

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Promethean Ltd. and Promethean Inc.,
Petitioners,

v.

FlatFrog Laboratories AB,
Patent Owner.

Case IPR2022-00065
Patent 10,775,935

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT 10,775,935
PURSUANT TO 35 U.S.C. § 311**

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LIST OF EXHIBITS

Exhibit Number	Description
1001	U.S. Patent No. 9,775,935 (“935 Patent”)
1002	Declaration of Darran R. Cairns, Ph.D.
1003	U.S. Patent Application Publication No. 2019/0235701 to Han et al. (“Han”)
1004	Korean Pub. App. No. KR2018-0037749 to Han et al.
1005	Certified Translation of KR2018-0037749 (with Affidavit)
1006	Chinese Published Patent Application CN104808843A to Kang
1007	Certified Translation of Chinese Published Patent Application CN104808843A (with Affidavit) (“Kang”)
1008	U.S. Patent No. 9,983,626 to Cao et al. (“Cao-626”)
1009	U.S. Patent No. 9,291,845 to Shin et al. (“Shin-845”)
1010	U.S. Patent Application Publication No. 2017/0123257 to Zhao (“Zhao”)
1011	Amended Joint Claim Construction Chart (D.E. 113) <i>FlatFrog Labs. AB v. Promethean Ltd. et al.</i> , C.A. No. 19-2246 (D. Del.)
1012	Redacted Joint Claim Construction Brief (D.E. 110) <i>FlatFrog Labs. AB v. Promethean Ltd. et al.</i> , C.A. No. 19-2246 (D. Del.)
1013	U.S. Patent No. 9,207,800 (“Eriksson”)
1014	U.S. Patent Application Publication No. 2011/0080361 to Miller et al. (“Miller”)

Exhibit Number	Description
1015	U.S. Patent No. 4,751,379 to Sasaki et al. (“Sasaki”)
1016	File History of U.S. Patent No. 10,775,935
1017	Scott McKeown, <i>District Court Trial Dates Tend to Slip After PTAB Discretionary Denials</i> (July 24, 2020)
1018	Order (D.E. 90) <i>FlatFrog Labs. AB v. Promethean Ltd. et al.</i> , C.A. No. 19-2246 (D. Del.)
1019	Scheduling Order (D.E. 69) <i>FlatFrog Labs. AB v. Promethean Ltd. et al.</i> , C.A. No. 19-2246 (D. Del.)
1020	U.S. Patent Application Publication No. 2012/0223916 to Kukulj (“Kukulj”)
1021	U.S. Patent Application Publication No. 2013/0044073 to Christiansson et al. (“Christiansson”)
1022	Stipulation (D.E. 60) <i>FlatFrog Labs. AB v. Promethean Ltd. et al.</i> , C.A. No. 19-2246 (D. Del.)

I. INTRODUCTION

Petitioners Promethean Ltd. and Promethean Inc. (collectively “Petitioner”) respectfully petition for *Inter Partes* Review (“IPR”) of claims 1-3 of U.S. Patent No. 10,775,935 (Ex-1001) (“the ‘935 Patent”). As set forth below, the prior art renders those claims invalid as obvious under 35 U.S.C. § 103.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1) AND PAYMENT AUTHORIZATION

A. REAL PARTY-IN-INTEREST UNDER 37 C.F.R. § 42.8(b)(1)

The real parties-in-interest for this Petition are Promethean Ltd. and Promethean, Inc.

B. RELATED MATTERS UNDER 37 C.F.R. § 42.8(b)(2)

Petitioner identifies the following related proceeding: *FlatFrog Laboratories AB v. Promethean Ltd. et al.*, No. 1:19-cv-02246-MN (D. Del.) (“the related litigation”). Patent Owner originally filed the related litigation on December 10, 2019 and at that time asserted U.S. Patent No. 10,282,035 (“the ‘035 Patent”). Patent Owner later amended its complaint to add U.S. Patent Nos. 10,606,414 (“the ‘414 Patent”) and 10,606,416 (“the ‘416 Patent”). After Petitioner answered the second amended complaint and counterclaimed for non-infringement and invalidity, Patent Owner statutorily disclaimed all claims of each of the ‘035, ‘414, and ‘416 Patents pursuant to 35 U.S.C. § 253. Patent Owner served a third amended complaint October 16, 2020, and in that complaint it first asserted that Petitioner infringes the

‘935 Patent and U.S. Patent No. 10,739,916, which are continuations of the ‘035 and ‘416 Patents, respectively.

C. LEAD AND BACK-UP COUNSEL UNDER 37 C.F.R. § 42.8(b)(3) AND SERVICE INFORMATION UNDER 37 C.F.R. § 42.8(b)(4)

Petitioner designates the following counsel for this proceeding and a Power of Attorney is filed herewith:

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D. SERVICE INFORMATION UNDER 37 C.F.R. § 42.8(b)(4)

Petitioner concurrently submits a Power of Attorney, 37 C.F.R. § 42.10(b), and consents to service by email to lead and back-up counsel provided in the above

designation, whereby such service is to be made at each of the email addresses listed above.

E. PAYMENT OF FEES

The undersigned authorizes payment for any additional fees due in connection with this Petition or in this proceeding to be charged to Deposit Account No. 50-1196.

III. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies that the '935 Patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR on the grounds identified herein.

IV. STATEMENT OF PRECISE RELIEF REQUESTED

Petitioner requests *Inter Partes* Review and cancellation of Claims 1-3 of the '935 Patent on the following Grounds of Unpatentability:

Ground 1: Claims 1 and 3 are Obvious Over Han in view of Shin-845.

Ground 2: Claim 2 is Obvious Over Han in view of Shin-845 and Eriksson.

Ground 3: Claims 1-3 are Obvious Over Cao-626 in view of Han and Shin-845.

Ground 4: Claims 1-3 are Obvious Over Cao-626 in view of Han and Zhao.

Ground 5: Claims 1-3 are Obvious Over Sasaki in view of Han and Shin-845.

V. SUBJECT MATTER BACKGROUND AND THE ‘935 PATENT

Prior to the ‘935 Patent, it was already known in the field of optical touch-sensitive systems that if the touch surface of the cover plate is concavely curved, rather than being flat, then the amount of light transmitted from the emitters that is received at the detectors will increase, thereby improving the functionality of touch detection. For example, Han discloses that a cover plate of a touch screen display apparatus can be concavely curved according to a radius, i.e., so that the touch surface curves along a portion of a circle, along either or both of the directions in which light moves. (Ex-1003, Fig. 3; ¶¶ 0074-78, 0082-83, 0085-0088). Han teaches, among other things, that this configuration can increase the light efficiency of a touch detector and, correspondingly, the accuracy of touch recognition. (*Id.*, ¶¶ 0082-0086, 0091-0095, Fig. 5).

Likewise, the prior art teaches that the touch surface of a plate in an optical touch-sensitive system can have a parabolic curvature. As described in more detail below, the curvature of the plate disclosed in Han is parabolic within the meaning of the ‘935 Patent. Other references, such as Miller and Kang, also expressly teach that

touch surfaces may be parabolic in shape. (See Ex-1014, ¶¶ 0047, 0049, Fig. 9; Ex-1007, ¶¶ 0028, 0040).¹

Further, the prior art teaches that a frame assembly can be used to control curvature of a glass plate in an above-surface optical touch sensing apparatus. (Ex-1002, ¶ 131). For instance, Cao-626 discloses a frame assembly defining peripheral grooves in which the edges of touch glass are received in order to force the “four rising corners of the glass” to “remain flat without deformation caused by external forces.” (Ex-1008, 2:20-24, 2:39-44). Also, it was known that there are various ways to achieve a concavely curved plate touch surface. Shin-845 teaches that, as an alternative to a plate that is manufactured as curved, a frame assembly can be configured to induce a curvature in the touch surface of an initially flat plate, such that, when the plate is installed in the frame assembly, the touch surface of the plate becomes curved. (See, e.g., Ex-1009, 18:40-64, Fig. 4). Other references, such as Zhao, provide the same teaching in the context of large format displays having a cover glass. (See, e.g., Ex-1010, ¶¶ 0045, 0048, 0050, Figs. 1, 3). In both Shin-845

¹ Kang (Ex-1007) is a certified English-language translation of a prior art reference originally published in Chinese. Petitioner also has included the original publication as Ex-1006.

and in Zhao, a tapered surface is used in inducing the curvature. (See, e.g., Ex-1009, 20:53-21:55, Fig. 5; Ex-1010, ¶¶ 0051-52, Fig. 1).

The ‘935 Patent purports to address the same problems mentioned above, and it does so in the same way as the prior art. For example, the ‘935 Patent states that in systems where light is directed closer to the touch surface, distortions in the plate have a disproportionately large effect on the touch signal, and a touch panel that has a shape conducive to transmitting as much light from the emitters as possible to the detectors is needed. (Ex-1001,

1:56-59; 2:23-25). According to

the ‘935 Patent, a plate having a parabolic curvature increases the amount of light transmitted from the emitters that is received at the

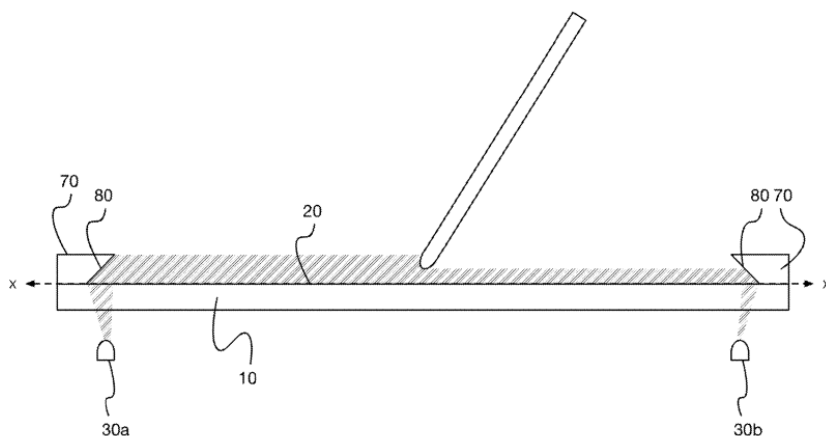


Figure 10b

detectors (rather than being “lost” above or below the detectors), resulting in a “signal boost” that improves touch recognition. (See *id.*, Figs. 13a-17b; 17:48-18:44).

More particularly, with reference to Figures 10a-10b, the ‘935 Patent explains that prior art touch apparatuses employed a “substantially flat rectangular touch plate 10.” (See *id.*, 15:35-46). Although the prior art contemplates a number of different arrangements of emitters and detectors, Figure 10b shows that light is emitted by

emitter 30a, passes through light transmissive plate 10 through touch surface 20, and is reflected by reflector surface 80 of edge reflector 70 to travel in a plane substantially parallel with touch surface 20. (*See id.*, 15:47-16:3). The light will then continue until deflected by reflector surface 80 of the edge reflector 70 at an opposing edge of the light transmissive plate 10, wherein the light will be deflected back down through transmissive plate 10 and onto detectors 30b. (*Id.*, 15:54-58).

Where an object is applied to touch surface 20, some of the light above touch surface 20 is occluded. This occlusion is detected by the touch apparatus and used to determine the presence, size, and/or shape of the object. (*Id.*, 15:58-61).

The '935 Patent purports to improve on this approach by use of a touch plate 10 that is parabolically curved. (*See id.*, 16:4-20:65, Figs. 11a-21d). With reference to Figures 11a-11b, the '935 Patent contemplates a touch plate 10 that is substantially flat in the direction of the y-axis but curved in a concave direction relative to the x-axis. (*Id.*, 16:4-10). The vertex of the parabola or paraboloid of the touch surface is where the touch surface is deepest relative to the edges of the touch plate. (*Id.*, 16:10-13). Where the x-axis is positioned at the edge of the touch plate, the curvature of the plate can be measured using the distance of the touch surface from the x-axis. (*Id.*, 16:13-16).

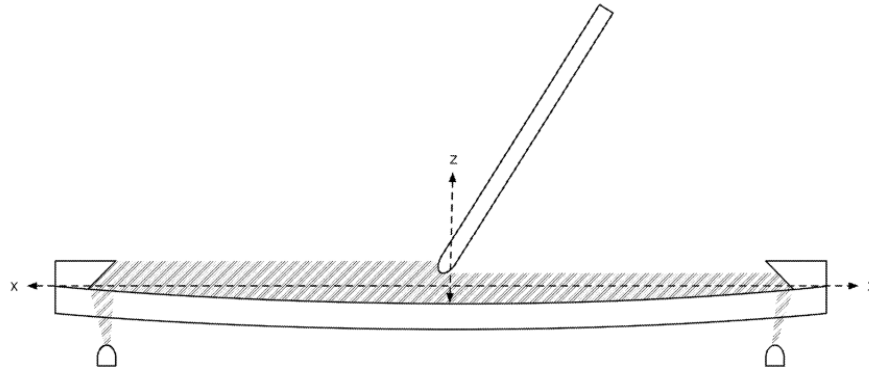
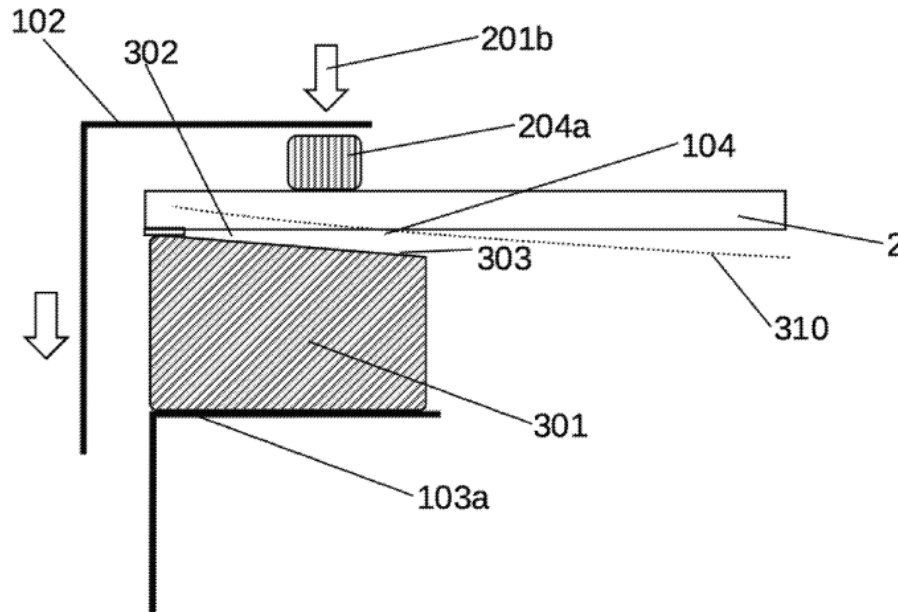


Figure 11b

As in the prior art, the ‘935 Patent notes that a touch plate 10 curved along the x-axis can result in a “detection signal boost” of a factor of approximately 2.19 to approximately 3.3, depending on the emitter position. (*Id.*, 17:48-18:44; Figs. 13a-17b). In another embodiment, the ‘935 Patent contemplates that the touch plate 10 could be curved in two axes, rather than one. (*Id.*, 16:63-17:47 & Figs. 12a-12b).

The ‘935 Patent also explains that it is desirable for the concavity in the touch surface described above to be induced (i.e., as opposed to starting with pre-curved glass), for example to minimize convexity in the touch surface and/or to improve the touch system. (*E.g., id.*, 6:7-21; 8:26-32). Just as in Shin-845 and Zhao, however, the ‘935 Patent contemplates that a frame assembly component having a tapered edge can be used in inducing concavity. (*See id.*, 13:29-42, Fig. 7). In particular, and with reference to Fig. 7 below, a support block 301 is arranged to support glass plate 2. Support block 301 has a surface portion comprising a tapered edge 303 at an angle from second frame element 103A, and plate 2 is pressed against the top surface of support block 301. (*Id.*, 13:31-36). The applied pressure causes plate 2

to follow the contour of the top surface of block 301 and plate 2 is forced into a curving plane at an angle to the plane of second frame element 103A. (*Id.*, 13:36-39).



VI. CLAIM CONSTRUCTION

Petitioner's proposed claim constructions for this proceeding are provided below and, for purposes of this proceeding, any other claim terms do not require an express construction and should be interpreted in accordance with their ordinary meaning to a POSITA at the time of the alleged invention in light of the teachings of the intrinsic evidence. (*See* Ex-1002, ¶¶ 12-15). Petitioner reserves the right to propose alternative constructions for any and all claim terms in the related litigation and to respond to any of Patent Owner's explicit or implicit claim constructions in this proceeding.

In the related litigation, the District Court held a claim construction hearing on October 15, 2021. The District Court orally ruled on the meaning of certain claim terms, as noted below, but the District Court had not issued a written claim construction order at the time this Petition was filed. Petitioner will seek leave to submit any written claim construction order as a supplemental exhibit when it becomes available.

