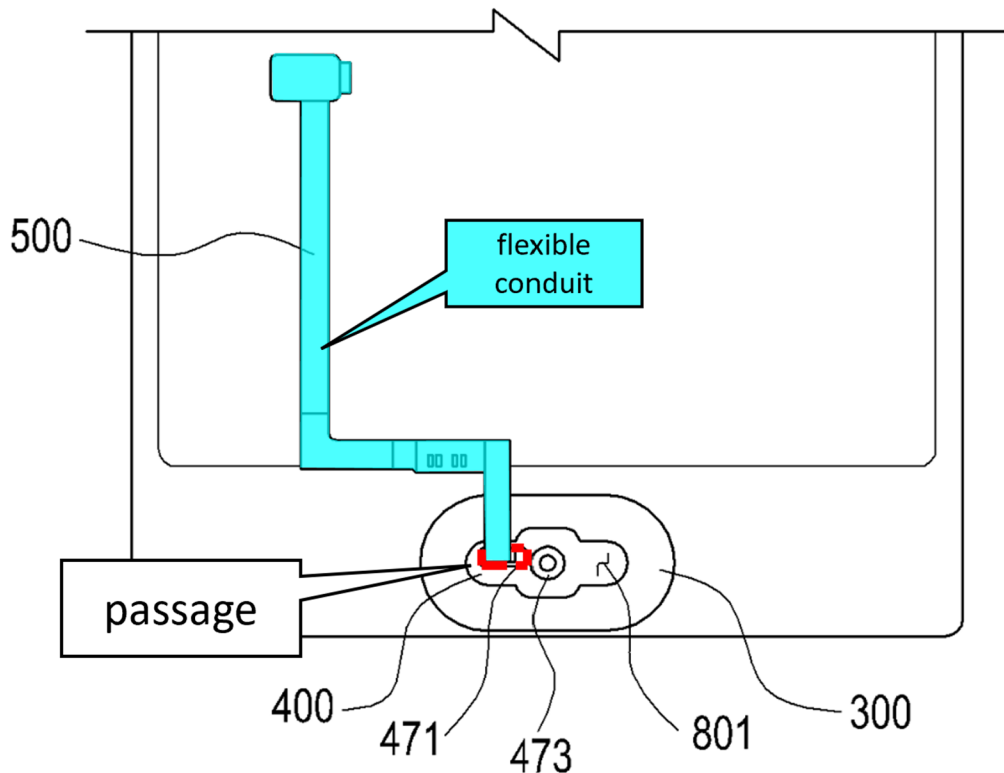


FIG.4B

506. Thus, *Chang* discloses claim 12.

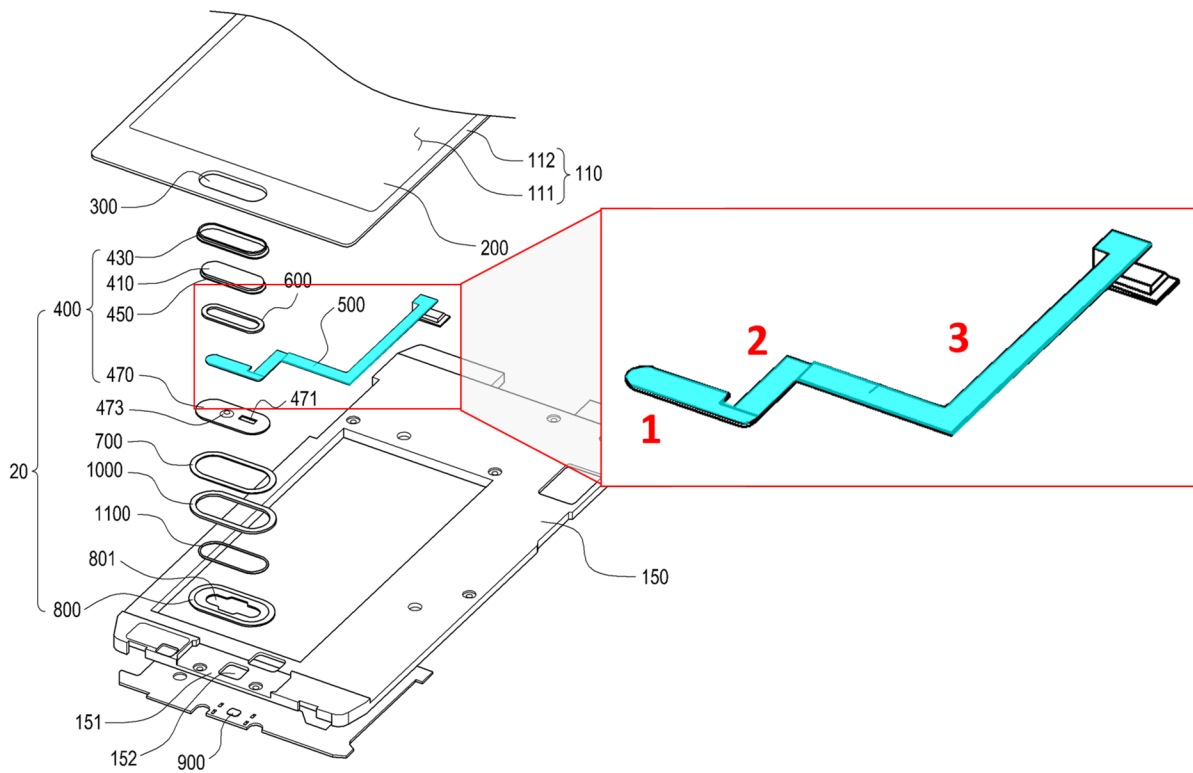
Claim 13: The fingerprint sensing system of claim 11, wherein the flexible conduit is coupled to a second flexible conduit that extends through the passage.

507. *Chang* discloses claim 13. Specifically, *Chang* discloses the fingerprint sensing system of claim 11, wherein the flexible conduit is coupled to a second flexible conduit that extends through the passage.

508. *Chang* discloses the fingerprint sensing system of claim 11. *See* claim 11, above.

509. Likewise, *Chang* discloses that flexible conductive member 500 consists of multiple segments coupled to one another, wherein the second segment extends through the passage. Specifically, it states that “the flexible conductive member 500 may be implemented plurally” (Ex-1015, 11:36-42). This is depicted in at least annotated Figure 3, below.

Ex-1015, Fig. 3



510. Likewise, *Chang* discloses that it is the second flexible conductive member 500 (labeled “2” in the above annotation), which extends through the passage. This is further depicted in claim element [11.e], above.

511. Thus, *Chang* discloses claim 13.

Claim 14: The fingerprint sensing system of claim 11, wherein the fingerprint sensor is further configured to detect a touch.

512. *Chang* discloses claim 14. Specifically, *Chang* discloses the fingerprint sensing system of claim 11, wherein the fingerprint sensor is further configured to detect a touch.

513. *Chang* discloses the fingerprint sensing system of claim 11. *See* claim 11, above.

514. *Chang* discloses a fingerprint recognizing member 450 (*i.e.* “fingerprint sensor”) comprising “a fingerprint recognizing pad including a plurality of conductive lines formed ***to recognize a fingerprint***” (Ex-1015, 1:58-2:24) (emphasis added). *Chang* further discloses that the fingerprint recognizing member is configured to produce an output signal, stating that: “[w]ith this bonding, the flexible conductive member 500 and the circuit region 453 may be electrically connected to each other, and ***may transfer a signal or a pressure, which is transferred from the fingerprint recognizing member 450, to the inside of the electronic device 10***” (Ex-1015, 13:1-10). A person of ordinary skill in the art would have understood that the “signal” discussed herein is an electrical signal that represents the fingerprint

recognized by the fingerprint recognizing pad. *Chang* also discloses that the fingerprint recognizing member responds to a touch, stating that: “[i]n order to recognize only a fingerprint, the operation of the electronic device 10 may be performed merely by a touch without transferring a pressure to the button structure 400 by the user” (Ex-1015, 11:43-59 (emphasis added)).

515. Thus, *Chang* discloses claim 14.

Claim 15, Element [15.pre]: The fingerprint sensing system of claim 11, wherein:

516. *Chang* discloses claim element [15.pre]. Specifically, *Chang* discloses the fingerprint sensing system of claim 11.

