

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Jonathan O'Toole et al.
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Appl. Serial No.: 17/203,292
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Title: BREAST PUMP SYSTEM

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 11,813,381 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBIT LIST

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1001	U.S. Patent No. 11,813,381 to Jonathan O'Toole et al. ("the '381 patent")
1002	File History of Application 17/203,292 ("the File History")
1003	Declaration of Ryan Bauer in Support of Petition
1004	File History of Application No. 16/009,547
1005	File History of Application No. 17/181,057 (as of October 2, 2024)
1006	Curriculum Vitae of Ryan Bauer
1007	U.S. Patent Application Publication No. 2018/0333523 ("Chang")
1008	CN Utility Model CN205913571U ("Fang CN")
1009	Certified English Translation of CN Utility Model CN205913571U ("Fang")
1010	U.S. Patent Application Publication No. 2013/0023821 ("Khalil")
1011	U.S. Patent No. 7,641,629 ("Yuen629")
1012	PCT Publication No. WO 2016/186452 ("Park KR")
1013	Certified English Translation of PCT Publication No. WO 2016/186452 ("Park")
1014	U.S. Patent Application Publication No. 2016/0206794 ("Makower794")
1015	U.S. Patent No. 10,483,002 ("Guthrie002")
1016	U.S. Patent Application Publication No. 2016/0271305 ("Kurihara")

Exhibit	Reference
1017-1030	RESERVED
1031	AU Patent Application Publication No. 2010300058 (“Weber”)
1032	U.S. Patent Application Publication No. 2017/0080135 (“Chen”)
1033	U.S. Application Publication No. 2015/0217033 (“Pollen”)
1034	U.S. Application Publication No. 2012/0116299 (“Tack”)
1035	U.S. Patent Application Publication No. 2016/0082166 (“Guthrie166”)
1036	U.S. Application Publication No. 2015/0157775 (“Hu”)
1037	PCT Publication No. WO 2002/102437 (“Myers437”)
1038	PCT Publication No. WO 2008/137678 (“Myers678”)
1039	U.S. Patent Application Publication No. 2007/0219486 (“Myers486”)
1040	U.S. Patent Application Publication No. 2009/0281485 (“Baker”)
1041-1050	RESERVED
1051	Declaratory Judgment Complaint, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), filed 4/28/2023
1052	Chiaro Technology Ltd.’s Answer, Defenses, and Counterclaims to Plaintiff’s Amended Complaint, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), filed 8/14/2023
1053	Chiaro Technology Ltd.’s Amended Counterclaims, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), filed 5/1/2024

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1054A	Elvie's Disclosure of Asserted Claims and Initial Infringement Contentions Under Local Patent Rule 120, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), served 6/10/2024
1054B	Elvie's Disclosure of Asserted Claims and Supplemental Infringement Contentions Under Local Patent Rule 120, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), served 8/1/2024
1054C	Exhibit 15 – U.S. Patent No. 11,813,381 – Infringement Claim Chart for Momcozy S9 Product, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), served 6/10/2024
1055	Order on Motion to Continue Pretrial Deadlines and Strike Trial Date, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), issued 6/28/2024
1056	Momcozy's Motion to Continue Pre-Trial Deadlines and Strike Trial Date, <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), issued 6/4/2024
1057	Docket of <i>Shenzhen Root Technology Co., Ltd., v. Chiaro Technology, Ltd.</i> , Case No. 23-cv-00631 (W.D. Wash.), as of October 02, 2024

LISTING OF CHALLENGED CLAIMS

Element	Claim Limitations
Claim 1	
1[pre]	A breast pump device comprising:
1[a]	a self-contained, in-bra wearable device comprising:
1[a][1]	a diaphragm configured to prevent milk from reaching an air pump by forming a seal around its outer edge;
1[a][2]	a housing that includes:
1[a][2][i]	a battery, and
1[a][2][ii]	the air pump powered by the battery and configured to generate negative air pressure by driving the diaphragm;
1[a][3]	a breast shield comprising a breast flange and a nipple tunnel extending from the breast flange,
1[a][3][i]	the nipple tunnel comprising a closed end and a milk port intermediate to the breast flange and the closed end, and
1[a][3][ii]	the breast shield being separate from the diaphragm; and
1[a][4]	a milk container that is configured to attach to the housing and receive expressed milk via the milk port.
Claim 2	
[2]	The breast pump device of claim 1, wherein the breast shield is configured to rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct positioning of the breast shield onto a breast.
Claim 3	
[3]	The breast pump device of claim 1, wherein the breast shield is a one-piece item that, in use, presents a single continuous surface to a nipple and a breast.

Claim 4	
[4]	The breast pump device of claim 1, wherein the breast shield integrates the breast flange and nipple tunnel as a one-piece item.
Claim 5	
[5]	The breast pump device of claim 1, wherein the breast flange and the nipple tunnel are a single, integral item with no joining stubs.
Claim 6	
[6]	The breast pump device of claim 1, wherein the breast shield is generally symmetrical about a centre-line running from a top to a bottom of the breast shield when positioned upright for normal use.
Claim 7	
[7]	The breast pump device of claim 1, wherein the breast shield is configured to slide in and out from the housing, together with the diaphragm, on guide members in the breast shield.
Claim 8	
[8]	The breast pump device of claim 1, wherein the housing is configured to slide onto the breast shield, when the breast shield has been placed onto a breast, using guide members.
Claim 9	
[9]	The breast pump device of claim 1, wherein the breast pump device includes only the breast shield and the milk container that are directly removable from the housing in normal use or normal dis-assembly.
Claim 10	
[10]	The breast pump device of claim 1, wherein the diaphragm is substantially circular and is configured to self-seal under the negative air pressure to a substantially circular diaphragm holder that is part of the housing.

Claim 11	
[11]	The breast pump device of claim 1, wherein the diaphragm is a membrane, and the diaphragm deforms in response to changes in air pressure caused by the air pump to create negative air pressure in the nipple tunnel.
Claim 12	
[12]	The breast pump device of claim 1, wherein the diaphragm is removable from a diaphragm holder that sits above the breast flange and the nipple tunnel.
Claim 13	
[13]	The breast pump device of claim 1, wherein the milk container is substantially rigid.
Claim 14	
[14]	The breast pump device of claim 1, wherein the milk container is configured to attach to a lower part of the housing and to form a flat bottomed base for the breast pump device.
Claim 15	
[15]	The breast pump device of claim 1, wherein the milk container has a surface shaped to continue a curved shape of the housing, so that the breast pump device can be held comfortably inside the bra.
Claim 16	
[16]	The breast pump device of claim 1, wherein the milk container includes a flexible valve that self-seals under negative air pressure against the milk port in the nipple tunnel and that permits the expressed milk to flow into the milk container.

Claim 17	
[17]	The breast pump device of claim 1, wherein the milk container is attachable to the housing with a mechanical or magnetic mechanism that releasably attaches or latches when the milk container is sufficiently pressed on to the housing with a single push action.
Claim 18	
[18]	The breast pump device of claim 1, wherein the milk container includes a cap that is removable from the milk container and a removable valve that enables milk to pass into the milk container in one direction.
Claim 19	
[19]	The breast pump device of claim 1, wherein a top of the milk container includes an optically clear region that is aligned below one or more light emitters positioned in a base of the housing.
Claim 20	
[20]	The breast pump device of claim 1, wherein the milk container is wider than the milk container is tall.
Claim 21	
[21]	The breast pump device of claim 1, wherein the nipple tunnel includes on a lower surface the milk port through which the expressed milk flows under gravity into the milk container.
Claim 22	
[22]	The breast pump device of claim 1, wherein the housing includes a wireless data communication system powered by the battery.
Claim 23	
[23]	The breast pump device of claim 1, wherein the housing has a front surface that is configured to fit inside a bra and to contact an inner surface of the bra, and a rear surface that is shaped to contact, at least in part, the breast shield.

Claim 24	
[24]	The breast pump device of claim 1, wherein the housing includes at least one of a visual or haptic indicator that indicates whether milk is flowing or not flowing into the milk container.
Claim 25	
[25]	The breast pump device of claim 1, wherein the housing includes at least one of a visual or haptic indicator that indicates if the air pump is operating correctly to pump milk, based on whether a quantity or a height of liquid in the milk container above a base of the milk container is increasing above a threshold rate of increase.
Claim 26	
[26]	The breast pump device of claim 1, wherein the air pump comprises a piezo air pump system.
Claim 27	
[27]	The breast pump device of claim 1, wherein a total mass of the breast pump device, unfilled with milk, is less than 250 gm.
Claim 28	
[28]	The breast pump device of claim 1, wherein the breast pump device makes less than 30 dB noise at maximum power and less than 25 dB at normal power, against a 20 dB ambient noise.
Claim 29	
[29]	The breast pump device of claim 1, wherein the air pump is configured to generate negative air pressure with a maximum suction of approximately 240 mmHg.

Petitioner Shenzhen Root Technology Co., Ltd. (“Petitioner”) requests *inter partes* review (“IPR”) of claims 1-29 (“Challenged Claims”) of U.S. Patent 11,813,381 (“the ’381 patent”).

I. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner certifies the ’381 patent is available for IPR and Petitioner is not barred or estopped. Patent Owner Chiaro Technology (“PO”) first alleged infringement of the ’381 patent on 5/1/2024. Petitioner files this Petition within one year of that event.

B. Challenge and Relief Requested—37 C.F.R. § 42.104(b)

Petitioner requests IPR on the following grounds. A declaration of Mr. Bauer (EX1003) supports this Petition. EX1003, ¶¶8-14, 108.

Grounds	Claim(s)	§103 Grounds
1A	1-13, 16, 17, 22, 23, 27, 29	Chang-Fang
1B	19	Chang-Fang-Yuen629
1C	24	Chang-Fang-Makower794
1D	25	Chang-Fang-Makower794-Guthrie002
2A	1-13, 16, 17, 22, 23, 26-29	Chang-Fang-Kurihara
2B	19	Chang-Fang- Kurihara-Yuen629

Grounds	Claim(s)	§103 Grounds
2C	24	Chang-Fang- Kurihara-Makower794
2D	25	Chang-Fang- Kurihara-Makower794-Guthrie002
3A	1-18, 20-23, 27, 29	Chang-Fang-Khalil
3B	19	Chang-Fang-Khalil-Yuen629
3C	24	Chang-Fang-Khalil-Makower794
3D	25	Chang-Fang-Khalil- Makower794-Guthrie002
4A	1-18, 20-23, 26-29	Chang-Fang-Khalil-Kurihara
4B	19	Chang-Fang-Khalil- Kurihara-Yuen629
4C	24	Chang-Fang-Khalil- Kurihara-Makower794
4D	25	Chang-Fang-Khalil-Kurihara-Makower794-Guthrie002

Each reference pre-dates the filing of the earliest claimed priority application filed on 6/15/2017. The applied references qualify as prior art under §102:

Reference	Date	Section
Chang	Feb. 9, 2017 (filed)	102(a)(2)
Fang	Feb. 1, 2017 (published)	102(a)(1)
Khalil	Jan. 24, 2013 (published)	102(a)(1)
Kurihara	Sep. 2, 2016 (published)	102(a)(1)
Yuen629	Jan. 5, 2010 (published)	102(a)(1)
Makower794	Jul. 21, 2016 (published)	102(a)(1)

Reference	Date	Section
Guthrie002	Oct. 28, 2016 (filed)	102(a)(2)

Fang (EX1009) is a certified English translation of Chinese Utility Model CN205913571U and is cited through the petition to identify relevant aspects of Fang (EX1008).

II. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) would have had at least a bachelor’s degree in mechanical engineering or a similar field and at least two years of experience designing human breast pump equipment. More education could substitute for experience and vice versa. EX1003, ¶¶15-18.

III. CLAIM CONSTRUCTION

During prosecution of a parent application, the Examiner construed the term “*self-contained, in-bra wearable device*” to mean “‘complete, or having all that is needed, in itself’ and is capable of being worn in a bra.” EX1005, 2290. PO did not dispute this construction, and Petitioner applies it herein. Other terms of the Challenged Claims should receive their plain and ordinary meaning, and no formal claim constructions are necessary because “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); EX1003, ¶¶72-73.

IV. THE '381 PATENT

A. Specification

The '381 patent relates to a breast pump that is wearable inside a bra. EX1001, 3:66-4:4. The specification acknowledges that fully integrated in-bra breast pumps existed in the prior art, including as disclosed by US2016/0206794 (“Makower794”) and US2013/0023821 (“Khalil”). *See* EX1001, 2:7-59; EX1003, ¶38. The '381 patent describes that Makower794’s disadvantages include a collapsible bag as the container, a noisy and complex pump, and limited capacity, and that Khalil’s disadvantages were an annular diaphragm resulting in a large, bulky device. EX1003, ¶39.

The '381 patent purports to overcome these disadvantages with “a self-contained, in-bra wearable” breast pump device with a housing, a pump powered by a rechargeable battery, a breast shield, a milk container, a diaphragm (or membrane) that deforms in response to changes in air pressure caused by the pump. *See* EX1001, 5:58-65; *see also* EX1003, ¶¶40-43.

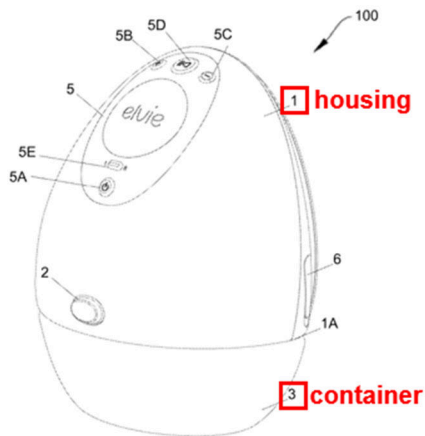


FIGURE 1

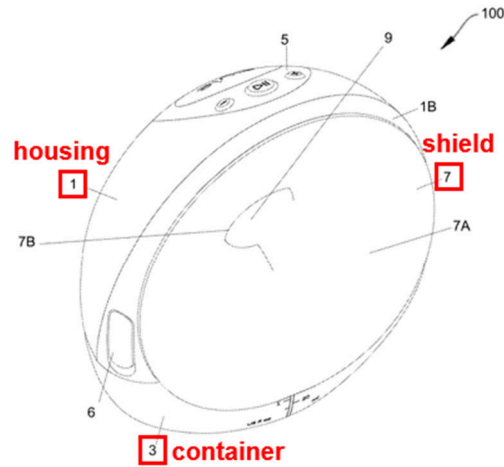


FIGURE 2

EX1003, ¶42 (annotating EX1001, Figs. 1, 2); *see* EX1001, 5:66-6:15, 6:25-32

The breast pump system includes a “diaphragm” (or “membrane” or “barrier”) for transferring “negative air pressure” (or “suction” or “vacuum”) from the pump to the milk-collection side (i.e., breast side) of the system. EX1001, 10:35-44, 11:10-17.

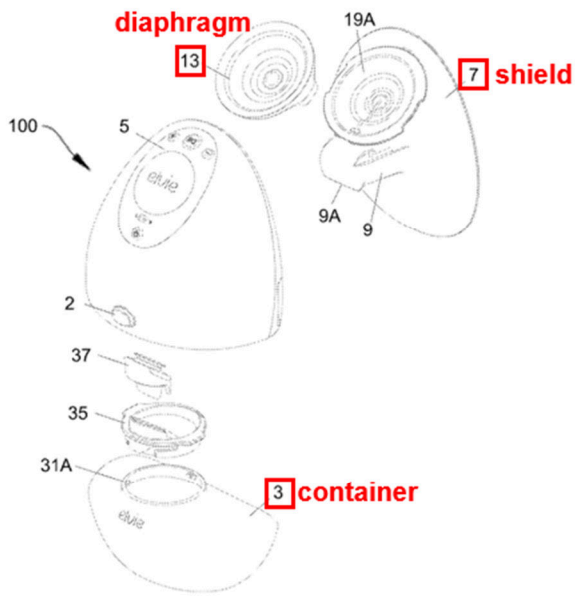


FIGURE 5

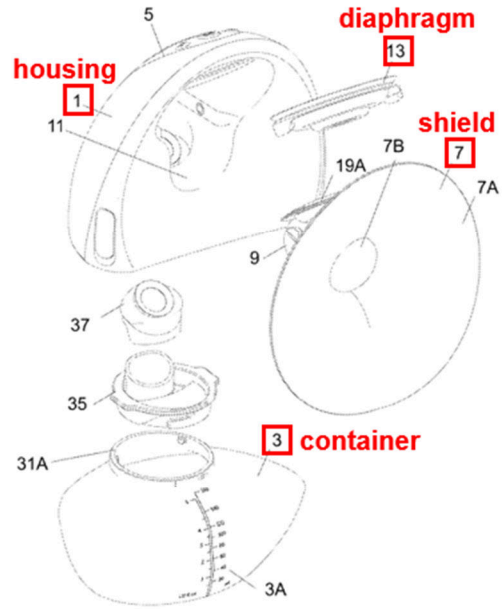


FIGURE 6

EX1003, ¶44 (annotating EX1001, Figs. 5, 6)

Diaphragm 13 is positioned in diaphragm housing and transfers negative pressure generated by the pump into nipple tunnel 9. EX1001, 10:35-44, 11:27-48. The diaphragm housing has a first half (19A) attached with breast shield 7 and a second half (19B) in a recessed portion of housing 1:

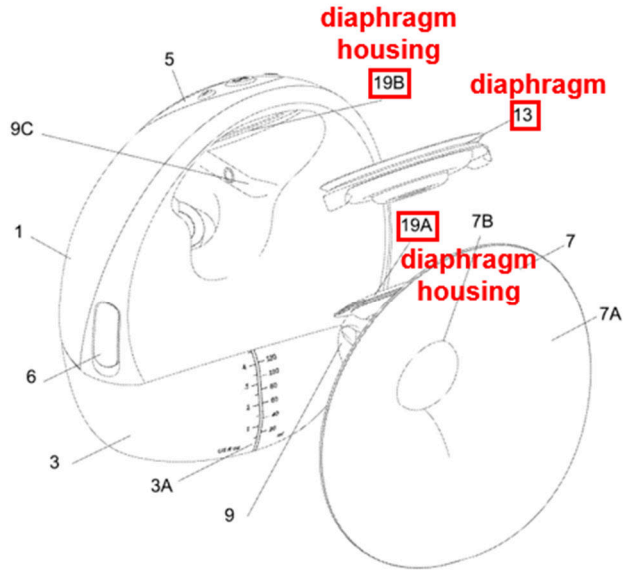


FIGURE 4

EX1003, ¶¶45-47 (annotating EX1001, Fig. 4); *see* EX1001, 11:27-48

B. Prosecution

In the First Office Action issued in the '259 application, the examiner never raised any substantive prior art rejections, and instead identified original claim 1 as allowable based on the mistaken belief that the prior art lacked a “breast shield configured to slide out from the housing together with the diaphragm.” EX1002, 564-65 (citing Khalil’s breast shield in Fig. 11).

Oddly, Applicant subsequently amended claim 1 to remove the feature the examiner had identified as allowable. EX1002, 678. Claim 1 was later amended to recite a “nipple tunnel” extending from the breast flange, the nipple tunnel comprising “a closed end and a milk port intermediate to the breast flange and the closed end, and the breast shield being separate from the diaphragm.” *Id.*, 1469.

After an examiner-initiated interview (*id.*, 2255), the examiner allowed the claims based on the mistaken belief that the prior art did not suggest “a nipple shield comprising a closed end and a milk port intermediate to the breast flange and the closed end, in combination with the total structure and function as claimed.” *Id.*, 2246-54 (citing Khalil’s breast shield in Fig. 11)); *see also id.*, 2364-68, 2400-09, 2508-09.

The examiner’s mistaken conclusion overlooked the actual state of the art. As explained in this Petition, Chang and Fang plainly taught the features that the Examiner believed to be missing from the prior art. *Infra* §VI; EX1003, ¶¶48-56. Had the prior art combinations in the grounds below been considered (especially in view of supporting expert testimony), the Challenged Claims never would have issued in their current form.

V. TECHNOLOGY BACKGROUND

The breast pump industry has been significantly influenced by government policies and related market forces. For example, the ACA significantly increased demand for all types of breast pumps and accessories. EX1003, ¶¶19-25. One example of the resulting products and competitors was the Willow Breast Pump, which was shown at the Consumer Electronics Show (CES) in January 2017—months before the alleged priority date of the ’381 patent. *Id.*, ¶¶26-27. Breast pumps are relatively simple electromechanical devices that were configured in a

variety of ways before June 2017. The components of breast pumps were often compactly assembled together or separated (and connected by lines, hoses, or wires), as desired. In this crowded field, a POSITA knew that there is no single design ideal for all purposes and all types of users, and instead the ordinary creativity in this field generated a flourishing variety of design combinations long before June 2017. EX1003, ¶¶28-37.

VI. DETAILED EXPLANATION OF GROUNDS

A. Ground 1A: Chang-Fang Renders Claims 1-13, 16, 17, 22, 23, 27, And 29 Obvious

1. Chang-Fang

a. Chang

Chang describes “portable breast pump systems...for collecting milk from a breast of a nursing mother.” EX1007, [0001]. Chang’s breast pump “is contemplated to fit comfortably and conveniently into a bra” (*id.*, [0011]) such that “the flange or skin contact member, the conduit, the driving mechanism, the external shell and the milk collection container are all contained within a cup of a brassiere” (*id.*, [0019]). EX1003, ¶¶74-75.

