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Paper 38
Date: June 15, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

IPR2022-00300
Patent 7,952,570 B2

Before BARBARA A. PARVIS, SHEILA F. McSHANE, and JOHN D. HAMANN, *Administrative Patent Judges.*

HAMANN, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively "Petitioner") challenge the patentability of claims 1–20 and 22 ("the challenged claims") of U.S. Patent No. 7,952,570 B2 (Ex. 1001, "the '570 patent"), owned by Power2B, Inc. ("Patent Owner"). We have jurisdiction under 35 U.S.C. § 6 (2018). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 (2022). For the reasons discussed herein, we determine that Petitioner shows by a preponderance of the evidence that the challenged claims are unpatentable.

A. Procedural History

Petitioner filed a Petition requesting *inter partes* review of the challenged claims[1] of the '570 patent. Paper 3 ("Pet."). Patent Owner filed a Preliminary Response. Paper 7. With our authorization, Petitioner filed a Preliminary Reply (Paper 9) relating to whether Petitioner correctly identified an exhibit, and Patent Owner filed a Preliminary Sur-reply (Paper 10) in response to the Preliminary Reply. We instituted *inter partes* review of the challenged claims of the '570 patent on all of the grounds raised in the Petition. Paper 11 ("Dec. on Inst."), 34.

Following institution, Patent Owner filed a Response to the Petition. Paper 14 ("PO Resp."). Petitioner filed a Reply to Patent Owner's

[1] The Petition also challenged claim 21. Patent Owner, however, filed a statutory disclaimer for claim 21 prior to the issuance of our institution decision. Ex. 2001. Hence, we did not institute as to claim 21. 37 C.F.R. § 42.107(e) ("No *inter partes* review will be instituted based on disclaimed claims.").

Response. Paper 20 ("Pet. Reply"). Patent Owner filed a Sur-reply to Petitioner's Reply. Paper 25 ("PO Sur-reply").

An oral hearing was held on March 29, 2023. A transcript of the oral hearing is included in the record. Paper 37 ("Tr."). After the hearing, we authorized the parties to file additional briefing relating to claim construction. Paper 29. With this authorization, Petitioner and Patent Owner simultaneously filed opening claim construction briefs (Paper 30, "Pet. Open. Br.") and (Paper 31, "PO Open. Br."), and simultaneously filed responsive claim construction briefs (Paper 33, "Pet. Resp. Br.") and (Paper 32, "PO Resp. Br.").

B. Real Parties-in-Interest

The parties identify themselves as the real parties-in-interest. Pet. 1–2; Paper 5, 2.

C. Related Matters

The parties identify *Power2B Inc. v. Samsung Electronics Co.*, Case No. 2:21-cv-00348 (E.D. Tex.) as a matter that may affect, or be affected by, a decision in this proceeding. Paper 34, 1; Paper 5, 2. In addition, Petitioner has filed five petitions for *inter partes* review covering four additional patents that are related to the '570 patent: (i) U.S. Patent No. 10,664,070 B2 (IPR2022-00315); (ii) U.S. Patent No. 9,946,369 B2 (IPR2022-00325); (iii) U.S. Patent No. 8,816,994 B2 ("the '994 patent") (IPR2022-00334 and IPR2022-01378); and (4) U.S. Patent No. 8,547,364 B2 (IPR2022-00405). Paper 17, 1.

D. The Challenged Patent

The '570 patent relates to computer navigation and particularly, to facilitating navigation of software stored on an apparatus where its display is small. Ex. 1001, 1:3–6. According to the '570 patent, "[i]t is known to

provide small, hand-held computer devices such as pocket organisers, Personal Digital Assistants . . . , cellular phones or the like." *Id.* at 1:7–9. "Smaller devices are more easily carried and generally require a reduced power supply," however, "the reduced size forces a reduction in the size of the user interface, and particularly in the size of the screen or display used to display information or data stored on or processed by the device." *Id.* at 1:11–17. "Those familiar with such pocket devices will appreciate the problem of displaying all of the necessary information on a relatively small display, particularly where the user is able to select specific functions from a large number of options." *Id.* at 1:25–28.

The '570 patent discloses that "[c]onventionally, the selection of one option, for example, results in a new 'window' opening which displays further options and sub options." *Id.* at 1:28–30. And "devices having smaller screens tend to use data 'layers' or 'levels' whereby the selection of one option having a number of sub options causes the full screen to display the sub options fully eclipsing the original menu." *Id.* at 1:32–36. According to the '570 patent, "[i]t would be advantageous to provide a pocket computer or hand held device which incorporates means for enabling easier access to data on the device and improves the user interface of the device." *Id.* at 1:40–43. The '570 patent therefore discloses embodiments directed to enabling easier access. *See, e.g.*, *id.* at 1:44–67.

Figure 4, shown below, illustrates an embodiment of the '570 patent. *Id.* at 2:9–12.

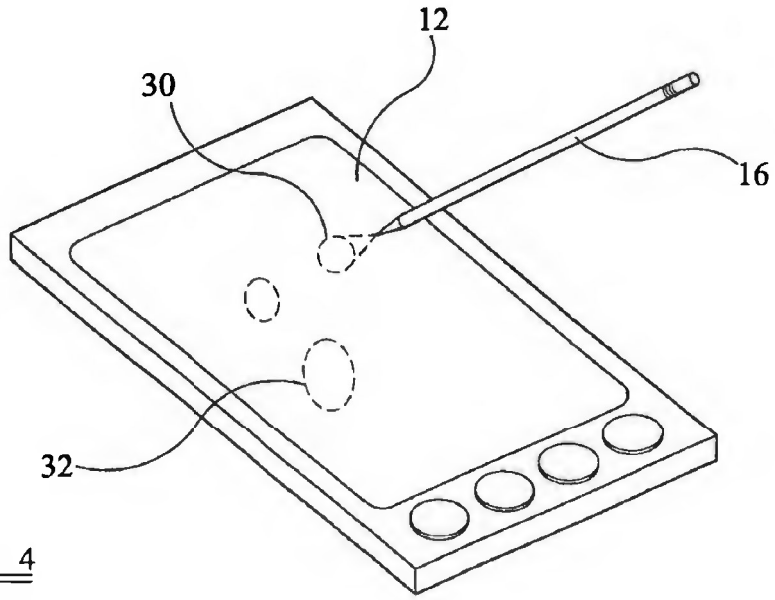

FIG 4

Figure 4 "shows illustratively one embodiment in which the stylus when moved closer to the display produces a circle or ellipse of smaller dimensions than the circle or ellipse formed when the stylus is moved away." *Id.* As illustrated, "the stylus 16 is a so-called 'smart stylus' which contains a source of electromagnetic radiation," and "emits a beam of light, for example infrared or other spectrum light, from a circular, spherical, or other shaped tip." *Id.* at 4:18–23. "The light is sensed by a sensitive layer (not shown) positioned over, or incorporate[d] in, the display 12." *Id.* at 4:23–25. The '570 patent discloses that "[a]s the stylus 16 is moved across the display 12, only certain parts of the sensitive layer will be illuminated by the beam of light emitted by the stylus 16 and this will be detected by the sensitive layer." *Id.* at 4:27–30. "The sensitive layer determines the appropriate X-Y coordinates of the stylus 16 . . . ." *Id.* at 4:30–31.