A. CLAIM 1: “ADJACENT”

In the related litigation, Patent Owner contended that, if the court determined construction was needed, then this term means “near.” (*See* Ex-1011, 8 (citing Ex-1001, 3:26-46, 14:10-17, 15:47-58, 15:65-16:3, 18:1-8, Figs. 9, 10b, 11b, 12c, 12d)). In this petition, Petitioner applies Patent Owner’s construction from the related litigation. *See Western Digital Corp. v. SPEX Techs., Inc.*, IPR2018-00084, Paper No. 14, at 9-12 (PTAB Apr. 25, 2018).

B. CLAIMS 1 AND 3: “CURVATURE”

In the related litigation, Patent Owner and Petitioner agreed that this term means “the amount, if any, by which a line or surface deviates from a straight line or flat surface.” (*See* Ex-1011, 2). That construction is applied herein.

C. CLAIM 1: “CONFIGURING THE FRAME ASSEMBLY TO SUPPORT THE PLATE INCLUDES INDUCING A PARABOLIC CURVATURE IN THE TOUCH SURFACE”

Pursuant to the District Court’s ruling in the related litigation dated October

15, 2021, Petitioner construes this term as meaning “assembling the plate into the frame assembly induces a parabolic curvature in the touch surface.” (*Cf.* Ex-1001, 2:35-3:23, 5:60-6:29, 8:4-36, 8:49-56, 9:15-29, 9:37-13:54, 13:60-14:9). A written order has not yet issued but will be subsequently provided to the Board.

**D. CLAIM 1: “CURVATURE IN THE TOUCH SURFACE” / CLAIM 3:
“CURVATURE . . . AFTER THE PLATE IS CONFIGURED IN THE FRAME
ASSEMBLY”**

In the related litigation, Patent Owner and Petitioner agreed that this term means “the curvature in the touch surface, measured when the touch sensing apparatus is in its operative orientation, extends from one side of the touch surface to an opposite side of the touch surface.” (*See* Ex-1011, 2; *see also* Ex-1012, 24-32). That construction is applied herein.

E. CLAIM 1: “PARABOLIC CURVATURE IN THE TOUCH SURFACE”

Pursuant to the District Court’s ruling in the related litigation dated October 15, 2021, Petitioner construes this limitation as meaning “the curvature in the touch surface is substantially similar in shape to a mathematical parabola.” (*Cf.* Ex-1001, 18:45-20:65; Figs. 18a-21d). A written order has not yet issued but will be subsequently provided to the Board.

**F. CLAIM 1: “A PARABOLIC CURVATURE IN THE TOUCH SURFACE
RELATIVE TO A FIRST AXIS AND RELATIVE TO A SECOND AXIS
PERPENDICULAR TO THE FIRST AXIS”**

Petitioner construes this limitation to mean “the parabolic curvature is defined

in the touch surface relative at least to a first axis and to a second axis perpendicular to the first axis, wherein curvature of the parabolic curvature at the first axis may be different from curvature of the parabolic curvature at the second axis.” (See Ex-1012, 42-44). Claim 1 specifically provides that the parabolic curvature must exist in two dimensions, and the specification’s embodiments disclose that the curvature in the two dimensions can be different.² (See Ex-1001, 16:63-17:47).

G. CLAIM 3: “WHEREIN THE PLATE HAS A FIRST CURVATURE WHEN NOT CONFIGURED IN THE FRAME ASSEMBLY”

Pursuant to the District Court’s ruling in the related litigation dated October 15, 2021, Petitioner construes this limitation as meaning “wherein the plate possesses a first curvature when not configured in the frame assembly.” (Cf. Ex-1001, 3:8-23, 5:62-6:6, 8:24-30, 9:48-54, 10:8-64, 13:60-14:9, 14:18-21; Figs. 4b, 6-7). A written order has not yet issued but will be subsequently provided to the Board.

VII. LEVEL OF ORDINARY SKILL IN THE ART

A relevant POSITA is someone having at least a bachelor-of-science or comparable degree in mechanical engineering or an equivalent discipline and at least five years of experience designing touch sensors, provided that the educational level

² At the claim construction hearing on October 15, 2021, Patent Owner agreed with Petitioner’s construction.

can offset the experience level, and vice versa. (Ex-1002, ¶¶ 12-15). For example, a POSITA includes a person with at least a master's degree in those disciplines and at least two years of design experience in the field. (*Id.*).

VIII. GROUNDS FOR UNPATENTABILITY

A. GROUND 1: CLAIMS 1 AND 3 ARE OBVIOUS OVER HAN IN VIEW OF SHIN-845.

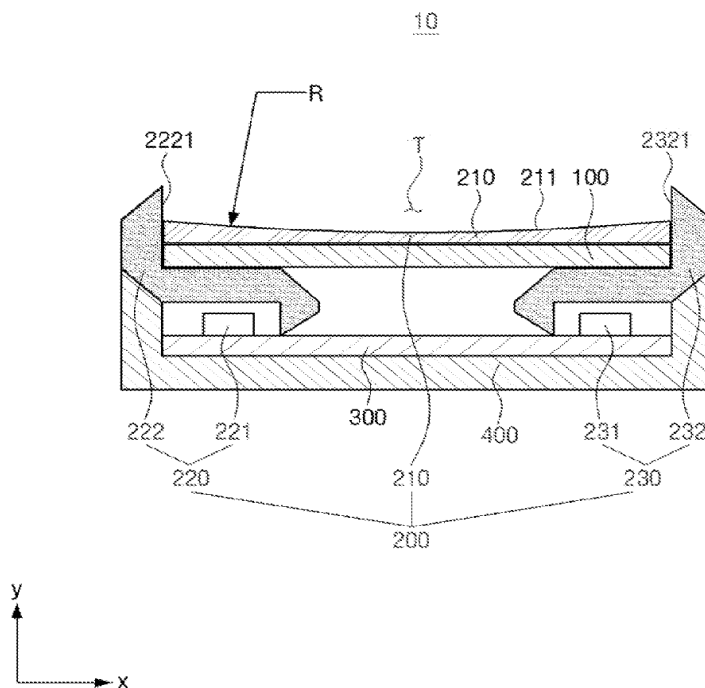
Claims 1 and 3 are obvious under 35 U.S.C. § 103 over Han (Ex-1003)³ in view of Shin-845 (Ex-1009).

1. CLAIM 1

Claim 1 is obvious at least because it encompasses the simple application of a known technique to a known device to obtain known advantages with predictable results. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 417 (2007). Han discloses each limitation of Claim 1, including a touch surface with a parabolic curvature, except that Han does not disclose that configuring the frame assembly to support the

³ Han is prior art to the '935 Patent under 35 U.S.C. §102(a)(2). Han is a continuation of PCT Application No. PCT/KR2017/000004, filed on January 2, 2017, which claims priority to Korean Patent Application No. 10-2016-0128325 (Ex-1004), filed on October 5, 2016. A certified translation of the Korean '325 application is submitted as Ex-1005. Han's disclosure is fully supported by the Korean '325 Application. (Ex-1002, ¶¶ 21-22).

plurality of photo diodes 231 (detectors) are positioned near the edge of the cover glass and emit and receive light, respectively, via the guide members 222/232 as explained below.



In general, light emitted from LEDs 221 is introduced into one end of guide member 222, reflected through a plurality of curved parts thereof, and then emitted to the touch area T through light emitting surface 2221. The emitted light passes over the touch area T and becomes incident on the incidence surface 2321 of guide member 232. The incident light is reflected through a plurality of curved parts of guide member 232, and ultimately, the light becomes incident on the photo diodes 231. (*Id.*, ¶¶ 0067-69; Ex-1002, ¶¶ 25-27).

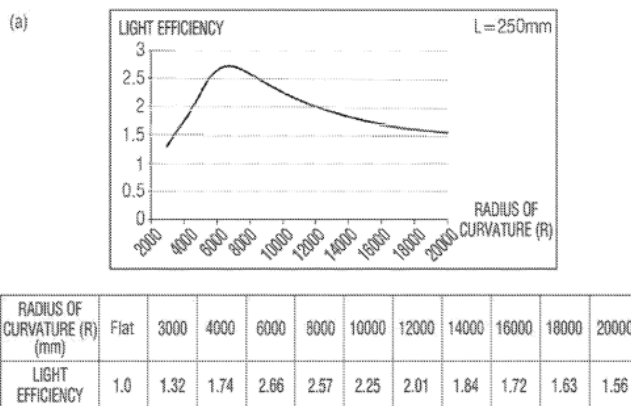
As illustrated above, if a user touches touch area T, light emitted from the left edge in the direction Ax and light emitted from the upper edge in the direction Ay are blocked at touch point TP. Accordingly, a controller (not shown) may determine the coordinate of the touch input. (Ex-1003, ¶¶ 0048-49; Ex-1002, ¶¶ 28-29).

Just as in the ‘935 Patent claims, Han teaches that the front surface 211 of cover glass 210 may be concavely curved along both the first direction Ax and the second direction Ay. (Ex-1003, ¶¶ 0074-77, 0113). Additionally, Han teaches that the front surface 211 “may include a spherical surface or an aspherical surface, and it may also include a multiple curved surface . . . [or] an atypical curved surface.” (*Id.*, ¶ 0078). Notably, as explained in detail below, Han’s concavely-curved front surface 211 of cover glass 210 is parabolic as contemplated by the ‘935 Patent. (Ex-1002, ¶¶ 30-31, 36-46).

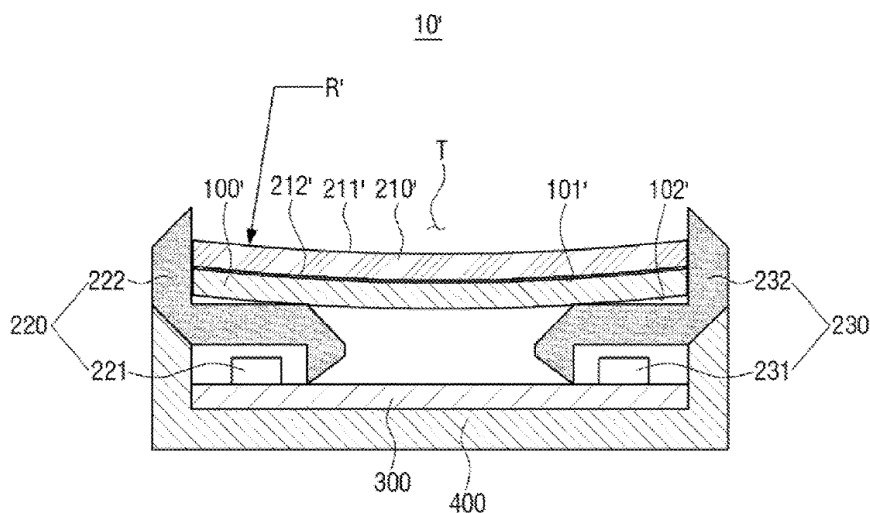
Moreover, Han teaches that its concave curvature of front surface 211 of cover glass 210 offers the same benefits as those described in the ‘935 Patent, i.e., a reduced amount of light lost by reflection and an increased amount of light received at light reception guide member 232, thereby enhancing the accuracy of touch recognition. (*See id.*, ¶¶ 0082-83, 0085-86; Ex-1002, ¶ 34). As an example, Han discloses that front surface 211 of cover glass 210 may be curved at one or more predetermined radiuses of curvature R. (*Id.*, ¶ 0088). Fig. 5 below illustrates the light efficiency relative to the radius of curvature R of the front surface 211 for one

embodiment in which the maximum light efficiency was measured around where the radius of curvature R was 6000 mm. (Ex-1003, ¶¶ 0090-95; Ex-1002, ¶¶ 34-35).

FIG. 5

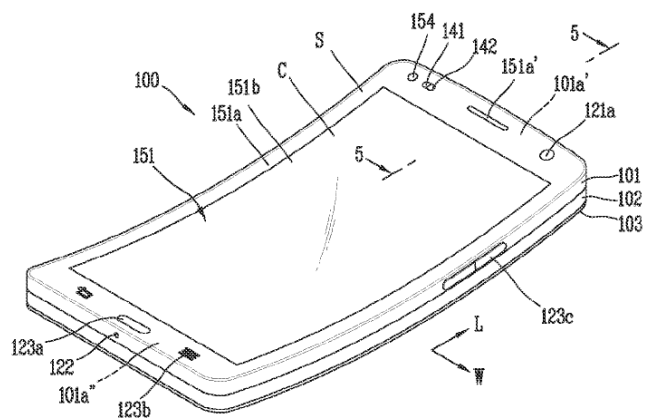


Discussing Fig. 7 below, Han also discloses that rear surface 212' of cover glass 210' may be concavely curved along the first direction A_x and the second direction A_y and in the same radius of curvature R' as front surface 211'. (Ex-1003, ¶¶ 0113-14, 117). Likewise, the display 100 may be curved with the same radius of curvature R' as the front and rear surfaces 211', 212' of cover glass 210'. (*Id.*, ¶ 0118; Ex-1002, ¶¶ 32-34).



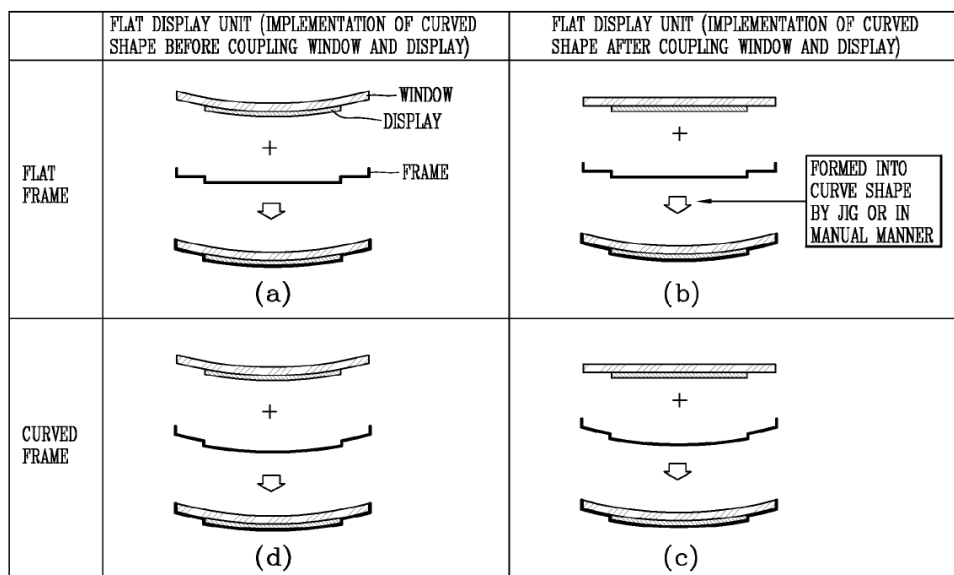
Although Han does not specifically disclose that configuring the frame assembly to support the plate includes inducing the parabolic curvature, it would have been obvious to modify Han to practice this limitation based on the teachings of Shin-845. (Ex-1002, ¶¶ 63, 81-89). In particular, Shin-845 discloses a touch-sensitive device configured to induce a curvature into an initially flat cover glass and display. (See Ex-1009, 1:52-2:22, 3:40-58, 10:45-49; Ex-1002, ¶¶ 64-80). Although certain embodiments describe a mobile phone, Shin-845 acknowledges that its disclosure is applicable to other mobile terminals, including “laptop computers, . . . portable computers (PCs), slate PCs, [and] tablet PCs,” along with “stationary terminals, such as digital TV, desktop computers, and the like.” (Ex-1009, 5:45-59). Shin-845, like Han, also contemplates touch sensors of various types, including “an infrared type.” (*Id.*, 10:45-62; Ex-1002, ¶¶ 65-66).

More particularly, and referring to Fig. 2 below, Shin-845 describes a mobile terminal 100 having a front case 101 and a rear case 102. (Ex-1009, 14:4-11). A curved display unit 151 on the front side includes a window 151a that is mounted to the front case 101 to form the front surface and a display 151b. (*Id.*, 14:12-17, 18:5-14, 18:23-29, Figs. 2-3). As in Han,



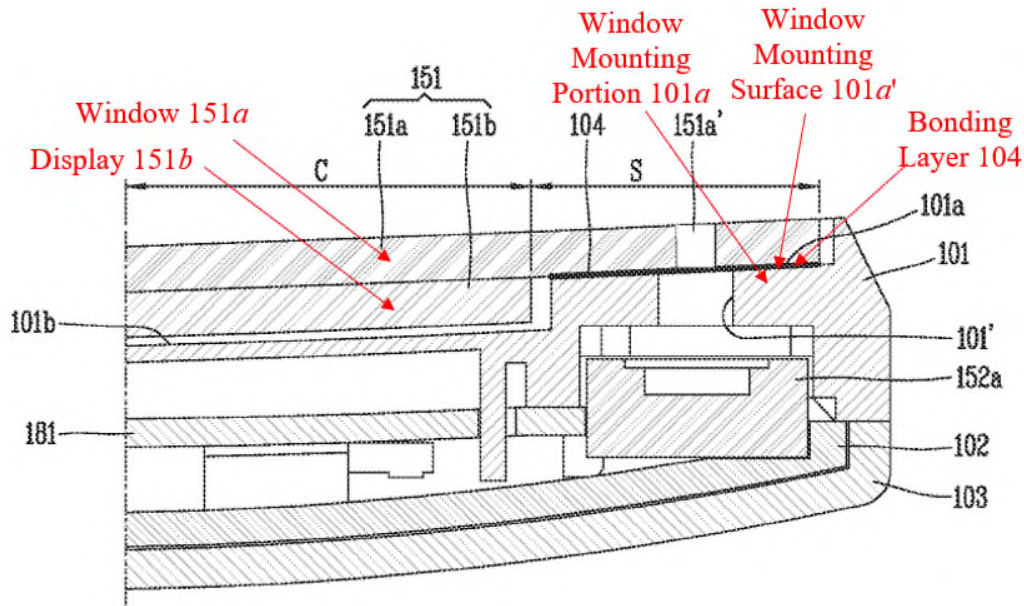
display 151*b* may be an LCD that is attached onto a rear surface of window 151*a*. (*Id.*, 19:4-6, 22:9-15; Ex-1002, ¶ 67).