Chang’s breast pump 10 includes “housing or outer shell 12” (blue) and “flange 14” (purple):

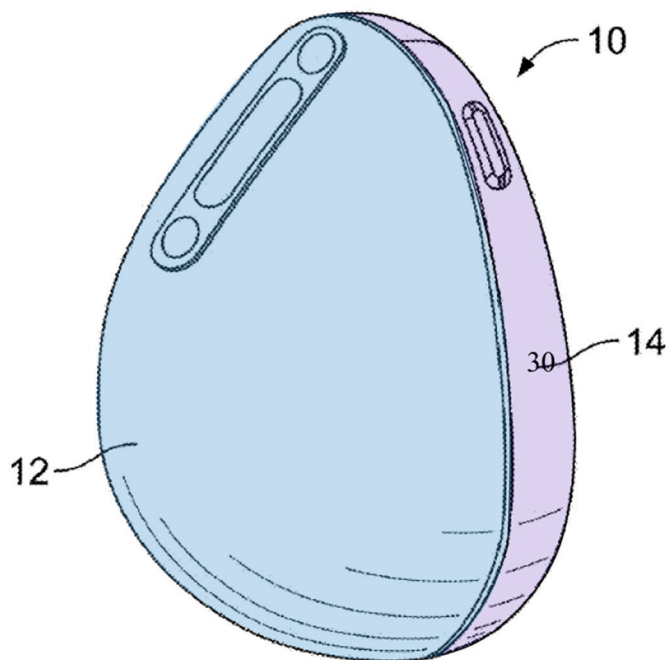
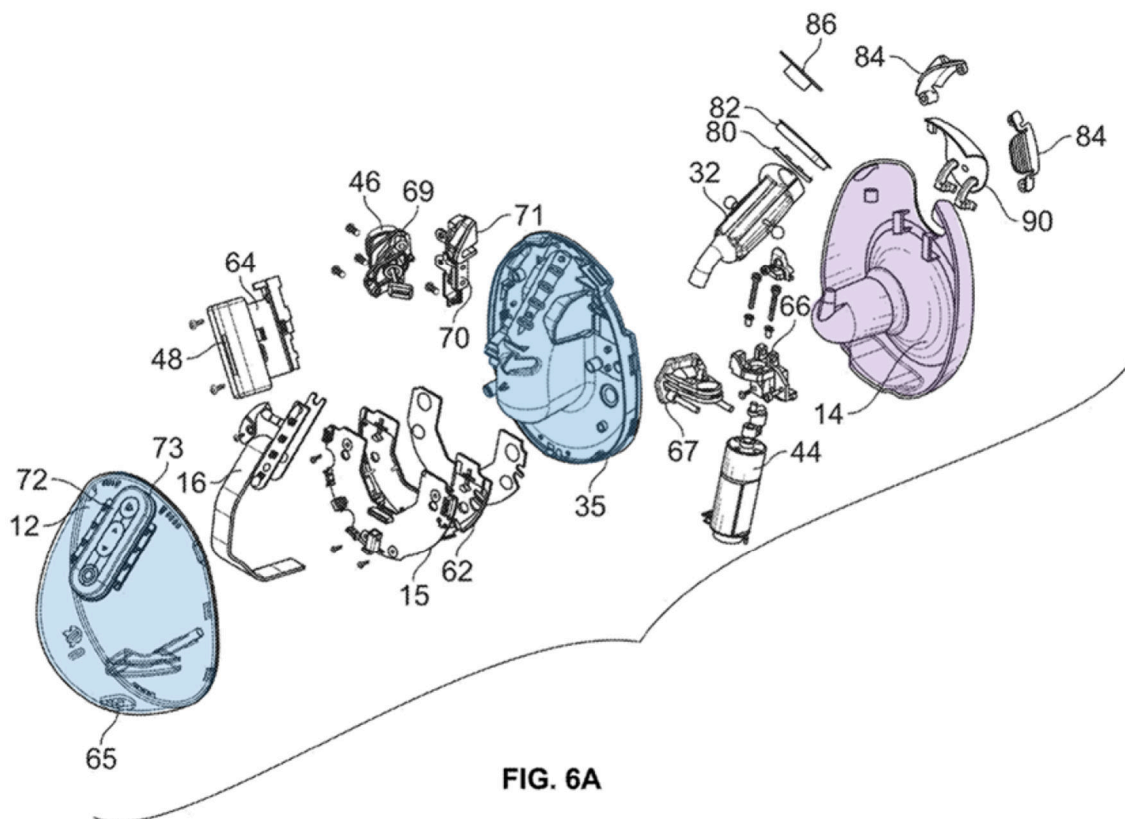


FIG. 1A

EX1003, ¶76 (annotating EX1007, Fig. 1A)

The flange “is sized and shaped to engage a breast of a user...to provide structure for sealingly engaging with breast tissue.” EX1007, [0071]. It includes a “nipple receiving portion...contoured to more closely match the natural shape of the nipple.” *Id.*, [0090]; EX1003, ¶77.



EX1003, ¶77 (annotating EX1007, Fig. 6A); *see also* EX1007, Figs. 1, 2, 4,
[0071]-[0072], [0080]

The “shell 12” and “pump chassis 35” provide a pump housing that accommodate pump components (e.g., “motor 46”), and the “pump chassis 35” includes a recessed surface (e.g., that accommodates portions of the “flex tube”). *Id.*; FIG. 6A.

In Chang, all system components are contained within the device, between outer shell 12 and the flange 14. EX1007, Fig. 6A, [0072], [0080]. The components include a “rechargeable battery” for powering the system, a “system controller” circuit board, and a pump (e.g., “motors 44, 46 are further provided and controlled electronically by the system to effect manipulation of actuators (described below)

operating on a conduit or flex-tube 32”). *Id.* Chang’s “pump” includes “one or more pumps and equivalents thereof known to those skilled in the art.” *Id.*, [0068]. EX1003, ¶77. The “shell 12” and “pump chassis 35” provide a pump housing that accommodate pump components (e.g., “motor 46”), and the “pump chassis 35” includes a recessed surface (e.g., that accommodates portions of the “flex tube”). *Id.*; FIG. 6A.

Chang’s system includes a “milk collection container.” EX1007, FIGS. 8, 11B.

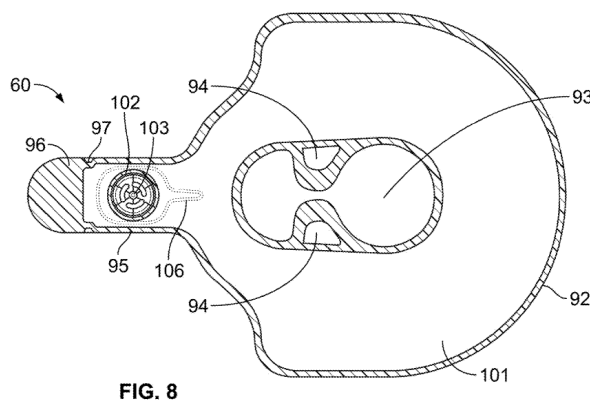


FIG. 8

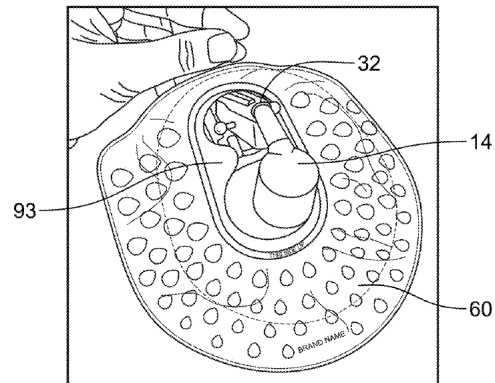


FIG. 11B

EX1007, FIGS. 8, 11B; *see id.*, [0081], [0086], [0099]-[0101], [0105], [0106];

EX1003, ¶78

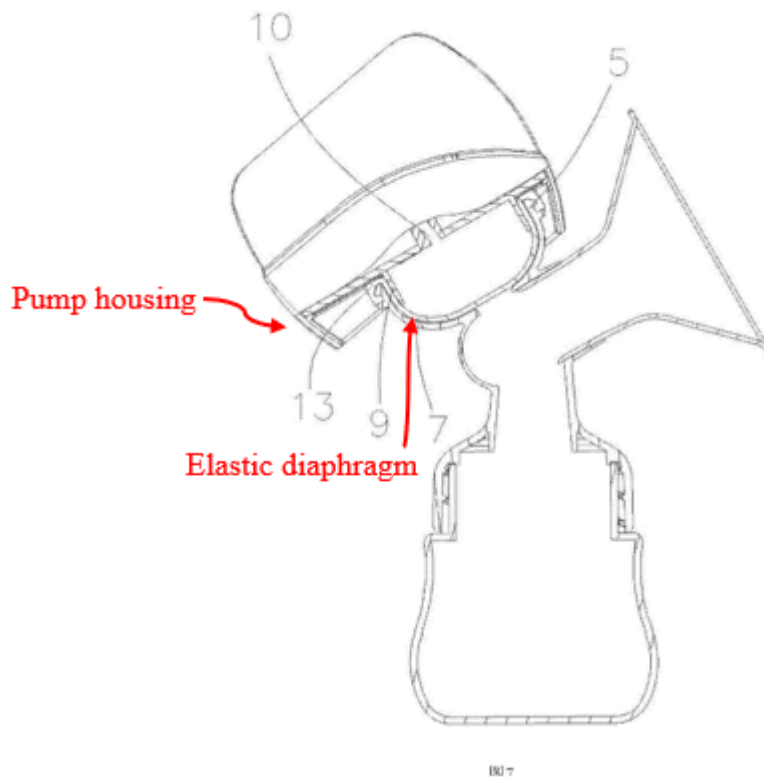
The system includes “a one-way valve that permits milk inflow into the milk collection container but prevents milk backflow from the milk collection container to the conduit.” EX1007, [0021]. The valve may “assume a myriad of shapes and kinds” and the container may be “flexible or rigid, or disposable or reusable” (*id.*)

and may be “inside or outside of the pump housing” (*id.*, [0101]). EX1003, ¶¶79-80.

b. Fang

Fang describes a “breast pump” having an “elastic diaphragm” that is “used to prevent the milk from flowing into the main body of the pump” and an “air pump main unit.” EX1009, Abstract. *Id.* The “elastic diaphragm” and the diaphragm housing it is seated in are connectable directly with features on an exterior surface of the pump housing. EX1009, FIG. 7; EX1003, ¶¶81-82.

In more detail, the “elastic diaphragm 7” has “a circular wrapping 13” that is “sleeved on the annular edge 5.” EX1009, [0020]; EX1003, ¶83. A “flange 9” and adjacent features serve as a first diaphragm housing, such that the pump housing “presses the wrapping edge 12 of the elastic diaphragm 7 against the annular edge 5.” *Id.*



EX1003, ¶83 (annotating EX1008, FIG. 7)

c. Predictable Combination

A POSITA would have been motivated to implement Chang's breast pump device using a pump system that utilizes a diaphragm to transmit negative pressure, as suggested by Fang, so as to achieve known benefits, as articulated below. EX1003, ¶110. Chang describes a pump that generates suction by cyclical compression and decompression of a conduit or flex-tube, and expressly notes that other configurations were known and suitable. *E.g.*, EX1007, [0022], [0025], [0028], [0068]; [0079]. Fang provides a diaphragm pump including a diaphragm housing component formed in a wall of the pump housing. *Id.*, [0024]-[0025], FIG.

7; EX1003, ¶110.

In the predictable combination, the breast pump device would have used a diaphragm pump including first and second diaphragm housing components and an elastic diaphragm, in accordance with Fang's suggestions. EX1009, [0019]-[0025] ("flaring 4," "ring rim 5," "elastic diaphragm 7," "flange 9"), FIGS. 4-5, FIG. 7. Consistent with Fang's express suggestion, a first diaphragm housing (e.g., as suggested by Fang's "flange 9" and adjacent surfaces) would have been positioned in a recessed wall of the pump housing (e.g., recessed surface of "chassis 35"), and the elastic diaphragm and second diaphragm housing (e.g., as suggested by Fang's "flaring 4" and "ring rim 5") would have been predictably positioned at the opposing/mating location—attached with the breast shield. EX1003, ¶111; EX1009, FIG. 7.

The overall form factor of the predictable combination generally would remain as taught by Chang, yet with an improved pump chamber defined between a recessed wall of the pump housing and the elastic diaphragm, in accordance with Fang's suggestions. EX1003, ¶111. As a result, a perimeter of the first diaphragm housing surface would have been part of the pump housing wall (e.g., "chassis 35") such that the diaphragm housing surface defines part of the surface of the pump housing, and the elastic diaphragm sealingly engages when the device is assembled—again, in accordance with Fang's suggestions. *Id.* This improved

diaphragm pump arrangement would provide a milk flow path to the container, as described by Chang, along a milk-side of the diaphragm. *Id.*

A POSITA would have likewise included vacuum pump components to generate a vacuum and drive the diaphragm, in accordance with Fang's suggestions. EX1003, ¶112. The use of a diaphragm pump in breast pump devices was widely known, including in "in-bra" devices, and a POSITA would have readily implemented such pump components within the pump housing (e.g., similar to the predictable locations of Chang's "motor" and "actuators," and/or associated components). *Id.*, ¶112 (citing EX1013 for corroboration). The selection and sizing of such pump components for "in-bra" devices was a common and predictable task for engineers in the field before June 2017. *Id.*

Multiple reasons would have prompted a POSITA to implement a diaphragm pump in Chang's breast pump device in accordance with Fang's suggestions.

First, a POSITA would have implemented Chang's breast pump using diaphragm components, according to Fang's suggestions, to facilitate convenient cleaning and maintenance. EX1003, ¶113. For example, a POSITA would have recognized from Fang's description that the elastic diaphragm components are readily accessed for cleaning while isolating a milk side from the pump side, preventing flow of milk to the pump components. EX1009, [0019] ("elastic diaphragm 7 is used to prevent the milk from flowing into the air pump main unit

8.”); Indeed, the cleaning and maintenance benefits of diaphragm pump components were known to a POSITA. *Id.*, ¶113; *see, e.g.*, EX1013, [0008] (“easily cleaned and maintained”), [0023] (“convenience in use due to easy cleaning and maintenance”), [0037] (“flow separation member 500”), [0040] (“inner space of the funnel connector 300 is sealed by the flow separation membrane 500, and thus, the breast milk is not allowed to flow backward”). A POSITA would have been prompted to implement the first diaphragm housing on a surface of the pump housing, according to Fang’s express suggestion, reducing the number of parts to be assembled/disassembled, and associated interfacing surfaces or small crevices. EX1003, ¶114. Relatedly, a POSITA would have been motivated to utilize such diaphragm components to reduce the length of tubing to be cleaned (e.g., Chang’s “flex tube” and associated tubing), thereby reducing cleaning difficulty and reducing the likelihood of mold and mildew growth over time (from tubing that was difficult to dry). *Id.*

Second, a POSITA would have been prompted to implemented Chang using the improved diaphragm pump components (according to Fang’s suggestions) to facilitate more rapid assembly and disassembly (e.g., during use). EX1003, ¶115. For example, a POSITA would have been motivated to avail Chang’s device of assembly benefits imparted by the diaphragm components, which are readily slid into engagement during assembly. *Id.* A POSITA would have recognized from

Chang and Fang that positioning the first diaphragm housing surface (e.g., as suggested by Fang’s “flange 9” and adjacent surfaces) as part of the pump housing wall (e.g., “pump chassis 35”), in accordance with Fang’s express teaching, would have facilitated reduced need for additional attachment features (e.g., to be manipulated and connected), and reduced interfaces between separate parts. *Id.*

Third, a POSITA would have been further motivated to implement Chang’s breast pump using diaphragm pump components (as suggested by Fang) as a particularly effective and suitable option to generate negative pressure within a breast pump. EX1003, ¶116; *Intel Corporation v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1381 (Fed. Cir. March 13, 2023) (holding that Petitioner “just had to show that [secondary reference’s feature] was a ‘suitable option’ to replace [primary reference’s feature],” and not that it was an “‘improvement’ in the categorical sense”). Chang itself proposes the use of other pump components (e.g., instead of the “flex tube 32”), and Fang plainly suggests suitable diaphragm pump features for a breast pump. EX1003, ¶116.

Fourth, a POSITA would have been motivated to combine Chang and Fang because doing so was the application of a known technique (Fang’s diaphragm pump components for generating negative pressure in a breast pump, including a pump chamber defined in part between an external surface of a pump housing and elastic diaphragm) to a known device (the primary Chang breast pump device that generates

negative pressure and has a recessed external pump housing) ready for improvement to yield predictable results (including several benefits articulated above). EX1003, ¶117; *see KSR Int'l Co., v. Teleflex, Inc.*, 550 U.S. 398, 416-17 550 U.S. at 417 (2007). Indeed, the modifications would have amounted to a simple substitution of one known pump configuration for another. EX1003, ¶117.

A POSITA would have had a reasonable expectation of success in making the modification based on the similarity of the breast pump device configurations, both including flexible pump components, and would have been predictably achieved without hindering the functionality of Chang's existing device. EX1003, ¶¶116-118. Indeed, the use of such diaphragm pump components in similar breast pump devices was widely known, including implementing a first diaphragm housing on an external surface of the pump housing and a second diaphragm housing with the breast shield. *Id.* (citing to corroborating examples at EX1031, 12:3-5 ("The diaphragm 14 is arranged in a recess 112 of the housing 10, which forms part of a pump chamber.") and 5:5-7 ("breast shield[]connected directly to the first port of the chamber."); *see also* EX1010, EX1034, and EX1036. Moreover, such diaphragm pumps were used in "wearable" in-bra devices. EX1003, ¶118 (citing to corroborating examples at EX1010 and EX1013, FIG. 5).

2. Analysis

a. Claim 1

1[pre]

If the preamble is limiting, the Chang-Fang device describes it. EX1003, ¶¶108, 119-20. Chang describes “portable breast pump systems and methods for collecting milk from a breast of a nursing mother.” EX1007, [0001], Abstract, FIGS. 1-21.

1[a]

The Chang-Fang device provides a *self-contained, in-bra wearable device*. EX1003, ¶121. Chang describes “a small, portable, self-powered, energy efficient, wearable breast pump system” (EX1007, [0004]) that “is contemplated to fit comfortably and conveniently into a bra of a user” (*id.*, [0011]), with the components of the device “all contained within a cup of a brassiere.” *Id.*, [0019]; EX1003, ¶121. The Chang-Fang device is “complete, or having all that is needed, in itself and is capable of being worn in a bra.” EX1003, ¶121; *supra*, §VI.A.1 (Chang-Fang); *infra* 1[a][1]-[4]. Implementing the device using diaphragm pump components would have predictably maintained the compact, in-bra configuration of the breast pump device. *Id.*

1[a][1]

The Chang-Fang device provides a *diaphragm*, e.g., Fang’s elastic diaphragm 7. EX1009, [0019]-[0021]; *supra*, §VI.A.1 (Chang-Fang); EX1003, ¶¶122-23.

In the Chang-Fang device, the flexible diaphragm is configured to prevent milk from reaching the pump (i.e., a membrane). *Id.*, [0019]. For example, the flexible diaphragm forms a watertight and airtight seal around its outer edge, thereby preventing passage of milk from reaching the air pump and providing for generating of negative pressure. EX1009, [0010], [0020], [0025], FIG. 7. As explained in Fang, when a vacuum is created on a pumping chamber, the elastic diaphragm 7 deforms away from the nipple tunnel, creating negative air pressure in the nipple tunnel. *Id.*, [0019]-[0025]; EX1003, ¶123.

The Chang-Fang device also provides an *air pump*, e.g., Fang's air pump. EX1003, ¶124. The pump is in pneumatic connection with the elastic diaphragm and configured to generate negative air pressure, as taught by Fang. EX1009, [0019], [0024], FIG. 7. Further, consistent with Chang's teachings of the location of pump components (e.g., "motor"), the air pump components of the combined device are positioned within the device housing. EX1007, [0072] (motor 46), [0080], FIG. 6A. The air pump is also powered by the rechargeable battery based on the descriptions of Chang. EX1007, [0072], [0080] ("rechargeable battery 48 assembly that powers the system 10" and "the system motor which is powered by the battery").

1/a][2]

The Chang-Fang device provides a *housing*, e.g., a pump housing formed by

Chang's housing or outer shell 12 and pump chassis 35. EX1007, [0071], [0073], FIGS. 1A, 6A; EX1003, ¶125. The “outer shell” and “pump chassis” together form a pump housing that accommodates pump components. *Id.*

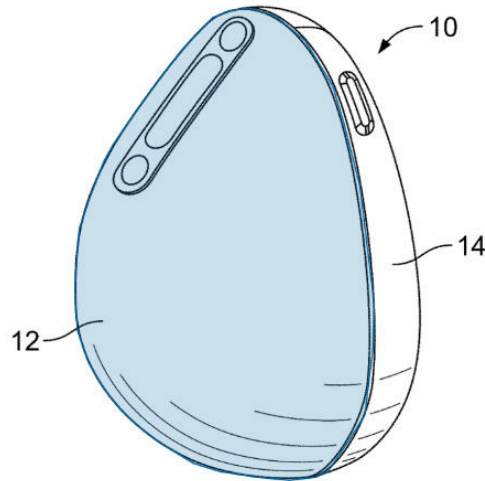


FIG. 1A

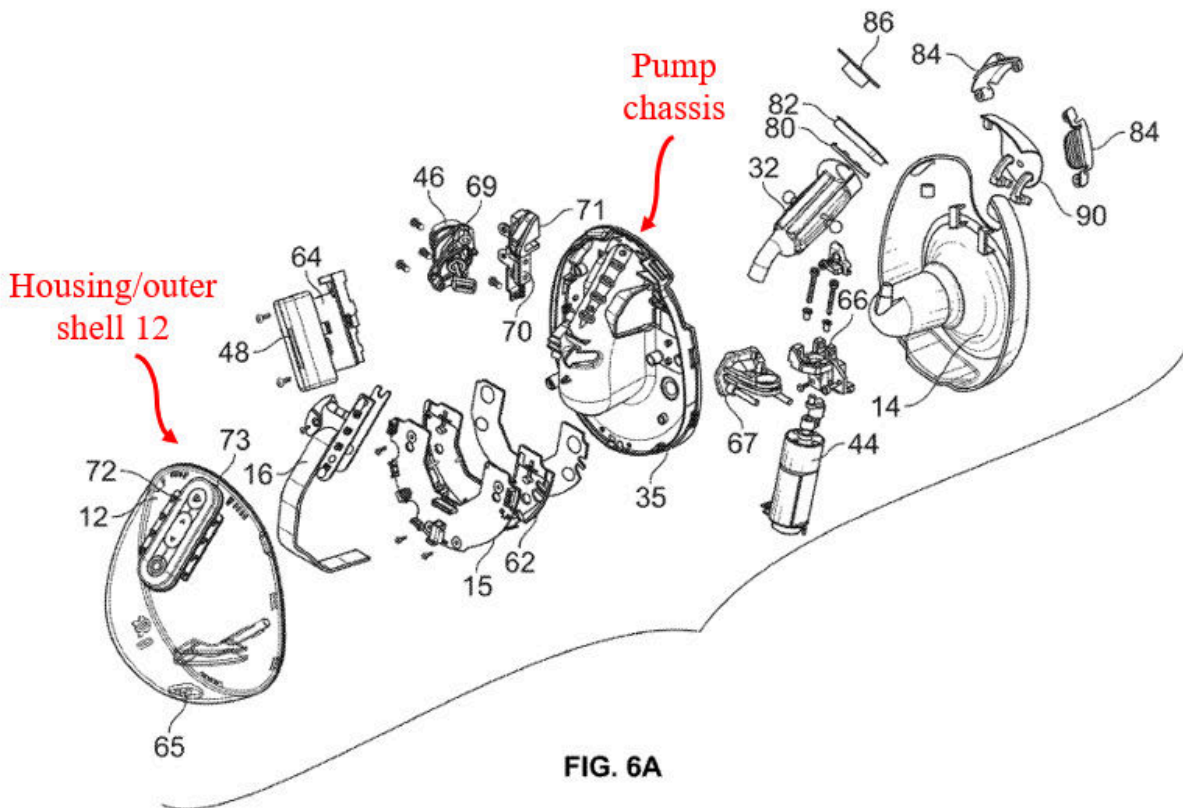


FIG. 6A

EX1003, ¶125 (annotating EX1007, FIGS. 1A, 6A)

1[a][2][i]

The Chang-Fang device provides a **battery** located in the **housing**. EX1003, ¶126. For example, Chang describes a rechargeable battery used to power the pump device: “A **battery 48** is included to provide a rechargeable power source and is configured to be plugged into a power source for charging.” EX1007, [0072]; *see also, id.*, [0020] (“battery powered” and battery is “received in the compartment of the external shell”); [0080] (“A battery bracket 64A” within the chassis inside housing 12 is “sized and shaped to receive a **rechargeable battery 48** assembly that powers the system”); Fig. 6A; EX1003, ¶126.