In addition, as illustrated, "[t]he stylus 16 when moved closer to the display produces a circle or ellipse 30 of smaller dimensions than the circle or ellipse 32 formed when the stylus is moved away." *Id.* at 4:34–37. According to the '570 patent, "[t]he same eccentricity of the ellipse means

that the input stylus is at the same angle to the display and the size of the area indicates the distance of the stylus from the display." *Id.* at 4:37–40. "In a different embodiment, . . . the device 10 is provided with a plurality of light sensors 20 positioned around the perimeter of the display 12 . . . such that as the stylus 16 moves towards or away from the display 12, different or segments or layers of the light sensors will be illuminated by the conical beam emitted by the stylus 16." *Id.* at 5:58–64.

E. Illustrative Claim

Among the challenged claims, claims 1, 20, and 22 are independent. Claim 1 is illustrative of the challenged claims, and reads as follows:

> 1. An electronic input device comprising:
> an input object wherein said input object includes a source of said electromagnetic radiation;
> an input area;
> a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object; and
> input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object; and
> wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

Ex. 1001, 7:28–45.

F. Instituted Grounds of Unpatentability

We instituted trial based on the following grounds of unpatentability, which are all the grounds of unpatentability raised in the Petition:

Claim(s) Challenged	35 U.S.C. §[2]	Reference(s)/Basis
1, 2, 9, 10, 12, 13, 16, 18–20, 22	103(a)	Bird,[3] Ishii[4]
3–8, 11, 15	103(a)	Bird, Ishii, Geva[5]
14, 17	103(a)	Bird, Ishii, Kameyama[6]
1–12, 15–20, 22	103(a)	Geaghan,[7] Ishii
13, 14	103(a)	Geaghan, Ishii, Kameyama

Pet. 3–4, 27–73. Petitioner submits in support of its arguments the Declaration of Benjamin B. Bederson (Ex. 1002). Patent Owner submits in support of its arguments the Declaration of Darran R. Cairns, Ph.D. (Ex. 2020).

II. LEVEL OF ORDINARY SKILL IN THE ART

To determine whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). In assessing the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citing

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[2] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '570 patent issued from an application having an effective filing date before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability.
[3] US 5,959,617, issued Sept. 28, 1999 (Ex. 1009, "Bird").
[4] EP 0572182 B1, issued Sept. 20, 2000 (Ex. 1010, "Ishii").
[5] GB 2299856 A, published Oct. 16, 1996 (Ex. 1011, "Geva").
[6] JP H05-265637, published Oct. 15, 1993 (Ex. 1012, "Kameyama").
[7] US 2005/0110781 A1, published May 26, 2005 (Ex. 1013, "Geaghan").

Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 962–63 (Fed. Cir. 1986)). "[O]ne or more factors may predominate." *Id.*

In our Decision on Institution, we adopted the following definition for one having ordinary skill in the art at the time of the invention of the '570 patent: one who "would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and . . . two years of experience in the research, design, development, and/or testing of touch and/or proximity sensors, human-machine interaction and interfaces, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa." Dec. on Inst. 12 (quoting Pet. 5 (citing Ex. 1002 ¶ 46)). This definition mirrors what Petitioner proposed, except we excised the phrase "at least" which modified the years of experience as that language is vague and open-ended. *Id.*

Patent Owner proposes a different definition for one of ordinary skill in the art, but does not specifically address any deficiencies in Petitioner's proposed definition. PO Resp. 15.

Because Petitioner's definition of the level of skill in the art (excluding "at least") is consistent with the '570 patent and the asserted prior art, we maintain it for purposes of this Final Written Decision. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *GPAC*, 57 F.3d at 1579; *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978). Our analysis herein, however, does not turn on which of the parties' definitions we adopt.

III. CLAIM CONSTRUCTION

Because the Petition was filed after November 13, 2018, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). In

applying such standard, claim terms are generally given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art, at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

The parties agree for this proceeding that the terms of the claims have their plain and ordinary meaning. *See, e.g.*, Pet. 15; PO Resp. 15. However, the parties' arguments about whether the prior art teaches the challenged claims show that the parties dispute what is the plain and ordinary meaning of "input area," as recited in independent claim 1 and other challenged claims. *See, e.g.*, Pet. 29–31; PO Resp. 22–37; Pet. Reply 1–5; PO Sur-reply 14–19. Thus, we need to resolve this dispute. *See Eon Corp. IP Holdings v. Silver Spring Networks*, 815 F.3d 1314, 1318 (Fed. Cir. 2016) (finding that disputes between the parties over the plain and ordinary meaning of a term should be resolved as a matter of claim construction). To that end, after the oral hearing, we authorized additional briefing concerning how to construe "input area." Paper 29, 2–3.

Below, we address (i) Patent Owner's arguments that authorizing this additional briefing was improper, and (ii) the parties' arguments concerning how to construe "input area."

A. Authorizing Additional Briefing

In our Order authorizing additional briefing, we provided our reasoning for doing so. Paper 29, 2. In particular, we stated the following:

> In their initial papers, the parties submitted that no terms require an express construction. Paper 3 (Pet.) 15; Paper 14 (PO Resp.) 15.
>
> The parties' responsive papers, however, dispute what is the plain and ordinary meaning of "input area," when used in the challenged claims. *E.g.*, Paper 20 (Pet. Reply) 1–5; Paper 25 (PO Sur-reply) 14–19. In light of this dispute, and based on arguments presented at the oral hearing, we determine that additional briefing may be helpful to the Board. Specifically, we authorize additional briefing for the parties to address what is the plain and ordinary meaning of "input area," in the context of the challenged claims.

Id. By allowing additional briefing regarding claim construction we better ensured that the parties would be afforded an opportunity to fully address their dispute as to the plain and ordinary meaning of "input area" before we issued this Final Written Decision. *See Belden, Inc. v Berk-Tek LLC*, 805 F.3d 1064, 1080–82 (Fed. Cir. 2015); *TQ Delta, LLC v. DISH Network LLC*, 929 F.3d 1350, 1355–56 (Fed. Cir. 2019).

And we agree with Petitioner that additional briefing "is routine Board practice to resolve claim construction disputes that become apparent from the parties' papers or the hearing." Pet. Resp. Br. 2–3 (citing *Microsoft Corp. v. D3D Techs.*, IPR2021-00878, Paper 39 at 2–3 (PTAB Nov. 8, 2022); *Volkswagen Gp. of Am., Inc. v. Stratosaudio, Inc.*, IPR2021-00721, Paper 63 at 40 (PTAB Jan. 24, 2023); *Dell Techs. Inc. v. WSOU Invests., LLC*, IPR2021-00272, Paper 30 at 2 (PTAB June 27, 2022)).

We find unavailing Patent Owner's argument that "Petitioner failed at the outset to bear its burden to identify with particularity how to construe" input area. PO Open. Br. 1. Rather, Petitioner states that it "interprets the claims of the '570 [p]atent according to the *Phillips* claim construction standard," and that "[t]o resolve the particular grounds presented in this

Petition, Petitioner does not believe that any other term requires explicit construction." Pet. 15. This is sufficient, and is consistent with our Consolidated Trial Practice Guide (Nov. 2019) ("CTPG").[8]

> If a petitioner believes that a claim term requires an express construction, the petitioner must include a statement identifying a proposed construction of the particular term and where the intrinsic and/or extrinsic evidence supports that meaning. On the other hand, a petitioner may include a statement that the claim terms require no express construction.

CTPG, 44. In other words, by stating that no terms require an explicit construction, Petitioner complied with 37 C.F.R. § 42.104(b)(3) as to "[h]ow the challenged claim[s are] to be construed."

In sum, we determine that allowing additional briefing on the construction of "input area" was appropriate.