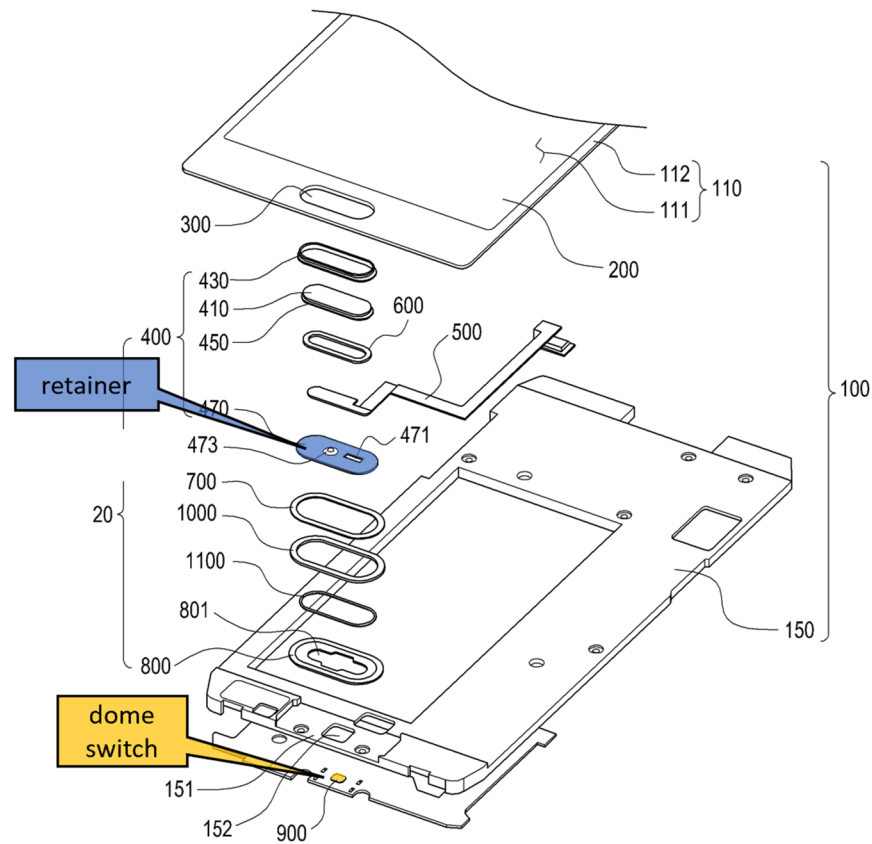
517. See claim 11, above.

Claim 15, Element [15.a]: the button assembly further comprises a tactile dome switch disposed inward from the retainer; and

518. *Chang* discloses claim element [15.a]. Specifically, *Chang* discloses the button assembly further comprises a tactile dome switch disposed inward from the retainer. *Chang*’s retainer is described above (claim element [11.c.ii]).

519. This is illustrated in at least *Chang*’s Figure 3 (annotated below) and is described in further detail as follows.

Ex-1015, Fig. 3



520. *Chang* discloses a tactile dome switch. Specifically, *Chang* teaches that “[t]he dome switch 900 may be disposed inside the seating portion 151 through the hole 152 of the seating portion 151 (see FIG. 3). ***The dome switch 900 may be elastically and mechanically deformed by the user’s click to transmit the signal to the inside of the electronic device 10.*** The above-mentioned concave recess 473 may be disposed to face the dome switch 900” (Ex-1015, 9:38-49) (emphasis added).

521. *Chang* discloses that “[t]he protruding upper portion of the key module 20 is a portion to be in direct contact with a user’s fingerprint, and may be configured

to move up and down to correspond to the upward and downward movements of the dome switch 900 disposed therebelow *according to the user's click*” (Ex-1015, 9:1-19) (emphasis added).

522. Moreover, *Chang* discloses the tactile dome switch in the same configuration as the '619 patent. Specifically, both *Chang* and the '619 patent teach that the dome switch is mounted to the enclosure underneath the moving portions of the button assembly. *Chang* goes on to explain that “[t]he dome switch 900 may be disposed inside the seating portion 151 through the hole 152 of the seating portion 151” (Ex-1015, 9:38-49). This is further depicted in annotated Figure 3, above, which shows that the tactile dome switch is disposed inward from the retainer.

523. Thus, *Chang* discloses claim element [15.a].

Claim 15, Element [15.b]: the tactile dome switch compresses in response to a press on the input surface.

524. *Chang* discloses claim element [15.b]. Specifically, *Chang* discloses the tactile dome switch compresses in response to a press on the input surface.

525. See claim element [15.a].

526. Thus, *Chang* discloses claim element [15.b].

Claim 16, Element [16.pre]: A watch comprising:

527. To the extent that it is found to be limiting, *Chang* discloses claim element [16.pre]. Specifically, *Chang* discloses a watch.

528. *Chang* discloses:

An electronic device according to various embodiments of the present disclosure may include at least one of, for example, a smart phone, a tablet Personal Computer (PC), a mobile phone, a video phone, an electronic book reader (e-book reader), a desktop PC, a laptop PC, a netbook computer, a workstation, a server, a Personal Digital Assistant (PDA), a Portable Multimedia Player (PMP), a MPEG-1 audio layer-3 (MP3) player, a mobile medical device, a camera, and a wearable device. According to various embodiments, *the wearable device may include at least one of an accessory type (e.g., a watch, a ring, a bracelet, an anklet, a necklace, a glasses, a contact lens, or a Head-Mounted Device (HMD)), a fabric or clothing integrated type (e.g., an electronic clothing), a body-mounted type (e.g., a skin pad, or tattoo), and a bio-implantable type (e.g., an implantable circuit), or the like, but is not limited thereto.*

(Ex-1015, 5:5-20) (emphasis added).

529. Thus, *Chang* discloses claim element [16.pre].

Claim 16, Element [16.a]: an enclosure defining an enclosed volume and an opening formed in a sidewall;

530. *Chang* discloses claim element [16.a]. Specifically, *Chang* discloses an enclosure defining an enclosed volume and an opening formed in a sidewall.

531. This element is substantially similar to claim element [11.a]. As such, I incorporate my analysis with respect to claim element [11.a] herein.

532. Although the opening depicted in Figure 3, above, is shown on the front wall of the electronic device, *Chang* explicitly teaches that the depiction in Figure 3

is exemplary only, and that the key module described therein “may be variously applied to various keys such as a side key” (Ex-1015, 7:18-26).

In the present embodiment, *the key module is described with reference to the above-described home key by way of an example*, but is not limited thereto, and when the key module is a key module that is driven for data input, *it may be variously applied to various keys such as a side key, in addition to the above-mentioned home key 11 a*. In the present embodiment, descriptions will be made with reference to a key module that is provided with a waterproof function.

In the following, descriptions will be made with reference to a configuration of the key module 20 provided in the electronic device 10 according to various embodiments of the present disclosure.

FIG. 3 is a perspective view illustrating the components of a key module 20 provided *in an example electronic device according to various example embodiments of the present disclosure*.

(Ex-1015, 7:18-34) (emphasis added).

533. Thus, *Chang* discloses claim element [16.a].

Claim 16, Element [16.b]: a processor disposed in the enclosed volume;

534. *Chang* discloses claim element [16.b]. Specifically, *Chang* discloses a processor disposed in the enclosed volume.

535. This element is substantially similar to claim element [11.b]. As such, I incorporate my analysis with respect to claim element [11.b] herein.

536. Thus, *Chang* discloses claim element [16.b].

Claim 16, Element [16.c]: a display positioned within the enclosure and operably coupled to the processor;

537. *Chang* discloses claim element [16.c]. Specifically, *Chang* discloses a display positioned within the enclosure and operably coupled to the processor.

538. At least Figure 13 of *Chang* shows that the display is operably connected to the processor:

Ex-1015, Fig. 13

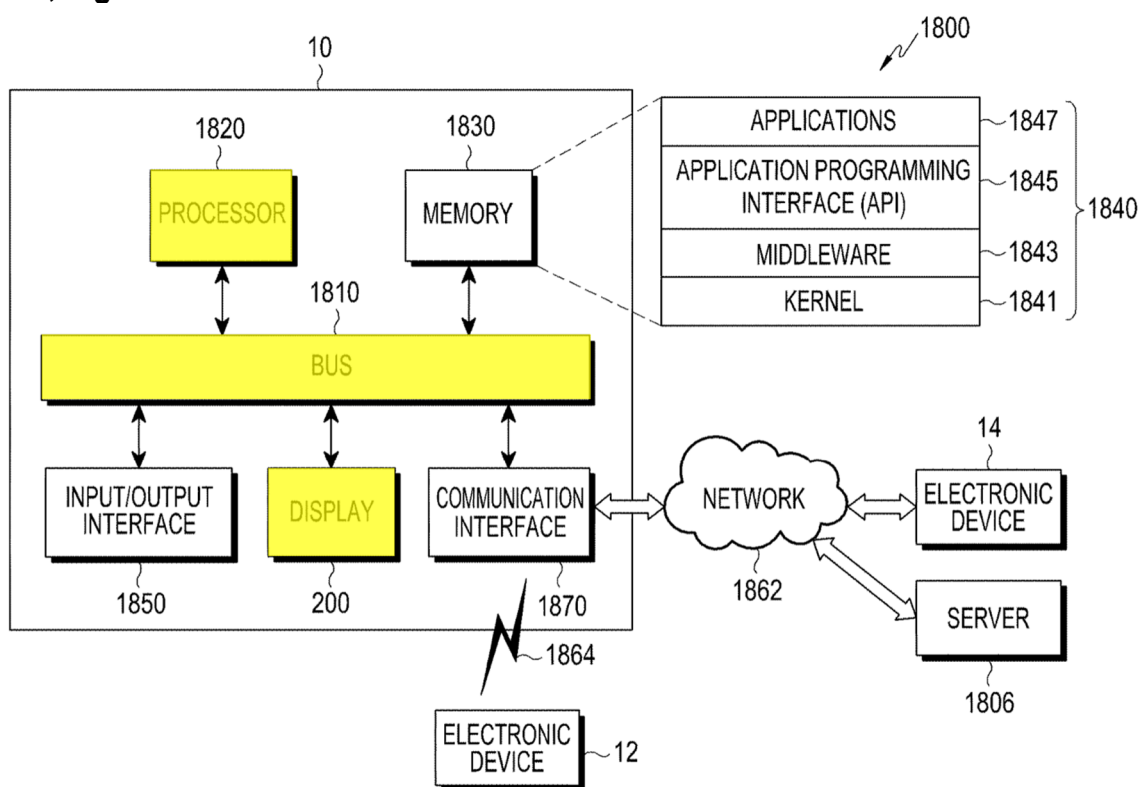


FIG.13

539. *Chang* discloses that “[a]ccording to an example embodiment, the display 200 may include the above-mentioned touch screen 11 (see FIG. 1) or the like in concept. In an example embodiment of the present disclosure, **the display 200**

may be disposed in the space formed between the first plate 110 and the second plate 130 and may be configured to include a screen region exposed through the first region 111 of the first plate 110.” (Ex-1015, 8:10-20) (emphasis added); *see also* Figure 1.