1[a][2][ii]

As discussed for 1[a][1], the Chang-Fang device provides an **air pump**, e.g., Fang’s air pump. EX1003, ¶127. The pump is in pneumatic connection with the elastic diaphragm and configured to **generate negative air pressure by driving the diaphragm**, as taught by Fang. EX1009, [0019], [0024], FIG. 7. Further, consistent with Chang’s teachings of the location of pump components (e.g., “motor”), the air pump components of the Chang-Fang device are positioned within the **housing**. EX1007, [0072] (motor 46), [0080], FIG. 6A. The air pump is also **powered by the battery**, in accordance with Chang. EX1007, [0072], [0080] (“rechargeable battery 48 assembly that powers the system 10” and “the system motor which is powered

by the battery”).

1/a/3

The Chang-Fang device provides a ***breast shield***, e.g., Chang’s breast shield, which includes a nipple receiving portion (***nipple tunnel***) and breast contact portion (***breast flange***). EX1007, [0071], [0090]; EX1003, ¶128. The breast shield is “sized and shaped to engage a breast of a user,” and “contoured to comfortably fit against a wide range of user’s bodies and to provide structure for sealingly engaging with breast tissue.” EX1007, [0071]. The breast shield has two portions—a “nipple receiving portion...contoured to more closely match the natural shape of the nipple” (*id.*, [0090]), and “surfaces that extend outwardly from a nipple receiving portion of the flange to engage breast tissue, thus providing extra surface area for comfortably contacting tissue” (*id.*, [0071], [0090]. Figure 4 of Chang illustrates a flange comprising the nipple receiving portion (green) and breast-contact portion (blue).

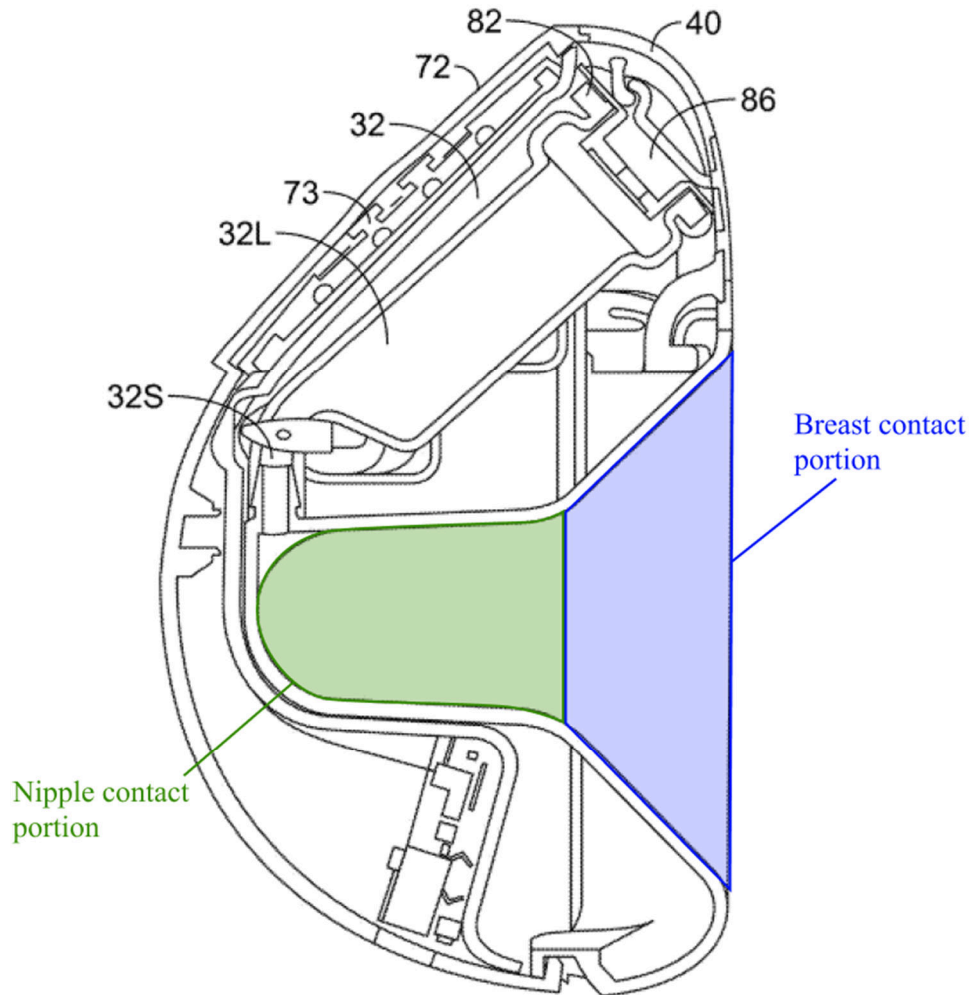


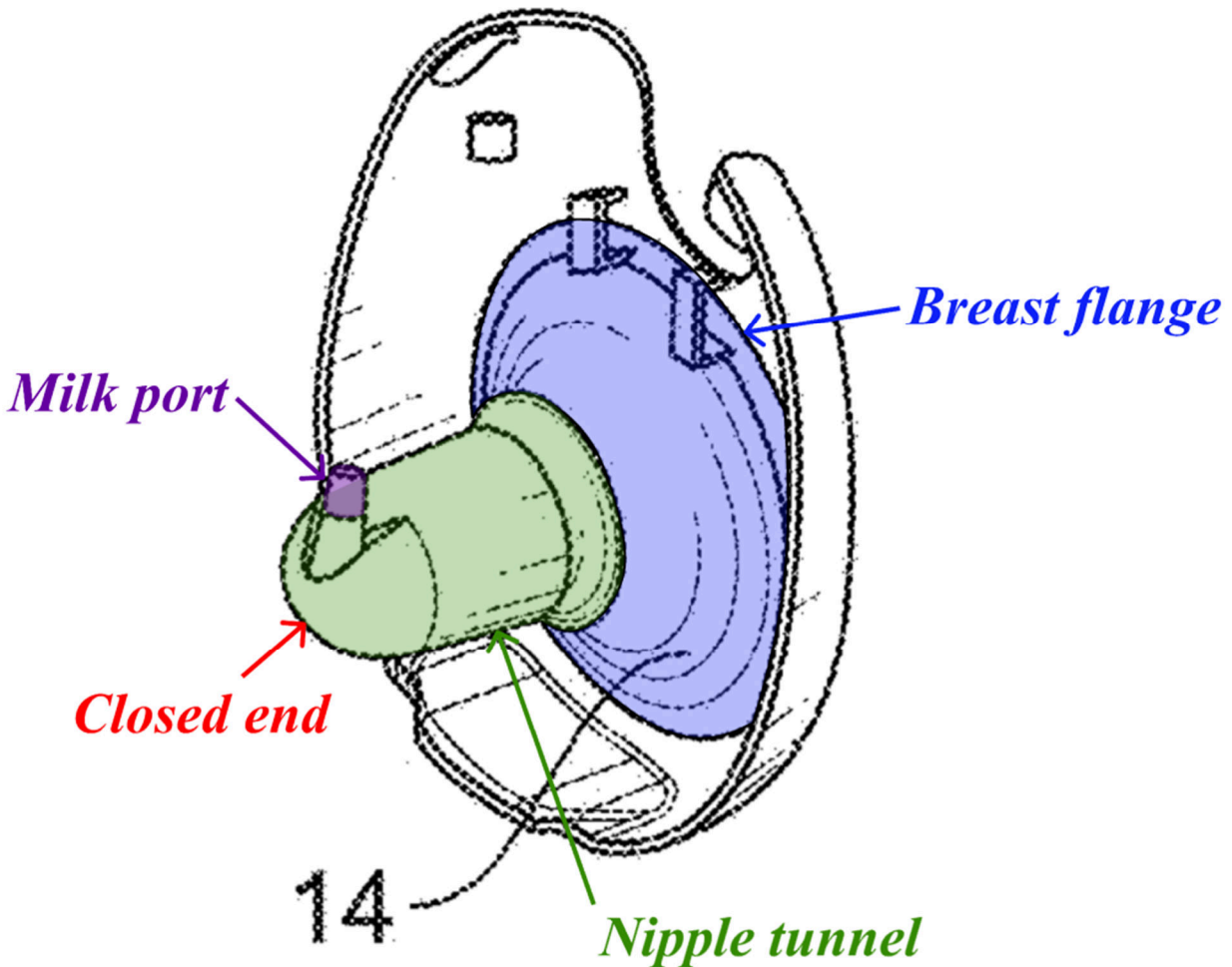
FIG. 4

EX1003, ¶128 (annotating EX1007, FIG. 4)

1[a][3][i]

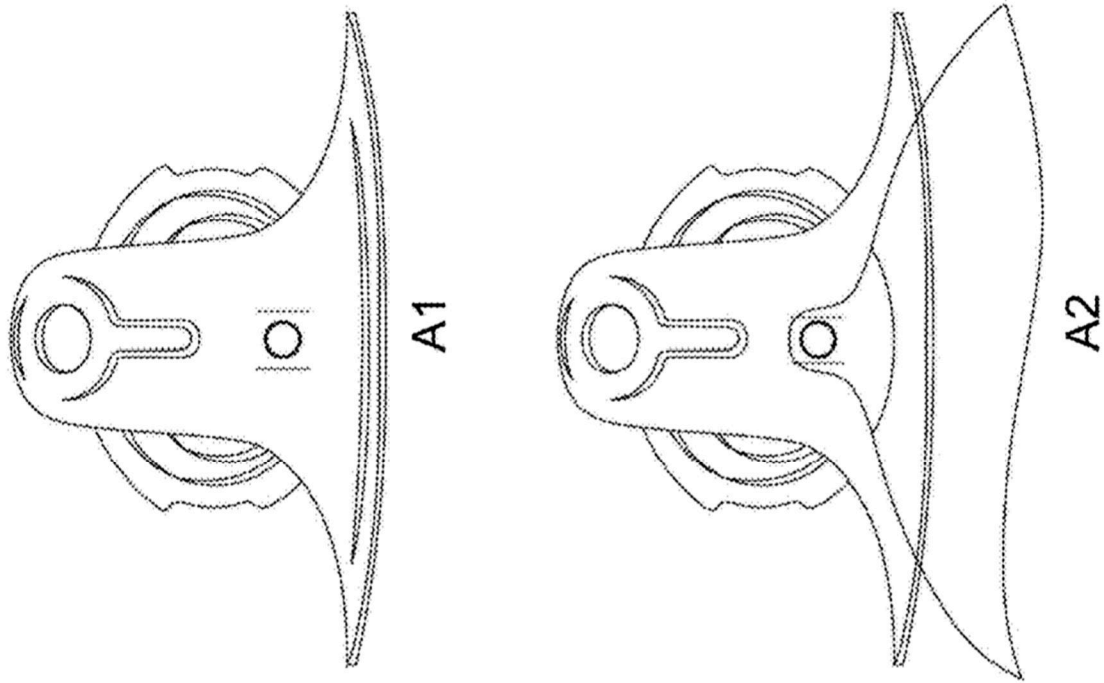
As discussed for 1[a][3], the Chang-Fang device provides a breast shield, e.g., Chang's breast shield, which includes a nipple receiving portion (***nipple tunnel***) and breast contact portion (***breast flange***). EX1007, [0071], [0090]. As shown in the annotated and excerpted version of Chang's Figure 6A (below), the nipple receiving

portion includes a closed circular end (*closed end*) and a port (*milk port*).



EX1003, ¶129 (annotating and excerpting EX1007, FIG. 6A); *see id.*, 130-31

As shown above, in Chang's breast shield, the port is *intermediate to* the breast contact portion and the closed circular end. For example, the structures providing the milk port are not positioned at a distal end of the nipple receiving portion (i.e., at the curved closed end). EX1003, ¶130. Indeed, the positioning of the port in Chang's breast shield largely coincides with the positioning depicted in Figure 14 of the '381 patent:



EX1001, FIG. 14 (excerpt)

The analysis above is also consistent with both the intrinsic record (*see* EX1002, 2252) and PO's allegations of infringement of this limitation before the district court (*see* EX1054C, 15). *Id.*, ¶¶131-32.

1[a][3][ii]

As discussed for 1[a][3], the Chang-Fang device provides a ***breast shield***, e.g., Chang's breast shield. EX1007, [0071], [0090]; EX1003, ¶133. Further, as discussed for 1[a][1], the Chang-Fang device also provides a ***diaphragm*** (e.g., Fang's elastic diaphragm 7). EX1009, [0019]-[0021]; *supra*, §VI.A.1 (Chang-Fang). In the Chang-Fang device, the breast shield is ***separate from*** the flexible

diaphragm, in accordance with Chang and Fang. Chang describes the breast shield can be “removed from engagement with the remainder of” the device. EX1007, [0105]. A POSITA would have understood and found obvious that removability of the breast shield in the Chang-Fang device indicates that the breast shield is *separate from* the elastic diaphragm. *Id.*; see EX1007, [0021], [0023], [0081], [0086], [0092], [0099]-[0100]. Such a configuration “enables access to the breast shield during normal disassembly for cleaning.” *Id.*; EX1003, ¶134.

1[a][4]

The Chang-Fang device provides a *milk container*, e.g., Chang’s container assembly. EX1003, ¶135. Chang describes its container assembly as being located within the device and configured to be directly connected to and removed from the pump housing such that the container assembly receives expressed milk via the milk port. EX1007, [0008], [0010], [0019] (“the milk collection container are all contained within a cup of a brassiere”), [0021], [0023], [0081], [0086], [0092], [0099], [0100] (“positioning of collection or container assembly 60 within a pump system 10.”), [0101] (“the system is configured to pump into a sealed collection or container assembly 60” and “inside or outside of the pump housing”). As Chang describes, the milk container is configured to be attached to and removed from the pump housing such that the container is within the device in a fixed position relative other components as part of the wearable, in-bra form factor. *Id.*, [0019] (“the milk

collection container are all contained within a cup of a brassiere”); [0106]-[0107];

FIGS. 11A-11E.

b. Claims 2-13, 16, 17, 22, 23, 27, 29

Claim [2]¹

As discussed for 1[a][3], the Chang-Fang device provides a ***breast shield***, e.g., Chang’s breast shield, which includes a nipple receiving portion (***nipple tunnel***) and a breast contact portion (***breast flange***). EX1007, [0071], [0090]; EX1003, ¶136. Based on Chang, the breast shield is “symmetrical about the nipple receiving portion,” which is “cylindrical.” EX1007, [0090]. The combined device is configured to be “disabled when the flange [“breast shield”] is not placed in an operating position.” EX1007, [0017]. A POSITA would have understood, and found obvious from Chang’s description, the ***breast shield*** in the Chang-Fang device is symmetrical about the cylindrical nipple receiving portion and has an operating position, and thus, is configured to ***rotate smoothly around a nipple inserted into the nipple tunnel to provide a correct operating position onto a breast.***

¹ Regardless of the outermost bounds of the ambiguous “smoothly” phrase in Claim 2, the prior art is fully consistent with the preferred embodiment of the ’381 patent, and thus, falls within claim scope. See EX1001, 18:8-16, 37:7-10.

Claim [3]

In the Chang-Fang device, the ***breast shield*** (e.g., Chang’s breast shield, which includes a nipple receiving portion and a breast contact portion) is a “skin contact member” or “configured to form a seal with the breast.” EX1007, [0008], [0071]; EX1003, ¶137. As shown below, the ***breast shield*** also ***presents a single continuous surface to a nipple and a breast***, in accordance with Chang. *Id.*

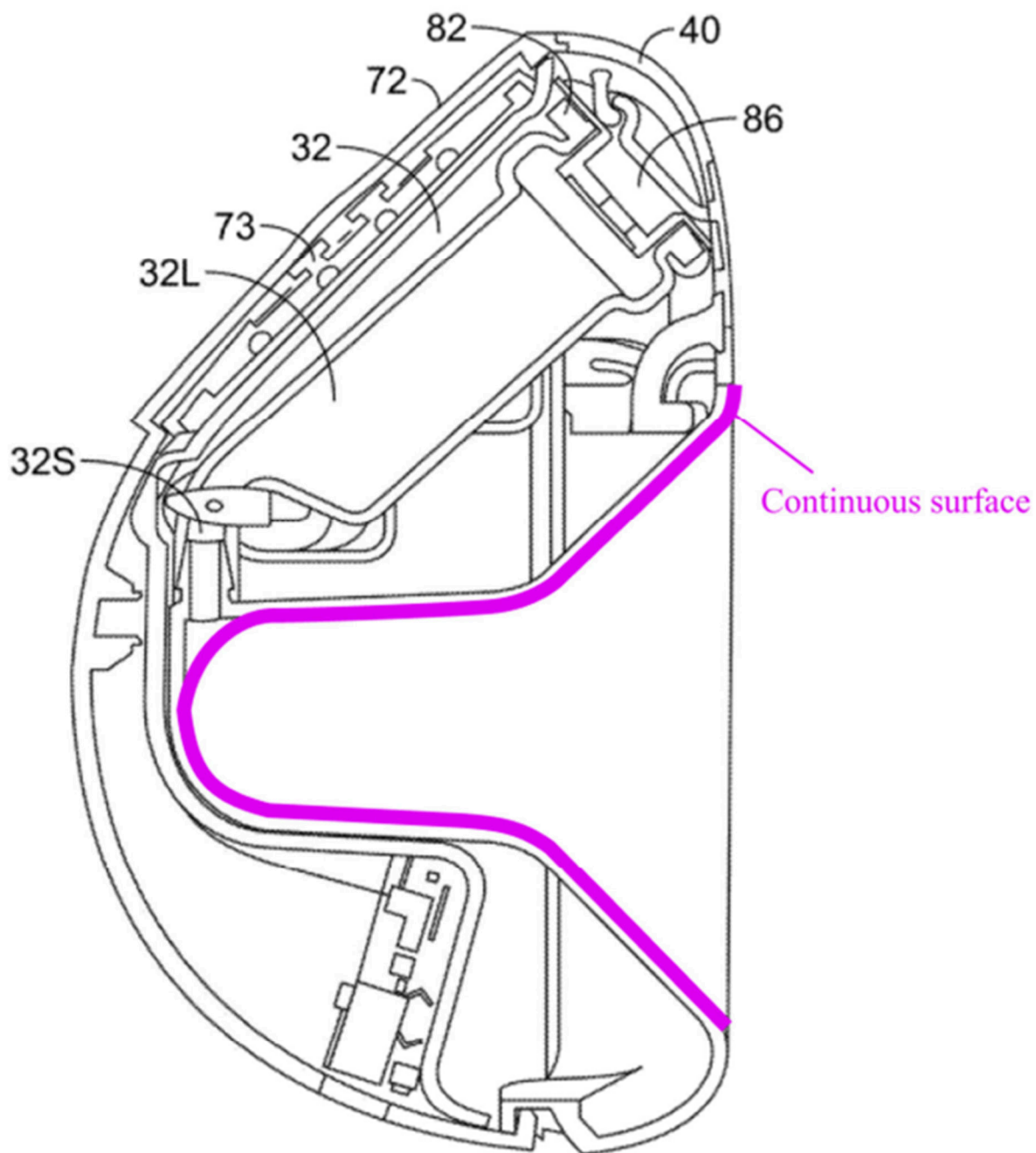


FIG. 4

EX1003, ¶137 (annotating EX1007, FIG. 4)

The breast shield has a “nipple receiving portion...contoured to more closely match

the natural shape of the nipple” and “surfaces that extend outwardly from a nipple receiving portion of the flange to engage breast tissue.” EX1007, [0071], [0090]; FIGS. 4-6A. A POSITA would have also recognized and found obvious that the **breast shield** “form[s] a seal with the breast” (*id.*, [0022]) and to avoid edges or interfaces that could create discomfort when sealingly engaged with the breast during use. EX1003, ¶137.

Claim [4]

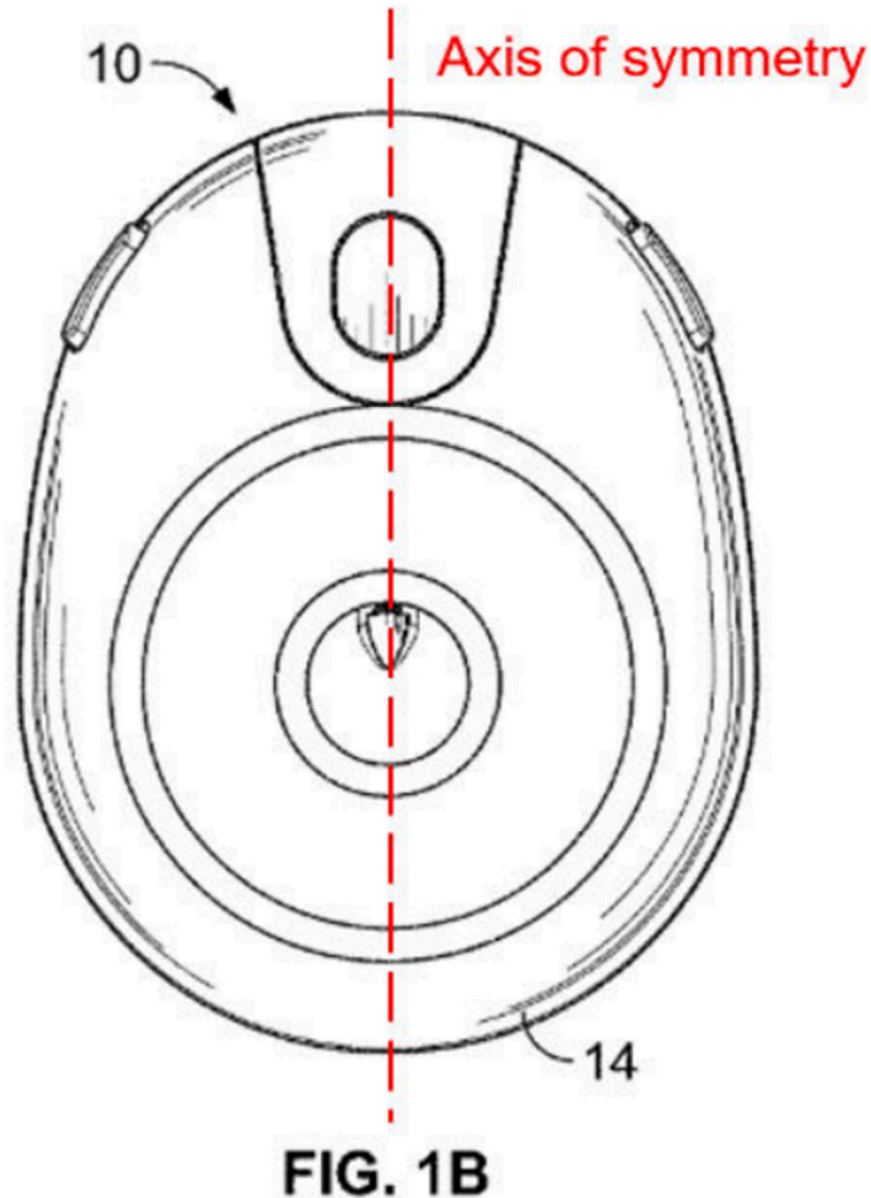
As discussed for 1[a][3], the Chang-Fang device provides a **breast shield**, e.g., Chang’s breast shield, which includes a nipple receiving portion (**nipple tunnel**) and a breast contact portion (**breast flange**). EX1007, [0071], [0090]. Chang’s breast shield is “sized and shaped to engage a breast of a user,” and “contoured to comfortably fit against a wide range of user’s bodies and to provide structure for sealingly engaging with breast tissue.” EX1007, [0071]. Further, in Chang, outer shell 12 and pump chassis 35 are formed as a pump housing, and thus, the **breast shield** of the Chang-Fang device is similarly configured as a **one-piece item**. EX1003, ¶138; *see* EX1007, [0073], FIGS. 1A, 6A; *supra* 1[a][2].