B. Plain Meaning of Input Area

Petitioner provides two constructions for "input area." First, Petitioner argues that the plain and ordinary meaning of "input area" "is the *area onto which the input object directs electromagnetic radiation*." Pet. Open. Br. 1. Second, Petitioner argues that "an 'input area' is an area for input, regardless of any relationship that 'input area' may or may not have with a 'display.'" Pet. Reply 2.

Patent Owner argues that "in the relevant context, the plain meaning of the claimed 'input area' refers to the coextensive display input area or the integrated display itself." PO Resp. Br. 1–2, 4; *see also id.* at 4 (same). Patent Owner also argues that one of ordinary skill in the art "would have understood the plain meaning of the standalone 'input area' term refers to an

[8] *Available at* https://www.uspto.gov/TrialPracticeGuideConsolidated.

integrated or coextensive display itself." PO Open. Br. 6 . From what we can gather from how Patent Owner uses these terms in its papers, (i) "coextensive display input area," (ii) "integrated display itself," and (iii) "coextensive display itself" all mean having an input area and display that are coextensive—which we gather is synonymous with integrated—without having sensors therein.[9] PO Open. Br. 6; PO Resp. Br. 1–2, 4. Patent Owner does not explain what, if any, difference there is in these terms for input area.

In addition, Patent Owner argues that "[t]he relevant context for construing the claimed 'input area' relates to integrated or coextensive input displays." PO Open. Br. 4. Patent Owner faults Petitioner for "not explain[ing] why it would be incorrect, 'contrary to claim construction principles,' 'confusing,' 'irreconcilable,' 'an unproductive side-show,' or 'not necessary' to interpret the meaning of the 'input area' in the relevant context of the asserted integrated display teachings." PO Resp. Br. 3 (citing Pet. Open. Br. 1, 3, 5–6).

We find Patent Owner's arguments about the relevant context unavailing. The meaning of a claim term should not change based on what art is asserted against it. Below we apply a *Phillips* based analysis in construing "input area." And we address the parties' arguments, starting with the intrinsic evidence.

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[9] In contrast, Patent Owner appears to use the terms "integrated input display" and "coextensive input display" to mean that the input area and display are coextensive, and sensors *are* contained within their area. PO Open. Br. 7; PO Resp. Br. 1–2, 4. We find that these terms are confusingly similar to the terms Patent Owner uses for "input area," which does not have sensors therein.

1. Claim Language

Petitioner argues that "'[i]nput area' is not defined, but the surrounding claim limitations make plain its meaning." Pet. Open. Br. 1–2 (citing *Phillips*, 415 F.3d at 1314). More specifically, Petitioner argues that claim 1 recites: (i) an "input object . . . [that] includes a source of electromagnetic radiation," (ii) "'an input area' and 'a sensor array' outside of it," and (iii) that "[t]he sensor array 'sense[s]' the 'radiation pattern *on* said input area *produced by* said input object.'" *Id.* at 2 (quoting Ex. 1001, 7:28–45) (alterations in original). Petitioner argues "[t]he input object thus directs radiation onto a specific area—the 'input area' is this 'area onto which the radiation is directed.'" *Id.* "Thus, the claims are plain, unambiguous, and internally consistent: the 'input object' directs input radiation onto an area (the 'input area'), a sensor array outside the input area senses the input radiation on the input area." *Id.*

Patent Owner does not explain specifically how the language of claim 1 supports its proposed construction that input area means "coextensive display input area," "integrated display itself," and "coextensive display itself." Rather, Patent Owner argues that Petitioner's first proposed meaning for "input area" has "an unbounded *radiation area*." PO Resp. Br. 4. In particular, Patent Owner argues that "this radiation/'input area' is ambiguous or 'variable' as a matter of 'basic physics' because the area changes according to the distance from the radiation source." *Id.* (citing Ex. 1002 ¶¶ 78–80; Ex. 1001, 7:66–8:6).

We agree with Petitioner that the language of claim 1 supports its proposed construction of the "area onto which the input object directs electromagnetic radiation." In particular, claim 1 recites (i) an input object that has a source of electromagnetic radiation, (ii) an input area, and (iii) a

sensor array to sense an electromagnetic radiation pattern on the input area produced by the input object. Ex. 1001, 7:28–45. Taken together, this claim language is consistent with this proposed meaning for input area. *Id.*

We agree, however, with Patent Owner that this proposed meaning has ambiguity, but not for the reason Patent Owner advances.[10] Rather, Petitioner leaves unstated that this area is "for input." PO Open. Br. 1. Thus, any area—including areas away from the device—onto which the input object directs electromagnetic radiation arguably falls within its scope.

The language of claim 1 that we discuss above also supports the first part of Petitioner's second proposed construction (i.e., "an 'input area' is an area for input"). Ex. 1001, 7:28–45; Pet. Reply 2. We find that this meaning is sufficient for purposes of this Final Written Decision, and we now turn to the parties' dispute over whether "input area" must include a display. *See Realtime Data, LLC v. Iancu,* 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner argues that "claim 1 has no 'display,'" which "is only added in dependent claim 2." Pet. Open. Br. 3; Pet. Reply 2. Claim 2 recites "[a]n electronic input device according to claim 1 and also comprising a display providing a visually sensible output which is responsive to said electronic input." Ex. 1001, 7:46–48. Petitioner adds that "[d]isplay areas and input

[10] Patent Owner's argument that the area changes according to the distance from the radiation source incorrectly is directed to particular instances of the input object being used, rather than the total area of the device available for use for input by the input object. PO Resp. Br. 4.

areas are two distinctly described and claimed concepts," and that "[a] construction that couples displays and input areas is contrary to claim construction principles." Pet. Open. Br. 3.

We agree with Petitioner and find that the language of claim 1 does not recite a display, which is added by dependent claim 2. *Compare* Ex. 1001, 7:28–45, *with id.* at 7:46–48. Hence, we determine that the language of the claims also supports that the meaning of input area is not impacted by "any relationship that 'input area' may or may not have with a 'display.'" *See* Pet. Reply 2; *Phillips*, 415 F.3d at 1315 ("[T]he presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim."); *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004) ("[W]here the limitation that is sought to be 'read into' an independent claim already appears in a dependent claim, the doctrine of claim differentiation is at its strongest.").

2. The '570 Patent Specification

The parties agree that the Specification does not use the term "input area." The parties also agree that the '570 patent discloses embodiments having a coextensive input area and display. *E.g.*, Pet. Reply 3; Pet. Open. Br. 2–3; PO Sur-reply 14–16. And some of these embodiments have sensors within the coextensive input area and display (e.g., Fig. 4), and some have the sensors positioned outside of the coextensive input area and display (e.g., Fig. 3). Ex. 1001, Figs. 3–4; Pet. Reply 2–3.

Notably, the '570 patent also teaches an embodiment having an input area and no display. In particular, the '570 patent discloses the following:

> While the above described embodiments talk of sensing the position of the stylus 16 relative to the display 12 of the

> device 10, it will be appreciated that the three dimensional position of the stylus 16 relative to any other part of the device 10 or relative to any fixed location could be used for the same purpose. In this regard, the invention may provide only a stylus 16 and a sensing "pad" or the like which is able to determine the three dimensional position of the stylus 16 relative thereto. The pad could be connected for communication with the electronic device 10 by any suitable means which will be well understood. Such an embodiment may enable the stylus 16 and "pad" to be used with conventional desk top or laptop computers in place of the more conventional mouse, scratch pad or tracker ball.