540. *Chang* likewise teaches that the processor “may further include a Graphic Processing Unit (GPU) and/or an image signal processor” (Ex-1015, 21:46-61). A person of ordinary skill in the art would understand that a processor with a GPU and/or image signal processor is operably coupled to a display, as depicted in Figure 13, above.

541. Thus, *Chang* discloses claim element [16.c].

Claim 16, Element [16.d]: a watchband attached to the enclosure and configured to couple the watch to a user;

542. *Chang* discloses claim element [16.d]. Specifically, *Chang* discloses a watchband attached to the enclosure and configured to couple the watch to a user.

543. *Chang* discloses an electronic device, wherein the electronic device is a watch. *See* claim element [16.pre], above. As discussed in Section VI, a watch necessarily includes a watchband attached to the outer surface of the watch (*i.e.*, the “enclosure”) and configured to couple the watch to the user. Given that the claimed enclosure constitutes the outer surface of the electronic device, a person of ordinary skill in the art would understand to connect the watchband of the disclosed watch to

the enclosure of the electronic device. Likewise, a person of ordinary skill in the art would understand that the purpose of a watchband is to couple the watch to the user.

544. Thus, *Chang* discloses claim element [16.d].

Claim 16, Element [16.e]: a button assembly disposed within the opening, the button assembly comprising: a button housing; an input member with an input surface; a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint; a touch sensor configured to detect the touch; a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor; and

545. *Chang* discloses claim element [16.e]. Specifically, *Chang* discloses a button assembly disposed within the opening.

546. This element is substantially similar to claim element [11.c]. As such, I incorporate my analysis with respect to claim element [11.c] herein.

547. Thus, *Chang* discloses claim element [16.e].

548. Claim element 16.e contains five sub-elements, discussed in turn below.

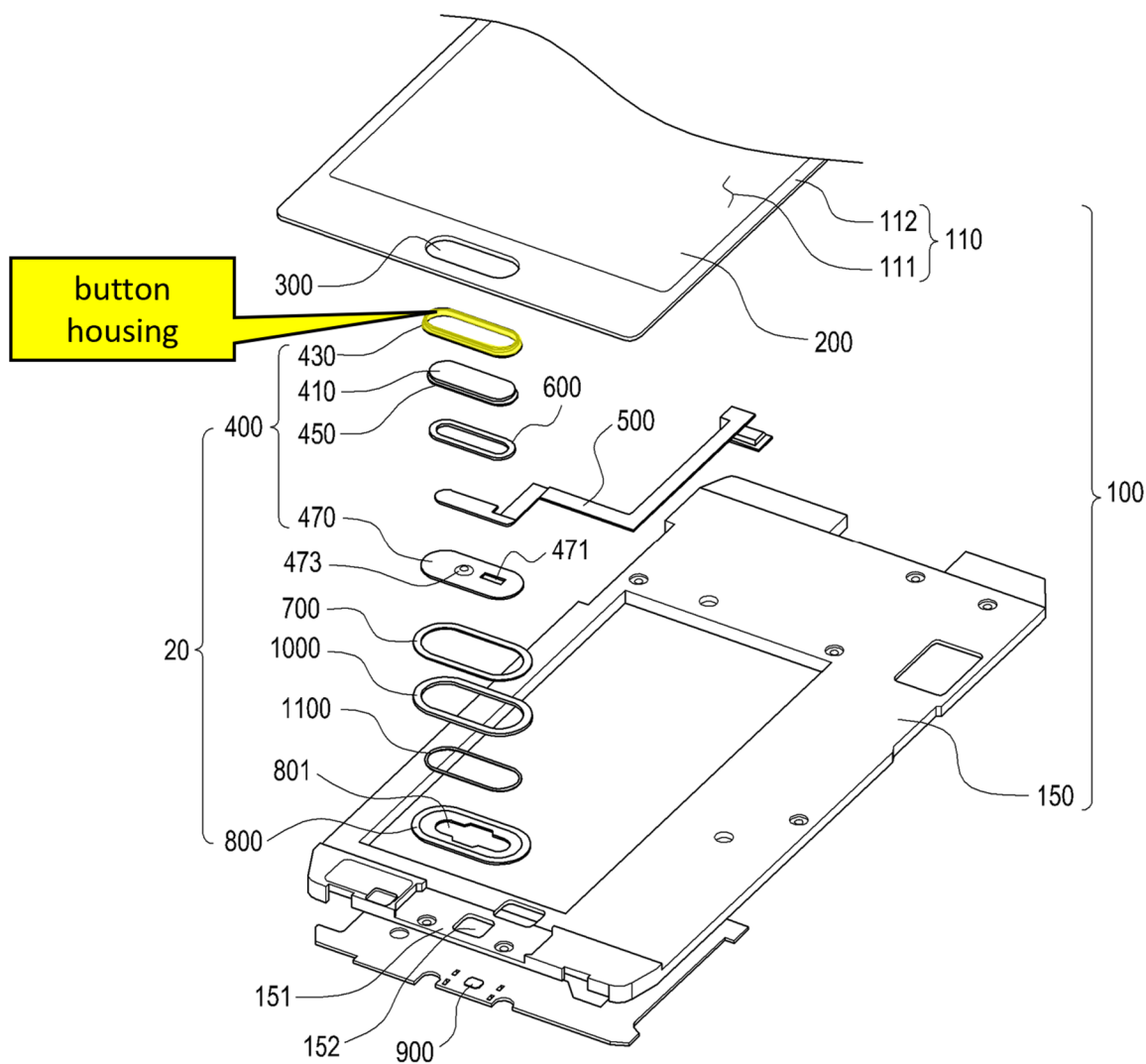
(iii) Claim 16, Element [16.e.i]: a button assembly disposed within the opening, the button assembly comprising: a button housing;

549. *Chang* discloses claim element [16.e.i]. Specifically, *Chang* discloses a button housing.

550. *Chang* discloses that “the key module 20 may include a fingerprint recognizing member 450, a cover layer 410, ***an annular structure 430***, a lower plate

470, one or more sealing members 600, 700, and 1100, an elastic member 800, and a bracket 1000” (Ex-1015, 9:59-63) (emphasis added). The annular structure 430 functions as the claimed button housing, and is depicted below.

Ex-1015, Fig. 3



551. *Chang* explicitly teaches that annular structure 430 serves as a housing, insofar as it “may be arranged along the outer peripheral surfaces of the cover layer

410 and the fingerprint recognizing member 450. For example, the annular structure 430 may be formed to enclose at least a portion of the cover layer 410 when viewed from the top side of the cover layer 410” (Ex-1015, 10:43-49). This is consistent with the description of the button housing, as explained by the ’619 patent:

The biometric button assembly 210 includes a button housing 203 that forms an exterior structure of the biometric button assembly 210. The button housing 203 defines an interior volume 216. The exterior structure of the biometric button assembly 210 includes input surface 212 and housing wall 234. The input surface 212 extends to a perimeter edge of the biometric button assembly 210. The housing wall 234 extends from the perimeter edge of the biometric button assembly 210 into the opening 222 of the electronic device 100. The input surface 212 and the housing wall 234 define an interior volume 216 of the button assembly 210.

(Ex-1001, 12:63-13:10).

552. Thus, *Chang* discloses claim element [16.e.1]

(iv) Claim 16, Element [16.e.ii]: a button assembly disposed within the opening, the button assembly comprising: . . . an input member with an input surface;

553. *Chang* discloses claim element [16.e.ii]. Specifically, *Chang* discloses an input member with an input surface.

554. This element is substantially similar to claim element [11.c]. As such, I incorporate my analysis with respect to claim element [11.c] herein.

555. Thus, *Chang* discloses claim element [16.e.ii].

- (v) **Claim 16, Element [16.e.iii]: a button assembly disposed within the opening, the button assembly comprising: . . . a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint;**

556. *Chang* discloses claim element [16.e.iii]. Specifically, *Chang* discloses a fingerprint sensor positioned below the input member and configured to produce an output signal in response to a touch on the input surface, the output signal corresponding to a fingerprint.

557. This element is substantially similar to claim elements [11.c.i] and 14. As such, I incorporate my analysis with respect to claim elements [11.c.i] and 14 herein.

558. Thus, *Chang* discloses claim element [16.e.iii].

- (vi) **Claim 16, Element [16.e.iv]: a button assembly disposed within the opening, the button assembly comprising: . . . a touch sensor configured to detect the touch;**

559. *Chang* discloses claim element [16.e.iv]. Specifically, *Chang* discloses a touch sensor configured to detect the touch.