Notably, discussing Fig. 4 below, Shin-845 discloses various alternative manners of implementing a curved display in the device. (Ex-1009, 19:33-20:18). For example, Fig. 4(d) shows a pre-curved display unit that is then coupled to a curved frame. (*Id.*, 20:9-14; Ex-1002, ¶ 69). By contrast, Shin-845 Fig. 4(c) alternatively shows a flat display unit that is then coupled to a curved frame such that the frame induces a curvature into the display unit when it is installed. (Ex-1009, 20:4-8; Ex-1002, ¶¶ 70-72). According to Shin-845, this method of Fig. 4(c) is advantageous because it simplifies the manufacturing process. (Ex-1009, 18:49-64; Ex-1002, ¶¶ 71, 80).



Shin-845 provides a detailed explanation of its method of inducing the curvature in a display as shown in Fig. 4(c). (Ex-1009, 20:32-36). Specifically, Fig.

5 of Shin-845 below shows that window 151a is coupled to a window mounting portion 101a on front case 101 of the mobile terminal 100. (*Id.*, 20:59-60). Window mounting portion 101a is formed in a curved shape so as to generate a bending force (or a curving force) by which window 151a is curved during installation. That is, “when the window 151a is mounted onto the mounting surface, the bending force may be applied to the window 151a such that the window 151a can be curved to correspond to the mounting surface.” (*Id.*, 20:66-21:21:6). As a result, the window 151a in a curved shape “transfers the bending force to the display 151b adhered to the window 151a, and the display 151b is also curved.” (*Id.*, 21:6-9; Ex-1002, ¶¶ 70-75).



Referring again to Fig. 2 and to annotated Fig. 5 above, Shin-845 explains that window mounting portion 101a may include a first mounting surface 101a' and a

second mounting surface 101a" on the end portions of window 151a (Ex-1009, 21:11-18) and also side mounting surfaces (*id.*, 21:19-24), thus forming a loop-shaped support around all edges (*id.*, 21:24-27). The end and side mounting surfaces may have the same curvature. (*Id.*, 21:37-42, 59-60). As explained in detail above, Shin-845 explains that the window 151a may be transformed into a curved shape corresponding with the curvature of those first and second mounting surfaces 101a' and 101a", such that the curvature of the mounting surfaces allows for a predetermined curvature in the window 151a. (*Id.*, 21:28-36; Ex-1002 ¶¶ 76-78).

Window 151a is maintained in a curved shape while being coupled to mounting surfaces 101a' and 101a" and the side mounting surfaces via bonding layers 104 (e.g., adhesive tape or optical clear adhesive) provided between window 151a and mounting surfaces 101a' and 101a". (*Id.*, 21:43-63; Ex-1002, ¶ 79). A display mounting portion 101b may be formed in either a curved shape, as shown, or a flat shape. (Ex-1009, 22:16-40).

Thus, Shin-845 teaches alternative methods for generating a curved touch surface that simplify the manufacturing process. (Ex-1002, ¶¶ 71, 80). Given that Han and Shin-845 are applicable to similar types of devices and both disclose a curved cover glass coupled with a curved LCD display, a POSITA would have been motivated to implement the teachings of Shin-845 to achieve the double-curved parabolic touch surface of Han to obtain Shin-845's disclosed manufacturing

advantage. (*Id.*, ¶¶ 81-90, 105-113). A POSITA would have applied the teaching of Shin-845 to the Han device in the same way as Shin-845, and the results of this combination would have been predictable. (*Id.*); see *Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (explaining “‘the test for obviousness’” is “whether ‘a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention’”) (citations omitted).

For example, based on Han’s disclosure of a double-curved surface along directions Ax and Ay, a POSITA would have induced such curvature by providing inclined window mounting portions, as taught by Shin-845, that extend parallel with each guide member 222, 232 beneath the periphery of cover glass 210, which may be slightly extended to rest on the mounting portions, also as shown in Shin-845. (Ex-1002, ¶¶ 83-85). In addition to being inclined on their top surfaces to impart curvature, the window mounting portions would be curved along the length of the edge so as to seat the curved cover glass 210, akin to the curved side mounting surfaces in Shin-845. (*Id.*, ¶ 84).

With this modified device of Han and Shin-845, the initially flat cover glass 210 and display 100 are inserted into the space between guide members 222, 232, and the peripheral edges of glass 210 are adhered to the inclined mounting surfaces of the window mounting surfaces via a bonding layer. (*Id.*, ¶¶ 85-86). Thus, the

frame assembly applies a bending force to the cover glass 210, which causes glass 210 and display 100 to curve (i.e., induces a curvature) based on the slope of the mounting surfaces, as taught by Shin-845, to achieve a parabolic curvature along both directions Ax, Ay, as disclosed by Han. (*Id.*). The bonding layer maintains glass 210 and display 100 in the curved shape. (*Id.*).⁴

In sum, Claim 1 reflects routine and obvious modifications to the Han device to induce, as taught by Shin-845, the parabolic curvature disclosed in Han, i.e., using known techniques to improve a similar device in the same way and to achieve known manufacturing advantages. (*Id.*, ¶¶ 87-88); *see KSR*, 550 U.S. at 417 (explaining that “if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill”). The limitations of Claim 1, along with the specific teachings in Han and Shin-845 that disclose such limitations, are provided below.

a. A method for assembling a touch sensing apparatus, the touch sensing apparatus comprising a display panel, a plate including a touch surface, and a frame assembly

Han discloses a method for assembling a touch sensing apparatus. (Ex-1002,

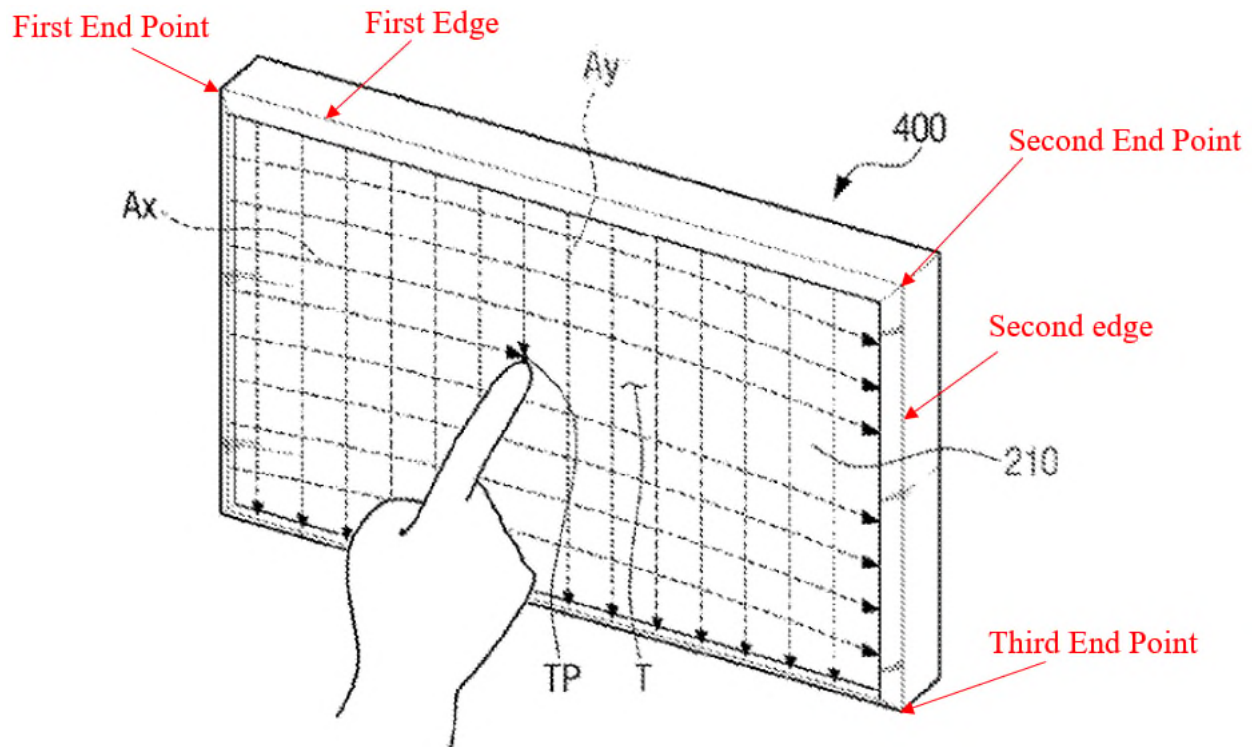
⁴ All of the examples discussed in this petition are illustrative only. *E.g., Facebook, Inc. v. Windy City Innovations, LLC*, 973 F.3d 1321, 1343-44 (Fed. Cir. 2020).

¶ 91). Han's display apparatus 10 comprises a display 100, a cover glass 210 with a front surface 211, and a frame assembly including rear cover 400 and guide members 222, 232. (Ex-1003, ¶¶ 0027-38, 0057-58, Figs. 2-3). Front surface 211 defines a touch area T, and an exemplary touch point TP is shown. (*Id.*, ¶ 0071; Ex-1002, ¶ 91).

b. wherein the frame assembly includes

- (i) a first edge extending between a first end point and an opposite second end point; and**
- (ii) a second edge extending between the second end point and a third end point**

With reference to annotated Fig. 2 below, Han's frame assembly (including rear cover 400 and guide members 222, 232) includes a first edge extending between a first end point and an opposite second end point, and a second edge extending between the second end point and a third end point. (*Id.*, Fig. 2; Ex-1002, ¶¶ 92).



c. the method comprising:

The claimed method steps are discussed in turn below.

d. configuring the frame assembly to support the display panel

In an example of the modified Han device discussed above and as contemplated by Han's Fig. 7, the display rests on and is supported by the guide members 222, 232, which form part of the frame and surround the side surfaces of display 100. (Ex-1003, ¶¶ 0045-46, 0057-58, Figs. 2-3, 7; Ex-1002, ¶¶ 94-96).

- e. **arranging a plurality of emitters adjacent to a periphery of the plate, said plurality of emitters configured to emit light to propagate over the touch surface**
- f. **arranging a plurality of detectors arranged adjacent to the periphery of the plate, said plurality of detectors configured to receive light from the set of emitters**

Han discloses that a plurality of LEDs 221 (emitters) and a plurality of photo diodes 231 (detectors) are disposed near opposing edges of display 100. (Ex-1003, ¶¶ 0039-46, Figs. 2-3). As shown in Han's Fig. 3, LEDs 221 and photo diodes 231 are near the periphery of cover glass 210, and thus adjacent thereto as that term is construed herein. (Ex-1002, ¶¶ 97-98). Light emitted from LEDs 221 is routed through light emission guide member 222, emitted to the touch area T over front surface 211 of cover glass 210, received by and reflected within light reception guide member 232, and then received by the photo diodes 231. (Ex-1003, ¶¶ 0067-69, Figs. 2, 4). Thus, Han discloses these limitations. (Ex-1002, ¶¶ 97-101; *cf.* Ex-1001 Figs. 10b, 11b). In addition, Patent Owner has effectively conceded that this configuration of emitters and detectors are adjacent, or near, the periphery of the plate. (*See* Ex-1011, 8 (relying on Figs. 10b and 11b of the '935 Patent, which show a configuration like Han, as supporting its construction of "adjacent" as "near"))).

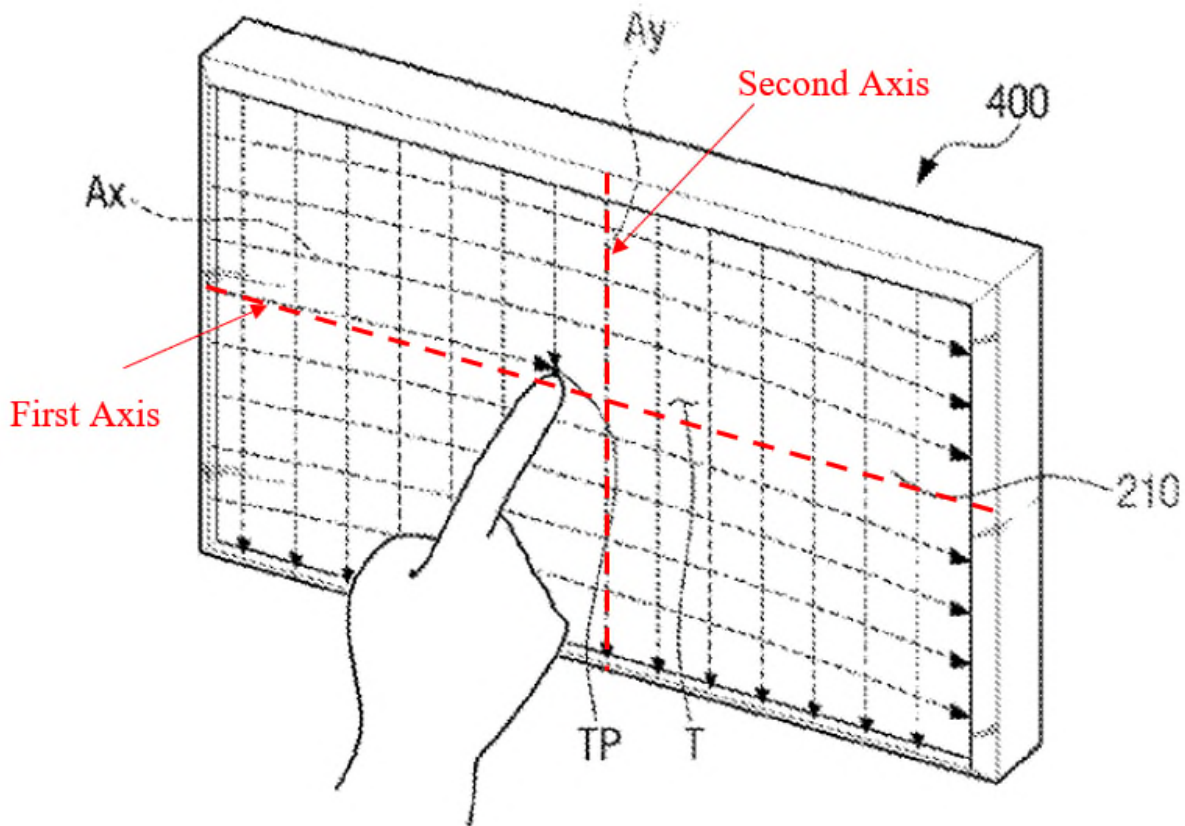
- g. **configuring the frame assembly to support the plate**

As noted above, the frame assembly includes guide members 222, 232 that, together with rear cover 400, form the exterior of display apparatus 10. (Ex-1003,

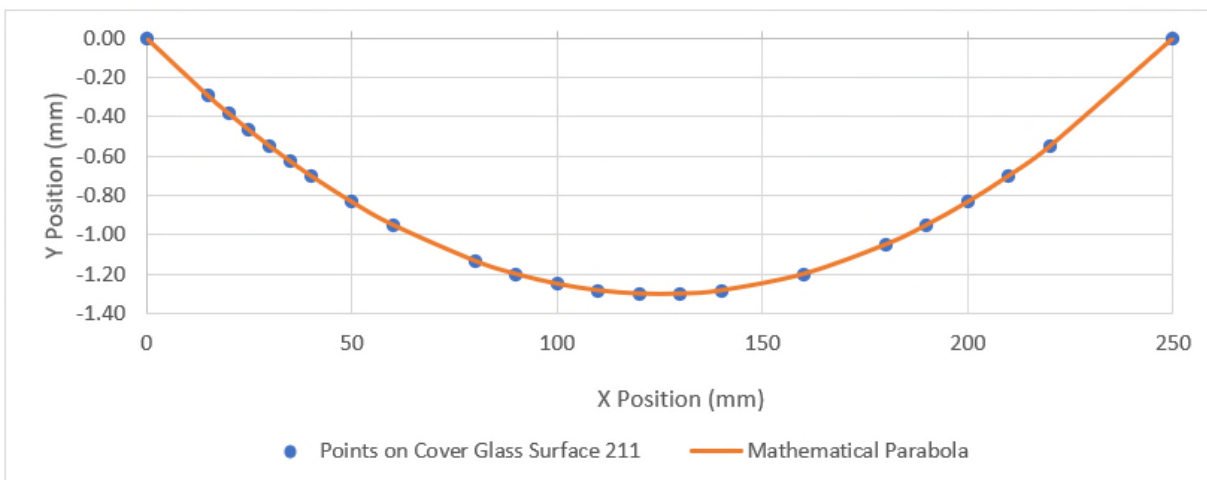
¶¶ 0057-58, Figs. 2-3). Han's guide members 222, 232, which form part of the frame assembly, support the cover glass 210 via the display 100, on which cover glass 210 is disposed. Thus, Han discloses the step of configuring the frame assembly to support the plate. (Ex-1002, ¶¶ 102-103). In the modified Han device described above, cover glass 210 is supported by the window mounting portion, as taught by Shin and which constitutes part of the frame assembly. (*Id.* ¶ 104).

h. wherein configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis,

Han discloses a parabolic curvature in the touch surface relative to a first axis and a second axis perpendicular to the first axis. First, as shown in annotated Fig. 2 below (depicting curvature in one direction Ax), there is a first axis in the direction Ax and a second axis in the direction Ay. (*Id.*, ¶ 105). However, Han states that, in other embodiments, the front surface 211 of cover glass 210 is concavely curved along *both* directions Ax, Ay. (Ex-1003, ¶¶ 0074-78, 0087). Thus, the curvature in direction Ax shown in Fig. 2 may also be present in direction Ay, thereby resulting in a bowl-shaped depression within surface 211. (Ex-1002, ¶¶ 105-106).