Ex. 1001, 6:58–7:4. In other words, the '570 patent discloses, in accordance with its invention, providing only a stylus and a sensing pad—without a display—to determine the three dimensional position of the stylus for uses such as a mouse. *Id.*

Patent Owner's proposed construction for input area, which includes a display, would exclude embodiments following this sensing pad teaching, which cuts against Patent Owner's proposed construction. *See SynQor, Inc. v. Artesyn Techs., Inc.*, 709 F.3d 1365, 1378–79 (Fed. Cir. 2013) ("A claim construction that 'excludes the preferred embodiment is rarely, if ever, correct and would require highly persuasive evidentiary support.'").

In sum, we determine that the '570 patent Specification supports Petitioner's proposed construction that whether there is a display is immaterial to the meaning of input area. In other words, "input area" does not require, nor preclude, a display, coextensive or otherwise.

3. Prosecution History

We now turn to the prosecution history of the '570 patent, and discuss portions thereof relevant to the construction of input area. The prosecution history "can often inform the meaning of the claim language by

demonstrating how the inventor understood the invention." *Phillips*, 415 F.3d at 1317. Such is the case here.

The claims as filed did not recite an "input area." Ex. 2022 ('570 file history), 14. Rather, claim 1 recited, in relevant part, a "sensor array operative to sense . . . an electromagnetic radiation pattern on said sensor array." *Id.* The Examiner rejected claim 1 as being anticipated by Bird. *Id.* at 342. As reflected by the Examiner in an interview summary, the Examiner and the applicant discussed amending claim 1 to "include a sensor array outside the display area." *Id.* at 387.

The applicant instead amended claim 1 by (i) adding "an input area," (ii) changing "radiation pattern on said sensor array" to "radiation pattern on said input area," and (iii) adding "said sensor array comprising at least one sensor positioned outside said input area." *Id.* at 390. The applicant stated that "[s]upport for the amendment is found, inter-alia, in Fig. 3 and the description thereof, specifically on page 9, lines 8–9 and in the paragraph bridging pages 10 and 11 of the application as filed." *Id.* at 396. Notably, this bridging paragraph is the paragraph we quote above that describes the sensing pad embodiment that has no display. *Compare id.* at 12–13, *with* Ex. 1001, 6:58–7:4; *see also* Pet. Resp. Br. 7. Hence, this supports that the input area need not include a display, contrary to Patent Owner's arguments.

In addition, we find unavailing Patent Owner's argument that the applicant canceling claim 4 at the same time as amending claim 1 to recite a sensor positioned outside the input area confirms that "input area" must include a display. *E.g.*, PO Sur-reply 18; *see also* PO Resp. 12, 27 (making same argument). Claim 4 recited "[a]n electronic input device according to claim 3 and wherein said display is generally coextensive with said sensor array." Ex. 2022, 14. We do not find this argument persuasive, especially

because claim 5 was canceled at the same time. *Id.* at 390. Claim 5 recited "[a]n electronic input device according to claim 3 and wherein said display is generally non-coextensive with said sensor array." *Id.* at 14. There would have been no reason to cancel claim 5 if the concern was over the sensor array location not being outside a coextensive display and input area because claim 5 already recited that the sensor array was "non-coextensive" with the display. *Id.* Simply put, whether a display is coextensive with an input area has nothing to do with where the sensors are located.

In sum, we determine that the prosecution history of the '570 patent supports Petitioner's proposed construction that whether there is a display is immaterial to the meaning of input area.

4. Extrinsic Evidence

Patent Owner extensively cites to the testimony of its Dr. Cairns in support of its arguments throughout its papers. We have reviewed the expert testimony Patent Owner cites, but we give it little, if any, weight in light of the clear disclosure of the intrinsic evidence. *See Wi-LAN, Inc. v. Apple Inc.*, 811 F.3d 455, 462 (Fed. Cir. 2016) (finding extrinsic evidence "is generally of less significance than the intrinsic record" in matters of claim construction); *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996) (finding that when "an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term[,] . . . it is improper to rely on extrinsic evidence").

In addition, we find unavailing Patent Owner's numerous arguments concerning purported admissions or agreements by Petitioner. First, we view these arguments as directed to extrinsic evidence, which is of less significance given the clear intrinsic evidence. *See Wi-LAN,* 811 F.3d at 462; *Vitronics Corp.*, 90 F.3d at 1583. Second, we agree with Petitioner and

find that there were no such admissions or agreements. *See, e.g.*, Pet. Resp. Br. 3–5 (refuting purported admissions and agreements).

5. Summary

We conclude that "input area" means an area for input, regardless of any relationship that input area may or may not have with a display.

IV. PRINCIPLES OF LAW

"In an [inter partes review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring inter partes review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of non-obviousness, if present.[11] *See Graham*, 383 U.S. at 17–18. When

[11] Patent Owner does not present arguments or evidence of such objective evidence of non-obviousness. *See generally* PO Resp.

evaluating a claim for obviousness, we also must "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

V. ALLEGED OBVIOUSNESS OVER BIRD AND ISHII

Petitioner argues that the combination of Bird and Ishii renders claims 1, 2, 9, 10, 12, 13, 16, 18–20, and 22 obvious. Pet. 3, 27–43. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders these claims obvious.

A. Summary of Bird

Bird "relates to a light pen input system comprising a light pen which emits a light beam and a light sensing device comprising a planar array of light sensing elements in rows and columns over which the light pen is moved, the light beam emitted from the light pen producing a light spot on the array which is sensed by the sensing elements." Ex. 1009, 1:4–10. Bird teaches that objects of its invention are "to provide a light pen input system which is capable of offering greater flexibility in use," and "in which the light pen offers more functionality." *Id.* at 2:13–18. Figure 1, shown below, illustrates an embodiment of Bird's invention. *Id.* at 3:40–41.

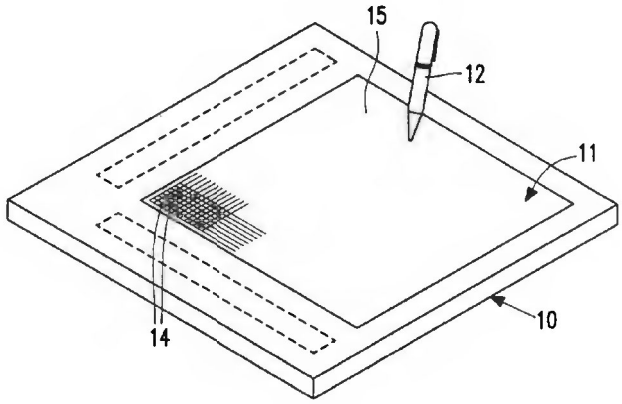

FIG. 1

Figure 1 "shows schematically an embodiment of a light pen input system according to the invention" of Bird. *Id.* As shown in Figure 1, Bird teaches a "system [which] comprises a light sensing device 10 which consists of a large area two-dimensional X-Y array of light sensing elements 14 defining a sensing area 11 having a writing surface over the surface of which a light pen 12 can be moved by a user to input information." *Id.* at 3:59–63. Bird teaches that "[t]he light sensing device can be of any known kind having a row and column, planar, array of light sensing elements." *Id.* at 4:12–13.

"In this particular embodiment [of Figure 1], the device 10 is of the type in which the light sensing element array is integrated in a liquid crystal display panel to form a single unit 15 providing input and display output functions." *Id.* at 4:15–19. "The sensing elements may comprise any suitable photosensitive device such as a photoresistor or photodiode." *Id.* at 4:14–15. Bird also teaches that instead "the light sensing element array may be of a kind which does not use a photoelectric device at each sensing element location but instead uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." *Id.* at 4:43–49.