560. This limitation is substantially similar to claim elements [11.c.i] and 14. As such, I incorporate my analysis with respect to claim elements [11.c.i] and 14 herein.

561. Specifically, claim 14 recites “wherein the fingerprint sensor is further configured to detect a touch .” A person of ordinary skill in the art would understand

that in order to produce an output signal in response to a touch, the fingerprint sensor must include a touch sensor configured to detect the touch.

562. Moreover, *Chang* explicitly discloses a touch sensor, stating that “the key module 20 (as illustrated in FIG. 3) applied to the electronic device 10 is a data input device, and may be formed of a touch pad, a touch screen, or the like, in addition to a key input device to which data may be input mainly by a finger pushing operation” (Ex-1015, 7:4-17).

563. Thus, *Chang* discloses claim element [16.e.iv].

(vii) Claim 16, Element [16.e.v]: a button assembly disposed within the opening, the button assembly comprising: . . . a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor;

564. *Chang* discloses claim element [16.e.v]. Specifically, *Chang* discloses a flexible conduit electrically coupled to the fingerprint sensor and configured to transmit the output signal to the processor.

565. This element is substantially similar to claim elements [11.f], and 14. As such, I incorporate my analysis with respect to claim elements [11.f], and 14 herein.

566. Thus, *Chang* discloses claim element [16.e.v].

Claim 16, Element [16.f]: a seal positioned between the button housing and a surface of the opening;

567. *Chang* discloses claim element [16.f]. Specifically, *Chang* discloses a seal disposed between the sealing surface of the retainer and a surface of the opening.

568. As discussed above, the “button housing” constitutes the exterior structure of the button assembly discussed in claim element [16.e.iv]. Moreover, as described with respect to previous claims, *Chang* explicitly discloses a seal positioned between the button housing, and the portion of the enclosure defining a surface of the opening. *See*, claim elements [11.d], [16.e.iv].

569. Thus, *Chang* discloses claim element [16.f].

Claim 16, Element [16.g]: wherein a portion of the flexible conduit is sandwiched between the seal and the button housing or between the seal and the surface of the opening.

570. *Chang* renders obvious claim element [16.g]. Specifically, *Chang* discloses wherein a portion of the flexible conduit is sandwiched between the seal and the button housing or between the seal and the surface of the opening.

571. As discussed above, the “button housing” constitutes the exterior structure of the button assembly discussed in claim element [16.e.iv].

572. And, as shown above, *Chang* renders obvious a portion of the flexible conduit sandwiched between the seal and the portion of the enclosure defining the opening. *See*, claim element [11.g]. As such, I incorporate my analysis with respect to claim elements [11.g], [16.e.iv] herein.

573. Thus, *Chang* renders claim element [16.g] obvious.

Claim 17, Element [17.pre]: The watch of claim 16, further comprising:

574. *Chang* discloses claim element [17.pre]. Specifically, *Chang* discloses the watch of claim 16. See claim 16, above.

Claim 17, Element [17.a]: a passage extending from the opening to the enclosed volume; wherein

575. *Chang* discloses claim element [17.a]. Specifically, *Chang* discloses a passage extending from the opening to the enclosed volume.

576. This element is substantially similar to claim element [11.e]. As such, I incorporate my analysis with respect to claim element [11.e] herein.

577. Thus, *Chang* renders claim element [17.a] obvious.

Claim 17, Element [17.b]: the flexible conduit extends from the opening to the enclosed volume through the passage.

578. *Chang* discloses claim element [17.b]. Specifically, *Chang* discloses the flexible conduit extends from the opening to the enclosed volume through the passage.

579. This element is substantially similar to claim 12. As such, I incorporate my analysis with respect to claim 12 herein.

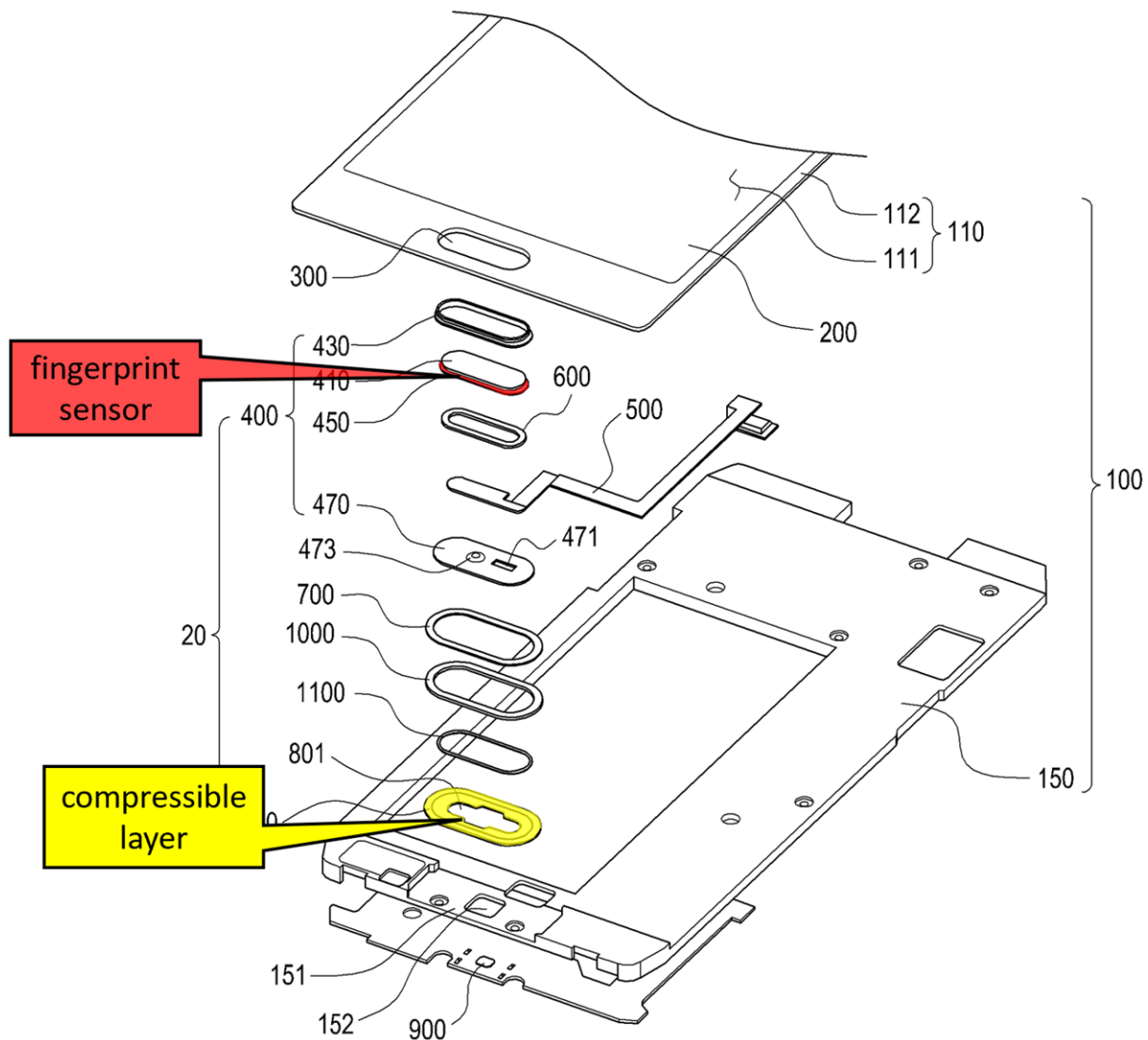
580. Thus, *Chang* discloses claim element [17.b].

Claim 19: The watch of claim 16, further comprising a compressible layer disposed below the fingerprint sensor, the compressible layer compressing to receive a displacement or a deflection of the input member upon receipt of a user force to the input surface.

581. *Chang* discloses claim 19. Specifically, *Chang* discloses the watch of claim 16, further comprising a compressible layer disposed below the fingerprint sensor, the compressible layer compressing to receive a displacement or a deflection of the input member upon receipt of a user force to the input surface.

582. *Chang's* elastic member 800 (*i.e.*, the compressible layer) is depicted in annotated figure 3, below.

Ex-1015, Fig. 3



583. *Chang* teaches that “the key module 20 may include an elastic member 800 disposed below the lower plate 470. The elastic member 800 enables the button structure 400, which is pushed by the user’s compression, to repeat click functions by returning to the initial position thereof, and is able to improve the click feeling with the dome switch 900” (Ex-1015, 13:11-18).

584. Thus, *Chang* discloses claim 19.

X. CONCLUSION

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 7, 2023



Ronald D. Berger, M.D., Ph.D., F.H.R.S.

Appendix A

<i>Kim</i>	<i>Kim-KR</i>
1:14-16: The present disclosure generally relates to an electronic device having a combined mechanical and virtual button and a method for controlling the combined button.	¶1: <1> The following embodiments relate to an electronic device having a combined button and a method for controlling an electronic device using a combined button.