Claim [5]

Supra Claim 4; EX1007, [0071]. Based on Chang’s suggestion, the **breast shield** of the Chang-Fang device is configured as a **single, integral item with no joining stubs**. EX1003, ¶139; *see* EX1007, [0073], FIGS. 1A, 6A; *supra* 1[a][2].

Claim [6]

In the Chang-Fang device, the ***breast shield*** includes structures based on Chang's suggestions (e.g., nipple receiving portion, breast contact portion). EX1003, ¶140. For example, Figure 1B shows a back view of Chang's breast pump, the side facing the user's breast and includes the breast shield. EX1007, [0071]. Annotated Figure 1B below shows the breast shield has a top and bottom and is symmetrical about a center-line running from the top to the bottom of the breast shield when positioned upright for normal use.

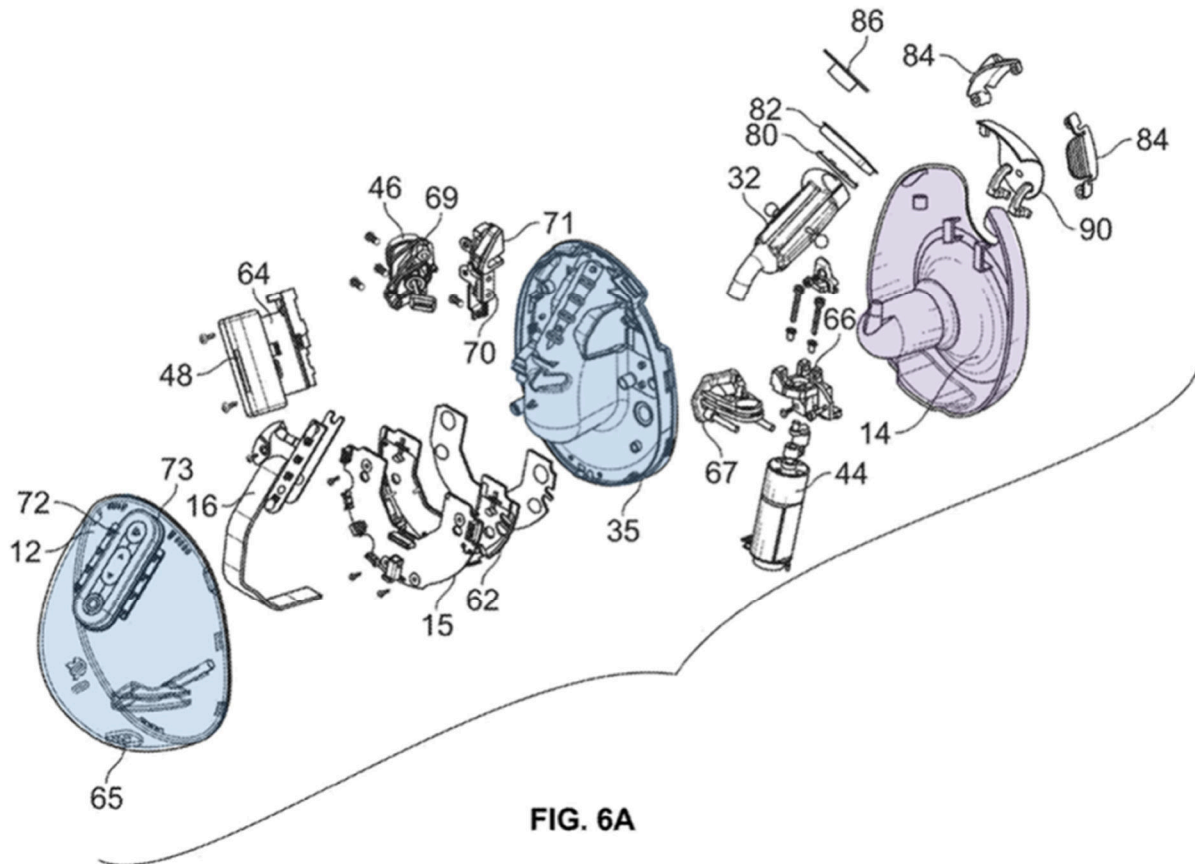


EX1003, ¶140 (annotating EX1007, FIG. 1B)

Claim [7]

In the Chang-Fang device, the ***breast shield*** (e.g., Chang’s breast shield, which includes a nipple receiving portion and a breast contact portion) and ***housing*** (e.g., Chang’s “outer shell 12” and/or “chassis 35”) are arranged based on Chang’s

teachings. See EX1003, ¶¶141; EX1007, [0071], [0073], FIGS. 1A, 6A. As shown in the annotated figure below, in the Chang-Fang device, the **breast shield** and the **housing** would have been arranged like Chang's outer shell 12 and chassis 35 (blue) and the breast shield (magenta), with the breast shield configured to slide in and out - 42 - when assembled/disassembled:



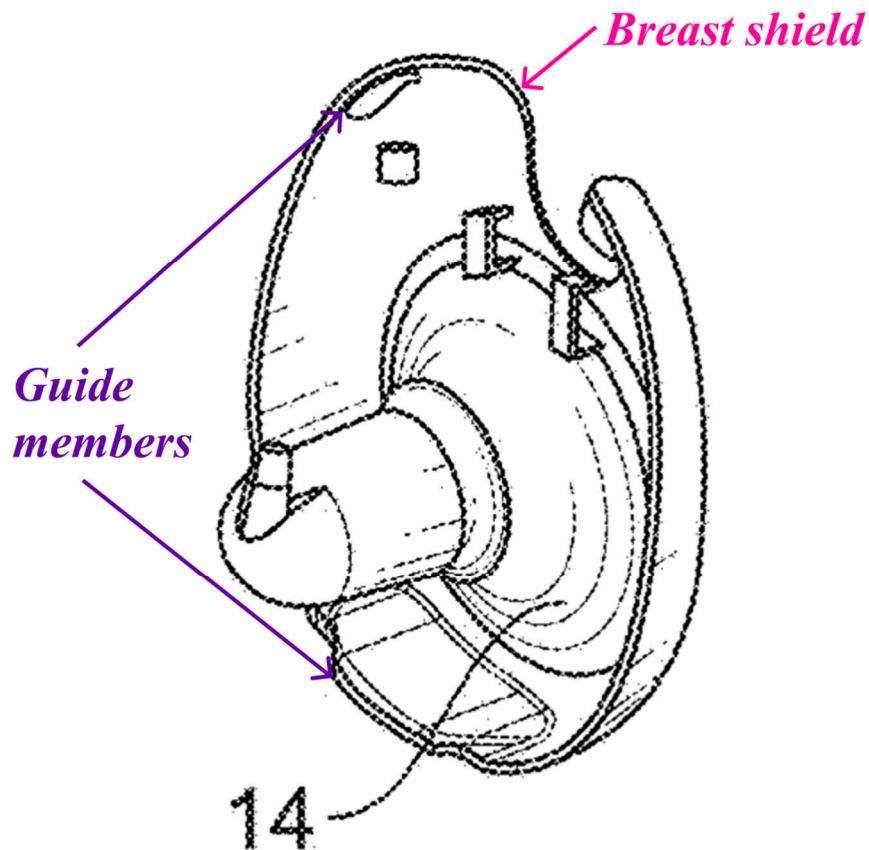
EX1003, ¶141 (annotating EX1007, FIG. 6A)

In the Chang-Fang device, the **diaphragm** (e.g. Fang's elastic diaphragm 7) are also attached with the **breast shield**. *Supra*, §VI.A.1 (Chang-Fang); EX1009, [0019], FIG. 7; EX1003, ¶141. The **diaphragm** therefore **moves together with** the **breast**

shield such that both are configured to slide in and out from the *housing*.

Further, the *breast shield* in the Chang-Fang device is configured to include *guide members* to enable attachment to the device housing, consistent with Chang.² EX1003, ¶142. Chang describes that “chassis 35” is “[c]onfigured between the housing 12 and flange 14,” and can “snap into engagement with the housing 12.” EX1007, [0080]. Chang also describes various ways of attaching flange 14, including use of “[a]alignment and attachment structure or holes” and “interface structure.” *Id.*, [0082]; EX1003, ¶142. Examples of *guide members* in Chang are shown below:

² Chang-Fang teachings provide more detail on this claim than the ’381 patent, which largely repeats the same description of a housing “using guide members” without definition of “guide members.” EX1001, 37:13-15, 38:26-28, 40:14-16, 41:1-3, 57:3-5, 64:57-60, 66:1-3, 67:1-3; *In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994).



EX1003, ¶142 (annotating and excerpting EX1007, FIG. 6A)

Claim [8]

As discussed for 1[a][2], the Chang-Fang device provides a ***housing***, e.g., formed by Chang's outer shell 12 and a recessed pump chassis 35. EX1007, [0071], [0073], FIGS. 1A, 6A; EX1003, ¶143. In the Chang-Fang device, device components would have been attached or assembled based on the suggestions of Chang, and thus, when the breast shield has been placed onto a breast, the ***housing is configured to slide onto the breast shield... using guide members***. See *supra* Claim 7; EX1007, [0080], [0082]. Fang further suggests a pump housing that is

configured to slide onto the breastshield using top annular edge 19 (*guide members*), as shown in Fang's Figure 7. EX1007, [0019], [0023], [0024], FIG. 7. This can be accomplished when the breastshield has been placed onto a breast. *Id.*; EX1003, ¶143.

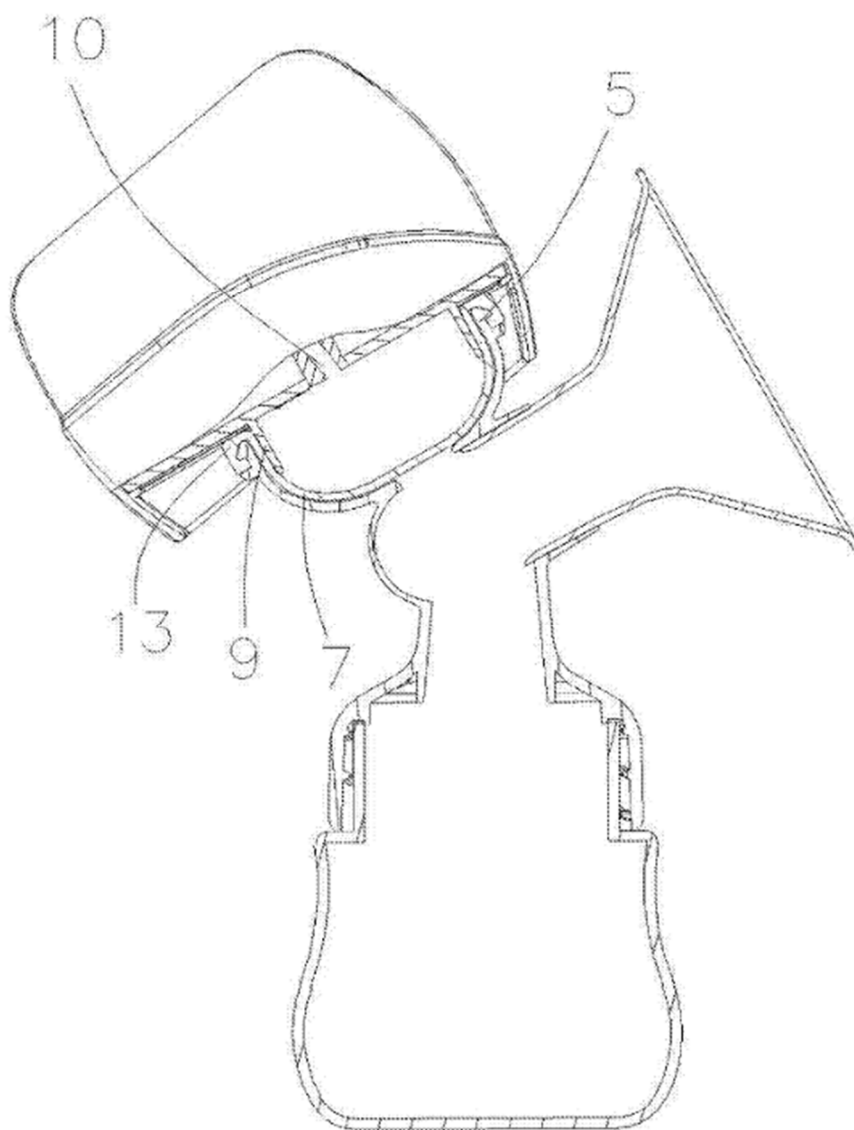


FIG. 7

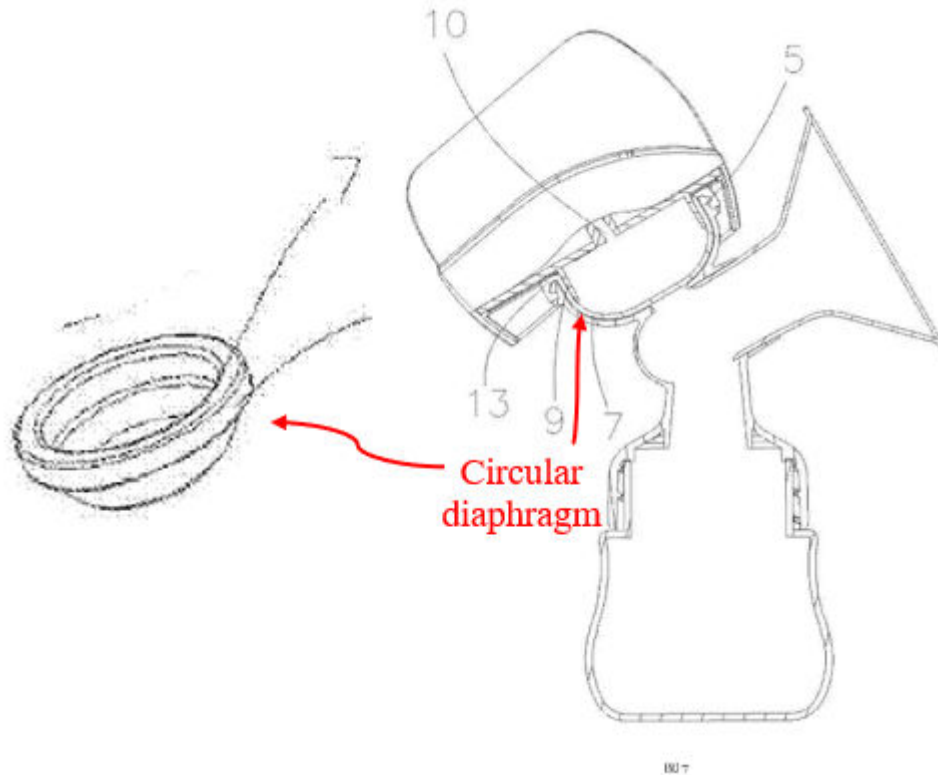
EX1009, FIG. 7

Claim [9]

In the Chang-Fang device, the ***breast shield*** (e.g., Chang’s breast shield) and ***milk container*** (e.g., Chang’s container assembly) are each ***directly removable*** from the ***housing*** based on the suggestions of Chang. *See supra* 1[a][2]-[4]. Chang describes the breast shield can be “removed from engagement with the remainder of” the device. EX1007, [0105]; EX1003, ¶144. The container assembly is likewise removable from the pump housing. EX1007, [0021], [0023], [0081], [0086], [0092], [0099]-[0100]. In normal use or disassembly (e.g., to empty the milk container or clean the milk flowpath), only the breast shield and container assembly are directly removable from the pump housing. EX1001, 5:66-6:15. Doing so provides access to empty the container assembly and clean the diaphragm components, for example, without requiring further disassembly. *Id.*

Claim [10]

In the Chang-Fang device, the ***diaphragm*** is substantially circular based on the suggestions in Fang. *See* EX1003, ¶145. Fang shows elastic diaphragm 7 to have a substantially circular shape:



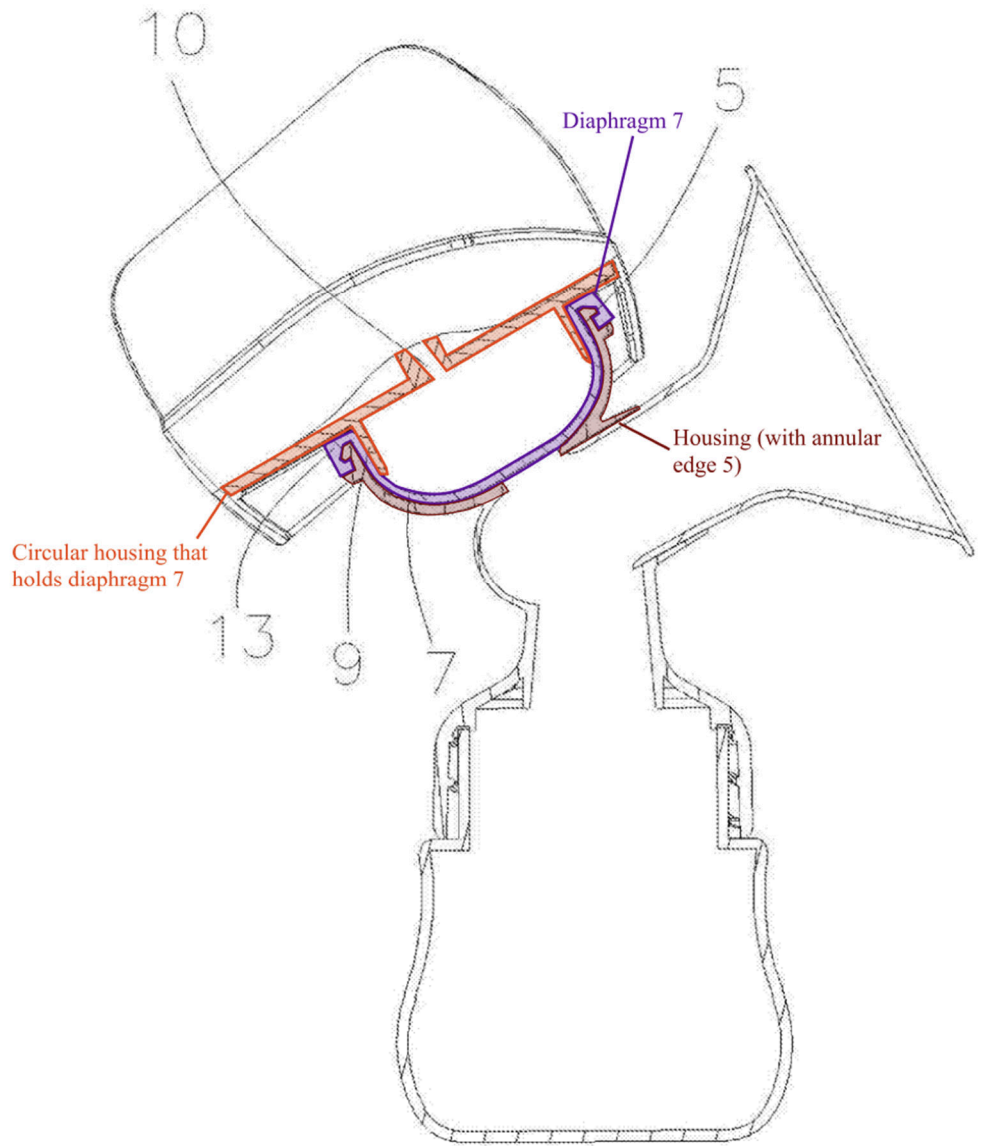
EX1003, ¶145 (annotating EX1009, Fig. 5 (partial), FIG. 7); *see also* EX1009,

[0020]

The *diaphragm housing* in the Chang-Fang device is likewise *substantially circular*, and thereby engages with, and secures, the *diaphragm*. EX1003, ¶145; EX1009, [0020]-[0025]; FIG. 7.

Further, in the Chang-Fang device, the *diaphragm* (e.g., Fang's elastic diaphragm 7) is *configured to self-seal under negative pressure* around its outer edge (e.g., without adhesive or moisture). *See* EX1009, [0019]-[0025], FIG. 7; *see also* 1[a][1]; EX1001, 6:33-60; EX1003, ¶146. A POSITA would have understood, and found obvious, that this configuration provides a watertight and airtight seal

around the recess or cavity in the housing (e.g., Fang's flange 9), thereby preventing passage of milk and providing for generating of negative pressure. EX1003, ¶146; *Id.*, [0020], [0025] ("secure installation"); *see also id.*, [0010], FIG. 7.



EX1003, ¶146 (annotating EX1009, Fig. 7); *see* EX1009, [0020]

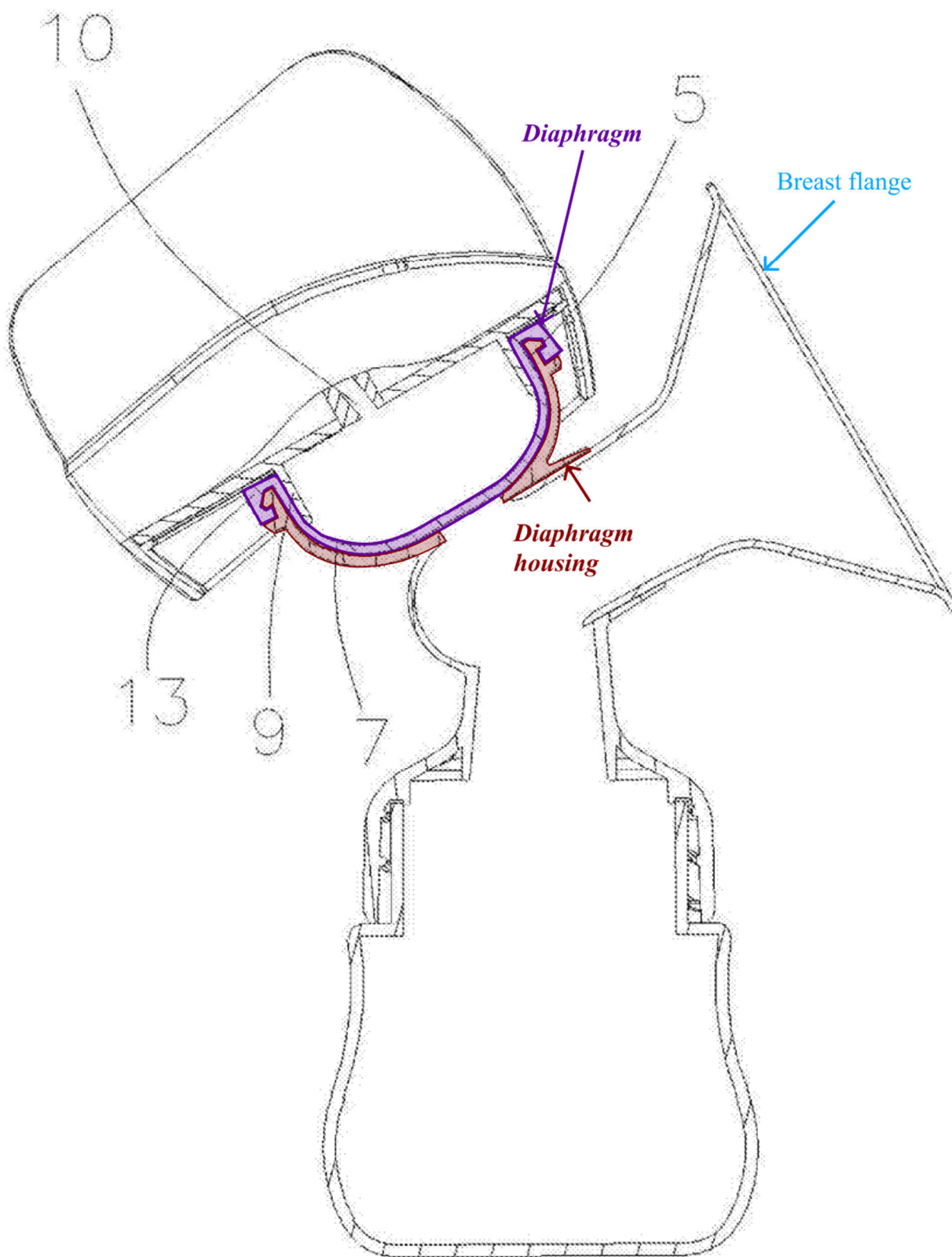
Claim [11]

As discussed for 1[a][1], the ***diaphragm*** of the Chang-Fang device (e.g.,

Fang's elastic diaphragm 7) is a *membrane* configured to prevent milk from reaching the pump. EX1009, [0019]-[0021]. The *diaphragm* also *deforms in response to changes in air pressure caused by the pump* to create negative air pressure in the nipple tunnel. EX1003, ¶147. As explained in Fang, when a vacuum is created on the pumping chamber, elastic diaphragm 7 deforms away from the nipple tunnel, creating negative air pressure in the nipple tunnel. EX1009, [0019]-[0025]; EX1003, ¶147.