Bird teaches that "light pen 12 includes a light source, for example an LED or a semiconductor laser." *Id.* at 4:51–52. "Light from the light source, which may be visible or non-visible, for example, infra-red light, is emitted from the pen in the form of a shaped light beam by optical means contained in the pen." *Id.* at 4:59–62. "The light beam emitted from the pen is such that with the pen, and thus the main optical axis of the emitted beam, perpendicular to the plane of the array, the light spot produced on the array by the beam in operation is substantially non-circular." *Id.* at 4:63–67. Bird teaches, for example, that "the shapes of the spots [can be] rectangular, elliptical, elongated (isosceles) triangular, ovoid, and non-rectangular parallelogram." *Id.* at 6:38–40.

Bird teaches that "[t]he light beam emitted by the light pen 12 causes a response in the sensing elements." *Id.* at 3:64–66. "The X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen are detectable . . . ." *Id.* at 2:40–44. Moreover, "[b]y monitoring the sensing elements outputs the changing pattern of illuminated elements can be detected and the direction of rotation of the beam determined, which information can then be used to provide functionality in addition to that obtained in the conventional manner of use merely by moving the light pen over the array and sensing the pen's position on the array in two coordinates." *Id.* at 5:65–6:5.

B. Summary of Ishii

Ishii "relates to a display unit of an input integral type for a handwriting input used in an office automation (OA) equipment and an audio visual device." Ex. 1010 ¶ 1. Ishii's invention provides "a display unit having a liquid crystal display panel and an input means[,] the liquid

crystal display panel comprising two substrates, . . . wherein the input means comprises signal conductors arranged in a matrix of X-conductors and Y-conductors . . . [that] are optical waveguides for guiding light parallel to the surfaces of the substrates." *Id.* ¶ 23. The waveguides are "formed in the shape of a matrix and approximately guide[] light having a predetermined wavelength in parallel with a surface of a display substrate," and thus, "the position of an optical pen can be detected by an inputting operation thereof." *Id.* ¶ 24.

C. Challenged Claim 1

1. Electronic Input Device (Preamble)

Petitioner argues that Bird teaches "[a]n electronic input device," as recited in the preamble of claim 1. Pet. 28. More specifically, Petitioner argues that Bird teaches an electronic input device as "light sensing device 10." *Id.* (citing Ex. 1009, 3:59–60, Fig. 1; Ex. 1002 ¶¶ 105–106).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Bird teaches "[a]n electronic input device." In light of our finding, we need not, and thus do not, reach whether claim 1's preamble is limiting.

2. Input Object

Petitioner argues that Bird teaches "an input object wherein said input object includes a source of said electromagnetic radiation," as recited in claim 1. Pet. 28–29. More specifically, Petitioner argues that Bird teaches "'light pen 12' that is an input object used by a user to input information." *Id.* (citing Ex. 1009, 3:62–63). Petitioner argues that "[t]he light pen includes a light source such as 'an LED or a semiconductor laser' and a power supply for the light source." *Id.* at 29 (citing Ex. 1009, 4:51–52).

According to Petitioner, Bird teaches that "[a] light source is a source of electromagnetic radiation." *Id.* (citing Ex. 1009, 1:58–60).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Bird teaches "an input object wherein said input object includes a source of said electromagnetic radiation."

3. Input Area

Claim 1 further recites "an input area." Ex. 1001, 7:31. We agree with Petitioner and find that Bird and Ishii teach this limitation. Pet. 29–31; Pet. Reply 7–14.

In particular, we agree with Petitioner and find that Bird teaches "a large area two-dimensional X-Y array of light sensing elements 14 defining a sensing area 11 having a writing surface over the surface of which a light pen 12 can be moved by a user to input information." Ex. 1009, 3:59–63, Fig. 1; Pet. 29. We also agree with Petitioner and find that Bird teaches that "[t]he light sensing element array may be of a kind which . . . uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements," as described in Ishii. Ex. 1009, 4:43–50; Pet. 30.

And we find that Ishii teaches forming optical waveguides in an X direction on a substrate and in a Y direction on another substrate such that the waveguides cross. *E.g.*, Ex. 1010 ¶ 47, Fig. 9. Put differently, Ishii teaches providing "input means compris[ing] signal conductors arranged in a matrix of X-conductors and Y-conductors," where "the signal conductors are optical waveguides for guiding light parallel to the surfaces of the substrates." *Id.* ¶ 23; Pet. Reply 10.

In addition, we agree with Petitioner and find that in view of Bird's and Ishii's teachings, one of ordinary skill in the art would have understood that the waveguides[12] define the extent of the input area. Pet. 31; Ex. 1009, 3:59–63, 4:43–50; Ex. 1010 ¶¶ 23, 47, Fig. 9; Ex. 1002 ¶ 113. In addition, we find persuasive Dr. Bederson's testimony on this point as it is consistent with the references' teachings. *Compare* Ex. 1009, 3:59–63, 4:43–50 *and* Ex. 1010 ¶¶ 23, 47, Fig. 9, *with* Ex. 1002 ¶ 113.

We find unavailing Patent Owner's argument that Ishii's integrated input display is the input area. PO Sur-reply 22 & n.14. Arguments regarding a display—and whether the input area is coextensive with the display—are inapposite. *See supra* Section III.B (construing "input area").

We also find unavailing Patent Owner's argument that Petitioner's "argument that Ishii's 'optical waveguides define the extent of the input area' is based on Dr. Bederson's testimony that copies/pastes attorney argument." PO Resp. 36–37 (comparing Pet. 31 with Ex. 1002 ¶ 113); *see also id.* (citing Ex. 2020 ¶ 100) (arguing no evidence supports Petitioner's arguments). As we discuss above, we find that this testimony from Dr. Bederson is consistent with Bird's and Ishii's teachings. Moreover,

[12] To be abundantly clear, we refer to waveguides as Petitioner does, meaning only those portions of the waveguides that conduct light to their ends. As we discuss below, we view Bird's peripheral light sensors and photosensing circuits connected to the waveguides to be separate from, and not a part of, the waveguides. *See infra* Section V.C.4. Likewise, we view Ishii's photosensors and sensor portions as being separate from, and not a part of the waveguides, for purposes of the claim limitations. *Id.* In addition, certain of the parties' arguments implicate both the "input area" and "a sensor array positioned outside said input area" limitations, and we address such arguments below in that section addressing the latter limitation. *Id.*

Dr. Bederson further supports this testimony by citing to portions of Ishii that discuss, *inter alia*, waveguides and how they relate to the sensor portions. *See* Ex. 1002 ¶ 113 (citing Ex. 1010 ¶¶ 45, 51, Fig. 9).

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii teaches "an input area."

4. Sensor Array Positioned Outside Said Input Area

Claim 1 further recites "a sensor array positioned outside said input area." Ex. 1001, 7:32. We agree with Petitioner and find that the combination of Bird and Ishii teaches this limitation. Pet. 30–31; Pet. Reply 6–14.

In particular, we agree with Petitioner and find that Bird teaches an embodiment that has a light sensing element array that "uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." Ex. 1009, 4:43–50. In other words, Bird teaches a sensor array (i.e., the peripheral light sensors) that is positioned outside the input area (i.e., the rows and columns of waveguides whose intersections constitute a planar array of light sensing elements). *Id.* Bird also teaches that an example of this light sensing element array is described by Ishii. *Id.*

Petitioner annotates Ishii's Figure 9, shown below, to address Ishii's teachings. Pet. 31.