1:38-2:38:

According to one embodiment of the present disclosure, an electronic device may comprise a housing including a first surface facing a first direction and a second surface facing a second direction, the first direction being opposite that of the second direction, the first surface including a first opening and a second opening; a touch screen display being disposed and visible through the first opening; a mechanical button located at least in part of the second opening and movable in response to a pressure applied thereto; a processor located inside the housing and electrically coupled to the display and the mechanical button; and a memory located inside the housing and electrically coupled to the processor, wherein the memory stores a plurality of instructions that cause, upon execution, the processor to: display a screen on at least a portion of the touch screen display; display a graphical user interface (GUI) on a specific region of the screen adjacent to the mechanical button such that the GUI visually extends the mechanical button. The mechanical button may have a first shape and the GUI may have a second shape. The second shape may be disposed about the first shape to form a third larger shape. The mechanical button may have a first color and the GUI has a second color, the first and second colors being different. When the processor receives a touch input

¶¶5-7:

<5> The electronic device according to one embodiment provides an electronic device comprising: a housing comprising a first face facing a first direction and a second face facing a second direction opposite the first direction; a touch screen display exposed through a substantial portion of the first face; an opening formed through a portion of the first face of the housing; a mechanical button which is movable in the second direction in response to pressure applied to the mechanical button, and which is positioned in at least part of the opening; a processor which is positioned inside the housing, and which is electrically coupled to the display and the mechanical button; and, a memory which is positioned inside the housing, and which is electrically coupled to the processor; wherein: the memory stores a plurality of instructions which, when executed, cause the processor to: display a screen on at least part of the display; display a graphic user interface (GUI) on a region of the screen visible from above the first face and which is adjacent to the mechanical button; and, cause the graphic user interface to visually expand the mechanical button.

<6> The electronic device according to another embodiment provides an electronic device comprising: a housing comprising a first face facing a first direction and a second face facing

through the specific region of the screen, a corresponding function associated with the mechanical button is activated in response to the touch input. A fingerprint sensor may be disposed in the specific region where the GUI is displayed.

An electronic device may comprise a housing including a first surface facing a first direction and a second surface facing a second direction, the first direction being opposite that of the second direction, the first surface including a first opening and a second opening; a touch screen display being disposed and visible through the first surface; a mechanical button located at least in part of the second opening and movable in response to a pressure applied thereto, the mechanical button having a corresponding function; a processor located inside the housing and electrically coupled to the touch screen display and the mechanical button; and a memory located inside the housing and electrically connected to the processor. The memory stores a plurality of instructions that cause, upon execution, the processor to: display a virtual button on at least a portion of the touch screen display, and display a graphical user interface (GUI) on a specific region of the screen, the virtual button being configured to perform the corresponding function of the mechanical button, wherein the GUI visually enlarges the mechanical button. The mechanical button may have a circular shape and the GUI may

a second direction opposite the first direction; a touch screen display exposed through a substantial portion of the first face; an opening formed through a portion of the first face of the housing; a mechanical button which is movable in the second direction in response to pressure applied to the mechanical button, and which is positioned in at least part of the opening; a processor which is positioned inside the housing, and which is electrically coupled to the display and the mechanical button; and, a memory which is positioned inside the housing, and which is electrically coupled to the processor; wherein: the memory stores a plurality of instructions which, when executed, cause the processor to: display a screen on at least part of the display; display a graphic user interface (GUI) on a region of the screen visible from above the first face and which is around or adjacent to the mechanical button; and, cause the graphic user interface to visually expand the mechanical button.

<7> Various examples of the present invention provide an electronic device having a combined button realized through a physical button and a virtual button to correspond to increased screen size, and a method for controlling the electronic device using the combined button.

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have a circular band shape surrounding the mechanical button. The mechanical button has a first color and the GUI has a second color, the first and second colors being different. When the processor receives a touch input through the specific region of the screen, a corresponding function associated with the mechanical button is activated in response to the touch input. A fingerprint sensor may be disposed in the specific region where the GUI is displayed. According to various embodiments of the present disclosure, the electronic device having a combined button implemented as a combination of a physical button and a virtual button in response to an increase in screen size is provided together with a method for controlling the combined button. These and further embodiments of the present disclosure are more fully described herein with reference to the accompanying figures in which like reference characters refer to similar elements.	

2:49-3:24:

FIG. 4 shows a front view of an electronic device according to an embodiment.

FIG. 5 Shows a back view of an electronic device according to an embodiment.

FIG. 6A shows six views (i.e., a plane view, a bottom view, a front view, a back view, a right-side view, and a left-side view) of an electronic device according to an embodiment.

FIG. 6B shows a perspective view of an electronic device according to an embodiment.

FIGS. 7(a)-(d) is a diagram illustrating examples of a combined button of an electronic device according to one embodiment.

FIGS. 8(a)-(b) shows a front view and a cross-sectional view of a combined button of an electronic device according to one embodiment.

FIGS. 9(a)-(b) shows a front view and a cross-sectional view of a combined button of an electronic device according to another embodiment.

FIGS. 10(a)-(b) shows a front view and a cross-sectional view of a combined button of an electronic device according to still another embodiment.

¶8:

<8> FIG. 1 is a diagram illustrating a network environment including the electronic device according to various embodiments of the present invention.

FIG. 2 is a block diagram of the electronic device according to various embodiments.

FIG. 3 is a block diagram of a program module according to various embodiments.

FIG. 4 is a front view of the electronic device according to various embodiments.

FIG. 5 is a back view of the electronic device according to various embodiments.

FIG. 6 is a perspective view and six views of the electronic device according to one embodiment of the present invention.

FIG. 7 is a diagram illustrating examples of the combined button of the electronic device according to one embodiment of the present invention.

FIG. 8 is a front view and a cross-sectional view of the combined button of the electronic device according to one embodiment of the present invention.

FIG. 9 is a front view and a cross-sectional view of the combined button of the electronic device according to one embodiment of the present invention.

FIG. 10 is a front view and a cross-sectional view of the combined button of the electronic device

FIGS. 11(a)-(b) shows a front view and a cross-sectional view of a combined button of an electronic device according to yet another embodiment. FIGS. 12(a)-(d) and 13 (a)-(b) are diagrams illustrating an example of controlling a combined button of an electronic device according to an embodiment. FIGS. 14 (a)-(c) is a diagram illustrating an example of controlling a combined button of an electronic device according to another embodiment. FIG. 15 is a diagram illustrating an example of controlling a combined button of an electronic device according to still another embodiment. FIG. 16 is a diagram illustrating an example of controlling a combined button of an electronic device according to yet another embodiment. FIGS. 17 (a)-(b) is a diagram illustrating an example of a screen having a combined button of an electronic device according to one embodiment. FIG. 18 shows a perspective view of an electronic device and a partially enlarged view of an area of the electronic device according to one embodiment.	according to one embodiment of the present invention. FIG. 11 is a front view and a cross-sectional view of the combined button of the electronic device according to one embodiment of the present invention. FIG. 12 is a diagram illustrating an example of a method for controlling the combined button of the electronic device according to one embodiment of the present invention. FIG. 13 is a diagram illustrating an example of a method for controlling the combined button of the electronic device according to one embodiment of the present invention. FIG. 14 is a diagram illustrating an example of a method for controlling the combined button of the electronic device according to one embodiment of the present invention. FIG. 15 is a diagram illustrating an example of a method for controlling the combined button of the electronic device according to one embodiment of the present invention. FIG. 16 is a diagram illustrating an example of a method for controlling the combined button of the electronic device according to one embodiment of the present invention. FIG. 17 is a diagram illustrating an example of a screen comprising a combined button of the electronic device according to one embodiment of the present invention. FIG. 18 is a perspective view and partial cross-sectional view of the combined button of the electronic
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<i>Kim</i>	<i>Kim-KR</i>
	device according to one embodiment of the present invention.
4:13-18: The terms used in the present disclosure are merely used to describe specific embodiments of the present disclosure, and are not intended to limit the present disclosure. As used herein, the singular forms of terms are intended to include the plural forms as well, unless the context clearly indicates otherwise.	¶9: <9> Hereinafter, various embodiments of the present disclosure are described in greater detail with reference to the accompanying drawings. The embodiments and the terms used therein are not intended to limit the art described in the present disclosure to specific examples, and shall be construed as comprising various changes, equivalents, and/or substitutes of the examples. With regard to the descriptions of the drawings, like reference symbols may be used for like component elements. Singular expressions may comprise plural expressions, unless they clearly mean otherwise in the context.

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4:19-31: In this disclosure, an electronic device may be able to perform a communication function. For example, an electronic device may be a smart phone, a tablet personal computer (PC), a mobile phone, a video phone, an e-book reader, a desktop PC, a laptop PC, a netbook computer, a personal digital assistant (PDA), a portable multimedia player (PMP), a Moving Picture Experts Group (MPEG) audio layer 3 (MP3) player, a portable medical device, a digital camera, or a wearable device (e.g., a head-mounted device (HMD) such as electronic glasses, electronic clothes, an electronic bracelet, an electronic necklace, an electronic appcessory, or a smart watch), or the like, but is not limited thereto.	¶¶12-13: <12> The electronic device according to various embodiments in the present disclosure may comprise at least one of a smartphone, tablet PC, mobile telephone, video telephone, e-book reader, desktop PC, laptop PC, netbook computer, work station, server, PDA, PMP (portable multimedia player), MP3 player, medical device, camera, or wearable device. <13> The wearable device may comprise at least one of an accessory type device (for example, watch, ring, bracelet, anklet, necklace, glasses, contact lens or head-mounted-device (HMD)), textile or garment-integrated (for example, electronic garment) device, device attached to the body (for example, skin pad or tattoo), or physically implanted circuit.