Claim [12]

As discussed for 1[a][1], the Chang-Fang device provides a *diaphragm*, e.g., Fang's elastic diaphragm 7, which is configured to prevent milk from reaching the pump. EX1009, [0019]; *supra*, §VI.A.1 (Chang-Fang); EX1003, ¶¶148-49. In the Chang-Fang device, the *diaphragm* is seated against a *diaphragm holder* (e.g., flaring 4, alone or together with annular edge 5) that sits above a breast flange, in accordance with Fang's suggestions. EX1003, ¶148. As shown in the annotated Figure 7 of Fang below, the *diaphragm housing* is attached to the nipple tunnel such that it *sits above* it. EX1009, FIG. 7.



EX1003, ¶148 (annotating EX1009, FIG. 7)

The *diaphragm housing* is configured to define a milk-flow side chamber with the *diaphragm*, as shown above. EX1003, ¶148.

Further, in the Chang-Fang device, the *diaphragm* (e.g., Fang’s elastic diaphragm 7) is similarly arranged such that it is *removable* from a *diaphragm holder* (e.g., Fang’s diaphragm housing) that *sits above* the *breast shield* (e.g., Chang’s breast shield, which includes a nipple receiving portion (*nipple tunnel*) and a breast contact portion (*breast flange*)). EX1007, [0071], [0090]; *see* 1[a][3]; EX1003, ¶149.

Claim [13]³

As discussed for 1[a][4], the Chang-Fang device includes a *milk container* (e.g., Chang’s container assembly). *See* EX1007, [0008], [0010], [0019], [0021], [0023], [0081], [0086], [0092], [0099], [0100], [0101]. Chang describes that its milk container may be “flexible or rigid, or disposable or reusable.” *Id.*, [0021]; EX1003, ¶150.

Claim [16]

As discussed for 1[a][4], the Chang-Fang device includes a *milk container*,

³ Regardless of the outermost bounds of the ambiguous “substantially rigid” phrase, the prior art is fully consistent with the preferred embodiment of the ’381 patent and thus falls within claim scope. *See* EX1001, 11:49-12:15.

e.g., Chang's container assembly. EX1007, [0008], [0010], [0019], [0021], [0023], [0081], [0086], [0092], [0099], [0100], [0101]. Chang describes a "one-way valve that permits milk inflow into [a] milk collection container but prevents milk backflow from the milk collection container to the conduit." *Id.*, [0021]. The valve "facilitates creating a seal with the container to establish a closed system[.]" e.g., "a one-way valve" that "can assume a myriad of shapes and kinds including an umbrella valve, a duckbill valve, a ball valve or other valve." *Id.* Chang teaches other types of valves that similarly enable a closed system commonly used to self-seal under negative pressure. *See id.*, [0099], [0101], [0102]. Thus, a POSITA would have understood and/or found obvious that the integral valve of the container assembly in the Chang-Fang device is configured to *self-seal[] under negative air pressure against a milk opening in the nipple tunnel and that permits milk to flow into the milk container*. EX1003, ¶151.

Claim [17]

As discussed for 1[a][4], the Chang-Fang device includes a *milk container*, e.g., Chang's container assembly. EX1007, [0008], [0010], [0019], [0021], [0023], [0081], [0086], [0092], [0099], [0100], [0101]. Chang describes that its container assembly includes "a rigid or flexible sealing component, such as a ring or gasket into which [a] pump or container valve is **pushed** or twisted and sealed." *Id.*, [0101]. The "sealing component" thus provides a mechanical mechanism that attaches to the

pump housing (e.g., at the pump valve) via a single push action (e.g., a single push to secure the sealing component to the container valve). *Id.* The attachment secures the milk container with the pump housing, and allows the milk container to be released (e.g., after a pump session). EX1003, ¶152.

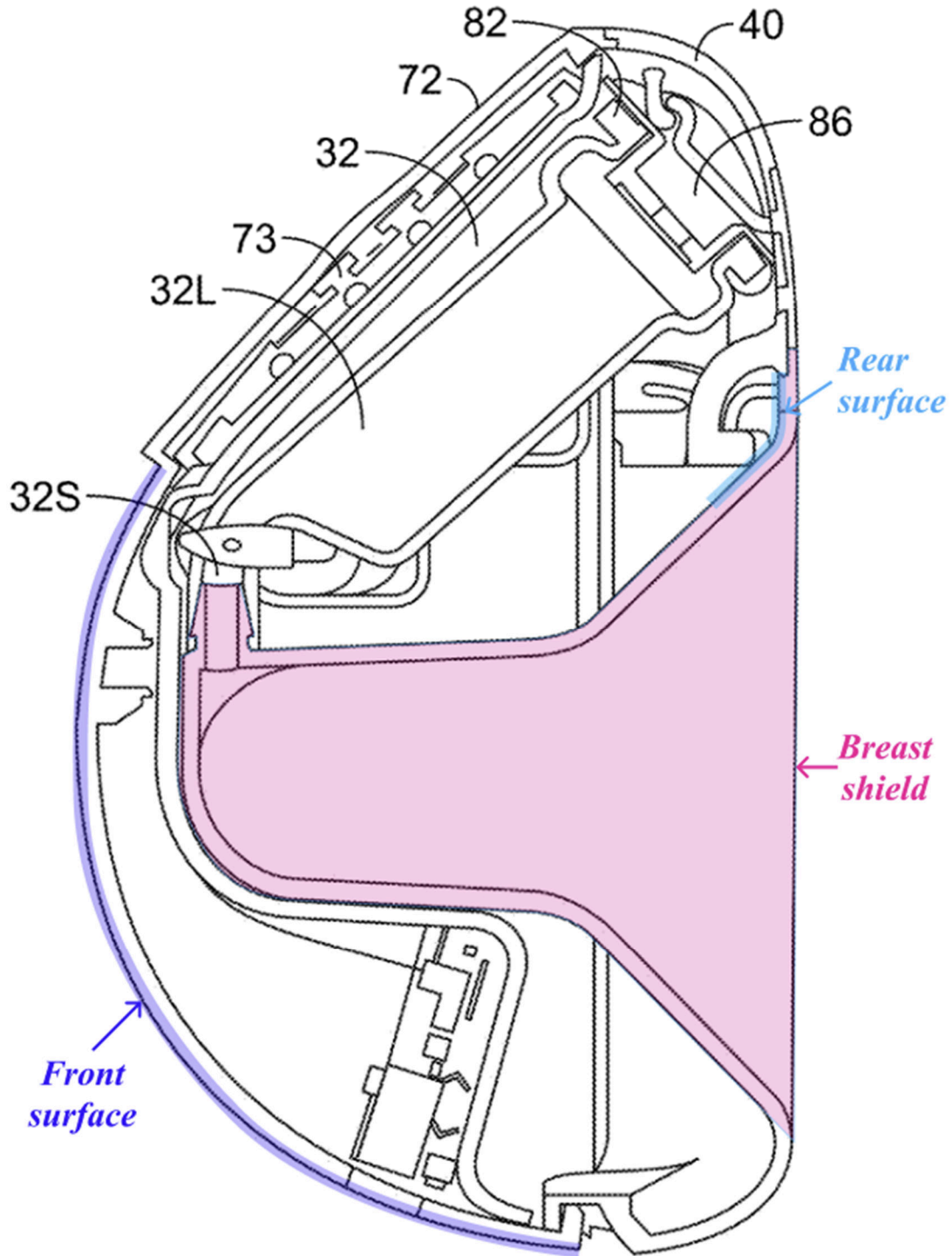
Claim [22]

The device housing of the Chang-Fang device included components that enable wireless communications (***wireless data communications system***) that are powered by a rechargeable battery (***battery***). EX1007, [0124]. Chang describes “various aspects of remote control and data collection approaches,” including an embodiment in which its breast pump device is “configured to communicate with a server, a remote computer, smartphone or other device such as through signal, such as by Wi-Fi, BLUETOOTH, BLUETOOTH Low Energy (BTLE), RFID, NFC or the like.” EX1007, [0124] (“wirelessly”). *Id.*; EX1003, ¶153.

Claim [23]

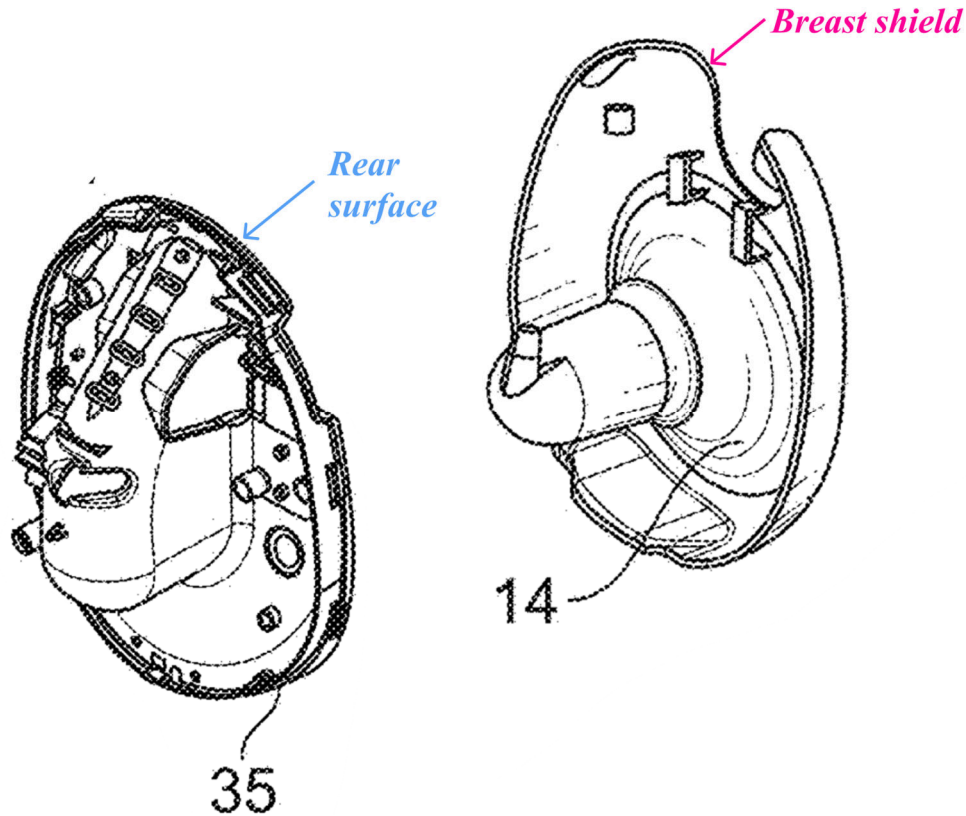
As discussed for 1[a][2], the Chang-Fang device provides a ***housing***, e.g., a device housing formed by Chang’s housing or outer shell 12 and pump chassis 35. EX1007, [0071], [0073], FIGS. 1A, 6A; EX1003, ¶154. As shown in the annotated version of Chang’s Figure 4 (below), this configuration would have included a surface on the housing/outer shell 12 (***front surface***) that contacts an inner surface of the bra when worn (***configured to fit inside a bra and to contact an inner surface***

of the bra), and a surface (*rear surface*) that contacts the *breast shield*. EX1003, ¶154.



EX1003, ¶154 (citing EX1007, FIG. 4)

Additionally, as shown in the excerpted and annotated version of Chang's Figure 6A below, Chang's pump chassis 35 also includes one or more surfaces near its periphery (including a *rear surface*) that contact the *breast shield* when assembled. EX1003, ¶155.



EX1003, ¶155 (annotating and excerpting EX1007, FIG. 6A)

Claim [27]

The Chang-Fang device would have provided the features recited in this claim based on the teachings of Chang and Fang. EX1003, ¶156-159. Chang broadly focuses on “portable breast pump systems and methods for collecting milk from a breast of a nursing mother.” EX1007, [0001]. Fang similarly recognizes that

advantages of certain breast pump systems is having “fewer handheld parts” and including “equipment [that] is relatively light...” EX1009, [0002]. A POSITA would have found it obvious that the Chang-Fang device, when unfilled with milk, has a certain weight that provides comfort during use. EX1003, ¶156.

As explained by Mr. Bauer, around the Critical Date, portable breast pump systems were designed to be lightweight by incorporating compact, efficient motors and soft, wearable components to ensure comfortable, hands-free use for busy mothers while maintaining discretion and mobility. *Id.*, ¶157. A breast pump that is too heavy would be undesirable because it could cause discomfort, strain, and inconvenience during use. *Id.* A POSITA would have thus found it obvious and been motivated to implement to have a weight less than 250 grams. EX1007, [0001]; EX1009, [0002].

Years before the Critical Date, Myers486 disclosed a portable breast pump system with the total mass, unfilled with milk, to be about 2.4 ounces without batteries (68 grams) or 4.2 ounces (119 grams) with batteries. EX1039, [0053]. Like Chang and Fang, Myers486’s breast pump includes a compact unit that gives the “natural appearance of the shape of a breast” and is meant to be “concealed underneath the user’s clothing,” and includes similar structural features of Chang and Fang *Id.*, [0045], [0047], [0084], FIG. 20B; EX1003, ¶158. Thus, Myers486’s disclosure corroborates that a POSITA would have found it obvious to implement

the Chang-Fang device to have a total mass of less than 250 grams when unfilled with milk. EX1003, ¶159.

Moreover, as discussed in Ground 1A, implementing the Chang-Fang device to have a specific weight, e.g., less than 250 gm, was an obvious design choice because these types of devices were “designed to be lightweight, compact, and portable to ensure convenient and user-friendly use.” EX1003, ¶160. This is also confirmed by the ’381 patent specification, which describes that “lightness has been a key design goal from the start.” EX1001, 7:18-24.

Claim [29]

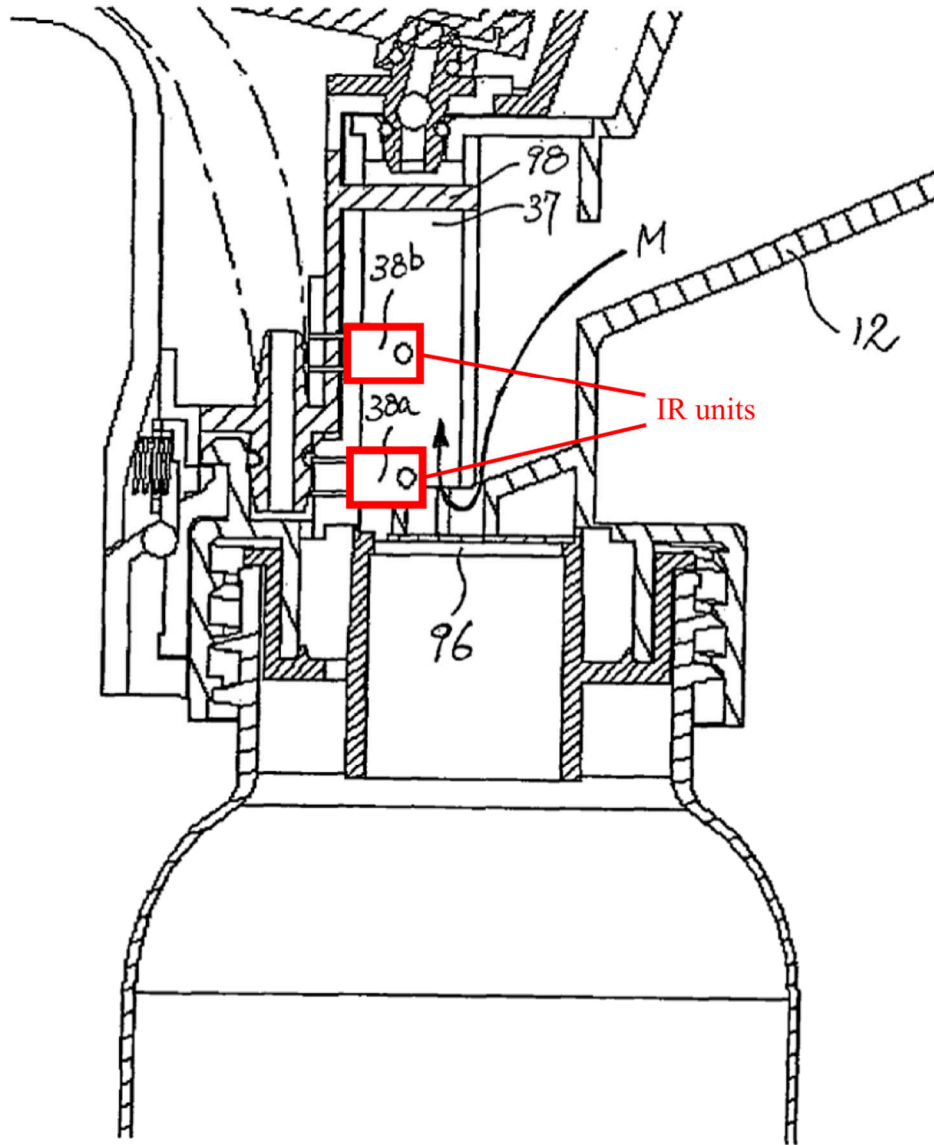
Chang describes that its breast pump device may function “by operating a control system that tracks internal pressure of the system against a known waveform,” where the waveform is a “vacuum waveform indicative of pressures applied to a breast, and can define a sine wave fluctuating between about 60 mmHg of vacuum to a vacuum **from about 120 mmHg to about 250 mmHg**, or other desirable or useful waveform.” EX1007, [0012]; *id.*, [0087]-[0088]; EX1003, ¶¶161-62. A POSITA would have understood and found obvious that Chang’s reference to “about 250 mmHg” corresponds to ***a maximum suction of approximately 240 mmHg***. EX1003, ¶163 (citing EX1001, 33:47-34:38).

B. Ground 1B: Chang-Fang-Yuen629 Renders Claim 19 Obvious

1. Chang-Fang-Yuen629

a. Yuen629

Yuen629 describes an electric breast pump that “includes sensors for detecting the passing of milk, and a microcontroller for calculating the rate of flow of milk on the basis of data received from the sensors.” EX1011, Abstract. Specifically, a “beast pump 10” includes a “chamber 37” with “two infrared (IR) units 38a, 38b, each including an IR transmitter and an IR receiver.” *Id.*, 3:12-21. In operation, “[m]ilk from the breast of the user will flow into [a] hood 12 and subsequently into the chamber 37 in the direction of the arrow M,” which is shown in the annotated version of Figure 14 below. EX1011, 4:63-5:6; EX1003, ¶¶93-94.



EX1003, ¶94 (annotating EX1011, FIG. 14)

As shown above, “the milk will accumulate in the chamber 37, first blocking the transmission of infrared signals between the transmitter and receiver of the lower IR unit 38a, and subsequently that between the transmitter and receiver of the upper IR unit 38b.” EX1011, 4:63-5:6. Further, “[w]hen the milk level rises to the upper IR unit 38b, [a] motor 43 will stop, thus releasing the ‘vacuum’ in the hood 12...”

Id., 5:7-28. In response, “milk in the chamber 37 will thus fall, on its own weight, through the one-way valve 96 into the bottle 18, during the course of which the level of milk in the chamber 37 will fall.” *Id.* This sensing technique ensures the breast pump 10 may “calculate the rate of flow of milk (in grams per second, g/s)” and also “count the number of times” milk is released from chamber 37 into bottle 18. *Id.*, 6:9-23; EX1003, ¶95.

b. Combination

As discussed in §VI.A.1(a), Chang describes a portable breast pump device designed to fit within a bra, and Fang introduces an elastic diaphragm pump that prevents milk from entering the pump's main body, thus ensuring ease of cleaning and maintenance. EX1007, [0019]; EX1009, [0020]. A POSITA would have recognized the benefits of combining these technologies to improve the overall functionality, hygiene, and user convenience of a breast pump system. EX1003, ¶164.

Yuen629 adds another layer of sophistication by incorporating sensors that detect the flow of milk and a microcontroller that calculates the rate of milk flow based on this data. EX1011, Abstract. Specifically, Yuen629's system uses IR units to monitor milk accumulation and control the pump's operation in real-time. *Id.*, 4:63-5:6. When the milk reaches a certain level, the system stops the pump, allowing the milk to flow into a collection bottle, and then resumes pumping as needed. *Id.*;

EX1003, ¶165.

Multiple reasons would have prompted a POSITA to integrate Yuen629's sensor and control technology with Chang's and Fang's breast pump systems to create a device that not only provides efficient and hygienic milk extraction but also offers real-time monitoring and control of the extraction process. EX1003, ¶166.

First, by combining Yuen629's sensor technology with Fang's diaphragm pump, the device could monitor milk flow in real-time and adjust the vacuum pressure dynamically. EX1003, ¶166. For example, Yuen629's sensors may detect when the milk flow slows down and trigger the diaphragm pump to adjust the suction accordingly, thereby optimizing milk extraction efficiency. *Id.* This dynamic adjustment would ensure that the milk is extracted gently and effectively, reducing the risk of discomfort or injury to the user. *Id.*

Second, Fang's diaphragm pump design, which isolates the milk from the pump components, could be further enhanced by Yuen629's ability to monitor milk flow and prevent overflow. EX1003, ¶167. The sensor-based system described in Yuen629 would allow for precise control over when the pump operates, ensuring that the milk does not come into contact with any part of the pump mechanism other than the milk collection chamber and associated tubing, thus maintaining a high level of hygiene. EX1011, 5:7-28; EX1009, [0019].

Third, integrating Yuen629's technology into Chang's compact and wearable

breast pump system would result in a highly convenient device that not only fits discreetly within a bra but also provides real-time feedback on the milk extraction process. EX1003, ¶168. The sensor data could be used to inform the user of the amount of milk collected, the rate of flow, and even potential issues such as blockages or reduced suction efficiency, thereby allowing for immediate adjustments. *Id.* This feature would significantly enhance the user experience by providing more control and information during the milk extraction process. *See* EX1007, [0011]; EX1011, 6:9-23.