Fig. 9

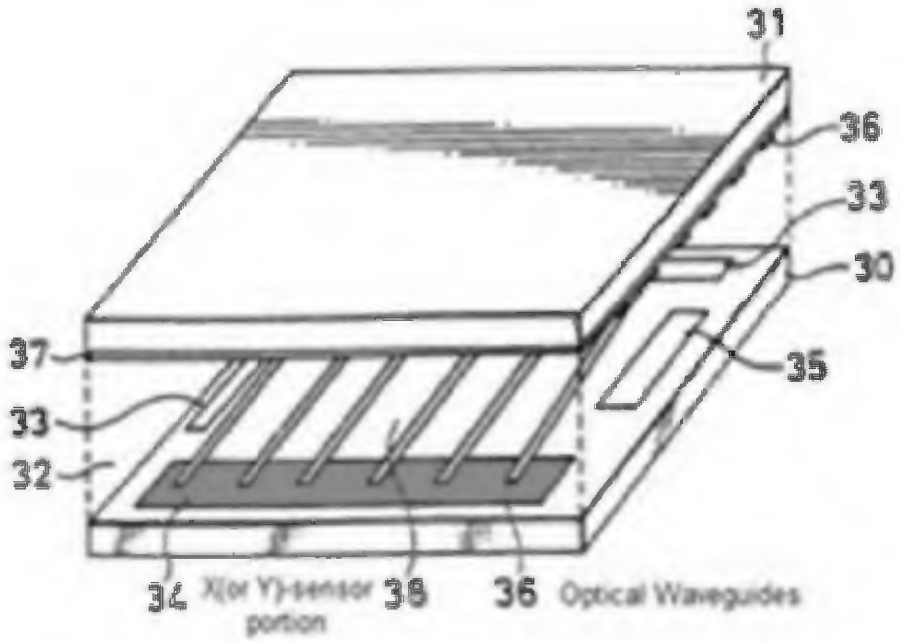

Figure 9 "is a perspective view showing a display unit of an input integral type in accordance with" Ishii's teachings. Ex. 1010 ¶ 27. As illustrated, "a silicon monocrystal substrate 30 and a glass substrate 31 are opposed to each other and a liquid crystal 32 is sealed into a clearance between the silicon monocrystal substrate 30 and the glass substrate 31." *Id.* ¶ 44. Ishii teaches that "[a]n optical waveguide in the Y or X direction is formed in the glass substrate 31 opposed to the silicon monocrystal substrate 30 such that this optical waveguide crosses the optical waveguide of the silicon monocrystal substrate 30." *Id.* ¶ 47. Figure 9 further illustrates "[a]n optical waveguide 36, an X(or Y)-sensor portion 34 and a Y(or X)-sensor portion 35 [which] are formed in an X or Y direction between the picture element electrode portions 38." *Id.* ¶ 45. Petitioner annotates the figure by (i) labeling reference numeral 34 with "X (or Y)-sensor portion" and coloring the portion in red, and (ii) coloring in orange the illustrated optical waveguides

on the silicon monocrystal substrate 30 and labeling the corresponding reference numeral 36 with "Optical Waveguides." Pet. 31 (annotating Ex. 1010, Fig. 9).

We agree with Petitioner and find that Ishii teaches that the sensor portions are positioned outside the input area. *Id.* at 30–31; Pet. Reply 7–12. In particular, Ishii teaches the following:

> A photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions. An end portion of the optical waveguide formed on the glass substrate in the Y or X direction is recessed or projected to leak light onto the silicon substrate. The photosensor on the silicon substrate is formed in a position for receiving this leaked light.

Ex. 1010 ¶ 51. In other words, Ishii teaches a sensor array (i.e., the photosensors in the X direction (sensor portion 34) and the photosensors in the Y direction (sensor portion 35)), which is positioned outside the input area (i.e., the photosensors are positioned at the end of the waveguides for receiving leaked light from the ends of the waveguides). *Id.* ¶¶ 45, 51, 53, 76–79, Fig. 9. Again, we find that the waveguides in Ishii correspond to the input area, and the sensor portions 34 and 35 are positioned at the end of the waveguides so that they can receive light that is leaked from the ends of the waveguides. *See supra* Section V.C.3 (finding that Bird and Ishii's waveguides teach the claimed input area); Ex. 1010 ¶¶ 51, 53, 76–79, Fig. 9.

We find persuasive the testimony of Dr. Bederson that one of ordinary skill in the art "would have understood that Ishii's photosensors . . . are at the end of each optical waveguides," and that "[t]hey are thus positioned . . . 'outside' . . . the input area," as we find this testimony is consistent with Ishii's teachings. *Compare* Ex. 1002 ¶ 113, *with* Ex. 1010 ¶¶ 45, 51, 78 ("A photosensor is formed on the silicon substrate in an end portion of the

optical waveguide and is connected to the optical waveguide on the silicon substrate in the X-axis direction through a light leaking portion."), 79 ("[A] light leaking portion is also formed by etching in an end portion of the optical waveguide on the glass substrate in the Y-axis direction," and "[a] photosensor on the silicon substrate is arranged below this light leaking portion and is opposed to this light leaking portion"), Fig. 9.

In addition, we find that Petitioner has provided sufficiently articulated reasoning with rational underpinning to support Petitioner's modifications of Bird with Ishii. *See Kahn*, 441 F.3d at 988. In particular, we agree with Petitioner and find that Bird expressly teaches employing Ishii's teaching of having sets of waveguides which conduct input light to peripheral light sensors. Ex. 1009, 4:46–50; Pet. 31. Hence, we also agree with Petitioner and find that one of ordinary skill in the art "would have found it obvious to follow this express teaching." Ex. 1002 ¶ 114.

We find unavailing Patent Owner's argument that "Petitioner argues waveguides are not sensors based on an incorrect distinction between electrical/optical components." PO Sur-reply 28 (citing Pet. Reply 6–7, 11–12). And we disagree with Patent Owner that "lightguides or waveguides *are* indeed sensors" in the context of the '570 patent. *Id.* As Bird and Ishii teach, "waveguides" and "light guides" just "conduct" or "guide" light to their ends. Ex. 1009, 1:28–31, 4:44–50; Ex. 1010 ¶¶ 23–24, 53, 58; *see also* Ex. 1042 (Cairns Depo.), 77:11–78:1 (testifying that light guides are "useful for moving light around"). In particular, Bird teaches that "[t]he sets of light guides are connected at their ends to respective photosensing circuits which produce an electrical signal in response to light being conducted thereto by the light guides." Ex. 1009, 1:28–31. Bird also teaches that the "sets of row and column light waveguides . . . conduct input light to *peripheral light*

sensors." *Id.* at 4:43–50 (emphasis added). Similarly, Ishii teaches that a photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in a position for receiving leaked light. Ex. 1010 ¶ 51. In other words, Bird's and Ishii's photosensing circuits or sensors sense the light, while the light guides or waveguides convey the light to the sensors. Ex. 1009, 1:28–31, 4:43–50; Ex. 1010 ¶¶ 51, 53.