5:1-28:

With reference to FIG. 1, a network environment 100 includes the electronic device 101. The electronic device 101 may include a bus 110, a main processor (e.g., including processing circuitry) 120, a memory 130, an input/output interface (e.g., including input/output circuitry) 150, a display 160, a communication interface (e.g., including communication circuitry) 170, a sub-processor (e.g., including processing circuitry) 180, and/or a camera module (e.g., including a camera) 190.

The bus 110 may be a circuit designed for connecting the above-discussed elements and communicating data (e.g., a control message) between such elements.

The main processor 120 may include various processing circuitry configured to receive commands from the other elements (e.g., the memory 130, the input/output interface 150, the display 160, or the communication interface 170, etc.) through the bus 110, interpret the received commands, and perform the arithmetic or data processing based on the interpreted commands.

The memory 130 may store therein commands or data received from or created at the main processor 120 or other elements (e.g., the input/output interface 150, the display 160, or the communication interface 170, etc.).

¶¶17-19:

<17> Referring to FIG. 1, various embodiments of the electronic device 101 within a network environment 100 are illustrated. The electronic device 101 may comprise a bus 110, a processor 120, a memory 130, an input/output interface 150, a display 160, and a communication interface 170. In some embodiments, the electronic device 101 may omit one or more of these component elements or comprise other component elements additionally. The bus 110 may be a circuit designed to connect the component elements 110-170 to each other and may comprise circuitry for transmitting communications (for example, a control message or data) among the component elements.

<18> The processor 120 may comprise one or more of a central processing unit, an application processor, or a communication processor (CP). The processor 120 may carry out computation or data processing with regard to the control and/or communication of at least one other component element of the electronic device 101.

<19> The memory 130 may comprise volatile and/or non-volatile memory. The memory 130 may store commands or data relating to at least one other component element of the electronic device 101. According to one

<i>Kim</i>	<i>Kim-KR</i>
The memory 130 may include programming modules 140 such as a kernel 141, a middleware 143, an application programming interface (API) 145, and an application 147. Each of the programming modules may be composed of software, firmware, hardware, and any combination thereof.	embodiment, the memory 130 may store software and/or a program 140.
7:33-38: Referring to FIG. 2, an electronic device 201 may form, for example, all or a part of the electronic device 101 illustrated in FIG. 1. The electronic device 201 may include at least one main application processor (AP) (e.g., including processing circuitry) 215, a communication module	¶33: <33> FIG. 2 is a block diagram illustrating an example electronic device 201 according to various embodiments. The electronic device 201 may comprise, for example, all or a part of the electronic device 101 illustrated in FIG. 1. The electronic device 201 may comprise at least one main application processor (e.g. AP) 210, a communication module 220, a subscriber identification module 224, a memory 230, a sensor module 240, an input device 250, a display 260, an interface 270, an audio module 280, a camera module 291, a power management module 295, a battery 296, an indicator 297, and a motor 298.

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9:13: a biometric sensor 240I	¶43: <43> The sensor module 240 may comprise, for example, at least one of a gesture sensor 240A, a gyro sensor 240B, an atmospheric pressure sensor 240C, a magnetic sensor 240D, an accelerometer 240E, a grip sensor 240F, a proximity sensor 240G, a color sensor 240H (e.g., RGB (Red, Green, Blue) sensor), a biometric sensor 240I, a temperature-humidity sensor 240J, an ambient light sensor 240K, and a UV (ultra violet) sensor 240M. Additionally or alternatively, the sensor module 240 may comprise, for example, an E-nose sensor, an EMG (electromyography) sensor, an EEG (electroencephalogram) sensor, an ECG (electrocardiogram) sensor, an IR (infrared) sensor, a iris scanner, and/or a fingerprint sensor.

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10:37-46: Each of the above – described elements of the electronic device disclosed herein may be formed of one or more components, and the name of each element may vary according to the type of the electronic device. The electronic device disclosed herein may be formed of at least one of the above-discussed elements without some elements or with additional other elements. Some of the elements may be integrated into a single entity that still performs the same functions as the respective functions of such elements before integrated.	¶60: <60> Each of the above elements described herein may be formed of one or more components, and the name of each element may vary according to the type of the electronic device. In various examples of the electronic device (e.g. electronic device 201), some component elements may be omitted, additional component elements may be comprised, or, some of the component elements may be integrated into a single unit that performs the same functions as the those performed by the integrated component elements prior to their integration.

13:42-67:

As shown in FIG. 4, the electronic device 401 may include a display 410, which may be a touch screen display, a housing 420, an optical sensor 430, a receiver 440, a camera 450, and a home button 460 (or a fingerprint sensor) which is one of combined buttons. The combined buttons may include a recent apps button (or key) 461 and a back button (or key) 462 as well as the home button 460. In addition, the combined buttons may further include a power button (764 in FIG. 18) and / or a volume button (not shown). Although the home button is described as an example of the combined button in this embodiment, the combined button is not limited to the home button.

The combined button 460 may be implemented as a combination of a physical button 460a and a virtual button 460b. The physical button 460a is located near the display 410 (namely, located on the housing 420), and the virtual button 460b is functionally extended from the physical button 460a and displayed on the display 410. The virtual button 460b may include a soft or virtual button (or key).

The physical button 460a located on the housing 420 may include a mechanical button. The virtual button 460b displayed on the display 410 may include a graphical user interface (GUI) that may be displayed on the display 410.

¶¶89-92:

<89> FIG. 4 is a front view of the electronic device 401 according to various examples. The electronic device 401 may comprise a display 410, a housing 420, an optical sensor 430, a receiver 440, a camera 450, and a home button (or fingerprint sensor 460) which is a combined button. The combined button may comprise not only a home button 460 but also a recent apps button (key) 461 and a back button (key) 462. Further, the combined button may comprise a power button 730 (see FIG. 18) and/or volume button (not illustrated). In examples of the present invention, the home button is described as an example of the combined button, and the type of button is not limited to a home button.

<90> The combined button 460 may be implemented as a physical button 460a adjacent (e.g. positioned on the housing 420) to the display 410, and a virtual button 460b which is functionally extended from the physical button 460a and displayed on the display 410. The virtual button may comprise a soft button (key).

<91> The physical button 460a positioned on the housing may be a mechanical button. The virtual button 460b displayed on the display may comprise a graphic user interface (GUI).

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Each of the recent apps button (or key) 461 and the back button (or key) 462 may be located near a left or right side of the home button 460.	<92> On one side of the home button 460 may be positioned a “recent apps button” (key) 461 and a “back button” (key) 462.
15:1-13: The cover glass 620 may protect components, such as the display panel 630, of the electronic device 600. The cover glass 620 may correspond to at least the front surface of the electronic device 600. For example, the cover glass 620 may occupy the entire front surface. Alternatively, the cover glass 620 may occupy the entire front surface and a part of the lateral surface. Therefore, the cover glass 620 may be formed of a flat surface, or may further have a curved surface at upper, lower, left and/or right edges thereof. The cover glass 620 may be formed of a transparent material. For example, the cover glass 120 may be formed of a material such as reinforced glass, plastic (e.g., PET), and/or aluminum oxide, for example but is not limited thereto.	¶102: <102> The cover glass 620 may protect component elements such as the display panel 630 of the electronic device 600. The cover glass 620 may correspond to at least the front face of the electronic device 600. For example, the cover glass 620 may occupy the entire front face. The cover glass 620 may also occupy the front face and part of the side face. The cover glass 620 may be flat, or be curved at the top, bottom, left and/or right edges. The cover glass 620 may be formed of transparent material. The cover glass 120 may be formed of, for example, reinforced glass, plastic (e.g. PET) or aluminum oxide and the like.

16:48-17:12:

The home button 660, which is the combined button, may be disposed at a lower portion of the front surface of the electronic device 600. The home button 660, i.e., the combined button, may be a physical key (or button) or a soft key (or button). The home button 660, i.e., the combined button, may be formed of a physical button 660a in part and a soft or virtual button 660b in part.

When a part of the home button 660 which is the combined button is the physical button 660a, the display panel 630 may include an opening (not shown, similar to the opening 631 formed at an upper portion of the active area) or a cutout formed at a lower portion of the active area so as to dispose the part of the home button 660. Namely, the part of the home button 660 may be disposed in a space formed by the opening or cutout.

A part of the home button 660 which is the combined button may be formed of the soft button 660b at a lower portion of the front surface 611 of the electronic device 600. Namely, the home button 660 which operates as the combined button may be formed of a combination of the physical button 660a and the soft button 660b at a lower portion of the front surface 611 of the electronic device 600. When a part of the home button 660 is the soft button 660b, a fingerprint sensor may be disposed under the home button 660

¶¶118-120:

<118> The home button 660, which is the combined button, may be disposed at a lower portion of the front face of the electronic device 600. The home button 660, i.e., the combined button, may be a physical key (or button) or a soft key (or button). The home button 660, i.e., the combined button, may be formed of a physical button 660a in part and a soft or virtual button 660b in part.

<119> When a part of the home button 660 which is the combined button is the physical button 660a, to arrange a part of the home button 660, the display panel 630 may be formed at the bottom of the active area. For the arrangement of a portion of the home button 660, the display panel 630 may comprise an opening (e.g., an opening at the top, not shown) or a cutout formed at the bottom of the active area. A portion of the home button 660 may be disposed within the opening 631 or a space formed by the cutout.