Second, the curvatures in front surface 211 are substantially similar in shape to a mathematical parabola. (Ex-1002, ¶¶ 36-62, 107). More particularly, Han discloses an embodiment in which the radius of curvature of the surface 211 is approximately 6000 mm, with the circular curve extending 250 mm across the glass plate's surface. (Ex-1003, at ¶¶ 0093, 0095). Based on the dimensions disclosed in Han, that embodiment, which provided the maximum light efficiency in Han, results in a curvature relative to the first-axis illustrated by the graph below. (Ex-1002, ¶¶ 36-44).



As shown, the radiused data points fit almost exactly to the parabolic function. As additional evidence of substantial similarity, the deviation is well within the 0.5mm “Max parabolic deviation” parameter provided in the ‘935 Patent. (*Id.*, ¶¶ 44-46; *see* Ex-1001, 18:50-19:26). Han teaches that such a curvature can be applied in both directions A_x , A_y , and based on the dimensions Han discloses, both curvatures would also be parabolic, as that term is construed herein, in such an embodiment. (Ex-1003, ¶¶ 0087-89; Ex-1002, ¶¶ 36-62, 107).

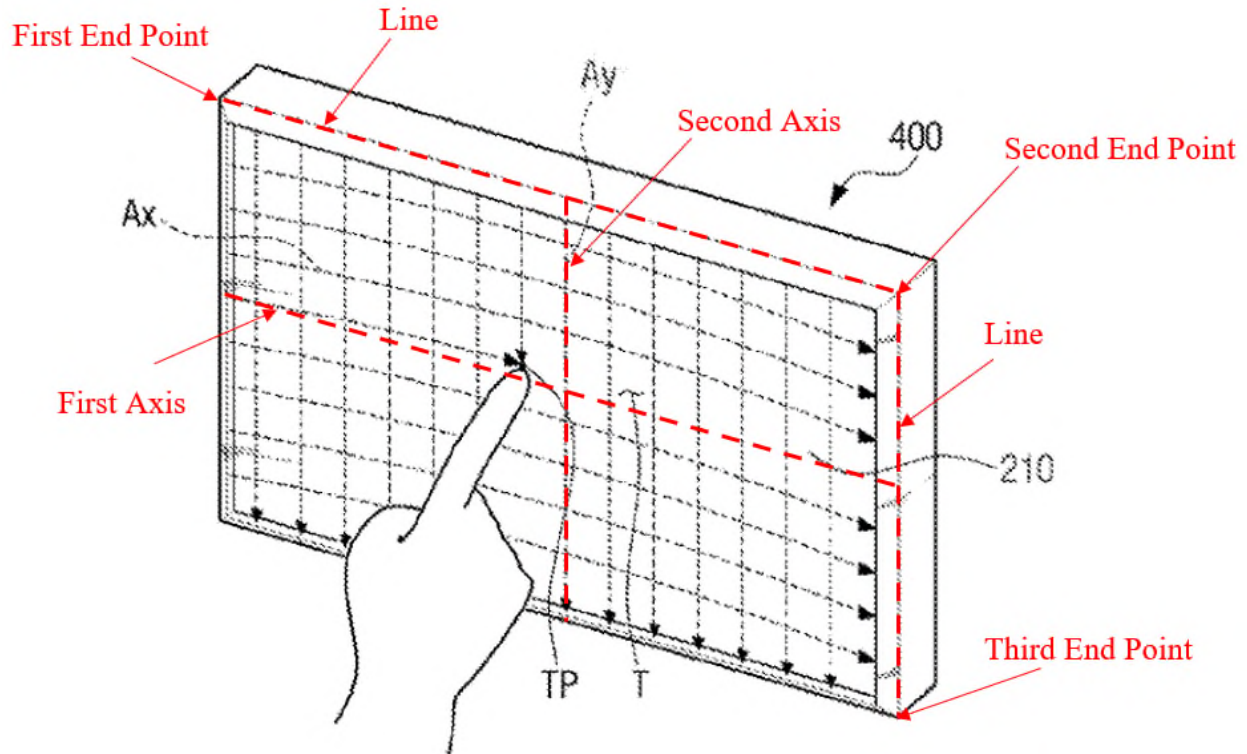
As discussed in detail above, it would have been obvious to a POSITA to modify the Han device with curved window mounting portions as taught by Shin-845 to configure the frame assembly to support the plate so that it induces that parabolic curvature. (Ex-1002, ¶ 81-90, 109-110). In the modified Han device described above, the initially flat cover glass 210 and display 100 are assembled into the frame assembly (rear cover 400 and guide members 222, 232) and glass 210 is adhered to the inclined mounting surfaces via a bonding layer. (*Id.*, ¶¶ 70-80). As

taught by Shin-845, assembly of cover glass 210 and display 100 into the frame applies a bending force to the cover glass 210, which induces glass 210 and display 100 to curve according to the slope of the mounting surfaces along both directions Ax, Ay, and the bonding layer maintains glass 210 and display 100 in the curved shape. (Ex-1002, ¶¶ 70-90, 108). The resulting curvatures would be parabolic. (*Id.* ¶¶ 36-62, 110). The curvatures would extend from one side of the front surface 211 to an opposite side of surface 211. (*See* Ex-1003, Figs. 2-4, 6-7; Ex-1002, ¶ 110).

Also, in the modified device, Han discloses that its curvatures are present in both vertical and horizontal operative orientations and that its curvatures should be present in the chosen operative orientation. (*E.g.*, Ex-1003, ¶¶ 0048, 0081, Figs. 2, 4-5; Ex-1002, ¶¶ 111-113). Thus, the curvatures would be parabolic when the device is in its operative orientation as required by the '935 Patent. (Ex-1002, ¶¶ 111-113).

- i. said first axis is parallel to a line between the first end point and the second end point and said second axis is parallel to a line between the second end point and the third end point**

As explained above, the modified Han device includes induced parabolic curvatures along the first-axis direction Ax and the second-axis direction Ay as taught by Han. (Ex-1002, ¶ 114). As shown in annotated Fig. 2 below, the first axis Ax is parallel with a line between the first end point and the second end point, and the second axis Ay is parallel to a line between the second end point and the third end point. (*Id.*, ¶ 115).



2. **CLAIM 3: The method of claim 1, wherein the plate has a first curvature when not configured in the frame assembly, and wherein the plate has a second curvature greater than the first curvature after the plate is configured in the frame assembly.**

In the modified Han device, glass 210 is initially flat before being inserted into the frame. (*Id.*, ¶ 116). Therefore, it possesses a first curvature when not configured in the frame assembly. (*Id.*).⁵ Further, when installed in the frame assembly, a parabolic curvature is induced in glass 210 along both directions Ax, Ay, thereby providing a “second curvature greater than the first curvature” after the glass is configured in the frame assembly. (*Id.*, ¶¶ 117-118)

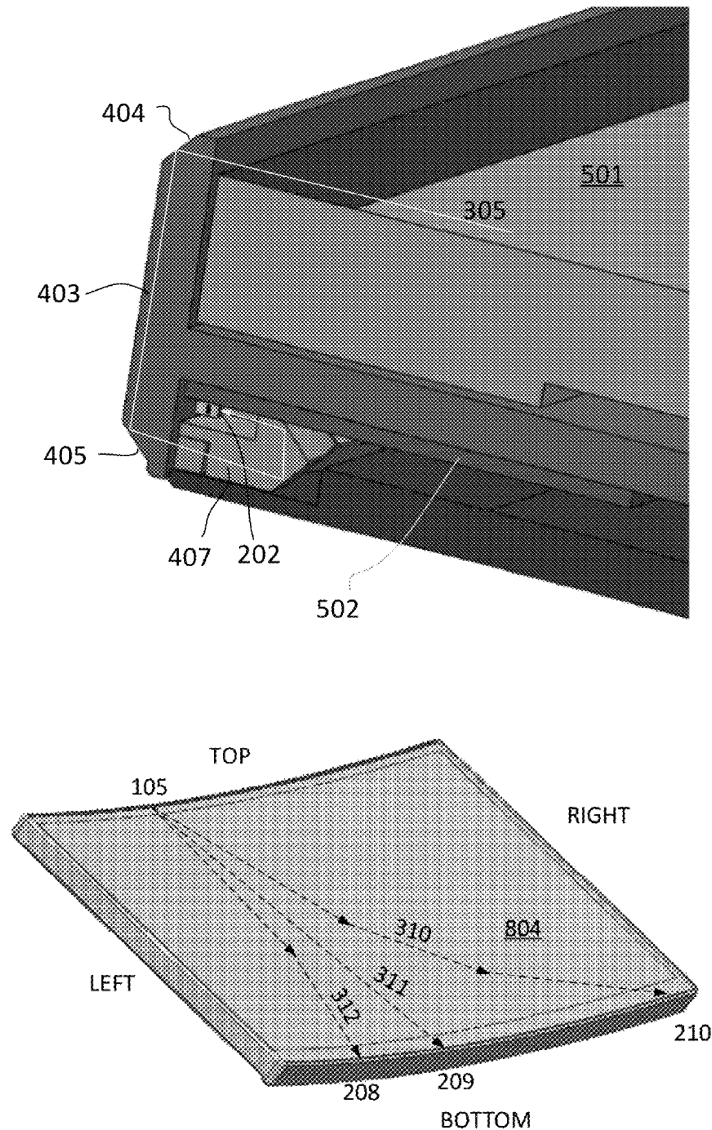
⁵ As construed above, a flat plate has a “first curvature” in the context of the claim.

B. GROUND 2: CLAIM 2 IS OBVIOUS OVER HAN IN VIEW OF SHIN-845 AND ERIKSSON

Claim 2 is obvious over Han in view of Shin-845, as set forth in Ground 1 above, further in view of Eriksson (Ex-1013). (Ex-1002, ¶¶ 119-127).

1. CLAIM 2: THE METHOD OF CLAIM 1, WHEREIN THE FIRST EDGE IS CURVED AND THE SECOND EDGE IS CURVED.

In an example of the Han device as modified based on Shin-845 and Eriksson, the top edges of guide members 222, 232 have a curved profile along each side of the Han device, with the same curvature as that of the window mounting surfaces. (*Id.*, ¶¶ 123-127). More particularly, Eriksson discloses a touch screen having a display 501 and, like Han, an exposed surrounding frame 403 that serves as a light guide for directing near-infrared light beams from emitters to the receivers. (Ex-1013, 9:51-60; *see id.*, 10:51-11:26). As shown in Fig. 26 below, the path of a light beam 35 toward receiver 202, is reflected by surfaces 404 and 405, just as in Han. (*Id.*, 10:51-64; Ex-1002, ¶¶ 119-122). Also, as shown in the additional embodiment in Fig. 29 subsequently below, Eriksson's light guide may be curved along the edge of the frame to maintain the same relative distance between the touch screen. (*Id.*)



At least based on Shin-845's disclosure of side mounting surfaces having a curved profile (*see, e.g.*, Ex-1009, 21:37-42, Fig. 2) and the disclosure in Eriksson of a light guide structure similar to Han's but that also is curved (Ex-1013, Abstract, Fig. 29), it would have been obvious to a POSITA to modify Han to curve the top edges of guide members 222, 232, (Ex-1002, ¶¶ 123-127). Moreover, such a configuration would permit the relative distance between the curved glass and the

top of the guide members to remain constant, which would increase touch accuracy and reduce touch errors. (*Id.*, ¶ 126). Accordingly, a POSITA would have known how to curve guide members 220, 230 in Han, using the known technique in Eriksson to improve the similar device in Han, and the results would have been predictable. (Ex-1002, ¶ 124-127). As a result, Claim 2 is unpatentably obvious.

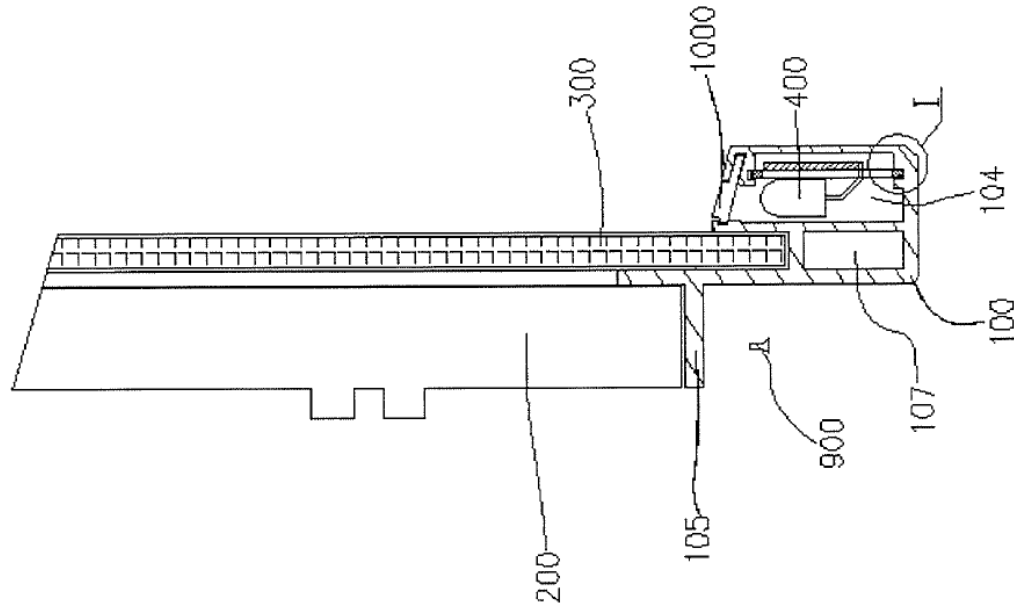
C. GROUND 3: CLAIMS 1-3 ARE OBVIOUS OVER CAO-626 IN VIEW OF HAN AND SHIN-845

Claims 1-3 and 5 also are obvious under 35 U.S.C. § 103 over Cao-626 (Ex-1008) in view of Han and Shin-845.

1. CLAIM 1

Just as the ‘935 Patent teaches using the frame to control the curvature of a plate to be flat or curved, Cao-626 discloses an infrared “all-in-one smart tablet PC” having a frame assembly that controls glass curvature to be flat. (Ex-1002, ¶ 128). In particular, with reference to Figs. 1, 9, and 16, the Cao-626 device comprises four screen supports 100, each of which defines a groove 103 to receive an edge of glass 300. (Ex-1008, 4:2-14, 7:16-21). During assembly, a screen support 100 is positioned on each side of glass 300 so that glass 300 is positioned into grooves 103, and the screen supports are joined together via corner cover seats 700. (*Id.*, 6:53-69; 7:16-21, Figs. 14-15). Cao-626 discloses that, for a glass 300 that has “four rising corners,” the grooves 103 of screen supports 100 force “glass 300 [to] be flat without deformation caused by external forces.” (*Id.*, 4:13-16). Further, “[t]his will avoid

the oversized gap between the glass 30 and the front frame caused by the four rising corners of the glass 300, which improves the quality and the qualified rate of the product.” (*Id.*, 4:16-19; Ex-1002, ¶¶ 129-131).



The Cao-626 device also includes a slot 104 in which an infrared touch module 400 is inserted so that it is in the peripheral border of the frame. (Ex-1008, 4:3-6, 6:25:28). Further, each screen support 100 defines a supporting tab 105 which, when four screen supports are joined together, define a screen frame 106. (*Id.*, 4:7:10, 5:34-36, 7:21-27, Figs. 3, 9, 14). A screen 200 is positioned into screen frame 106 and fixed by a screw 900 passing through screw holes defined in supporting tab 105 and screen back plate 203. (*Id.*, 7:21-27, Fig. 9; Ex-1002, ¶¶ 132-133).