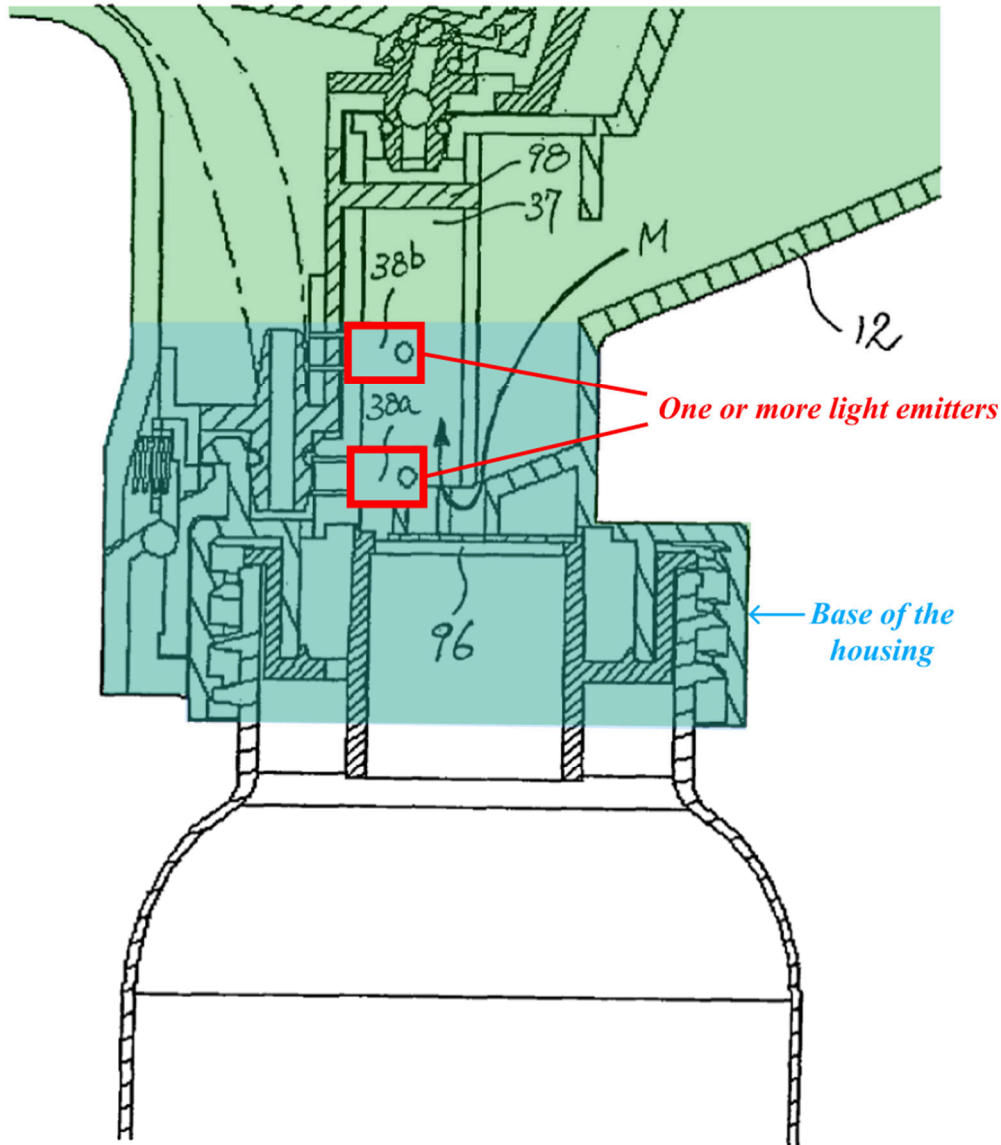
2. Analysis

Claim [19]

The Chang-Fang-Yuen629 device includes *one or more light emitters*, e.g., Yuen629's IR units 38a and 38b, positioned in a *base of the housing*, in accordance with Yuen629's suggestions. EX1003, ¶169; EX1011, 4:63-5:6, 5:7-28, 6:9-23, FIG. 14. Specifically, based on Yuen629's teachings, flow of milk "block[s] the transmission of infrared signals between the transmitter and receiver of" IR units, which enables the calculation of "the rate of flow of milk (in grams per second, g/s)." EX1011, 4:63-5:6, 6:9-23. In the Chang-Fang-Yuen629 device, the IR units (*one or more light emitters*) are also positioned near a bottom portion (*in a base*) of a pump housing (*housing*). Such a configuration is consistent with Yuen629's suggestions of IR units 38a, 38b being positioned in a bottom portion of "head portion 22" of the

“breast pump 10,” as shown in the annotated version of Yuen629’s Figure 14 below.

EX1011, 3:22-32.



EX1003, ¶169 (annotating EX1011, FIG. 14)

Further, based on Yuen629’s suggestions, it would have been obvious that a *milk container* of the Chang-Fang-Yuen629 device (e.g., Chang’s container assembly) includes an *optically clear region* aligned below the IR units. EX1007,

[0099]. A POSITA would have found it obvious that Chang's container assembly is optically clear given Chang's door assembly being "transparent so that a direct view to the container assembly is provided." *Id.*, [0081]; EX1011, 2:60-3:11; 6:9-23; EX1003, ¶170. Moreover, "milk containers with optically clear regions in portable breast pump systems represented obvious design choices by the Critical Date." EX1003, ¶171.

C. Ground 1C: Chang-Fang-Makower⁷⁹⁴ Renders Claim 24 Obvious

1. Chang-Fang-Makower⁷⁹⁴

a. Makower⁷⁹⁴

Makower⁷⁹⁴ focuses on "pumping milk from a breast" under suction such that "milk is expelled from the pumping mechanism to a collection container under positive pressure." EX1014, Abstract. A wearable device (e.g., portable breast pump device) may be "designed with the capability of communicating to an external computer," including "a smartphone." *Id.*, [0228]. As shown in FIG. 47 (below), a breast pump device may be configured to enable "transfer of data wirelessly from controller 52 [of the breast pump device] to smartphone 470." *Id.*; EX1003, ¶96-97.

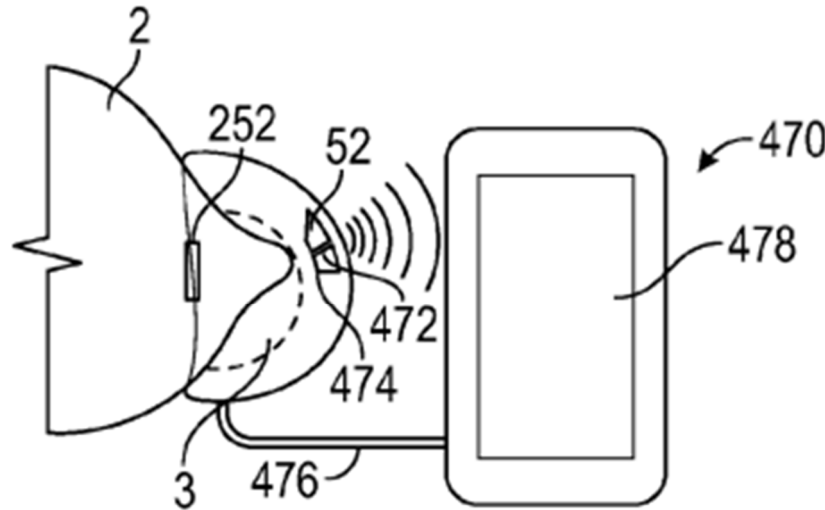


FIG. 47

EX1014, FIG. 47

Controller 52 includes “a wireless transmitter 472 that can be actuated by the user via controls 252 to send data to the external device 470 at will, so along as the external device 470 is in range of the transmitter 72.” EX1014, [0228]. As other examples, “controller 52 can be provided with a BLUETOOTH transmitter, so that data is automatically transmitted to the external device 470 whenever the external device 470 is in range of the BLUETOOTH transmitter.” *Id.*; EX1003, ¶97.

Makower⁷⁹⁴ also describes embodiments where a breast pump system includes display elements for showing information relating to device operation. For example, as shown in FIG. 57 (below), system 100 may be “provided with an indicator light 570.” EX1014, [0250]; EX1003, ¶98.

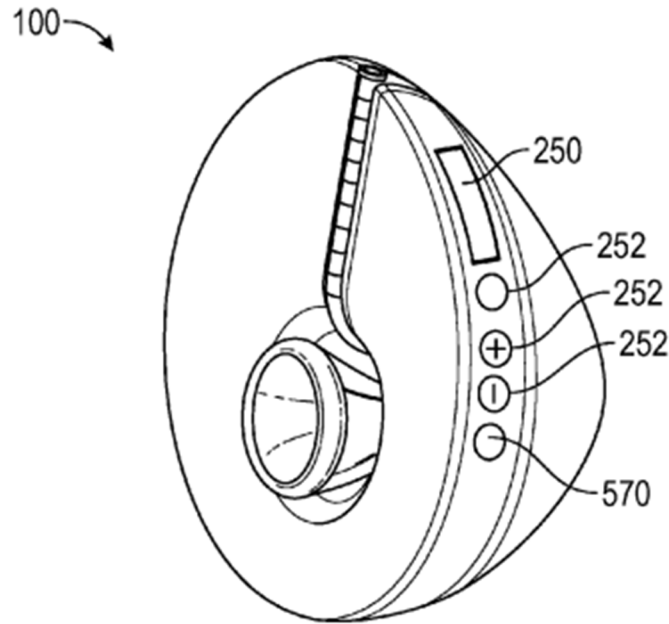


FIG. 57

EX1014, FIG. 57

Also shown above, system 100 includes a “display 250, which can be outputted to by controller 52” to indicate various types of information, such as “if an air leak develops, what the current suction/pressure reading in the adapter 10 tube 32 is, approximate value of milk Volume having been expressed, approximate flow rate of milk, pressure waveforms, phases of feeding timing, rest programming, heating applied to breast, vibration applied to breast, etc.” *Id.*, [0163]; EX1003, ¶99.

b. Combination

As discussed above, the Chang-Fang device (Ground 1A) provides a portable breast pump system that utilizes a diaphragm to transmit negative pressure, as suggested by Fang, so as to achieve known benefits. *Supra* §VI.A.1. Makower794

complements these teachings through using a display to provide real-time feedback on critical operational parameters such as suction level, milk volume, and flow rate. EX1003, ¶172. In the resulting system, the device would have included a display to show such information. *Id.*

Multiple reasons would have prompted a POSITA to implement the Chang-Fang device (Ground 1A) in accordance with Makower794. EX1003, ¶173.

First, a POSITA would have been motivated to improve user feedback and control while user uses a breast pump device, facilitating enhanced tracking and optimization of milk expression. EX1003, ¶173. A POSITA would have recognized that adding a display would allow users to monitor the effectiveness of the diaphragm pump (from Fang's teachings) and adjust suction levels or pumping rhythms more easily (from Chang's teachings). *Id.* Makower794's display improves the functionality of the Chang-Fang combination by providing real-time visual indicators, helping the user monitor the pump's performance, troubleshoot any issues (e.g., air leaks or improper suction), and track milk output during each session. *Id.*

Second, POSITA would have found it advantageous to integrate a display into the Chang-Fang device to simplify the monitoring process and make it more convenient for the user to keep track of the pump's status. EX1003, ¶174. A display on the device housing can convey important information such as suction pressure,

phase of feeding, and whether an air leak has developed. The real-time display also eliminates the need for a user to rely solely on tactile or auditory cues, allowing her to continue her activities while effortlessly glancing at the pump's status. *Id.*

Third, a POSITA would have been motivated to incorporate Makower794's description of a breast pump that communicates wirelessly with external devices into the Chang-Fang device, further complementing the data logging capabilities. EX1003, ¶175. The integration of a display would facilitate an onsite summary of key metrics while allowing users to also access more detailed data on their smartphone later. *Id.*

2. Analysis

Claim [24]

The Chang-Fang-Makower794 device provides a ***display***, as suggested by Makower794's display 250, configured to display ***at least one of a visual...indicator***. EX1003, ¶176. As shown in Makower794's Figure 57, a display 250 on a device housing may be used to display information "outputted to by controller 52." EX1014, [0163].

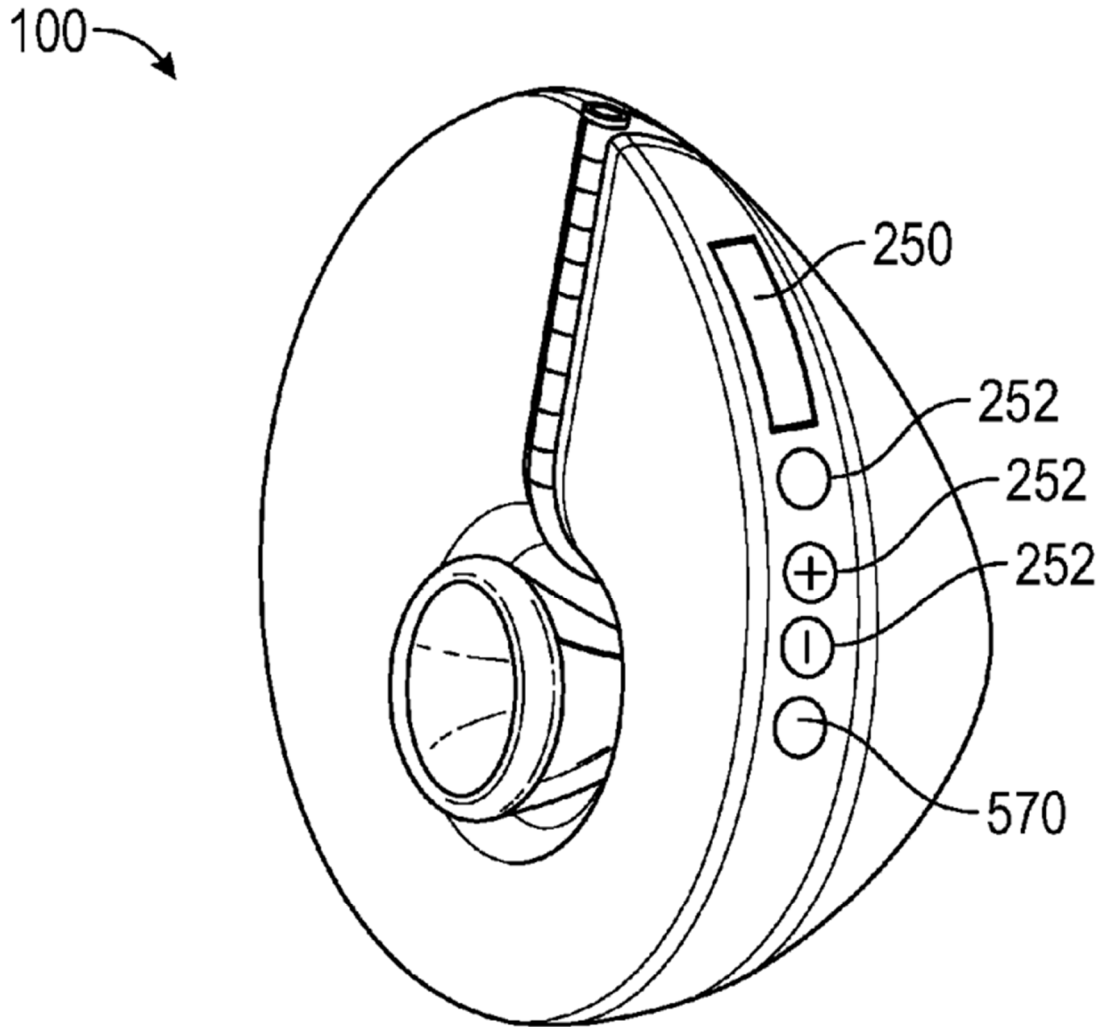


FIG. 57

EX1014, FIG. 57

Displayed information includes indications relating to “if an air leak develops, what the current suction/pressure reading in the adapter 10 tube 32 is, approximate value of milk Volume having been expressed, approximate flow rate of milk, pressure waveforms, phases of feeding timing, rest programming, heating applied to

breast, vibration applied to breast, etc.” EX1014, [0163]. Thus, the *display* of the Chang-Fang-Makower794 device indicates “approximate flow rate of milk” (*whether milk is flowing or not flowing into the milk container*). EX1003, ¶177.

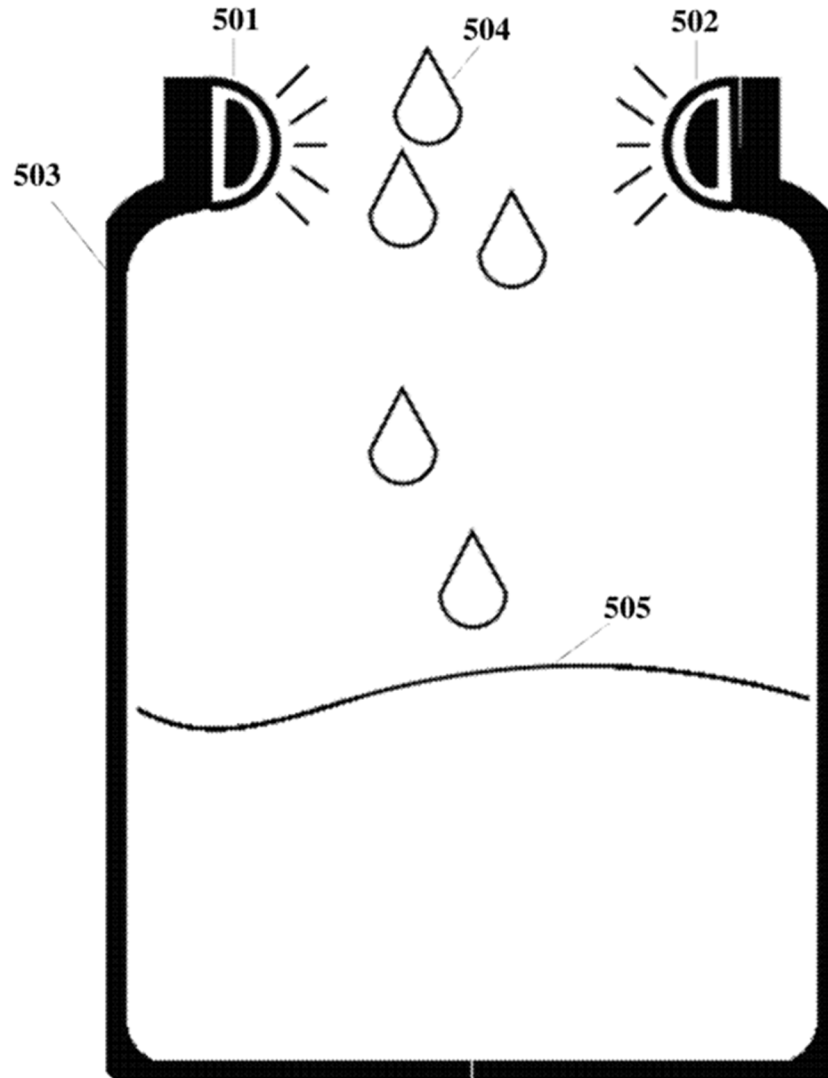
D. Ground 1D: Chang-Fang-Makower794-Guthrie002 Renders Claim 25 Obvious

1. Chang-Fang-Makower794-Guthrie002

a. Guthrie002

Guthrie002 describes a “breast pump sensor network” for breast pump devices. EX1015, Abstract. As described in Guthrie002, “breast pump accessory parts (including flanges, bottles and tubing) may be augmented with “sensors and accompanying software application that runs on the user’s smartphone or mobile device.” *Id.*, 1:28-51. The sensors “relay data such as volume pumped, flow rate and temperature data in real-time.” *Id.* The software application provides a “network for mothers to communicate with each other and with experts in the lactation, prenatal, pediatric and post-partum care fields.” *Id.*; EX1003, ¶¶100-01.

Figure 5 shows an “example location” for one or more sensors being disposed in a breast pump device:



EX1015, FIG. 5

In the configuration shown in Figure 5, sensors 501 and 502 “may be measuring flow rate or temperature or counting drops.” EX1015, 10:39-60. Additionally, “[f]low rate and volume sensors may be based on liquid level measurements by means of capacitive sensors, ultrasonic sensors, microphones or optical sensors based on light and sound reflectivity.” Id.; EX1003, ¶¶102-03.

b. Combination

Chang-Fang-Makower794 (Ground 1C) provides a portable breast pump system with an integrated display for showing key parameters. *See* §VI.E.1. Guthrie002 complements these teachings through embedded sensors in breast pump devices to monitor information relating to device operation. EX1003, ¶178. When combined, the device would have included embedded sensors that enable monitoring of parameters relating to device operation, such as the progression and/or rate of milk collection. *Id.*

Multiple reasons would have prompted a POSITA to implement the Chang-Fang-Makower794 device (Ground 1C) in accordance with Guthrie002. EX1003, ¶179.

First, POSITA would have been motivated to enhance real-time monitoring capabilities of the Chang-Fang-Makower794 device to give users more precise control over their breast pump device, especially in portable systems where optimizing milk expression is critical. EX1003, ¶179. By integrating Guthrie002's sensors into the Chang-Fang-Makower794 system, the device would provide real-time feedback on parameters like flow rate, volume pumped, and temperature, allowing users to make immediate adjustments. *Id.* This configuration would have enabled continuous feedback on critical pumping parameters, making the Chang-Fang-Makower794 device more responsive and efficient. *Id.*

Second, a POSITA would have been motivated to add data logging capabilities, especially as users increasingly expected devices to track and analyze health-related data. EX1003, ¶180. Combining Guthrie002's sensor-driven data logging with the Chang-Fang-Makower794 system would have also allowed users to track long-term data like milk volume and pumping frequency, helping mothers optimize their routines and understand trends. *Id.*

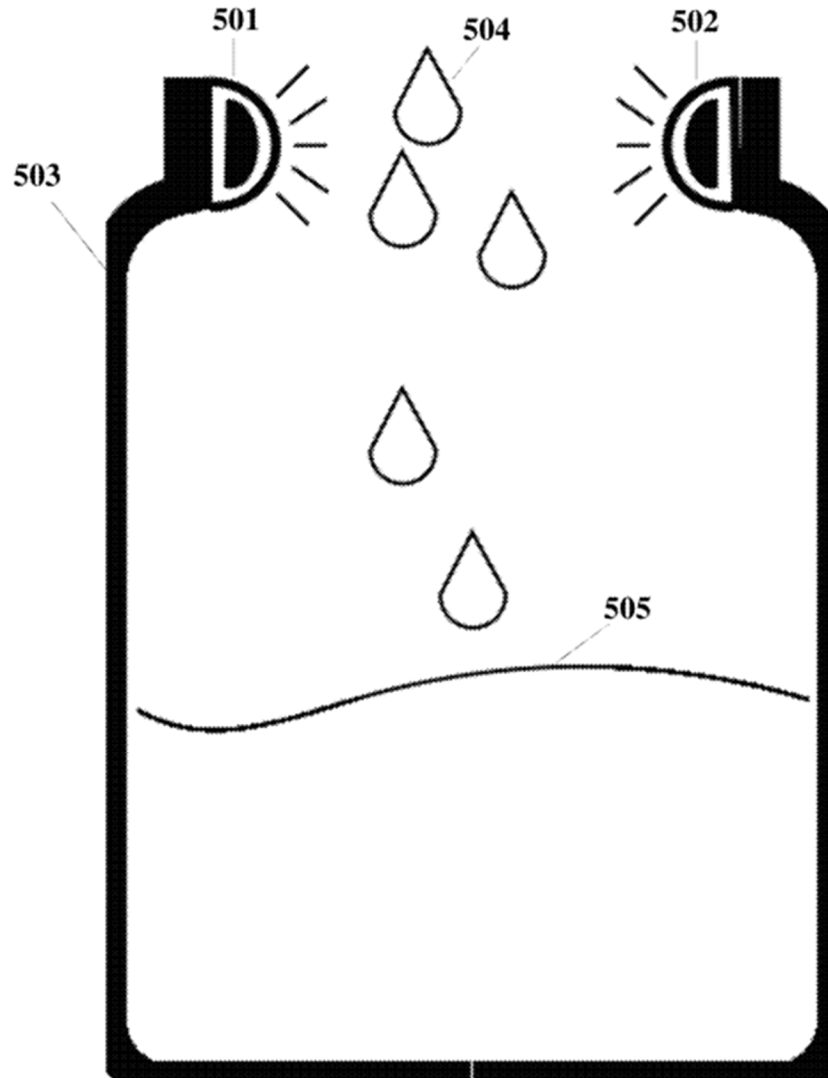
Third, a POSITA would have been motivated to improve user comfort and personalize pumping sessions, especially in wearable pumps, where adaptability is crucial. EX1003, ¶181. Guthrie002's sensors may monitor conditions like temperature, allowing the system to make automatic adjustments for enhanced comfort, and facilitate a more personalized experience. *Id.* Guthrie002's temperature and flow rate sensors may enable the pump to automatically adjust suction or rhythm based on real-time data, improving comfort and effectiveness. Moreover, a POSITA would have predictably implemented such a combination, with a reasonable expectation of success, especially in view of the known use of such features in breast pump applications.