<120> A part of the home button 660 which is a combined button may be formed as a soft button 660b at a lower portion of the front face 611 of the electronic device 600. A part of the home button 660, which is a combined button, may be implemented as a soft button 660b on the lower part of the front surface 611 of the electronic device 600 and on the upper part of the physical button 660a. When part of the

<i>Kim</i>	<i>Kim-KR</i>
in the display panel 630. In this case, the cover glass 620 may have a recess formed at a position where the fingerprint sensor is disposed. A recently app button 661 and a back button 662 may be located near a left or right side of the home button 660. These buttons 661 and 662 may also be the combined buttons. Further, a power button (not shown) located on the lateral surface of the electronic device 600 may also be the combined button.	home button 660, which is a combination button, is a soft button, a fingerprint sensor may be disposed below the home button 660 area of the display panel 630. The cover glass 620 may comprise a concave portion formed on a location where the fingerprint sensor is disposed. A recently launched app button 661 and a return button 662 may be positioned on one side of the home button 660. Buttons 661 and 662 positioned on one side of the home button 660 may be a combination button. A power button (not shown) positioned on the side of the electronic device 600 may also be a combination button.
18:8-13: Under the virtual button 760b of the home button 760, a sensor (e.g. a fingerprint sensor) may be disposed. The fingerprint sensor may include an optical fingerprint sensor, a capacitive fingerprint sensor, or an ultrasonic fingerprint sensor.	¶130:3 <130> Under the virtual button 760b of the home button 760, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may comprise an optical fingerprint sensor. Also, the fingerprint sensor disposed under the virtual button 760b may comprise a capacitive fingerprint sensor or an ultrasonic fingerprint sensor.

<i>Kim</i>	<i>Kim-KR</i>
18:19-24: In FIG. 7(b) the combined button located at a lower portion of the front surface of the electronic device 701 may be implemented as a home button 760-1. The display 710 (or a display panel) may include an opening 711 (or a cutout). In the opening 711, a part of the home button 760-1 which is the combined button may be positioned.	¶132: <132> In FIG. 7(b), the combined button positioned at a lower portion of the front face of the electronic device 701 may be implemented as a home button 760-1. The display 710 (or a display panel) may comprise an opening 711 (or a cutout). In the opening 711, a part of the home button 760-1 which is the combined button may be positioned.
18:28-32: Under a physical button 760a1 of the home button 760-1 a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may include an optical fingerprint sensor, a capacitive fingerprint sensor, or an ultrasonic fingerprint sensor.	¶134: <134> Under a physical button 760a1 of the home button 760-1, a sensor (e.g., a fingerprint sensor) may be disposed. Also, the fingerprint sensor positioned below the physical button 760a1 may comprise an optical fingerprint sensor or an ultrasonic fingerprint sensor.

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18:47-53: Under the physical button 760a2 of the home button 760-2, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may include an optical fingerprint sensor, a capacitive fingerprint sensor, and/or an ultrasonic fingerprint sensor. Alternatively, the fingerprint sensor may be positioned under both the physical button 760a2 and the virtual button 760b2 of the home button 760-2.	¶139: <139> Under the virtual button 760b2 of the home button 760-2, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may comprise a capacitive fingerprint sensor. Also, the fingerprint sensor disposed under the virtual button 760b2 may comprise an optical fingerprint sensor and/or an ultrasonic fingerprint sensor. A fingerprint sensor (e.g., a capacitive fingerprint sensor, an optical fingerprint sensor, or an ultrasonic fingerprint sensor) may be respectively positioned under the physical button 760a2 and the virtual button 760b2 of the home button 760-2.
19:1-2: Under the physical button 760a3 of the home button 760-3, a sensor (e.g. a fingerprint sensor) may be disposed.	¶143: <143> Under the physical button 760a3 of the home button 760-3, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may comprise an optical fingerprint sensor, a capacitive fingerprint sensor, or an ultrasonic fingerprint sensor. The home button 760-3 which is the combined button disposed in the display 710 may comprise a circular shape, a circular band shape, an oval shape, or a rounded rectangular shape.

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19:26-30: Under the physical button 764a of the power button 764, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may include an optical fingerprint sensor, a capacitive fingerprint sensor, or an ultrasonic fingerprint sensor.	¶146: <146> Under the physical button 764a of the power button 764, a sensor (e.g., a fingerprint sensor) may be disposed. The fingerprint sensor may comprise a capacitive fingerprint sensor or an ultrasonic fingerprint sensor. The fingerprint sensor disposed beneath the physical button 764a may be an optical fingerprint sensor or an ultrasonic fingerprint sensor.
19:47-51: button 760. The sensing area s12 may refer to a specific area in which the fingerprinting sensor (e.g., an optical fingerprint sensor 240p1) positioned under the virtual button 760b of the home button 760 can detect a user fingerprint contacted (or non-contacted) on a cover glass 725. There may be a gap	¶150: <150> The non-sensing area s11 may correspond to the physical button 760a of the home button 760. The sensing area s12 may correspond to the virtual button 760b of the home button 760. The sensing area s12 may refer to a specific area in which the fingerprint sensor (e.g., an optical fingerprint sensor 240p1) positioned under the virtual button 760b of the home button 760 can detect a user fingerprint contacted (or non-contacted) on a cover glass 725. There may be a gap between the physical button 760a and the virtual button 760b.

19:63-20:26:

On the intermediate housing 720 in the sensing area s12, a flexible PCB 706 may be disposed. In the sensing area s12, the flexible PCB 706 may be electrically connected to a force touch panel 730, a display panel 731, a touch screen panel 732, and the fingerprint sensor 240p1. The force touch panel 730, the display panel 731, and the touch screen panel 732 may be collectively referred to as a display hereinafter.

The optical fingerprint sensor 240p1 may be disposed on a portion of the flexible PCB 706. Namely, when the fingerprint sensor is the optical fingerprint sensor 240p1, the optical fingerprint sensor 240p1 may be mounted on the flexible PCB 706 connected to the display 730, 731, and 732 may be bent in a space 706b separated from the home button 760 so as to prevent interference with the home button 760.

A stack of a first protective layer 707 and a second protective layer 708 may be disposed on another portion of the flexible PCB 706, namely, located near the optical fingerprint sensor 240p1 on the flexible PCB 706. On the stack of the first and second protective layers 707 and 708, the display composed of the force touch panel 730, the display panel 731, and the touch screen panel 732 may be disposed. The force touch panel 730 may be formed of a

¶¶153-155:

<153> Above the housing 720, a printed circuit board 705 corresponding to the sensing area s12 may be disposed, and above the housing 720, a flexible printed circuit board 706 connected to a force touch panel 730 may be disposed. The flexible printed circuit board 706 connected to the display panel 731 may be electrically connected to a display panel 730, a force touch panel 731, and the fingerprint sensor 240p1.

<154> The optical fingerprint sensor 240p1 may be disposed on a portion of the flexible PCB 706. When the fingerprint sensor is the optical fingerprint sensor 240p1, the optical fingerprint sensor 240p1 may be mounted on the flexible PCB 706 connected to the display 730 to 732. A portion (e.g., a chip on panel (COP)) of the flexible PCB 706 that is connected to the display 730 to 732 may be bent in a space 706b above the electronic device 701 and separated from the home button 760 so as to prevent interference with the home button 760.

<155> A first protective layer 707 and a second protective layer 708 may be disposed above the flexible PCB 706 and on one side of the optical fingerprint sensor 240p1. The display panel 731 may be disposed between the first protective layer 707 and the force touch panel 730. The force touch panel 730 may be formed of an opaque

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transparent material for transmitting light in the sensing area s12. Alternatively, in case of being formed of an opaque material, the force touch panel 730 may have an opening for light transmission. On the touch screen panel 732, a cover glass 725 is placed.	material (e.g. opening) or transparent material for transmitting light in the sensing area s12. A touch screen panel 732 may be disposed between the cover glass 725 and the force touch panel 730.

20:27-50:

The physical button 760a of the home button 760 corresponding to the non-sensing area s11 may be accommodated in a home button recess 760r2 formed near the optical fingerprint sensor 240p1. The physical button 760a may include a dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or push or selection) and then come in contact with a tact point 721 located at the bottom of the home button recess 760r2. The physical button 760a and the optical fingerprint sensor 240p1 may be separated (or partitioned) from each other by a sealing rubber 722.

FIG. 9 shows a front view and a cross sectional view of a combined button of an electronic device according to another embodiment.

When the display is increased in size or enlarged, the home button recess 760r2 may be integrated with a display recess 760r1 to form an integrated recess 760r as shown in FIG. 9. In the integrated recess 760r, the sealing rubber 722 separates the display recess 760r1 and the home button recess 760r2.

The sealing rubber 722 may have a sealing and water-proof function. The sealing rubber 722 may be adhered to the force touch panel 730 with an adhesive 760t (or an adhesive tape).

¶¶156-159:

<156> The physical button 760a of the home button 760 corresponding to the non-sensing area s11 may be accommodated in a home button recess 760r2 formed near the optical fingerprint sensor 240p1. The physical button 760a may comprise a dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or push or selection) and then come in contact with a tact point 721 positioned at the bottom of the home button recess 760r2. The physical button 760a and the optical fingerprint sensor 240p1 may be separated (or partitioned) from each other by a sealing rubber 722.

<157> FIG. 9 is a front view and a cross-sectional view of the combined button of the electronic device according to one embodiment of the present invention.