Although Cao-626 does not disclose a parabolically curved touch surface, Han, discussed in detail above, teaches that providing an above-surface optical touch

sensing apparatus with a double-curved (and parabolic) touch surface can increase light efficiency and improve touch recognition. (Ex-1002, ¶¶ 31-62, 134). Shin-845, also discussed in detail above, teaches assembling an initially flat plate into a curved frame assembly to induce a curvature in the plate, thereby achieving manufacturing efficiencies. (*Id.*, ¶¶ 64-80, 135). In light of these disclosures and advantages applicable to similar touch sensing apparatuses, a POSITA would have been motivated to modify and improve the Cao-626 device by applying the teachings of Han and Shin-845 in the same way, and the results of this combination would have been predictable. (*Id.*, ¶¶ 134-166).

To obtain such known advantages, and as described above in Ground 1, a POSITA would have used inclined mounting surfaces that are also bowed, or curved, along the length of the frame in the Cao-626 device, as taught by Shin-845, to obtain the advantageous parabolic curvature disclosed in Han along the directions Ax and Ay. (*Id.*, ¶ 140). For example, each of Cao-626's four screen supports 100 can be modified so that first groove wall 112 and second groove wall 113 are inclined, such that a mounting surface is defined in groove 103. (*Id.*, ¶ 140-142).

Shin-845 teaches that glass 300 can be initially flat (when not configured in the frame assembly) and that it is assembled into a curved frame to induce curvature in the glass 300. In the modified Cao-626 device, each side of the initially flat glass 300 is inserted into respective now-inclined and curved grooves 103 of each screen

support 100, and the screen supports 100 are coupled together using corner cover seats 700. As the glass 300 is assembled into the frame, the grooves apply a bending force to the glass 300, as in Shin-845, which induces glass 300 to curve according to the slope of the mounting surfaces along both directions Ax, Ay. (*Id.*, ¶¶ 143-145).

Finally, while Cao-626 does not explicitly state that its “infrared touch module” comprises a plurality of emitters and a plurality of detectors, the ‘935 Patent concedes that it was well known in the prior art to arrange emitters and detectors around the periphery of the plate in order to enable touch-sensing functionality. (Ex-1001, 1:26-46, 15:62-16:3). For example, Han, which is in the same field as Cao-626 and discloses a similar infrared touch device, discloses that a plurality of LEDs 221 (emitters) and a plurality of photo diodes 231 (detectors) are disposed near opposing edges of display 100. (Ex-1003, ¶¶ 0039-46, Figs. 2-3). Given that Cao-626 is intended to use infrared touch-sensing technology, it would have been obvious to modify Cao-626’s “infrared touch module 400,” to the extent not already apparent to a POSITA, to include a plurality of emitters and detectors as taught by Han. This routine modification to Cao-626 is well within a POSITA’s skill, and the results would have been predictable. (Ex-1002, ¶¶ 160-166).

Thus, Claim 1 reflects a routine and obvious modification of Cao-626’s frame assembly to induce a double-curved concave, parabolic touch surface, as taught by

Han and Shin-845, and of Cao-626's infrared touch module 400 to include a plurality of emitters and detectors, as taught by Han. (*Id.*, ¶ 164). Because these modifications use only known techniques to improve a similar device in the same way, Claim 1 is invalid as obvious. (*Id.*); *see KSR*, 550 U.S. at 417.

The limitations of Claim 1, along with the specific teachings in the prior art, are provided below.

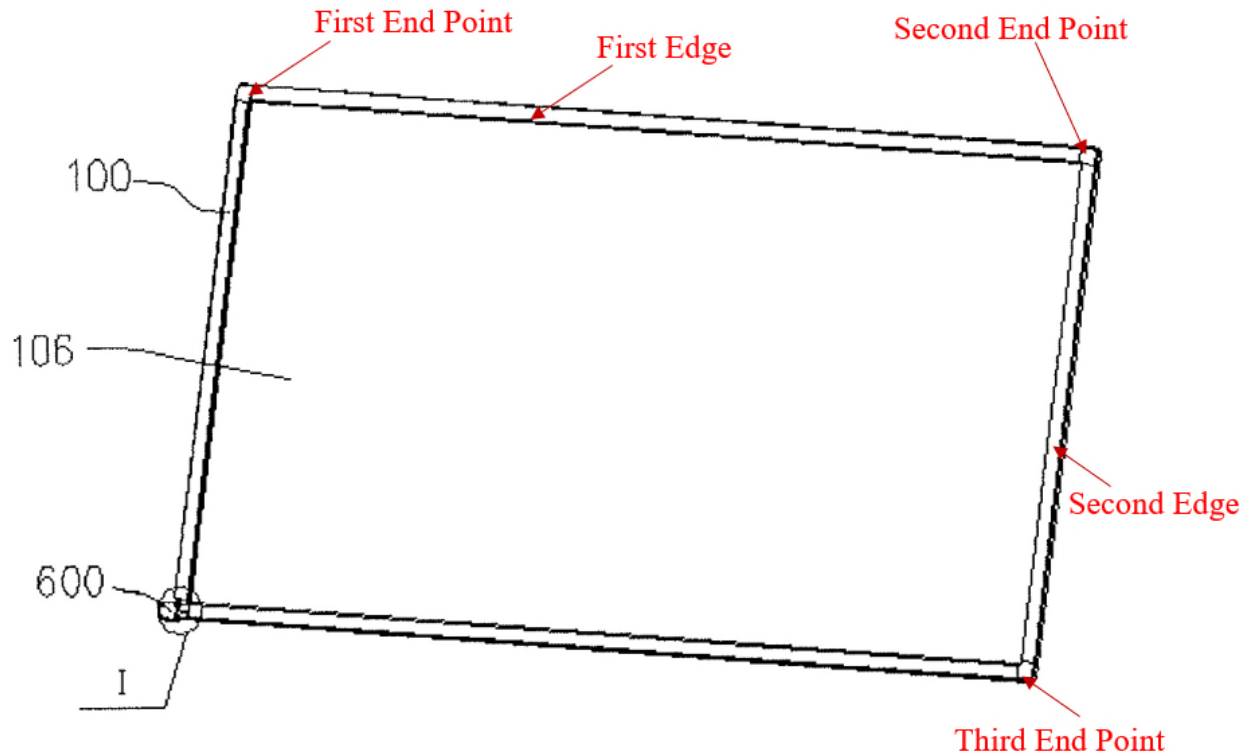
- a. A method for assembling a touch sensing apparatus, the touch sensing apparatus comprising a display panel, a plate including a touch surface, and a frame assembly**

Cao-626 discloses a method of assembling an “all-in-one smart tablet PC” having an infrared touch module. (Ex-1008, Abstract, 1:17-19). The device includes a display panel (screen 200), a plate (glass 300) with a touch surface on its upper side, and a frame assembly including four screen supports 100 joined at their ends to form a rectangular frame. (*Id.*, Abstract, 4:1-26, 4:41-42, 5:30-34, 5:47-6:2, 7:16-21, 7:66-67, Figs. 1, 9, 13; Ex-1002, ¶¶ 167-169).

- b. wherein the frame assembly includes**
 - (i) a first edge extending between a first end point and an opposite second end point; and**
 - (ii) a second edge extending between the second end point and a third end point**

As shown below, Cao-626's frame assembly (including four screen supports 100) includes a first edge extending between a first end point and an opposite second

end point and a second edge extending between the second end point and a third end point:



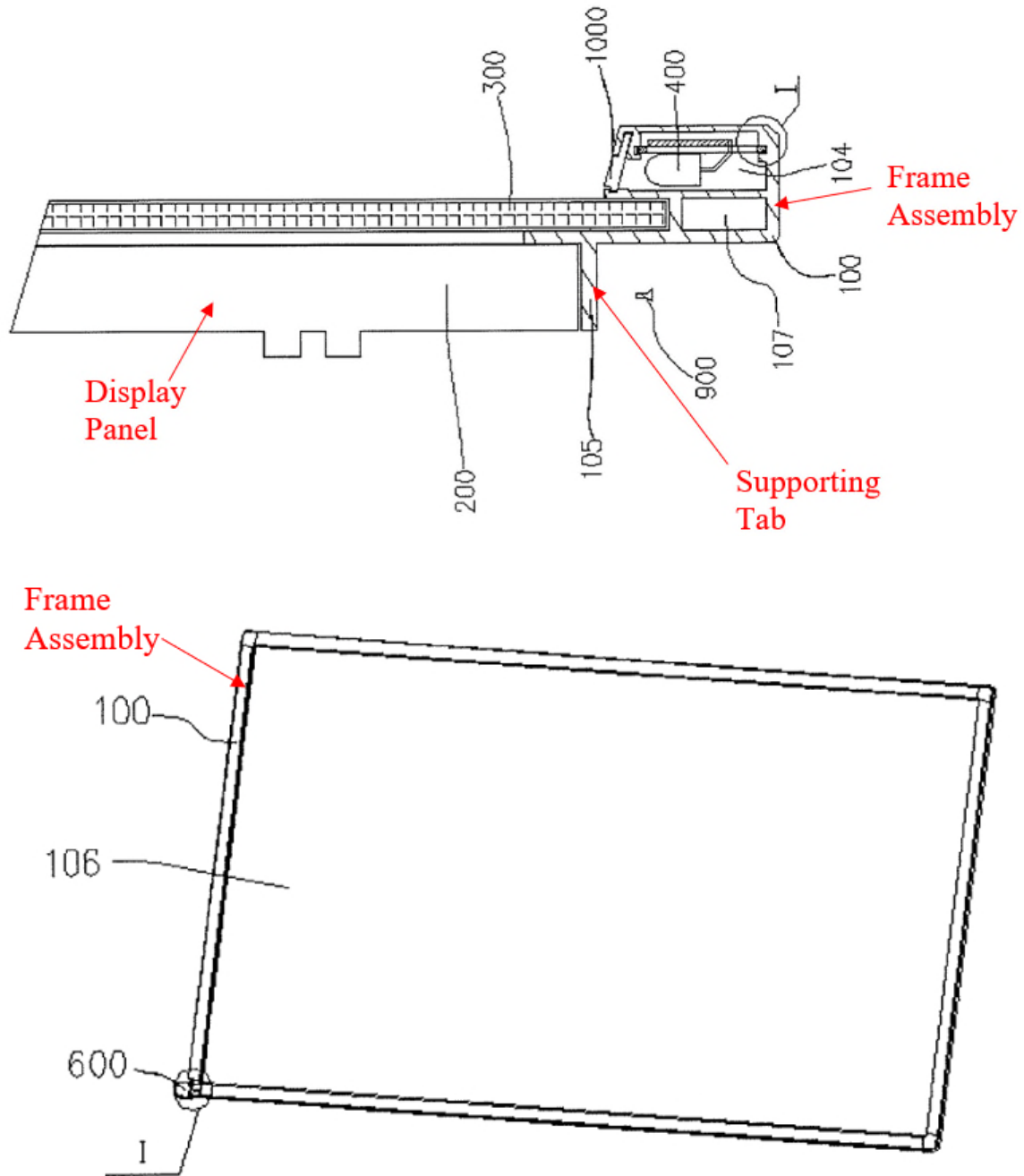
(Ex-1008, Figs. 1-3, 5-8, 14; Ex-1002, ¶ 170).

c. the method comprising:

The claimed method steps are discussed in turn below.

d. configuring the frame assembly to support the display panel

In the Cao-626 device, the four screen supports 100 each include a supporting tab 105 that, together, form a screen frame 106 (shown in the second figure below):



(Ex-1008, 4:7-12, 5:34-36, 7:16-27, Figs. 3-4, 9, 14; Ex-1002, ¶¶ 172-176). Screen 200 is positioned into the screen frame 106 and fixed by a screw 900 passing into the supporting tab 105. (*Id.*, 2:25-30, 4:10-11, 5:13-18, 7:22-27). Thus, Cao-626

discloses the step of configuring the frame assembly to support the display panel.
(Ex-1002, ¶ 175-176).

- e. **arranging a plurality of emitters adjacent to a periphery of the plate, said plurality of emitters configured to emit light to propagate over the touch surface**
- f. **arranging a plurality of detectors arranged adjacent to the periphery of the plate, said plurality of detectors configured to receive light from the set of emitters**

As shown in Fig. 9, the infrared touch modules 400 are arranged adjacent to, or near, the periphery of the plate. (Ex-1008, Fig. 9; Ex-1002, ¶¶ 177-178). However, Cao-626 does not explicitly disclose that infrared touch modules 400 comprise a plurality of emitters to emit light to over the touch surface and a plurality of detectors to receive that light. (Ex-1002, ¶ 177-179).

As articulated above, however, it would have been obvious to a POSITA to modify Cao-626, as routine in the art and taught by Han, to provide a plurality of emitters and detectors in the infrared modules 400 of Cao-626. (Ex-1002, ¶¶ 160-166, 177-180). In the modified device, the plurality of emitters and detectors are arranged adjacent to a periphery of glass 300 and, respectively, are configured to emit light to propagate over the touch surface and to receive light from the set of emitters. (*Id.*; see Ex-1003, ¶¶ 0067-69, Figs. 2, 4; Ex-1002, ¶¶ 160-166, 177-180).

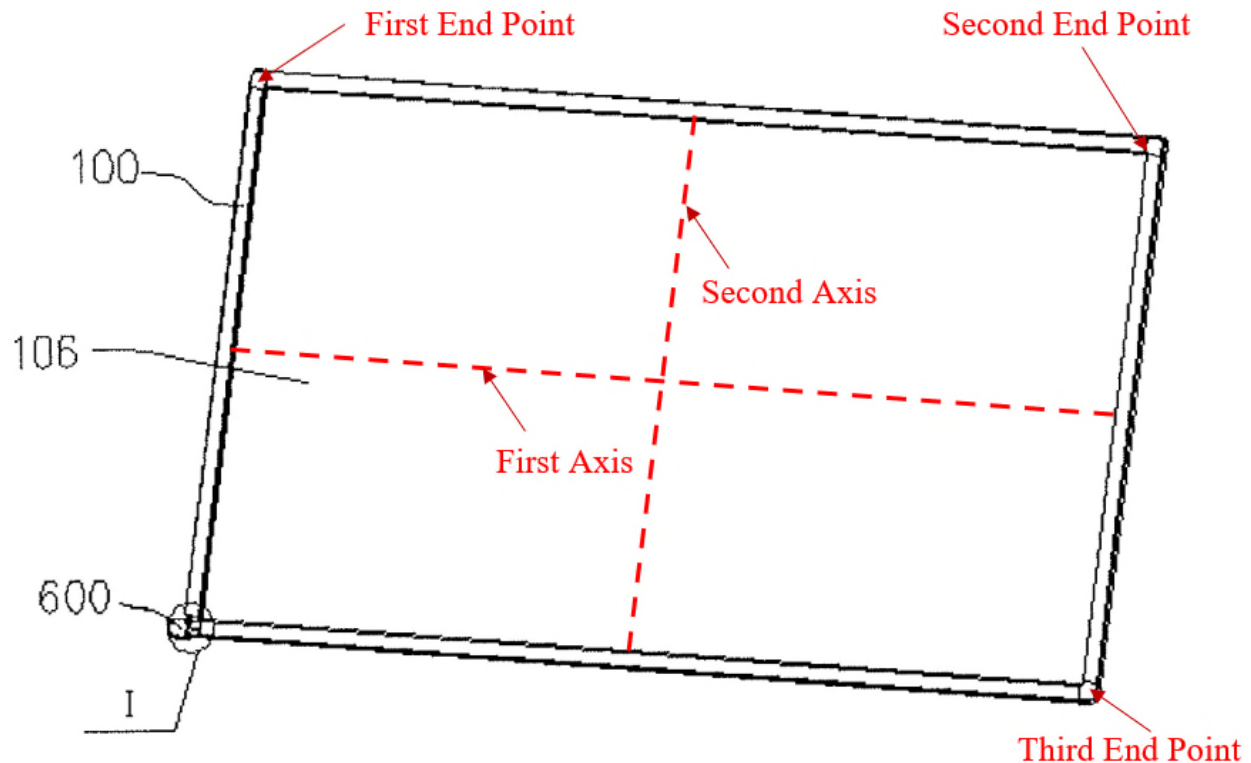
g. configuring the frame assembly to support the plate

In Cao-626, each support structure 100 defines a groove 103, and “the glass 300 is inserted and engaged therein.” (Ex-1008, 4:2-4, 4:13-14, 5:30-32). Assembling the device includes the step of “positioning four screen supports 100 to each side of a glass 300, aligning grooves 103 of each screen support 100 with edges of the glass 300 and fitting the four screen supports 100 into each side of the glass 300.” (*Id.*, 7:16-27). Therefore, Cao-626 discloses configuring the frame assembly to support the plate. (Ex-1002, ¶¶ 181-183).

h. wherein configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis,

Cao-626 teaches that a frame assembly of an above-surface optical infrared touch sensing apparatus is used to control the curvature of the touch surface of a glass plate and, more specifically, to induce a flat curvature. (*See* Ex-1008, 2:39-45, 4:13-19; Ex-1002, ¶¶ 184). As discussed in detail above, however, it would have been obvious to modify the Cao-626 device to practice the above limitations in view of the teachings in Han and Shin-845. (Ex-1002, ¶¶ 134-145, 186).