2. Analysis

Claim [25]

In the Chang-Fang-Makower794-Guthrie002 device, a display (e.g., Makower794's display 250) is configured to display the types of information

described in Makower794 and Guthrie002. EX1003, ¶182. For example, Makower794 describes that the display shows indication information relating to “if an air leak develops, what the current suction/pressure reading in the adapter 10 tube 32 is, approximate value of milk volume having been expressed, approximate flow rate of milk, pressure waveforms, phases of feeding timing, rest programming, heating applied to breast, vibration applied to breast, etc.” EX1014, [0163]. Guthrie002 further describes examples of sensor networks that includes sensors embedded in a portable breast pump device. EX1003, ¶182. For instance, as shown in Guthrie002’s Figure 5 (below), a collection container 503 of a breast pump device includes sensors 501 and 503 “located at the neck.” EX1015, 10:39-60.



EX1015, FIG. 5

In the configuration shown in Figure 5, sensors 501 and 502 “may be measuring flow rate or temperature or counting drops.” EX1015, 10:39-60. Additionally, “[f]low rate and volume sensors may be based on liquid level measurements by means of capacitive sensors, ultrasonic sensors, microphones or optical sensors based on light and sound reflectivity.” *Id.* Thus, based on the

disclosures of Makower794 and Guthrie002, the Chang-Fang-Makower794-Guthrie002 device includes the sensing elements (e.g., Guthrie002's sensors 501, 502) and display elements (e.g., Makower794's display 250) to display indication information relating to breast pump device operation, e.g., *if the pump is operating correctly to pump milk*. EX1003, ¶183. Further, based on the sensing functions described in Makower794, such as flow rate and liquid level measurements based on various methodologies (e.g., optical, capacitive, ultrasonic, light/sound reflectivity), it would have been obvious that the Chang-Fang-Makower794-Guthrie002 device is also configured to determine and assess whether *a quantity or a height of liquid in the milk container above a base of the milk container is increasing above a threshold rate of increase*. EX1003, ¶183.

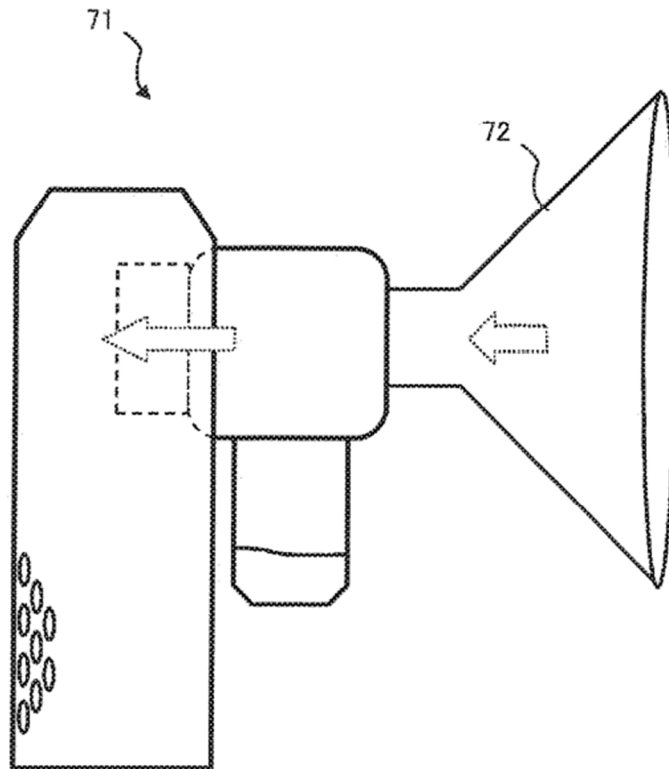
E. Ground 2A: Chang-Fang-Kurihara Renders Claims 1-13, 16, 17, 22, 23, 26-29 Obvious

1. Chang-Fang-Kurihara

a. Kurihara

Kurihara describes a breast milk suction device that can “suppress sound and vibration device use.” EX1016, Abstract; *see also, id.*, [0084], [0092], [0093], FIGS. 1, 6; EX1003, ¶¶104-05.

FIG. 6



EX1016, FIG. 6

Suction device 71 is “configured as a breast-milk suction device, and the nozzle 72 is shaped like a funnel to be fit the shape of breasts.” EX1016, [0092]. This device “can configure a compact and silent breast-milk suction device.” *Id.*, [0093]; EX1003, ¶¶106-07.

b. Combination

As discussed in §VI.A.1, the Chang-Fang device would have utilized a flexible diaphragm to transmit negative pressure, as suggested by Fang, so as to achieve known benefits. EX1003, ¶184; EX1007, [0022], [025], [0068]; EX1009,

[0024], [0025], FIG. 7. The Chang-Fang device further includes an air pump in pneumatic connection with the flexible diaphragm. EX1009, [0019], [0024], FIG. 7. A POSITA would have found it obvious that the piezoelectric-driven pump described in Kurihara facilitated efficiency and precision of the suction mechanism in the Chang-Fang breast pump system. EX1003, ¶184. Specifically, “[t]he piezoelectric system’s ability to create a precise and consistent negative pressure would enhance the milk expression process in a more compact and integrated design.” *Id.*, ¶185.

Multiple reasons would have prompted a POSITA to implement a piezoelectric pump in the Chang-Fang device in accordance with Kurihara’s suggestions.

First, a POSITA would have recognized that Kurihara’s cylindrical body and piezoelectric components are designed to be compact and could be integrated seamlessly into the existing structure of the Chang-Fang pump, particularly within the diaphragm housing. EX1003, ¶186. This would maintain the portability and in-bra usability of the device while enhancing its performance. *Id.* Further, Kurihara’s teachings of including a filter to prevent liquid from reaching the piezoelectric driving part aligns with Fang’s generalized concern about keeping milk separate from the pump’s internal mechanisms. *See* EX1009, [0040]; EX1016, [0061]. Thus, consistent with Fang and Kurihara, the Chang-Fang-Kurihara device would have

reduced the risk of contamination and make the device easier to clean and maintain.

EX1003, ¶186.

Second, a POSITA would have recognized that a piezoelectric system provides various advantages, such as “precise control of the pumping action, which could lead to more effective and comfortable milk expression.” EX1003, ¶187. Specifically, “[p]iezoelectric pumps were often known for their low energy consumption, which would enhance the battery life of the breast pump, making it more practical for extended use.” *Id.* Kurihara’s system would also likely reduce operational noise, making the device more discreet and suitable for use in various environments. EX1016, [0093], [0123].

Third, a POSITA would have recognized that replacing or augmenting the existing pump mechanism in the Chang-Fang device with Kurihara’s piezoelectric system is a straightforward substitution that leverages the known benefits of piezoelectric actuation. EX1003, ¶188. The combination of Kurihara’s technology with the Chang-Fang system would have been expected to succeed, given the compatibility of the components and the known benefits of piezoelectric actuation. *Id.*

2. Analysis⁴

1[a][1] / Claim [26]

The Chang-Fang-Kurihara device provides a pump, e.g., Kurihara's piezoelectric driving part 33, such that the device is configured as a *piezo air pump system* based on the teachings of Kurihara. EX1003, ¶189. Kurihara describes that the “piezoelectric driving part 33” includes “a piezoelectric element 34A, a reinforcing plate 34B, a floating terminal 34C, a diaphragm forming plate 37A, an opposed plate 37B, a case portion 35A, and a cover portion 35B.” EX1016, [0065]. The piezoelectric element “deforms by the application of a driving voltage and an elastic member to which the piezoelectric member is attached.” *Id.*, [0015]. Thus, the piezoelectric driving part 33 is configured to “generate[], inside of [a] flow-passage forming section 1 (flow passage 2), a flow of fluid directed from the suction port 20 to the discharge port 29 via the flow passage 21, the upper chamber 23, and the flow passage 28.” *Id.*, [0063]; EX1003, ¶189.

In the context of the Chang-Fang-Kurihara system, a POSTIA would have

⁴ Even if the “air pump” structure of Element 1[a][1] was interpreted as referring to a “piezo” pump like embodiments disclosed in the '381 patent, claim 1 is rendered obvious by Chang-Fang-Kurihara for the reasons articulated above. Where Kurihara is not addressed in Ground 2A, the Ground 1 analysis applies fully here.

understood and/or found obvious that “Kurihara’s piezoelectric driving part 33 may be configured as a piezoelectric pump that ‘applies a driving voltage to an elastic member’ to generate a flow of air to deform, for example, Fang’s flexible diaphragm.” EX1003, ¶190 (citing EX1009, [0019], FIG. 7 and EX1016, [0015]). Thus, “because Kurihara describes using piezoelectric elements (e.g., piezoelectric driving part 33) to move a flexible diaphragm to generate pressure differences, a POSITA would have understood and/or found obvious that the piezoelectric pump of the Chang-Fang-Kurihara device is configured as a piezo air pump system.” *Id.*

Claim [28]

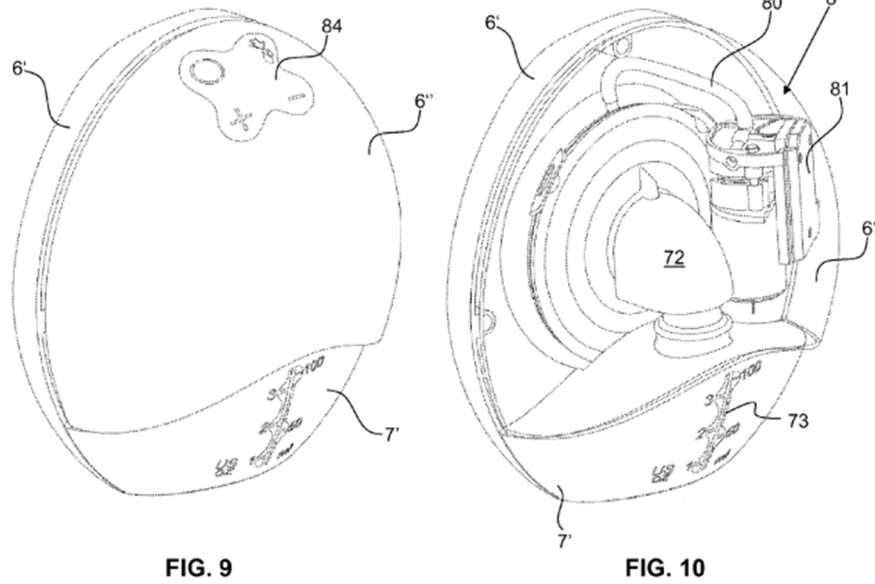
The Chang-Fang-Kurihara device would have been configured according to the suggestions of Kurihara to “configure a compact and silent breast-milk suction device,” thereby rendering this claim obvious. EX1016, [0093]; EX1003, ¶191. Silent operation of portable breast pump systems was conventional by the Critical Date. EX1003, ¶192 (citing EX1040, [0121] and EX1016).

F. Ground 3A: Chang-Fang-Khalil Renders Claims 1-18, 20-23, 27, And 29 Obvious

1. Chang-Fang-Khalil

a. Khalil

Khalil describes an integrated breast pump, referred to as a “breastshield unit.” EX1010, Abstract. The breastshield unit is “designed as a hands-free unit” that can be worn “under” or “in” a bra (*id.*, [0032], [0070]):



EX1010, FIGS. 9, 10, Abstract, [0066]

The unit includes a shell (cover 6'' and shell ring 6'), milk container 7' and integrated pump unit 8', including vacuum pump 81. *Id.*, [0066]-[0067]. The pump "is preferably a diaphragm vacuum pump of a known type, which is operated by means of an electric motor." *Id.*, [0067]. The pump may be powered by an integrated "power source." *Id.* Milk collection container 7' is "arranged in the lower area adjoining the cover (6'')" and uses locking lug 71, "integrally formed" on it, to "engage in a corresponding recess...of the shell ring (6'')" as shown below. *Id.*, [0069]. EX1003, ¶¶84-86.

The breastshield unit includes "breast interface 1 for placing on a human mother's breast." EX1010, [0048], [0066]. Khalil's breastshield may include

to the shell via cover ring 6':



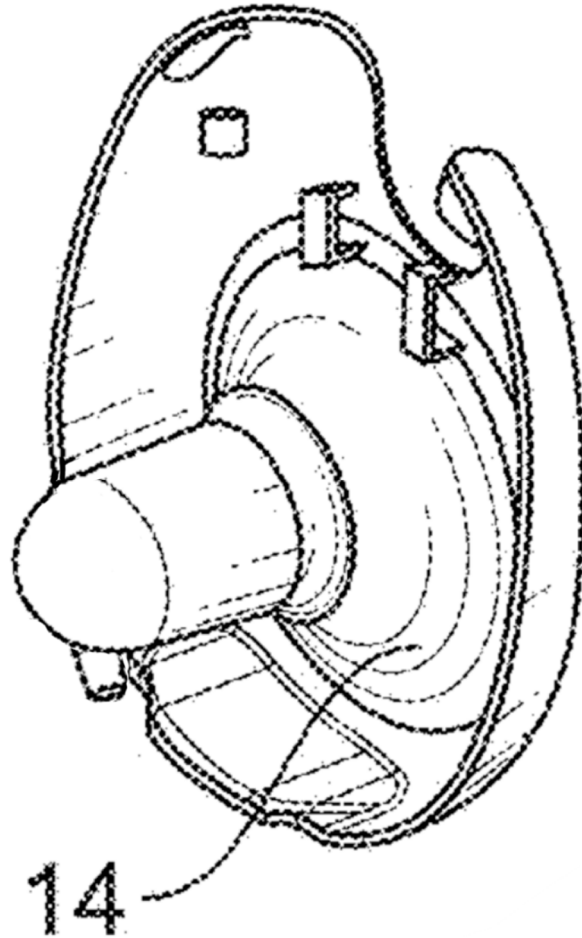
EX1010, FIG. 11; *see id.*, [0066]-[0067], [0053]-[0058]; EX1003, ¶¶ 87-92

b. Combination

A POSITA would have been motivated to implement the aforementioned Chang-Fang device (Ground 1A) with Khalil’s suggestion to utilize a rigid container at a lower portion of the device, and downward flow of milk to the container, so as to achieve known benefits (articulated below). EX1003, ¶193. Chang describes that its device can be implemented to have a “rigid” milk container that can be provided in “alternative locations.” EX1007, [0021], [0105]. Khalil provides a straightforward suggestion for implementing a rigid container in a wearable, in-bra

device. EX1010, [0032]. Khalil discloses the use of a rigid “milk collection container...integrated in the housing of the unit or coupled directly thereto.” *Id.*; *see also*, [0069], [0050], [0067].

In the resulting combination, the breast pump device would have included an integrated milk container at a lower location of the device, in accordance with Khalil’s suggestion. EX1003, ¶194. The milk container would have a contoured shape to complement the shape of other portions of the device (e.g., “outer shell 12”), and contributes to its wearable, in-bra configuration. *Id.* To enable the positioning of the milk container according to Khalil’s teachings, a POSITA would have modified the direction of the milk port of Chang’s breast shield such that it is configured to point downwards. *Id.* This modification is shown in a modified version of Chang’s Figure 6A below:



EX1003, ¶194 (excerpting and modifying EX1007, FIG. 6A)

Based on this predictable modification, milk flows through the nipple tunnel and then downward through the modified milk port (with a one-way valve) into the container, as suggested by Khalil. EX1010, [0053] (“non-return valve 5”/“duckbill valve”), [0069]; EX1003, ¶195. The container would have included a conventional removable attachment with the pump housing (e.g., “chassis 35” and/or “outer shell 12”), and fluidic connection with the nipple tunnel via the modified milk port. EX1010, [0069] (“locking lug” and “corresponding recess” and “expressed milk can

flow from the underpressure chamber 40 into the interior of the milk collection container”); EX1003, ¶195. Further, as explained in Ground 1A, based on Chang’s suggestions, the positioning of the modified milk port would have been intermediate to a closed end of the nipple tunnel and a breast flange of the breastshield. *See* EX1007, FIG 6A; EX1003, ¶130-31. A POSITA would have recognized that type of positioning in the Chang-Fang-Khalil device was an obvious configuration by the Critical Date because portable breast pumps were known to have breast flanges with milk ports positioned intermediate to a closed end of a nipple tunnel and a breast flange. EX1003, ¶¶196-97 (citing EX1037, [32], [33], FIGS. 10A, 10B for corroboration).

Multiple reasons would have prompted a POSITA to implement the Chang-Fang device to have a rigid container at a lower portion of the device, as suggested by Khalil. EX1003, ¶198.

First, a POSITA would have been motivated to combine Khalil with Chang, Fang, and Yuen to further enhance cleanability and assembly/disassembly in a wearable device having a diaphragm. Khalil specifically describes advantages of its configuration in providing a device that is “small and easy to clean” and “that can be worn in the bra.” EX1010, [0070]. A POSITA would have been motivated to further enhance these benefits in the Chang-Fang device by positioning the milk container at a lower portion that can be readily assembled and disassembled with the

remainder of the device, as suggested by Khalil. EX1003, ¶198; EX1010, [0069].

Moreover, in doing so, a POSITA would have recognized the benefits of a downward flow of milk in which the milk flow path remains below the diaphragm components, consistent with Fang and Khalil's suggestions, further enhancing the isolation of pump components from milk flow. *Id.*

Second, a POSITA would have been motivated to combine Khalil with Chang-Fang to enhance the user experience during pump removal from the breast at the conclusion of a pumping session. EX1003, ¶199. The diaphragm arrangement and downward flow of milk to a lower container (e.g., in which the milk is evacuated into the container during each pump stroke) facilitates removal without requiring the user to lean forward or otherwise adjust the orientation of their body to avoid spilling milk captured within the device. *Id.*

Third, a POSITA would have been motivated to avail the Chang-Fang device of Khalil's rigid milk container as a suitable option for collecting expressed milk within the device. EX1003, ¶200. Chang expressly describes that its container can be "rigid" and positioned in various locations. EX1007, [0021], [0101]. Khalil provides a suitable example to implement a rigid container at a lower portion of the device in an integrated manner. *Intel Corp.*, 61 F.4th, at 1381 ("was a 'suitable option' to replace [primary reference's feature]").

Fourth, the evidence confirms a POSITA would have been motivated to combine Khalil with Chang, Fang, and Yuen because doing so was the application of a known technique (Khalil’s milk container as part of an integrated wearable diaphragm breast pump) to a known device (the Chang-Fang device) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. at 416-17; EX1003, ¶201. A POSITA would have had a reasonable expectation of success given the similarity to the breast pump configurations. *Id.*

2. Analysis

a. Claim 1

1[pre], 1[a], 1[a][1], 1[a][2], 1[a][2][i], 1[a][2][ii], 1[a][3], 1[a][3][i], 1[a][3][ii]

The Chang-Fang-Khalil device provides these elements for the same reasons as discussed above for Chang-Fang based on the teachings of Chang and Fang. *Supra*, Ground 1A; EX1003, ¶¶201-11.

1[a][4]

The Chang-Fang-Khalil device provides a *milk container*, as suggested by Khalil. EX1003, ¶212. Khalil describes a rigid “milk collection container...integrated in the housing of the unit or coupled directly thereto.” *Id.*; see EX1010, [0069] (“made of plastic like the cover 6.”), [0050] (“The shell 6 is preferably in one piece and rigid, and usually made of a plastic”), [0067]. In the predictable combination, the breast pump device would have included an integrated milk container at a lower location of the device. EX1003, ¶212; *supra*, §VI.B.1

(Chang-Fang-Khalil). Such a conventional container is configured to be attached to and removed from the pump housing, and it receives expressed milk via the milk port (e.g., milk port in accordance with Chang, located at the lower side of the nipple tunnel). EX1010, [0069]; *supra*, §VI.B.1 (Chang-Fang-Khalil).

b. Claims 2-13, 22, 23, 27, 29

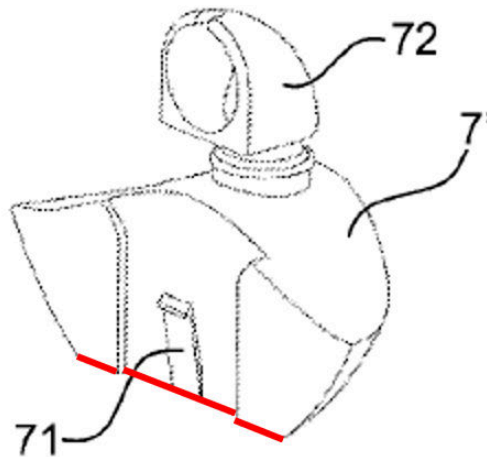
The Chang-Fang-Khalil device provides these claim elements for the same reasons as discussed above for Chang-Fang in Ground 1A. *Supra* §VI.A.2.b; EX1003, ¶¶213-24, 234-37.

c. Claims 14-18, 20, 21

Claim [14]

In the Chang-Fang-Khalil device, the *milk container* is configured to attach to a lower part of the pump housing (e.g., “chassis 35”). *Supra*, §VI.B.1 (Chang-Fang-Khalil). Khalil describes complementary mating features between the milk container and the pump housing such that the milk container is releasably attachable with a lower part of the pump housing. EX1010, [0069]; EX1003, ¶225.