This finding is consistent with the '570 patent's disclosures. For example, the '570 patent discloses that "light is sensed by a sensitive layer," which "may, for example, be in the form of a CCD or CMOS infrared sensitive array or the like." Ex. 1001, 4:23–27. We view this as teaching an array of CCD sensors or CMOS sensors forms the sensitive layer. *Id.* And CCD sensors and CMOS sensors produce an electrical signal in response to light. *See* Ex. 1025, 32 (explaining that a CMOS sensor is based on a transistor that is "inherently light sensitive" and that "the current through the transistor will be proportional to the light incident on it"); *see also id.* (explaining that a CCD sensor "work[s] by accumulating charge, proportional to the incident light, in an electronic 'bucket[,' which] must accumulate (or integrate) charge before it can be read out"). The '570 patent also discloses that a photodiode can be used to sense light—a photodiode is a photoelectric element. Ex. 1001, 4:41–44; Ex. 1009, 1:16–21 (stating that a photodiode is a photoelectric element for light sensing).

In addition, we find that Dr. Bederson's testimony on this issue is consistent with the claim language and the Specification. More specifically, we find persuasive Dr. Bederson's testimony that "[t]he Ishii system *collects*

light for sensing in the display area[13] which is different than the [']570 [p]atent which collects and senses light in the periphery of the display area.'" Ex. 1002 ¶ 113 (emphasis added); *see also* Ex. 1001, 6:3–15 (teaching having light sensing devices on two walls above the display that collect and sense light emitted from opposing light emitting devices). Notably, Dr. Bederson does not testify that Ishii teaches sensing light in the input area, but instead testifies that Ishii's photosensors are at the end of each optical waveguide, and are positioned outside the input area. Ex. 1002 ¶ 113.

We also find unavailing Patent Owner's argument that "Petitioner . . . fails to provide any constructions, evidence, or testimony to support the position that the claimed 'sensor array' structure cannot include multiple components." PO Sur-reply 32–33 (citing Ex. 2020 ¶¶ 90–91; Ex. 1042, 75:12–14, 79:14–23, 74:19–24). Patent Owner's attempt to create a broader "structure" to add components to the claimed sensor array is misplaced. As we find above, Bird's peripheral light sensors and Ishii's sensor portions, which constitute the array of photosensors at the end of the waveguides, teach the claimed sensor array. Ex. 1009, 4:44–50; Ex. 1010 ¶¶ 51, 53, 78–79, Fig. 9. As we also find above, the waveguides are distinct from the sensor array, and simply guide light to the sensor array. Ex. 1009, 1:28–31, 4:44–50; Ex. 1010 ¶¶ 53, 58, 78–79. Moreover, the claims use "comprising" as the transitional phrase, and thus, do not exclude having additional

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[13] Bird teaches also having a coextensive input area (i.e., waveguides) and display for its embodiment having peripheral light sensors. *See, e.g.*, Ex. 1009, Fig. 1; 4:43–50; *see also supra* Section V.C.3 (finding that Bird teaches the claimed input area). Hence, we view this testimony from Dr. Bederson referring to the display area as also referring to the input area for this embodiment. Ex. 1002 ¶ 113.

components from their scope. *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997). That the claims allow for additional components (e.g., waveguides, traces, electrical wires) does not mean that those additional components are part of the claimed components (e.g., a sensor array).

We also find unavailing Patent Owner's argument that Ishii teaches that "the photosensor portions are part of the same sensor array structure (optical waveguide) and are created during the waveguide fabrication process." PO Sur-reply 34 (citing Ex. 1010 ¶ 78; Ex. 1042, 79:14–23); *see also id.* at 27 (citing Ex. 1010 ¶¶ 71, 76–78; Ex. 1042, 72:6–73:14, 79:14–23, 75:12–14, 113:14–22, 114:4–15) (making same argument). In particular, Patent Owner argues that Ishii "teaches forming X-Y direction waveguides in between picture elements and then forming a 'photosensor' 'in an end portion of the optical waveguide' and connecting it 'to the optical waveguide on the silicon substrate . . . through a light leaking portion.'" *Id.* at 33–34 (quoting Ex. 1010 ¶ 78; citing Ex. 1010 ¶¶ 76–79) (alteration in original). In other words, Ishii "teaches forming photosensor circuits '***in***' ***each respective waveguide itself***," according to Patent Owner. PO Resp. Br. 6 (citing Ex. 1010 ¶¶ 43, 51, 53, 78). Patent Owner argues that "[t]he relative positions of these sub-structures inside respective waveguides do not matter," and that "Ishii's photosensing circuitry is an internal part of its waveguides/'sensor array.'" *Id.* at 7.

We disagree with Patent Owner. Ishii clearly refers to the photosensors as being "portions," which teaches that the photosensors are distinct from the other portions of the waveguide. Ex. 1010 ¶ 45 ("An optical waveguide 36, an X(or Y)-sensor portion 34 and a Y(or X)-sensor portion 35 are formed in an X or Y direction . . . ."). Moreover, as we

discuss above, waveguides conduct light to their ends and the photosensors sense the light—two separate functions. *E.g.*, *Id.* ¶ 58.

In addition, although Ishii teaches that "[a] photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions," Ishii also teaches that waveguides for a direction (e.g., the Y direction) are formed in the glass substrate, which is above the silicon substrate. *Id.* ¶¶ 47, 51, 78, Fig. 9. For these glass substrate waveguides, Ishii teaches that an end portion of the waveguide "is recessed or projected to leak light onto the silicon substrate" with "[a] photosensor on the silicon substrate . . . arranged below," and opposed to, this light leaking portion. *Id.* ¶¶ 51, 79. Hence, Ishii teaches that a waveguide's photosensor need not be physically part of the waveguide, which evidences that waveguides and photosensors are separate and distinct, and evidences that Ishii uses "formed in an end portion" broadly. *Id.* Moreover, Ishii teaches for the waveguides formed on the silicon substrate that their photosensors are formed in an end portion of the waveguides and are "connected" to the waveguides through a light leaking portion. *Id.* ¶ 78. Having a connection and an intervening portion also evidences that the photosensors and waveguides are separate. *Id.*

We also find unavailing Patent Owner's argument that Petitioner incorrectly "excludes the ends of Ishii's optical waveguides/photosensor circuits as if they would be prevented from receiving light over the corresponding portion of the display." PO Resp. Br. 7 (citing Pet. Open. Br. 7). According to Patent Owner, "Ishii's entire waveguide structure, including photosensor circuitry . . . directly receives and senses light over the entire coextensive display input area." *Id.* (citing Ex. 1010 ¶¶ 1, 62). Patent Owner, however, does not point to any portion of Bird or Ishii that

teaches that the photosensor circuitry or photosensors directly receive incident light. *Id.* To the contrary, Bird teaches that in Ishii the photosensing circuits sense light "conducted thereto by the light guides," rather than receiving incident light directly. Ex. 1009, 1:24–35; 4:43–50. Likewise, Ishii teaches that its photosensors received light leaked from the ends of the waveguides, rather than receiving incident light directly. Ex. 1010 ¶¶ 51, 78–79.

Regardless, Petitioner identifies the sets of waveguides as the input area, and Bird and Ishii teach that the photosensors are outside the waveguides. *See supra* Section V.C.3 (finding that Petitioner shows the claimed input area is taught); Ex. 1010 ¶¶ 51, 53, 78–79. This identification is consistent with Bird's and Ishii's teachings of sensing the light that falls on the waveguides' intersections (which represent two dimensions) to identify a lighted area. Ex. 1009, 1:24–35; Ex. 1010 ¶ 53. Purported light that falls directly on a photosensor would provide for identification of only one dimension, rather than an area.