<158> Referring to (a) and (b) of FIG. 9, when the display is increased in size or enlarged, the home button recess 760r2 may be integrated with a display recess 760r1 to form an integrated recess 760r as shown. In the integrated recess 760r, the sealing rubber 722 separates the display recess 760r1 and the home button recess 760r2. The integrated recess 760r may be divided, by the sealing rubber 722, into a display recess 760r1 and a home button recess 760r2.

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	<159> The sealing rubber 722 may have a sealing and waterproof function. The sealing rubber 722 may be adhered to the display panel 731 with an adhesive (or an adhesive tape).
20:56-60: On the PCB 705, a flexible PCB 706s may be disposed separately. The fingerprint sensor may be a capacitive fingerprint sensor 240p2 embedded in the physical button 760a. The flexible PCB 706s may be electrically connected to the capacitive fingerprint sensor 240p2.	¶161: <161> Above the PCB 705 may be positioned a separate flexible PCB (706s) connected to the capacitive fingerprint sensor 240p2 inside the physical button 760a.
21:12-19: The capacitive fingerprint sensor 240p1 embedded in the physical button 760a of the home button 760 may be surrounded by the sealing rubber 722 as shown in FIG. 9(a). The physical button 760a may include the dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or selection) and then come in contact with the tact point 721 located at the bottom of the home button recess 760r2.	¶165: <165> The capacitive fingerprint sensor 240p2 embedded in the physical button 760a of the home button 760 may be surrounded by the sealing rubber 722. The physical button 760a may comprise a dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or selection) and then come in contact with the tact point 721 positioned at the bottom of the sealing rubber 722.

21:20-21:41:

FIGS. 10(a) and 10(b) show a front view and a cross-sectional view of a combined button of an electronic device according to still another embodiment.

Referring to FIG 10(a) a circular home button 760 including a physical button 760a and a virtual button 760b may be implemented as an example of the combined button in the display 710.

Each of the physical button 760a and the virtual button 760b may include a fingerprint sensor. For example, the capacitive fingerprint sensor may be formed equally in each of the physical button 760a and the virtual button 760b.

The fingerprint sensor (e.g., the capacitive fingerprint sensor) corresponding to the virtual button 760b may be disposed (or mounted) to surround the fingerprint sensor (e.g., the capacitive fingerprint sensor) corresponding to the physical button 760a.

Alternatively, the physical button 760a and the virtual button 760b may include the same or different kinds of fingerprint sensors. For example, the physical button 760a may have the optical fingerprint sensor, and the virtual button 760b may have the capacitive fingerprint sensor or vice versa.

¶¶166-170:

<166> FIG. 10 is a front view and a cross-sectional view of the combined button of the electronic device according to one embodiment of the present invention.

<167> Referring to (a) and (b) of FIG. 10, a circular home button 760 comprising a physical button 760a and a virtual button 760b may be implemented as an example of the combined button in the display 730.

<168> Each of the physical button 760a and the virtual button 760b of the circular home button 760, which is a combined button, may comprise a fingerprint sensor. For example, the capacitive fingerprint sensor may be formed equally in each of the physical button 760a and the virtual button 760b.

<169> The fingerprint sensor (e.g., the capacitive fingerprint sensor) corresponding to the virtual button 760b may be disposed (or mounted) to surround the fingerprint sensor (e.g., the capacitive fingerprint sensor) corresponding to the physical button 760a.

<170> The physical button 760a and the virtual button 760b may comprise the same or different kinds of fingerprint sensors. For example, the physical button 760a may be implemented with the optical

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	fingerprint sensor, and the virtual button 760b may be implemented with the capacitive fingerprint sensor or vice versa.
21:58-22:3: The user may input his or her fingerprint through the first fingerprint sensor corresponding to the physical button 760a and the second fingerprint sensor corresponding to the virtual button 760b at a time (or together) in the home button 760. The electronic device 701 may acquire (or capture) the user fingerprint through the first fingerprint sensor corresponding to the physical button 760a and the second fingerprint sensor corresponding to the virtual button 760b in the home button 760. The electronic device 701 may compose fingerprint images 241a and 241b respectively obtained by the first and second fingerprint sensors into a single fingerprint image 241.	¶¶173-174: <173> The user may input his or her fingerprint through the first fingerprint sensor corresponding to the physical button 760a and the second fingerprint sensor corresponding to the virtual button 760b at a time (or together) in the home button 760. <174> The electronic device 701 may acquire (or capture) the user fingerprint through the first fingerprint sensor corresponding to the physical button 760a and the second fingerprint sensor corresponding to the virtual button 760b in the home button 760. The electronic device 701 may form fingerprint images 241a and 241b respectively obtained by the first and second fingerprint sensors into a single fingerprint image 241.

22:4-27:

In a cross-sectional view shown in FIG 10(b), the battery 296 is located on the bottom of the housing 720. The PCB 705 is disposed between the bottom and intermediate of the housing 720 so as to mount the plurality of electronic elements 705a.

On the intermediate of the housing 720, the flexible PCB 706 may be disposed. The flexible PCB 706 may be electrically connected to the capacitive fingerprint sensor 240p2 embedded in the physical button 760a.

The capacitive fingerprint sensor 240p2 embedded in the physical button 760a may be disposed on the flexible PCB 706. Alternatively, the optical fingerprint sensor 240p1 may be disposed on the flexible PCB 706.

A stack of the first and second protective layers 707 and 708 may be disposed on the flexible PCB 706. On the stack of the first and second protective layers 707 and 708, the display composed of the force touch panel 730, the display panel 731, and the touch screen panel 732 may be disposed. The cover glass 725 may be placed on the touch screen panel 732. In addition to the capacitive fingerprint sensor 240p2 embedded in the physical button 760a, another capacitive fingerprint sensor 240p2 may be further disposed between the cover

¶¶175-178:

<175> The battery 296 is positioned above the housing 720 of the electronic device 701. The PCB 705 may be positioned above the housing 720 and on one side of the battery 296 so as to mount the plurality of electronic elements 705a.

<176> The housing 720 may be positioned above the PCB 705, and a flexible PCB 706 connected to the capacitive fingerprint sensor 240p2 inside the physical button 760a connected to the force touch panel 730 may be positioned above the housing 720.

<177> The capacitive fingerprint sensor 240p2 inside the physical button 760a may be positioned on the flexible PCB 706. IN another example, an optical fingerprint sensor 240p1 may be positioned on the flexible PCB 706.

<178> A first protective layer 707 and a second protective layer 708 may be positioned on one side (or above one side) of the flexible PCB 706. The display panel 731 may be positioned between the first protective layer 707 and the force touch panel 730. The touch screen panel 732 may be positioned between the cover glass 725 and the force touch panel 730. Another capacitive fingerprint sensor 240p2 separate from the capacitive finger print sensor 240p2 inside the physical button 760a may be

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glass 725 and the touch screen panel 732.	additionally positioned between the cover glass 725 and the touch screen panel 732.
22:28-42: The capacitive fingerprint sensor 240p2 embedded in the physical button 760a may be surrounded by the sealing rubber 722. The physical button 760a may include the dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or selection) and then come in contract with a support fixture 721a located on the sealing rubber 722. Similar to the previous embodiment shown in FIG. 9, the display recess 760r1 and the home button recess 760r2 may be integrated with each other to form the integrated recess 760r. In the integrated recess 760r, the sealing rubber 722 seperates the display recess 760r1 and the home button recess 760r2. The sealing rubber 722 may be adhered to the force touch panel 730 with an adhesive (or an adhesive tape).	¶¶179-181: <179> The capacitive fingerprint sensor 240p2 embedded in the physical button 760a may be surrounded by the sealing rubber 722. The physical button 760a may comprise the dome switch 760a1. The dome switch 760a1 of the physical button 760a may move downward by a user's click (or selection) and then come in contact with a support fixture 721a positioned on the sealing rubber 722. <180> Similar to the previous example as shown in FIG. 9, the display recess 760r1 and the home button recess 760r2 may be integrated with each other to form the integrated recess 760r. In the integrated recess 760r, the sealing rubber 722 separates the display recess 760r1 and the home button recess 760r2. The integrated accommodating area 760r may be divided by a sealing rubber 722 into a display accommodating area 760r1 and a home button accommodating area 760r2. <181> The sealing rubber 722 may be adhered to the display panel 731 with an adhesive (or an adhesive tape).

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23:6-21: On the PCB 705, the flexible PCB 706s may be disposed and connected to the fingerprint sensor 240p1 or 240p2 located under the physical button 760a. The supports 721b may be disposed near both sides of the fingerprint sensor 240p1 or 240p2 or surround the fingerprint sensor. A stack of the first and second protective layers 707 and 708 may be disposed on the flexible PCB 706. On the stack of the first and second protective layers 707 and 708, the display composed of the force touch panel 730, the display panel 731, and the touch screen panel 732 may be disposed. On the touch screen panel 732, the cover glass 725 may be placed. The virtual button 760b may be disposed as if surrounding the physical button 760a formed on the cover glass 725.	¶187: <187> Above the PCB 705 may be positioned a flexible PCB 706 connected to the fingerprint sensor 240p1 or 240p2 positioned beneath the physical button 760a. Supports 721b may be positioned on both sides of (or encompassing) the fingerprint sensor 240p1 or 240p2.