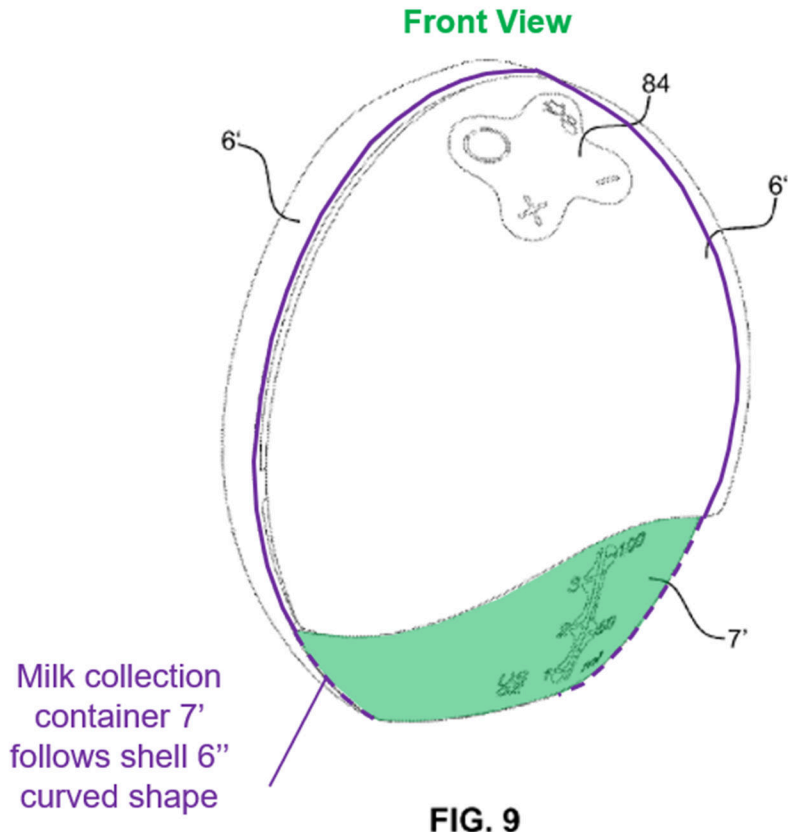
The container forms a flat-bottomed base for the device, consistent with Khalil. EX1010, FIGS. 10-11; EX1003, ¶226. Indeed, a POSITA would have recognized from Khalil’s description, that when the milk container forms a base of the device, a flat bottom promotes stability and beneficially facilitates an upright orientation of the container (e.g., preventing spillage when disassembled).



EX1003, ¶226 (EX1010, FIG. 11 (partial, annotated))

Claim [15]

The Chang-Fang-Khalil device provides the elements of claim 15, as suggested by Chang and Khalil. *See* EX1003, ¶227. For example, the outer surface of the milk container is shaped to continue a curved shape of the pump housing (e.g., “shell 12”) so that the breast pump device can be held comfortably inside a bra. Khalil describes a breast shield unit (or breast pump) “designed as a hands-free unit and worn under a bra” and including a “milk collection container...integrated in the housing of the unit or...coupled directly thereto.” EX1010, [0032], [0070]; EX1007, [0004], [0011], [0019], [0071]. Furthering these express design objectives of Chang and Khalil, Khalil describes a milk container (green) in a curved shape that continues the curved shape of the pump housing.



EX1003, ¶226 (annotating EX1010, FIG. 9)

Claim [16]

As discussed in §VI.B.1 (Chang-Fang-Khalil), the combined device would have provided a ***milk container*** according to Khalil's teachings, which a POSITA would have implemented by modifying the direction of the milk port of Chang's breast shield such that it is configured to point downwards. EX1003, ¶228. With this modification, the Chang-Fang-Khalil device ***permits the expressed milk to flow into the milk container*** through the modified milk port (***milk port***). *Id.*; EX1007, [0008], [0010], [0019], [0021], [0023], [0081], [0086], [0092], [0099], [0100], [0101].

Claim [17]

As discussed for 1[a][4], the Chang-Fang-Khalil device includes a ***milk container***, e.g., Khalil's milk container. EX1010, [0050], [0067], [0069]. Further, the Chang-Fang-Khalil device includes a modified milk port (pointed downwards) to enable fluid connection between the ***nipple tunnel*** and the ***milk container***. EX1003, ¶229. With this configuration, the ***milk container*** is configured to be attachable to the ***housing*** via the ***milk container*** with a ***mechanical or magnetic mechanism***, in accordance with the teachings of Chang and Khalil. *Id.*; EX1007, [0101]; EX1010, [0069].

Claim [18]

In the Chang-Fang-Khalil device, the milk container in the storing housing 700 is configured according to the suggestions of Khalil. EX1003, ¶230. As shown in the annotated version of Khalil's Figure 11 (below), Khalil's milk collection container 7' (which, like Park's breast pump device, is similarly arranged in a bottom portion of a device casing) has a "coupling part 72" that can be "plugged onto the milk port 34" and can act as a cap. EX1010, [0069].

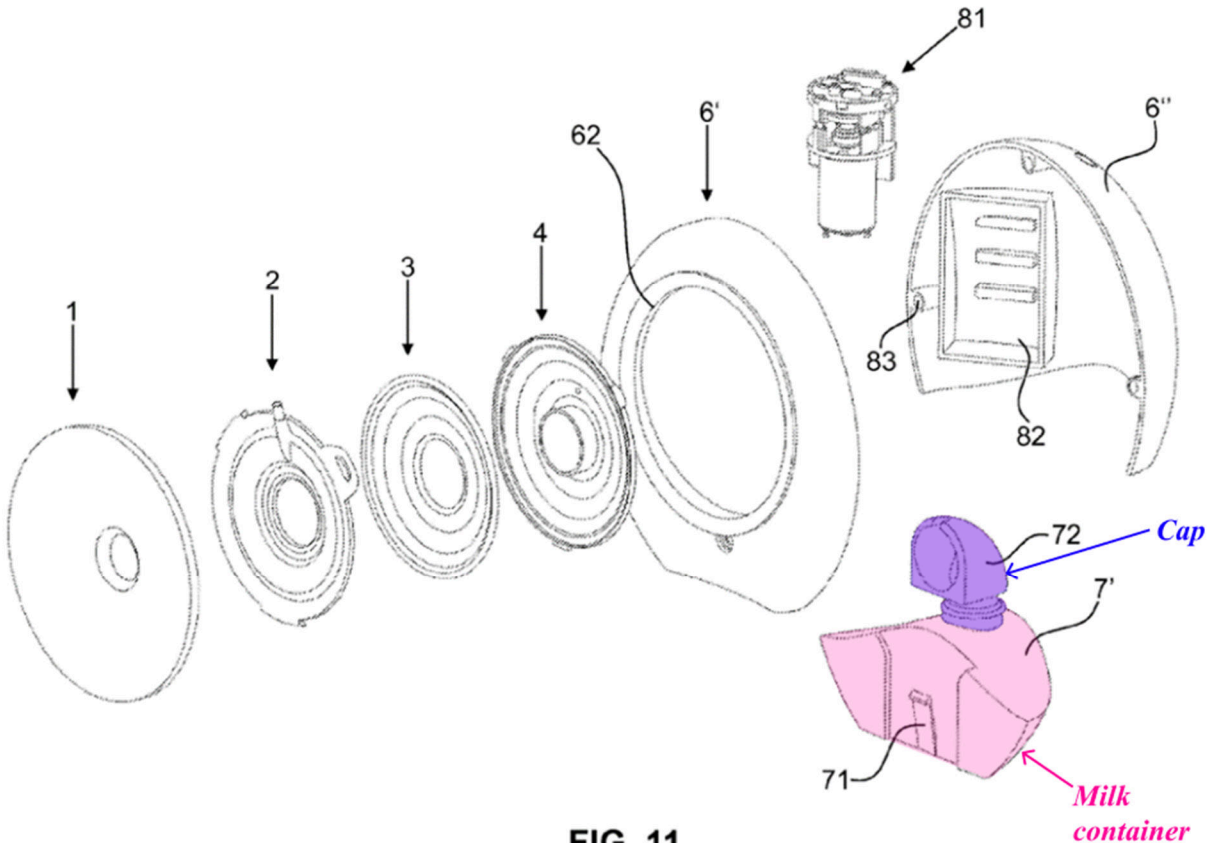


FIG. 11

EX1003, ¶230 (annotating EX1010, FIG. 11)

Claim [20]

The Chang-Fang-Khalil device includes a milk container, e.g., Khalil's collection container 7' (***milk container***). EX1010, [0050], [0067], [0069]. As shown below in Khalil's Figure 3, collection container 7' is sized such that it is wider than...tall. EX1003, ¶231.

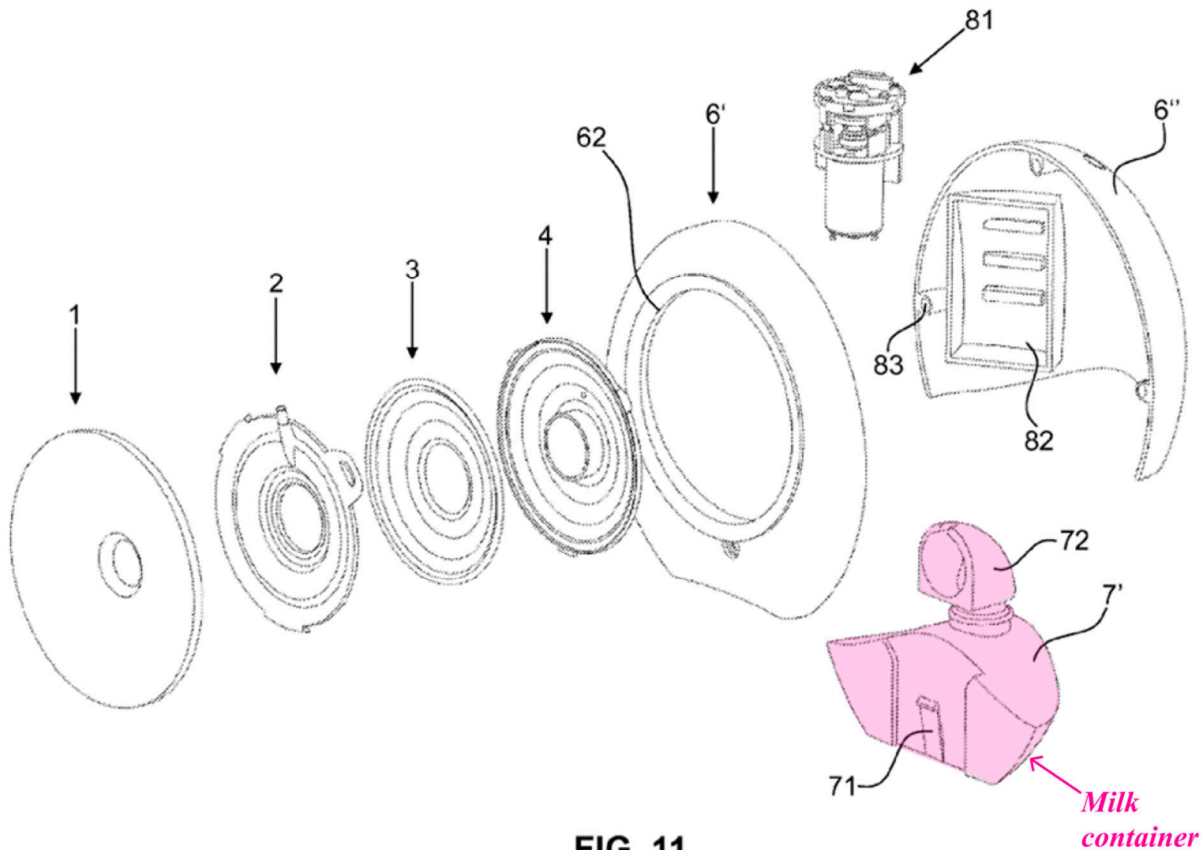


FIG. 11

EX1003, ¶231 (annotating EX1010, FIG. 11)

The disclosures of Chang, Fang, and Khalil also render obvious that, in some implementations, collection container 7' is sized to satisfy the requirements of claim 20. Indeed, “[s]uch a modification would be obvious to implement to accommodate the natural variation in breast sizes and shapes among users, ensuring a better fit and more efficient milk expression.” *Id.*, ¶231. Manufacturers of medical devices, particularly those intended for wearable use, typically design products in multiple sizes to enhance comfort, performance, and usability for a wide range of body types. Thus, “given the well-known variability in breast anatomy, a POSITA would

recognize that offering customizable breast pump components would meet the practical need for personalization and maximize the effectiveness of the device.” *Id.*

The size and shape of breast pump components (e.g., relative width of a milk container) also represented an obvious design choice based on the size and shape of the device. *Id.*, ¶232. The ’381 patent specification confirms this through the lack of any discernible disclosure regarding how the specific design recited in claim 20 (i.e., a milk container that is wider than tall) conveys any meaningful advantage in the operation of a breast pump device. Indeed, “a POSITA would have found it obvious that a variety of relative dimensions of collection container 7’ may be implemented in the context of the Chang-Fang-Khalil device without necessarily changing its utility or effectiveness.” EX1003, ¶232.

Claim [21]

As discussed in §VI.B.1 (Chang-Fang-Khalil), in the combined device, Chang’s breast shield is configured to have a milk port pointed downwards to enable connection with Khalil’s milk container. EX1003, ¶233. This configuration enables milk flow from the *nipple tunnel* to the *milk container* via the *milk port*. *See supra* 1[a][4], Claim 16. Further, in this configuration, the *milk port* is positioned on the *lower surface* of the *nipple tunnel* such that the milk flow via the *milk port* involves *the expressed milk flow[ing] under gravity into the milk container*. EX1003, ¶233. Further, a POSITA would have recognized the benefits of a downward flow of milk

in which the milk flow path remains below the diaphragm components, consistent with Fang and Khalil, further enhancing the isolation of pump components from milk flow. *Id.*; EX1010, [0069].

G. Ground 4A: Chang-Fang-Khalil-Kurihara Renders Claims 1-18, 20-23, And 26-29 Obvious

A POSITA would have found it obvious to combine the teachings of Kurihara with Chang-Fang-Khalil for the same reasons as discussed for the combination of Kurihara and Chang-Fang. *Supra*, Ground 2A. EX1003, ¶¶238-240. The combination thus renders obvious claims 1-18, 20-23, 26-29 for the same reasons as discussed above. *Supra*, Grounds 3A (Chang-Fang-Khalil), 2A (Chang-Fang-Kurihara).

H. Grounds 2B, 3B, 4B: Yuen629 In View of Chang-Fang-Kurihara (Ground 2B), Chang-Fang-Khalil (Ground 3B), And Chang-Fang-Khalil-Kurihara (Ground 4B) Render Claim 19 Obvious

The combined devices of each of Grounds 2B, 3B, 4B incorporate the teachings of Yuen629 and thereby satisfies this claim for the same reasons as discussed above for Chang-Fang-Yuen629. *Supra* Ground 1B; EX1003, ¶¶241-242.

I. Grounds 2C, 3C, 4C: Makower794 In View of Chang-Fang-Kurihara (Ground 2C), Chang-Fang-Khalil (Ground 3C), And Chang-Fang-Khalil-Kurihara (Ground 4C) Render Claim 24 Obvious

The combined devices of each of Grounds 2C, 3C, 4C incorporate the teachings of Makower794 and thereby satisfy this claim for the same reasons as

discussed above for Chang-Fang-Makower⁷⁹⁴. *Supra* Ground 1C; EX1003,

¶¶243-44.

J. Grounds 2D, 3D, 4D: Makower⁷⁹⁴ And Guthrie⁰⁰² In View of Chang-Fang-Kurihara (Ground 2D), Chang-Fang-Khalil (Ground 3D), And Chang-Fang-Khalil-Kurihara (Ground 4D) Render Claim 25 Obvious

The combined devices of each of Grounds 2C, 3C, 4C incorporate the teachings of Makower⁷⁹⁴ and Guthrie⁰⁰² and thereby satisfy this claim for the same reasons as discussed above for Chang-Fang-Makower⁷⁹⁴-Guthrie⁰⁰². *Supra* Ground 1D; EX1003, ¶¶245-46.

VII. DISCRETIONARY DENIAL

A. §314(a)

Essentially all of the *Fintiv* factors weigh against exercising discretionary denial. The related litigation in the Western District of Washington (2:23-cv-00631) remains in its infancy. Petitioner filed the complaint in the Lawsuit on 4/28/2023, seeking declaratory judgment of noninfringement and invalidity of U.S. Pat. No. 11,357,893. EX1051. PO then counterclaimed to allege infringement of U.S. Pat. No. 11,413,380. EX1052, 26.

On 5/1/2024—more than a year after the lawsuit commenced—PO added counterclaims to assert two more patents, including the '381 patent. EX1053, 2. In view of PO's expansion of the patents and issues in the case, the District Court struck the trial schedule in its entirety, and adopted a reset (partial) schedule that set some

initial dates through claim construction briefing in February 2025 while leaving subsequent dates, including a trial date, undefined. EX1055, 3-5; EX1056, 11-12. PO then expanded the case even further, including an additional party, delaying the claim construction schedule and other dates to an indefinite time. Petitioner did not receive infringement contentions until June 2024, and has been diligent in preparing this Petition, including filing within only a few months of learning of highly pertinent art (e.g., Fang; *supra*, §IV.B).

Factor 1—No motion to stay has been filed. The parties agreed to stay the claim construction schedule in view of the addition of another party to the litigation. This factor is neutral or favors institution.

Factor 2—Factor 2 heavily favors institution. In May 2024, PO added multiple patents to the litigation, doubling the number of patents more than a year after the lawsuit commenced. The District Court then essentially reset the schedule in June 2024—striking the existing schedule in its entirety. EX1055, 3-5; EX1056, 11-12. All dates subsequent to the claim construction briefing, including a trial date, remain undefined and will not be scheduled until after the *Markman* hearing (which itself has an undefined date sometime in 2025, with the briefing schedule recently delayed further). *Id.* The Board’s final decision will thus surely precede the not-yet-scheduled trial in district court.

Factor 3—Neither party has submitted any *Markman* briefing, and discovery

remains in its infancy. Petitioner diligently filed this petition, within a few months after receiving the initial infringement contentions and then learning, during its subsequent work on invalidity contentions, of highly pertinent art (e.g., Fang; *supra*, Section IV.B). As such, the investment “in the []lawsuit, particularly as related to any validity issues, has not been substantial.” *Illumina, Inc. v. Ravgen, Inc.*, IPR2021-01271, Paper 12, 27 (January 26, 2022).

To be clear, the average time to trial from initial complaint (29.2months) has limited bearing where, as here, the trial date and case schedule was essentially reset more than a year after the initial complaint in order to accommodate newly-added patents and parties. If anything, this average time should be applied from the starting point of the counterclaims introduced in 2024, or the recent expansion of the case to include a new party. EX1055, 3.

Factors 4 and 5—Factors 4 and 5 are neutral or favor institution. Petitioners are the defendants in the co-pending litigation. Resolution by the Board is expected in advance of a decision in the District Court, which mitigates against duplication of effort and serves efficiency and integrity goals.

Factor 6—The merits of this Petition are compelling as demonstrated by Grounds 1A-4D. Factor 6 weighs heavily in favor of institution.

B. §325(d)

The Petition does not involve the same or substantially the same art or

arguments previously presented during original prosecution. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 8-9 (PTAB February 13, 2020) (precedential). Fang was never before the Office and thus not considered by the Examiner. Further, while Yuen⁶²⁹, Makower⁷⁹⁴, Guthrie⁰⁰², and Kurihara are cited on the face of the '381 patent, these references were not applied by the examiner in a rejection of the claims. Each of these references are relied upon for disclosure of subject matter that is materially different than that cited during prosecution.

Advanced Bionics Part 1—each ground advanced in this Petition incorporates Fang—a reference never previously before the Office and yet highlights pertinent disclosures that disclose the very features that formed the Examiner's stated reasons for allowance. IPR2020-00935, Paper 12 at 9-12 (PTAB Nov. 17, 2020) ("the very one that, in the Examiner's view, placed the claims ... into a condition for allowance").

The Chang-Fang and Chang-Fang-Khalil combinations render obvious each of the features identified by the Examiner as representing allowable subject matter. *Supra*, §IV.B; EX1002, 1469, 2246-54. Though Chang and Khalil were applied by the Examiner in original prosecution, the specific combinations advanced in this Petition (Chang-Fang, Chang-Fang-Khalil) were not because Fang was never before the Office. Beyond Khalil and Chang, none of the five other references cited by the

Examiner in prior art rejections are applied in grounds advanced in this Petition. EX1002, 474-567, 811-34, 1103-69. Thus, the same or substantially the same arguments were not previously presented to the Office, and the combinations advanced in this Petition are not cumulative of previously evaluated prior art. Factors (a), (b), and (d) counsel in favor of institution.

Advanced Bionics Part 2—The Board need not reach part 2 of the *Advanced Bionics* framework because Part 1 is not satisfied. And yet, if assessing Part 2, original examination involved multiple material errors in failing consider relevant disclosures of Chang, Khalil, Kurihara, Yuen629, Makower794, and Guthrie002.

For example, as to Chang, the Examiner’s evaluation was superficially limited because only isolated aspects of Chang’s disclosure were relied upon to address perceived gaps in Khalil. *See* EX1002, 1107-09. Specifically, the Examiner relied on Chang’s disclosed use of a rechargeable battery to power a pump for obviousness regarding a modification of Khalil’s power source to “be a rechargeable battery, as taught by Chang, in order for the power source to be reused.” *Id.*, 1109. Thus, the Examiner erred in evaluating Chang by overlooking disclosure that provides the very claim features identified as being absent in the prior art. For example, in allowing claim 1, the Examiner found that Khalil did not teach or render obvious “a nipple tunnel comprising a closed end and **a milk port intermediate to the breast flange and the closed end**, in combination with the total structure and function as claimed.”

Id., 2252 (emphasis added). Yet, as discussed in §VI.2.a (1[a][3][i]), Chang’s Figure 6A clearly depicts this configuration. EX1003, ¶¶129-30. Indeed, Chang’s breast shield even satisfies the Examiner’s implicit interpretation of the phrase “intermediate to” in 1[a][3][i] as not being met by the milk port in Khalil’s Figure 4, which is positioned at “the distal end of nipple tunnel so that milk flows through the distal end of the nipple tunnel.” See EX1002, 2252; *Advanced Bionics*, IPR2019-01469, Paper 6 at 8 n.9.

VIII. MANDATORY NOTICES

A. Real Party in Interest

Petitioner identifies itself and the entities listed below as real parties in interest:

Shenzhen Root Technology Co., Ltd., which was also known as Shenzhen Lutejiacheng Network Technology Co., Ltd., which changed its name to Shenzhen Lute Innovation Technology Co., Ltd., in September 2023

Hong Kong Lute Technology Co., Ltd.

Shenzhen Conglin E-Commerce Co., Ltd.

Shenzhen Jinruihang Technology Co, Ltd.

Shenzhen Xitao Network Technology Co., Ltd.

ROOT Technology Ltd.

B. Related Matters

The ’381 patent is involved in the litigation in the Western District of Washington, as identified above (case no. 2:23-cv-00631).

C. Notice of Counsel and Service Information

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IX. PAYMENT OF FEES – 37 C.F.R. § 42.103

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 06-1050 for the fee set in 37 C.F.R. § 42.15(a) for this Petition and further authorizes payment for any additional fees to be charged to this Deposit Account.

Respectfully submitted,

Dated February 4, 2025

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(Control No. IPR2025-00560)

Attorneys for Petitioner

CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Pursuant to 37 C.F.R. §42.24(a), Petitioners hereby certify that portions of the above-captioned Petition for *Inter Partes* Review of U.S. Patent 11,813,381, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,863. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

Dated February 4, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on February 4, 2025, true copies of the Petition for *Inter Partes* Review of U.S. Patent No. 11,813,381 and supporting materials (Exhibits and Power of Attorney) were served via overnight delivery on the Patent Owner at the correspondence address of record as listed on PAIR:

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