Again, Han teaches a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis. (*Id.*, ¶¶ 36-62, 187; *supra*, VIII.A.1.h.). Such axes are also present in Cao-626 as shown in Fig. 14 below.



Shin-845 teaches a POSITA a desirable way to configure the frame assembly to support the plate so that it induces the advantageous parabolic curvatures of Han in the Cao-626 device. (Ex-1002, ¶¶ 138-140, 143-146). In the example of a modified Cao-626 device in view of Han and Shin-845 explained above, inclined mounting surfaces are provided on each of Cao-626's four sides to induce curvature, and the mounting surfaces also bow, or curve, along the length of the frame to form a seat for the resulting curved plate. (*Id.*, ¶¶ 185-186).

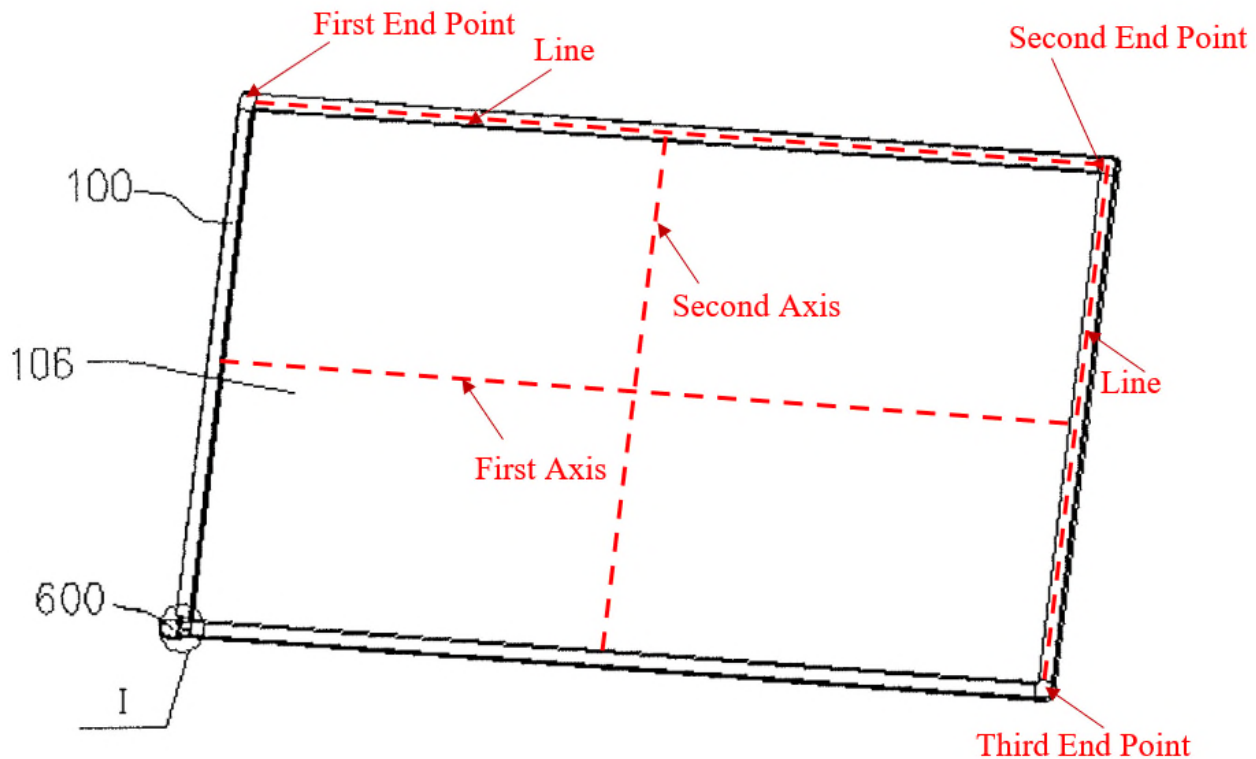
As noted above, Shin-845 teaches that an initially-flat glass 300 (when not configured in the frame assembly) may be inserted into a curved frame to induce curvature in the glass 300. Each side of the initially flat glass 300 is inserted into

respective grooves 103 of each screen support 100, and the screen supports 100 are coupled together using corner cover seats 700. As the glass 300 is assembled into the frame, grooves 103 apply a bending force to glass 300, which induces glass 300 to curve according to the slope of the mounting surfaces along both directions. The resulting curvatures would be parabolic. (*Id.*, ¶¶ 146-159, 190). The curvatures would extend from one side of the touch surface of glass 300 to an opposite side thereof. (Ex-1002, ¶¶ 145, 188-190; *cf.* Ex-1003, Figs. 2-4, 6-7).

Also, Han discloses that its curvatures are present in both vertical and horizontal operative orientations, (*e.g.*, Ex-1003, ¶¶ 0048, 0081, Figs. 2, 4-5), and a POSITA would implement the curvatures of Han such that they exist in either a vertical or horizontal operative orientation in Cao-626, (Ex-1002, ¶ 191).

- i. said first axis is parallel to a line between the first end point and the second end point and said second axis is parallel to a line between the second end point and the third end point**

As explained above, the modified Cao-626 device in view of Han and Shin-845 has an induced parabolic curvature relative to a first axis that is parallel with first direction Ax and an induced parabolic curvature relative to a second axis that is parallel with the second direction Ay. (Ex-1002, ¶ 192). As shown in annotated Fig. 14 below, the first axis is parallel with a line between the first end point and the second end point, and the second axis is parallel to a line between the second end point and the third end point. (*Id.*, ¶ 193).



2. CLAIM 2: The method of claim 1, wherein the first edge is curved and the second edge is curved.

The modified Cao-626 device has a curved first edge and a curved second edge. (*Id.*, ¶¶ 194-199). In one example of the Cao-626 device as modified in view of Han and Shin-845, each of the four screen supports 100 is inclined and curved lengthwise in the same manner as the mounting surfaces described above. (*Id.*, ¶ 195). In that embodiment, the upper portion of each screen support 100 has a curved profile along the side of the device. (*Id.*). Additionally, infrared light from touch module 400 may be directed parallel with the touch surface of glass 300. (*Id.*, ¶¶ 160-63, 196).

This modification would have been obvious based on at least Shin-845's disclosure of side mounting surfaces having a curved profile. (See, e.g., Ex-1009, 21:37-42, Fig. 2; Ex-1002, ¶ 197). A POSITA also would have understood that angling the infrared module so that light is emitted parallel with the surface of the screen would cause loss of less light and yield improved accuracy in touch recognition, as Han teaches in connection with its Fig. 6. (*Id.*, ¶ 198; *see* Ex-1003, ¶ 106, Fig. 6). Thus, claim 2 is obvious because it likewise uses known techniques to improve a similar device in the same way. (Ex-1002, ¶ 199); *see KSR*, 550 U.S. at 417.

3. CLAIM 3: The method of claim 1, wherein the plate has a first curvature when not configured in the frame assembly, and wherein the plate has a second curvature greater than the first curvature after the plate is configured in the frame assembly.

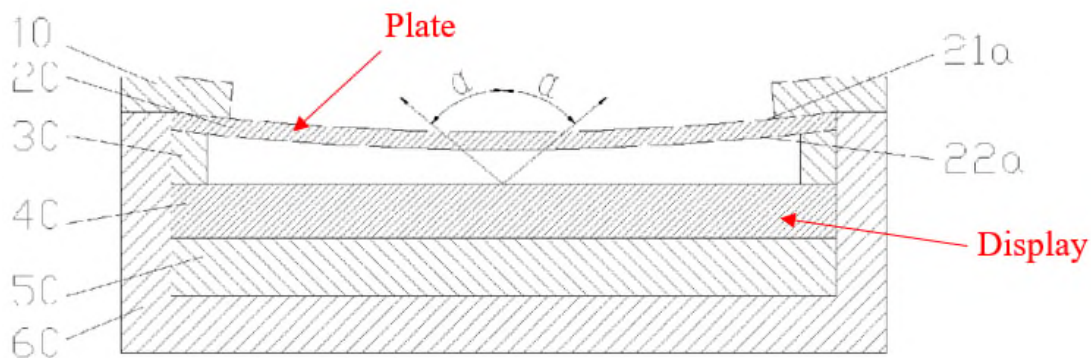
In the modified device described above, glass 300 is initially flat before it is inserted into the frame. (*Id.*, ¶ 200). Therefore, it possesses a first curvature, as that claim is construed above, when it is not configured in the frame assembly. (*Id.*). Each side of glass 300 then is inserted into respective grooves 103 of each screen support 100, and each screen support 100 is coupled together end to end using corner cover seats 700. (*Id.*, ¶ 201). As the glass 300 is assembled into the frame, grooves 103 apply a bending force to glass 300, which induces glass 300 to curve to a second

curvature greater than the first curvature based on the slope of the mounting surfaces along both directions. (*Id.*, ¶¶ 202-203).

D. GROUND 4: CLAIMS 1-3 ARE OBVIOUS OVER CAO-626 IN VIEW OF HAN AND ZHAO

For Claim 1, Ground 4 is identical in all respects to Ground 3, except that Zhao is alternatively relied upon, instead of Shin-845, as disclosing the limitation in Claim 1 reciting “wherein configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis.”

In particular, similar to Cao-626 and Han, Zhao discloses a device with a display (liquid crystal display panel 40) and a transparent plate (cover plate 20) having a concave curvature, as shown below:



(Ex-1010, ¶¶ 0004, 0045, 0048-49, Figs. 1, 3; Ex-1002, ¶¶ 204-205).

Notably, just as in Shin-845, Zhao teaches inducing curvature in a plate, providing that “[t]he cover plate 20 also may be a flat plate, and is forced to bend by squeezing the cover plate 20 in the installation process, so that its first surface 21a

is concave.” (Ex-1010, ¶ 0050; Ex-1002, ¶ 206). Specifically, as shown above, cover plate 20 is “sandwiched” between a frame 10, which is curved on two sides and straight on two sides, and support members 30, which may be present on some or all sides of frame 11. (Ex-1010, ¶¶ 0045, 0051, 0053-54, Figs. 1-2; Ex-1002, ¶ 207).

Zhao explains that “the curvature radius of the two curved sides 12 of the frame 10 is the same as that of the first surface 21a [of cover plate 20], and specifically, the shape of the frame 10 mates with that of edges of the first surface where the frame is located, such that the frame 10 fits the cover plate 20 better, to prevent structure loosening.” (Ex-1010, ¶¶ 0051-52). Likewise, the shape of the surface of each support member 30 in contact with cover plate 20 matches that of cover plate 10. (*Id.*, ¶ 0055). In other words, Zhao’s curved support members 30 are configured to support plate 20 so that, during assembly of plate 20 and the frame 10, the same curvature is induced in plate 20. (Ex-1002, ¶¶ 208-209). Thus, Zhao discloses a frame structure that is configured to support the plate and that, in doing so, induces a concave curvature in the touch surface. (*Id.*, ¶ 210).

As explained above in Ground 3, a POSITA would have been motivated to modify the Cao-626 device to provide a double-curved concave touch surface to obtain the technical advantage disclosed in Han. (*Id.*, ¶¶ 134-37, 147, 211-230). Particularly given Cao-626’s teaching regarding controlling curvature of glass 300

via a groove 103 defined between upper and lower groove walls 112, 113, the POSITA naturally would have considered Zhao, which also teaches control of touch glass curvature by sandwiching cover plate 20 between support member 30 and frame 10, for information on how to induce further curvature in glass 300. (*Id.*, ¶ 212).

A POSITA would have applied the teachings of Han and Zhao to the Cao-626 device, and the results of this combination would have been predictable. (*Id.*, ¶¶ 211-213). Specifically, based on Han's disclosure of a double-curved surface, a POSITA would understand from Zhao that curvature in Cao's touch surface would be induced by modifying each of the four screen supports 100 so that first groove wall 112 and second groove wall 113 are inclined to provide a mounting surface in groove 103, analogous to the space between support member 30 and frame 10 in which cover plate 20 is received in Zhao. (*Id.*, ¶ 214). Also, like the curved surfaces 12 of frame 10 in Zhao, the mounting surfaces in Cao would be curved lengthwise along each screen support 100. (*Id.*, ¶ 215).

As explained above, Zhao teaches that the glass 300 of Cao-626 can be initially flat (when not configured in the frame assembly) and that its assembly into a curved frame induces curvature in the glass 300. (*Id.*, ¶ 216). In the modified Cao-626 device in view of Han and Zhao, each side of the initially flat glass 300 is inserted into respective now-inclined and curved grooves 103 of each screen support

100, and the screen supports 100 are coupled together using corner cover seats 700. (*Id.*, ¶ 217). As the glass 300 is assembled into the frame, grooves 103 apply a bending force to the glass 300, which induces glass 300 to curve in two directions according to the slope of the mounting surfaces. (*Id.*, ¶ 218-220).

With respect to claim 2, in some embodiments of the modified Cao-626 device the upper portions of each screen support 100 are inclined and curved lengthwise in the same manner as the mounting surfaces described above. (*Id.*, ¶¶ 221-225). In that case, the upper portion of each of screen supports 100 has a curved profile along each side of the device. (*Id.*, ¶ 222). Additionally, infrared light from touch module 400 may be directed parallel with the touch surface of glass 300. (*Id.*, ¶ 224). This modification would have been obvious based at least on Zhao's disclosure of curved sides 12 of frame 10. (*See, e.g.*, Ex-1010, ¶ 0051, Fig. 3; Ex-1002, ¶ 223). A POSITA also would have understood that angling the infrared module so that light is emitted parallel with the surface of the screen would cause even less light loss and yield further accuracy in touch recognition, as Han teaches in connection with its Fig. 6. (Ex-1002, ¶ 224; *see* Ex-1003, ¶ 106, Fig. 6).

Based on the above, Claim 1 also is obvious over Cao-626 in view of Han and Zhao. As the modifications to the device of Cao-626 in this Ground are identical to those in Ground 3 above, Claims 2 and 3 are obvious for the same reasons stated in Ground 3.

E. GROUND 5: CLAIMS 1-3 ARE OBVIOUS OVER SASAKI IN VIEW OF HAN AND SHIN-845

Claims 1-3 also are obvious under 35 U.S.C. § 103 over Sasaki (Ex-1015) in view of Han and Shin-845.

1. CLAIM 1:

Sasaki discloses a photodetection type coordinate input device attached to a display. (Ex-1015, 1:24-28). Sasaki discloses each and every limitation of Claim 1, except it does not disclose that “configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface.” As set forth in detail below, however, it would have been obvious to modify the Sasaki device to practice this limitation based on the teachings of Han and Shin-845. (Ex-1002, ¶¶ 227-280).

More particularly, the Sasaki device comprises a rectangular frame 1 having an opening 2. (Ex-1015, 1:34-37). Display 3, which may be a CRT or the like (e.g., an LCD), is disposed on the reverse side of frame 1, and has a display screen 3a. (*Id.*, 1:40-42; 5:17-26; Figs. 3-4). Display 3 defines a support portion (annotated in Figure 4 below) that receives and supports both frame 1 and display screen 3a. (*See id.*, 1:40-42, Fig. 4; Ex-1002, ¶¶ 227-230).

FIG. 3
PRIOR ART

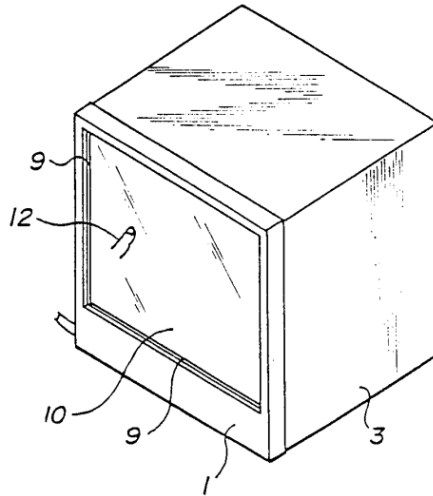
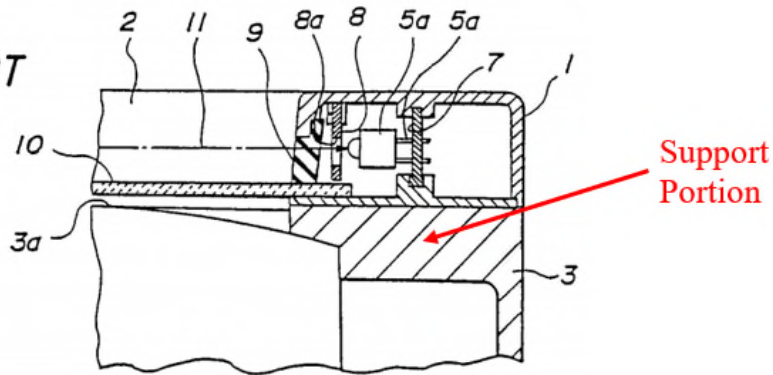
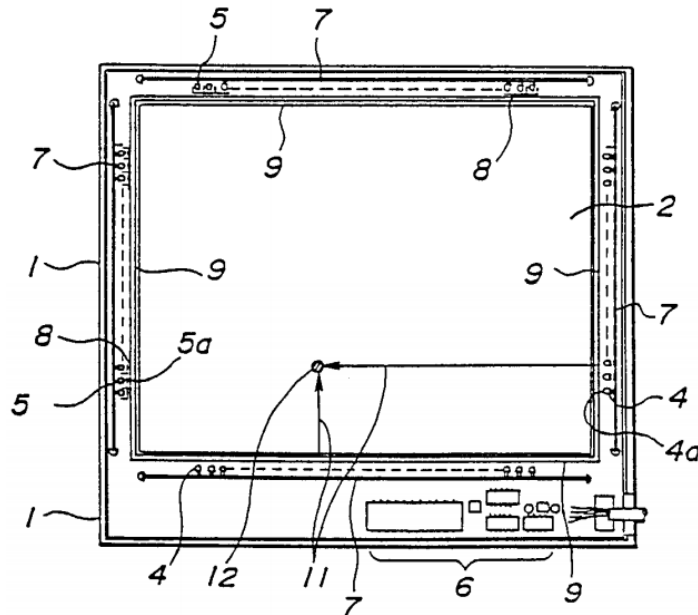


FIG. 4
PRIOR ART



As shown in Fig. 4 above and Fig. 5 below, frame 1 also comprises a plurality of pairs of light-emitting elements 4 and light-receiving elements 5 which are respectively disposed on the opposing sides of display 3. (Ex-1015, 1:37-40). Light-emitting elements 4 and light-receiving elements 5 are disposed on boards 7 mounted on the frame 1 so that the light-emitting portion 4a of one light-emitting element 4 and the light-receiving portion 5a of one light-receiving element 5 oppose each other. (*Id.*, 1:48-54; Ex-1002, ¶¶ 231-232).

FIG. 5
PRIOR ART



An operation panel 10 in the shape of a plate is provided in the opening 2. (Ex-1015, 1:55-56; 4:43-45). Optical paths 11 are formed through the infrared filter 9 on the front side of operation panel 10 on the side of panel 10 that is remote from display screen 3a. (*Id.*, 2:10-13). In operation, a finger 12 may press a position on panel 10 corresponding to a position on the display screen 3a that is desired to be input. (*Id.*, 2:14-18). Optical paths 11 that would otherwise pass through the position of finger 12 are blocked (*id.*, 2:18-21), and an arithmetic unit 6 identifies the blocked optical paths 11 and the corresponding coordinate position (*id.*, 2:26-29; Ex-1002, ¶¶ 233-236).

Han, discussed in detail above, teaches that providing an above-surface optical touch sensing apparatus with a double-curved (and parabolic) touch surface can increase light efficiency and improve touch recognition. (Ex-1002, ¶¶ 31-62, 237). Shin-845, also discussed in detail above, teaches that assembling an initially flat plate into a frame assembly having a curved frame induces curvature in the plate and achieves manufacturing efficiencies. (*Id.*, ¶¶ 64-80, 238). In light of these disclosures applicable to similar touch sensing apparatuses, a POSITA would have been motivated to modify the Sasaki device to improve it in the same way in order to achieve the same advantages. (*Id.*, ¶¶ 239-240).

For instance, the POSITA would have looked to Han to obtain the technical advantage offered by Han's double-curved concave touch surface, and the POSITA would have considered Shin-845, which teaches assembly of touch glass into a frame to induce glass curvature in similar device, for information on how to obtain such curvatures. (*Id.*, ¶ 240). As described below, a POSITA would have applied the teachings of Han and Shin-845 to the Sasaki device in the same way, and the results of this combination would have been predictable. (*Id.*, ¶ 241).

For example, and as described above in Ground 1, based on Han's disclosure of a double-curved surface along perpendicular directions, a POSITA would understand from Shin-845 that such a surface would be induced in Sasaki by

providing rectangular frame 1 with mounting surfaces that are inclined and that also bow, or curve along the length of the frame. (*Id.*, ¶ 242).

In one example, with reference to Fig. 2, the lower portion of frame 1 (with left to right cross-hatching) is modified so that the portion that receives panel 10 is inclined, defining a mounting surface around frame 1. (*Id.*, ¶ 243). As disclosed in Shin-845, a bonding layer is provided between panel 10 and the mounting surface to retain panel 10 in position. (*See id.*; Ex-1009, 21:43-63). In this example, the mounting surface also is curved lengthwise along the side of frame 1. (Ex-1002, ¶ 243).

As noted above, Shin-845 teaches that Sasaki's panel 10 can be initially flat (when not configured in frame 1) and can be assembled into a curved frame to induce curvature in panel 10. (*Id.*, ¶ 244). In the modified Sasaki device in view of Han and Shin-845, the initially flat panel 10 is adhered to the inclined mounting surface on the lower portion of frame 1 via the bonding layer. (*Id.*, ¶ 245). Thus, assembly of panel 10 into frame 1 applies a bending force to panel 10, as taught by Shin-845 and which induces panel 10 to curve according to the slope of the mounting surfaces along both directions A_x , A_y . (*Id.*, ¶ 246).

Thus, Claim 1 reflects a routine and obvious modification of Sasaki to induce a double-curved concave, parabolic touch surface, as taught by Han and Shin-845. (*Id.*, ¶¶ 247-248). Because these modifications use only known techniques to

improve a similar device in the same way, a POSITA would find Claim 1 to be obvious in view of these references. (*Id.*); *see KSR*, 550 U.S. at 417. The limitations of Claim 1, along with the specific teachings in the prior art that disclose such limitations, are provided below.

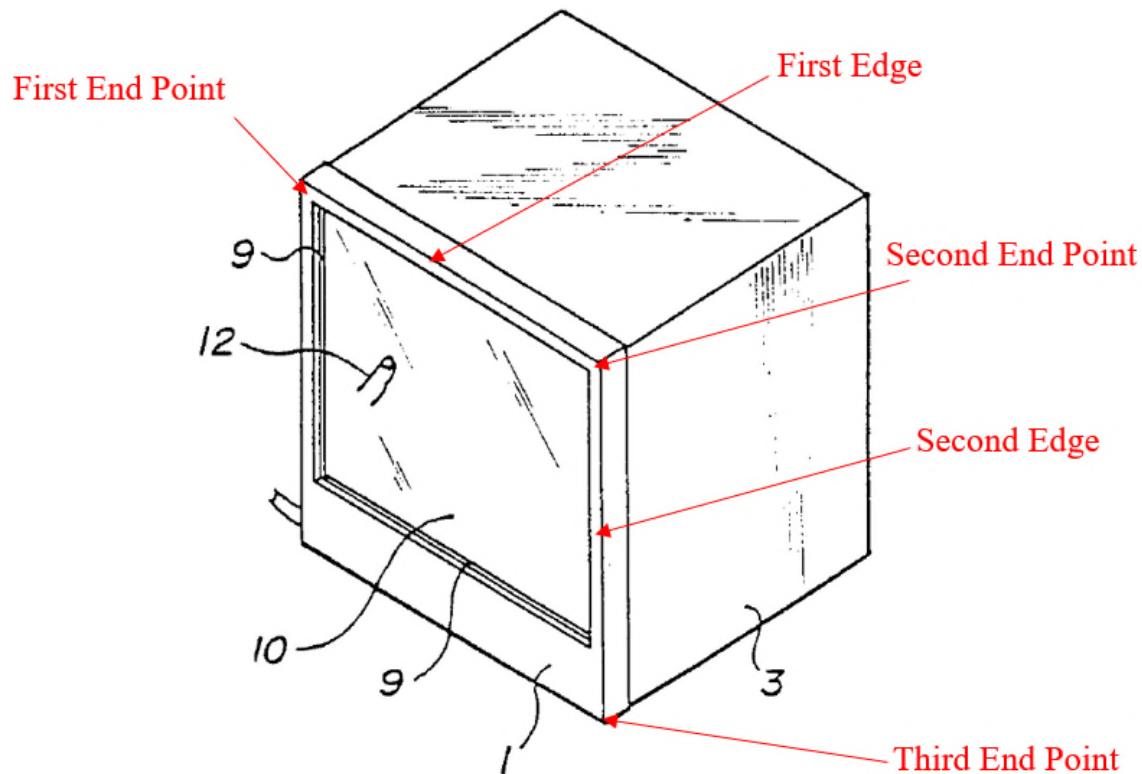
a. A method for assembling a touch sensing apparatus, the touch sensing apparatus comprising a display panel, a plate including a touch surface, and a frame assembly

Sasaki discloses an optical coordinate input device attached to a display 3 having a display screen 3a. (Ex-1015, 1:24-28). A plate (operation panel 10) is provided in the opening 2 in frame 1. (*Id.*, 1:55-56, 4:43-45). The frame assembly of Sasaki includes frame 1 and the housing of display 3 on which it is disposed. (*Id.*, 1:40-42, 3:61-63, 5:17-26, Figs. 3-4). Thus, Sasaki discloses these limitations. (Ex-1002, ¶¶ 250-252).

b. wherein the frame assembly includes

- (i) a first edge extending between a first end point and an opposite second end point; and**
- (ii) a second edge extending between the second end point and a third end point**

Sasaki's frame assembly includes a first edge extending between a first end point and an opposite second end point and a second edge extending between the second end point and a third end point:



(Ex-1015, 3:61-63, Fig. 3; Ex-1002, ¶ 253).

c. the method comprising

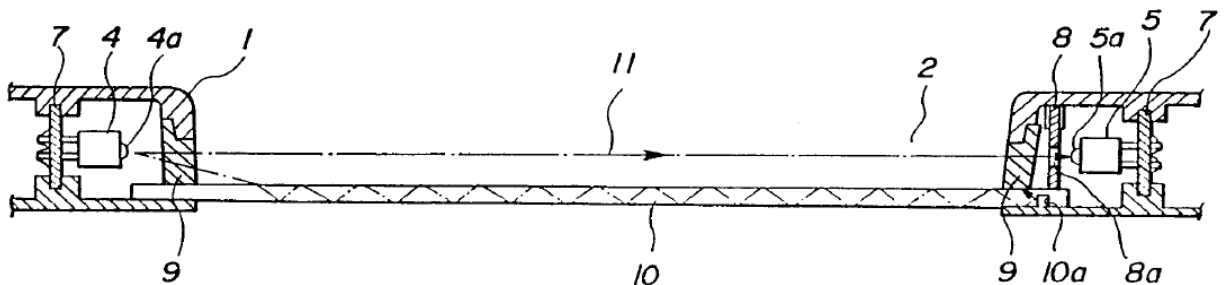
The claimed method steps are discussed in turn below.

d. configuring the frame assembly to support the display panel

Sasaki discloses configuring the frame assembly (e.g., the housing of display 3 and frame 1) to support display screen 3a. As shown in Figs. 3-4 above, for example, display 3 defines a support portion that extends around display screen 3a, which is received in a shoulder of the support portion. (Ex-1002, ¶ 255; *see* Ex-1015, 3:61-63, Figs. 3-4).

- e. **arranging a plurality of emitters adjacent to a periphery of the plate, said plurality of emitters configured to emit light to propagate over the touch surface**
- f. **arranging a plurality of detectors arranged adjacent to the periphery of the plate, said plurality of detectors configured to receive light from the set of emitters**

Frame 1 also comprises a plurality of pairs of light-emitting elements 4 and light-receiving elements 5 which are respectively disposed on the opposing sides of display 3. (Ex-1015, 1:37-40, Figs. 2, 4-5). Also, an operation panel 10 is provided in the opening 2. (*Id.*, 1:55-56; 4:43-45). As shown in Fig. 2 below, emitters 4 and detectors 5 are adjacent, or near, to the periphery of panel 10. (Ex-1002, ¶¶ 256-258).



Optical paths 11 are formed through the infrared filter 9 on the front side of operation panel 10 on the side of panel 10 that is remote from display screen 3a. (Ex-1015, 2:10-13). Thus, Sasaki discloses these limitations. (Ex-1002, ¶ 259).

- g. **configuring the frame assembly to support the plate**

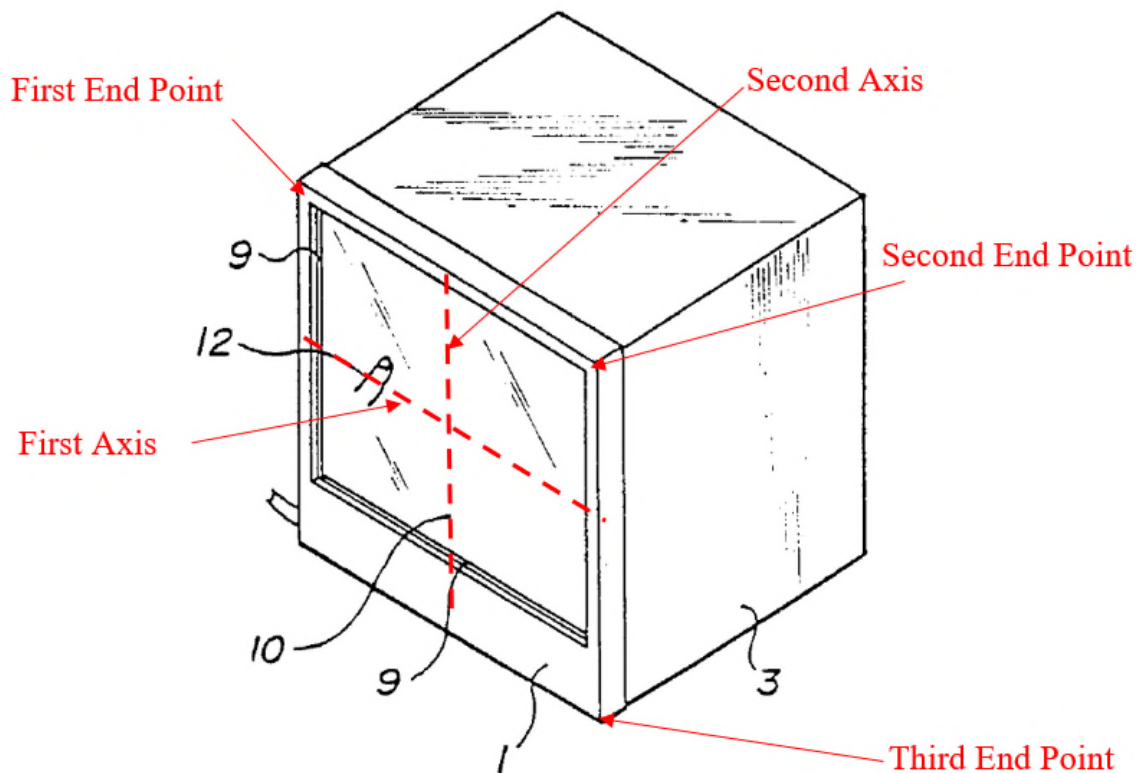
Sasaki discloses configuring the frame assembly (e.g., the housing of display

3 and frame 1) to support operation panel 10. (Ex-1002, ¶ 260). As shown in Figs. 2-4 above, for example, panel 10 is provided in opening 2 of frame 1 and is disposed between a lower portion of frame 1 (with left to right cross-hatching) and infrared filter 9. (*Id.*; *see* Ex-1015, 3:61-63, 4:43-45, Figs. 2-4).

h. wherein configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis,

As discussed in detail above, it would have been obvious to modify the device of Sasaki to practice the above limitations in view of the teachings in Han and Shin-845. (Ex-1002, ¶¶ 261).

Again, Han discloses a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis, as those terms are construed above. (*Id.*, ¶¶ 36-62, 262; *supra*, VIII.A.1.h.). These axes also are present in Sasaki, as shown below. (Ex-1002, ¶ 262). The curvatures in front surface 211 of Han are substantially similar to a mathematical parabola. (*See, supra*, VIII.A.1.h.).



Shin-845 teaches a POSITA a desirable way to configure the frame assembly to support the plate so that it induces the parabolic curvatures in the Sasaki device. (Ex-1002, ¶¶ 263-266). In one example, mounting surfaces are provided that are curved lengthwise along each side (like the side mounting surfaces of Shin-845) and that also are inclined (like the mounting surfaces 101a' and 101a" of Shin-845). (*Id.*, ¶ 264).

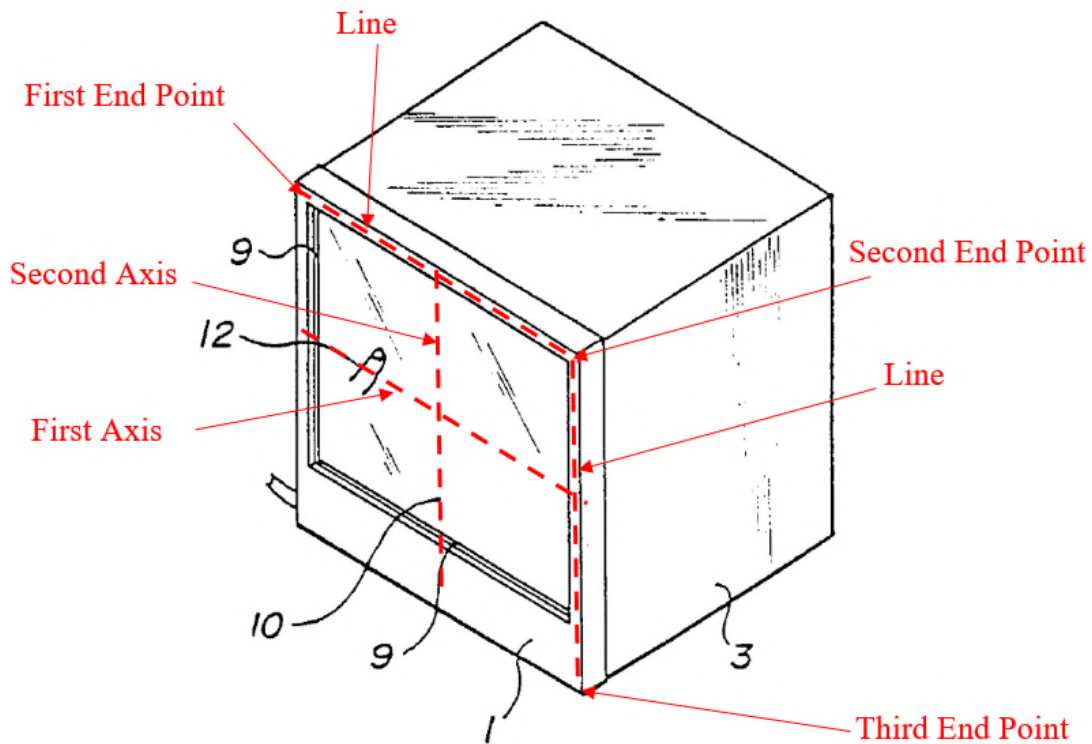
As noted above, Shin-845 teaches that panel 10 can be initially flat (when not configured in the frame assembly) and can be assembled into a curved frame to induce curvature in the glass 300. (*Id.*, ¶ 265). The initially flat panel 10 is adhered to the mounting surface on the lower portion of frame 1 via the bonding layer. (*Id.*, ¶ 266). Thus, assembly of panel 10 into frame 1 applies a bending force to panel 10,

which induces panel 10 to curve according to the slope of the mounting surfaces along both directions. (*Id.*). The resulting curvatures would be parabolic. (*Id.*, ¶¶ 146-159, 247). The curvatures would extend from one side of the touch surface of panel 10 to an opposite side thereof. (*Id.*, ¶ 267; *cf.* Ex-1003, Figs. 2-4, 6-7).

Finally, as discussed above, Han teaches the POSITA that its preferred radii of curvature should be present in the chosen operative orientation. (Ex-1002, ¶ 268). Sasaki discloses that its operative orientation is vertical (*see* Ex-1015, Fig. 3), and thus a POSITA would understand that the gravitational force would not appreciably impact the curvature of the touch surface in the device of Sasaki. A POSITA would implement the curvatures of Han in the device of Sasaki such that they are present as disclosed in Han in the vertical orientation of Sasaki. (Ex-1002, ¶ 268).

- i. said first axis is parallel to a line between the first end point and the second end point and said second axis is parallel to a line between the second end point and the third end point**

In the modified device, there is an induced parabolic curvature relative to a first axis that is parallel with first direction Ax and there is an induced parabolic curvature relative to a second axis that is parallel with the second direction Ay. (Ex-1002, ¶ 269). As shown in annotated Fig. 3 below, the first axis is parallel with a line between the first end point and the second end point, and the second axis is parallel to a line between the second end point and the third end point. (*Id.*, ¶ 270).



2. CLAIM 2: The method of claim 1, wherein the first edge is curved and the second edge is curved.

The modified device has a curved first edge and a curved second edge. (*Id.*, ¶¶ 271-276). In one example of the Sasaki device in view of Han and Shin-845, frame 1 is inclined and has a curved profile on each side in the same manner as the mounting surfaces described above. (*Id.*, ¶ 272). In that case, light from light emitting elements 4 will be directed parallel with the touch surface of panel 10. (*Id.*, ¶ 273).

This modification would have been obvious based at least on Shin-845's disclosure of side mounting surfaces having a curved profile. (*See, e.g.*, Ex-1009, 21:37-42, Fig. 2; Ex-1002, ¶ 274). A POSITA also would have understood that

angling the infrared module so that light is emitted parallel with the surface of the screen would cause loss of even less light and yield further accuracy in touch recognition, as Han teaches in connection with its Fig. 6. (*Id.*, ¶ 275; *see* Ex-1003, ¶ 106, Fig. 6). Thus, claim 2 is obvious because it likewise uses only known techniques to improve a similar device in the same way. (Ex-1002, ¶ 276); *see KSR*, 550 U.S. at 417.

3. CLAIM 3: The method of claim 1, wherein the plate has a first curvature when not configured in the frame assembly, and wherein the plate has a second curvature greater than the first curvature after the plate is configured in the frame assembly.

In the example modified device described above, panel 10 is initially flat before it is inserted into the frame. (*Id.*, ¶¶ 277). Therefore, it possesses a “first curvature,” as construed above, when it is not configured in the frame assembly. (*Id.*, ¶ 278). Panel 10 then is adhered to the mounting surface on the lower portion of frame 1 via the bonding layer. (*Id.*, ¶ 279). Thus, assembly of panel 10 into frame 1 applies a bending force to panel 10, which induces panel 10 to curve according to the slope of the mounting surfaces along both directions A_x , A_y . (*Id.*). Panel 10 accordingly also has a “second curvature greater than the first curvature” after the glass is configured in the frame assembly. (*Id.*, ¶ 280).

IX. DISCRETIONARY DENIAL IS UNWARRANTED UNDER § 325(D)

The invalidity grounds herein are not cumulative with the prior examination. In particular, during prosecution, the Examiner originally cited Kukulj (Ex-1020) as disclosing inducing curvature. (Ex-1016, 168-179). However, the Examiner subsequently conceded that Kukulj lacked such disclosure and instead cited Christiansson (Ex-1021), specifically paragraph 77 therein, for that limitation. (Ex-1016, 247-252). However, while Christiansson generically disclosed that a plate could be flat or curved, Christiansson lacked any disclosure of **inducing** curvature as required by the then-pending claims. (*See* Ex-1021, ¶ 71).

Following those rejections and an interview, the claims were amended via Examiner's amendment to require, *inter alia*, that “configuring the frame assembly to support the plate includes inducing a parabolic curvature in the touch surface relative to a first axis and relative to a second axis perpendicular to the first axis.” (Ex-1016, 683-684, 689) (amendments underlined). The claims were allowed with the Examiner noting that the this amended subject matter was not found in the prior art in combination with the other claim limitations. (*Id.*, 673-675, 680).

Contrary to the art considered during prosecution, both Shin and Zhao relied upon herein expressly disclose the step of inducing curvature in a plate, (*see, e.g.*, Ex-1002, ¶ 71, 206), which the Examiner indicated was not located in his prior art

analysis. As such, those references, which were not considered during prosecution, are highly relevant and not cumulative.⁶

Second, the Examiner allowed the claims after they were amended to require a “parabolic” curvature, which also was noted as not being found in the prior art. (Ex-1016, 673-675, 680, 684). Although Han was cited in an IDS during prosecution, Han was one of over 700 references before the Examiner. *See Amgen Inc. v. Alexion Pharm., Inc.*, IPR2019-00740, Paper 15 at 65 (PTAB Aug. 30, 2019) (“The Board has consistently declined exercising its discretion under Section 325(d) when the only fact a Patent Owner can point to is that a reference was disclosed to the Examiner during the prosecution.”); *Commscope Techs. LLC v. Dali Wireless Inc.*, IPR2020-01473, Paper at 12-16 (PTAB March 12, 2016) (refusing to deny institution over a reference in the file history that was not relied upon by the Examiner and was shown to be material in the IPR arguments). Here, the Examiner failed to identify that Han, or any other reference, disclosed the claimed parabolic

⁶ *Alcatel-Lucent USA Inc. v. Oyster Optics, LLC*, IPR2017-02146, Paper 12 at 12-13 (PTAB Feb. 28, 2018) (explaining a petitioner does bear the burden to distinguish all ninety-six references cited during prosecution); *see also Comcast Cable Commn’cs, LLC v. Promptu Sys. Corp.*, IPR2018-00342, Paper 13 at 19 (PTAB July 19, 2018).

curvature in the plate of a touch-sensing device. However, as shown above, Han includes such disclosure, and such oversight during prosecution was highly material. *See Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (precedential) (“if the record of the Office’s previous consideration of the art is not well developed or silent, then a petitioner may show the Office erred by overlooking something persuasive”); *id.* at 8 n.9 (“An example of a material error may include misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims.”); *accord Skechers U.S.A., Inc. v. Nike, Inc.*, IPR-2021-00160, Paper 10 at 19-20 (PTAB May 19, 2021) (petitioner demonstrated material error by demonstrating a “reasonable likelihood of prevailing” in its anticipation argument regarding a reference cited in an IDS but not substantively considered by the Examiner).

In sum, this Petition presents prior art (including Shin-845 and Zhao), arguments, and evidence that were not before the Examiner, and the Examiner further materially erred in overlooking the parabolic curvature taught by Han. As such, discretion should not be exercised to deny institution.

X. DISCRETIONARY DENIAL IS UNWARRANTED AND IMPROPER UNDER § 314(A)

Petitioner respectfully asserts that the guidance set forth in *NHK/Fintiv* (1) is beyond the scope of the Board’s statutory authority; (2) was adopted without

requisite notice-and-comment rulemaking; and (3) is arbitrary and capricious, such that discretionary denial is improper. 5 U.S.C. §§ 706(2)(A) and (C). However, even if considered, institution remains warranted as set forth below.

A. FACTOR 1 (STAY POSSIBILITY) IS NEUTRAL

Neither party has requested a stay, and this factor is neutral. *See Sand Revolution II, LLC v. Cont'l Intermodal Grp.–Trucking LLC*, IPR2019-01393, Paper 24 at 7 (June 16, 2020) (informative).

B. FACTOR 2 (TRIAL PROXIMITY) IS NEUTRAL

This factor concerns *proximity* to trial. Here, the final written decision (FWD) deadline is approximately six months after the currently-scheduled trial in December 2022, which was set in the original scheduling order and has not yet been extended. (Ex-1019). Such close proximity renders this factor neutral. For example, the Board has found a trial date five months before the FWD was “in relatively close proximity to the expected final decision” and insufficient to deny institution. *See Sand Revolution*, IPR2019-01393, Paper 24, 8-9; *see also Tennant Co. v. Oxygenator Water Techs., Inc.*, IPR2021-00625, Paper 9 at 13 (PTAB Aug. 20, 2021) (noting a projected FWD five months after the district court trial-ready date only weighed “somewhat” in favor of denial).

Furthermore, the trial date here is inherently uncertain, which weighs in favor of institution. *See In re Apple Inc.*, 979 F.3d 1332, 1344 n.5 (Fed. Cir. 2020) (noting

that considering trial scheduling “frequently calls for speculation” because even “scheduled trial dates are often subject to change”); *Apple Inc. v. Koss Corp.*, IPR2021-00255, Paper 22 at 11-12 (PTAB Aug. 23, 2021) (noting a scheduled trial date is speculative, giving this factor minimal weight, and declining discretionary denial when the trial date was two months before the expected FWD). According to an article, in the District of Delaware, “**100%** of the cases denied by the PTAB for an earlier trial date have been rescheduled – anywhere from 4 to 6 months.” (Ex-1017) (emphasis added). The average rescheduled trial date has been 138 days later and the maximum time for rescheduling has been 166 days, which has likely increased following the pandemic. (*Id.*) By contrast, the Board has adhered to the one-year statutory deadline for FWDs throughout the pandemic. *Sand Revolution*, IPR2019-01393, Paper 24 at 9.

C. FACTOR 3 (RELATED PROCEEDING INVESTMENT) FAVORS INSTITUTION

As of this filing, the parties have provided discovery responses and produced some documents, served preliminary contentions, and participated in claim construction briefing and a claim construction hearing. However, claim construction briefing was limited to ten claim terms concerning two patents with the acknowledgement that additional terms may require construction at a later stage of the case. (Ex-1018). Moreover, substantial efforts remain in the district court litigation, including additional fact discovery, depositions, third party discovery,

dispositive motions, expert reports, and expert discovery. As previously recognized, this posture weighs “only marginally, if at all,” in favor of denying institution. *See Sand Revolution*, IPR2019-01393, Paper 24 at 10-11 (explaining that infringement and invalidity contentions and a *Markman* hearing were completed but that “much of the district court’s investment relates to ancillary matters untethered to the validity issue itself” such that “much work remains in the district court case as it relates to invalidity: fact discovery is still ongoing, expert reports are not yet due, and substantive motion practice is yet to come”); *accord Tennant Co.*, IPR2021-00625, Paper 9 at 13-15.

Furthermore, Petitioner acted diligently in filing this Petition. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 11-12 (PTAB March 20, 2020) (considering diligence). Patent Owner originally asserted other three patents against Petitioner, and Petitioner expended significant resources defending against those claims. After developing non-infringement and invalidity positions against these patents, Patent Owner abandoned those allegations, disclaimed those three patents, and then filed an amended complaint asserting the ‘935 patent, which only issued in September 2020. (Ex-1022).

Despite having expended such efforts on the prior withdrawn patent claims, Petitioner filed this Petition approximately seven months after receiving Patent Owner’s *preliminary* infringement contentions in the lawsuit and less six months

after serving its *preliminary* invalidity contentions. And, as noted above, final contentions (with final asserted claims) are not due until January 2022. Ex-1019; *Apple Inc. v. Seven Networks, LLC*, IPR2020-00506, Paper 11 at 11 (PTAB. Sept. 1, 2020) (stating “the timing of the filing of this Petition slightly mitigates the investment in the District Court litigation” where the Petition was filed “over five months after [Petitioner’s] initial invalidity contentions were served”) (emphasis added). During that time, Petitioner reviewed a litany of prior art (as evidenced by the references cited on the ‘935 Patent alone) and prepared invalidity challenges on the two currently-asserted patents. Moreover, there have been no unnecessary efforts that would prejudice Patent Owner.

D. FOURTH FACTOR (ISSUE OVERLAP) FAVORS INSTITUTION

To mitigate potential overlap between the proceedings, Petitioner stipulates that, if IPR is instituted, Petitioner will not pursue the same grounds in the related litigation and also will not use Han, Cao, or Sasaki as a primary reference in any invalidity combination in the related litigation with respect to Claims 1-3. This stipulation is broader in scope to a stipulation the Board found “mitigates to some degree the concerns of duplicative efforts between the district court and the Board, as well as concerns of potentially conflicting decisions.” *Sand Revolution*, IPR2019-01393, Paper 24, at 11-12. Accordingly, this factor favors institution and weighs against discretionary denial.

E. FIFTH FACTOR (PARTIES) BEARS LITTLE WEIGHT

Petitioner and Patent Owner are the same parties in the Delaware litigation, but this factor only “weighs slightly in favor of denial.” *Church & Dwight Co., Inc. v. Randall Batinkoff*, IPR2020-00168, Paper 11 at 15-16 (PTAB May 15, 2020); *see also Cisco Sys., Inc. v. Ramot at Tel Aviv Univ. Ltd.*, IPR2020-00122, Paper 15 at 10-11 (PTAB May 15, 2020) (Crumbley, dissenting) (explaining this factor is neutral).

F. SIXTH FACTOR (MISCELLANEOUS) FAVORS INSTITUTION

Numerous other factors counsel against discretionarily denying institution. First, Patent Owner has at least one continuation application (Serial No. 16/989,292) pending. As previously noted, Patent Owner has asserted other patents against Petitioner and then withdrew those claims. A final written decision in this matter would bind the Patent Owner on prior art issues in further prosecution in a manner that does not apply after a civil trial. *See* 37 C.F.R. 42.73(d)(3)(i). Given the importance of such an estoppel for future conduct, particularly in light of Patent Owner’s efforts to serially assert patents against Petitioner, this factor weighs heavily in favor of institution.

Finally, Petitioner has presented strong grounds of invalidity herein, which favors institution. *See Fintiv*, Paper 11 at 14-16.

G. BALANCING FACTORS

Given the strong merits, substantial efforts remaining in the litigation, proximity to a speculative trial date, Patent Owner's serial patent assertions and pending continuation application, and the marginal examination of the issued patent claims during prosecution, discretion should not be exercised to deny institution.

XI. CONCLUSION

Based on the foregoing, Petitioner respectfully requests institution of an IPR proceeding and cancellation of claims 1-3.

Dated: October 16, 2021

Respectfully Submitted,

/Lloyd G. Farr/

Lloyd G. Farr

Registration No. 38,446

Counsel for Petitioners

CERTIFICATION UNDER 37 C.F.R. 42.24

Under the provisions of 37 CFR § 42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,632 words, which is less than the 14,000 allowed under 37 C.F.R. § 42.24(a)(1)(i).

Dated: October 16, 2021

Respectfully Submitted,

/Lloyd G. Farr/
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Registration No. 38,446

Counsel for Petitioners

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing, along with copies of Exhibit Nos. 1001-1022 and copies of Petitioner's powers of attorney, were served or are being simultaneously served on October 16, 2021 by sending a copy via Federal Express to the following:

Patent Owner's correspondence address of record:

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FOURTEENTH FLOOR
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Dated: October 16, 2021

Respectfully Submitted,

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