We also find unavailing Patent Owner's argument that Bird's waveguides are sensors because "Bird states optical waveguides define '*sensing* elements' multiple times." PO Sur-reply 28 (citing Ex. 1009, 1:25–34, 4:43–50). Patent Owner overreads Bird's use of the phrase "sensing elements." *Id.* For Bird's embodiment employing peripheral sensors, the

phrase "sensing elements"[14] refers to a matrix or array of the intersections of the rows and columns of the waveguides. Ex. 1009, 1:25–34, 4:43–50. Bird referring to these intersections as sensing elements does not alter Bird's teaching that the waveguides conduct incident light to their ends for the peripheral light sensors to sense. *Id.* We focus on what Bird and Ishii teach as to functionality and structure of the waveguides (and their intersections), rather than what Bird calls the intersections (i.e., "sensing elements"). *Cf. In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a reference does not have to satisfy an *ipsis verbis* test to disclose a claimed element).

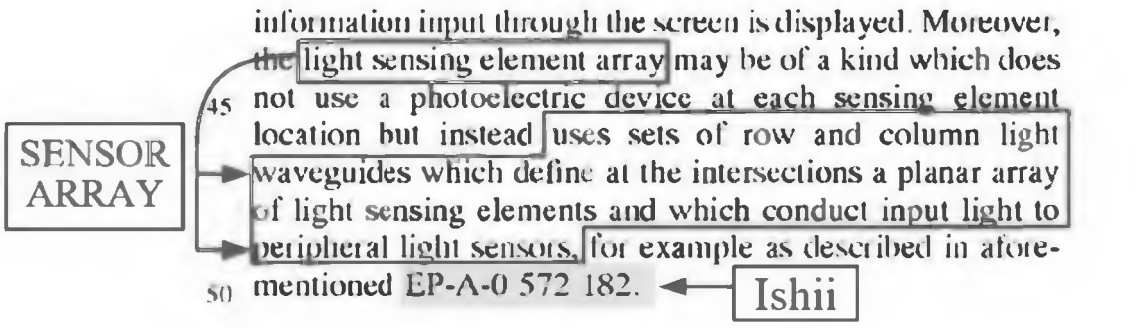
We also find unavailing Patent Owner's argument that waveguides are sensors in view of Ishii's teaching that "the position of an optical pen can be *detected by forming an optical waveguide* within a display panel." PO Sur-reply 28 (quoting Ex. 1010 ¶ 64; citing *id.* at code (54), ¶¶ 23, 77–79); *see also id.* at 33 (making same argument). This teaching relates to a handwritten character recognizing device, and the cited portion of Ishii does not explain how detection specifically occurs. Ex. 1010 ¶¶ 61–64. Moreover, for this embodiment, Ishii teaches "[a]n optical pen position detecting section 61 [which] detects a position of the optical pen on the display panel 60 on the basis of a signal transmitted from the display panel 60 in accordance with light from the optical pen." *Id.* ¶ 62. Patent Owner

[14] Bird also uses the term "sensing elements" in referring to other embodiments which instead use photosensitive devices (e.g., photoresistors or photodiodes) "arranged regularly-spaced in a row and column matrix array." *See, e.g.*, Ex. 1009, 3:59–4:6, 4:12–15, Fig. 1. Hence, in light of Bird's varied embodiments, we view Bird as using the term "sensing elements" broadly to teach arrays having elements for the light sensing devices, rather than teaching for all embodiments that the elements themselves are "sensing."

does not address this teaching. PO Sur-reply 28. In sum, Patent Owner overreads "detected by forming an optical waveguide" in arguing that this phrase teaches that waveguides are sensors. *Id.*

We also find unavailing Patent Owner's argument that Dr. Cairns explains that "lightguides or 'optical fibers' (as known in the industry are sensors, were widely used as sensors, 'certainly [one of ordinary skill in the art] would consider that optical fibers acted as sensors,' and 'people often call optical fiber "optical fiber sensors."'" *Id.* at 28–29 (quoting Ex. 1042, 72:6–73:14, 79:10–23; 75:12–14). We find this testimony unpersuasive because it is inconsistent with Bird's and Ishii's teachings of having the light guides guide light to photosensing circuits or sensors, which do the sensing. *See* Ex. 1009, 1:28–31, 4:43–50; Ex. 1010 ¶¶ 51, 53. This testimony also is inconsistent with the '570 patent's disclosures of employing an array of CCD sensors or CMOS sensors, or a photodiode, which produce an electrical signal in response to sensing the light. *See* Ex. 1001, 4:23–27, 4:41–44.

We also find unavailing Patent Owner's argument that "Bird's 'peripheral sensors' are actually within Ishii's planar array." PO Resp. 23 (citing Ex. 1009, 4:46–50; Ex. 2020 ¶ 74); *see also id.* at 33 (citing Ex. "202[0]" ¶ 94), 37 (making same argument). Similarly, Patent Owner argues that "Bird teaches Ishii's optical waveguides form 'a planar array of light sensing elements' that conduct light to peripheral portions *of the planar array itself*." *Id.* at 25–26 (citing Ex. 1009, 4:43–50, Ex. 1010 ¶ 45) (emphasis added). Patent Owner illustrates these arguments by annotating a passage from Bird, as shown below.



As illustrated, Patent Owner has excerpted lines 43–50 of column 4 from Bird, drawing a red outline around "light sensing element array" and a red outline around "uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." PO Sur-reply 27 (annotating Ex. 1009, 4:43–50). Patent Owner also draws in red an arrow from "light sensing array" to both "waveguides" and "peripheral light sensors," and labels such "sensor array." *Id.*

We disagree with Patent Owner and find that this passage does not teach that the peripheral light sensors are part of Bird's planar array. Rather, this passage clearly teaches that the "light sensing element array" is a planar array of light sensing elements, where each element is an intersection of a row and column of the sets of light waveguides. Ex. 1009, 4:43–50. The way the passage is structured (i.e., the sets of waveguides "which define" and "which conduct") shows that the passage teaches that the waveguides also "conduct input light to peripheral light sensors," rather than including the peripheral light sensors as part of the planar array. *Id.* Our reading of this passage is further supported by Bird's earlier description of Ishii:

> In [Ishii] two sets of optical light guides are provided extending in X and Y directions respectively, which define at their intersections a two-dimensional, X-Y, matrix of sensing elements. The sets of light guides are connected at their ends to

> respective photosensing circuits which produce an electrical signal in response to light being conducted thereto by the light guides.

Id. at 1:24–32. This description shows that defining a matrix (an array) of sensing elements, and teaching that light guides also are connected to photosensing circuits (sensors) are two separate concepts that should not be conflated, as Patent Owner does. *Id.*

We also find unavailing Patent Owner's arguments that relate to Bird's embodiments that have the sensors positioned in the input area. PO Resp. 27–28. Petitioner acknowledges that Bird teaches such embodiments, but Petitioner clearly relies on Bird's embodiment that employs peripheral sensors. *See, e.g.*, Pet. 30–31 (contrasting Bird's embodiment illustrated in Figure 1 with photosensitive devices as the matrix array's elements—which Petitioner does not rely on—with Bird's embodiment employing peripheral sensors, such as taught in Ishii). Thus, these arguments from Patent Owner are inapposite.

We also find unavailing Patent Owner's argument that Petitioner "reuses the words 'peripheral light sensors' throughout the Petition, but these words only appear in Bird, not in Ishii," and "attempt[s] to create a distinction between the sensor portions of Ishii's waveguides [which] is simply not supported by the evidence." PO Resp. 32 (citing Ex. 1009, 4:17–19[15]; Ex. 1010; Ex. 2020 ¶ 92). Rather, we find Bird's description of Ishii teaching peripheral light sensors to be correct. Ex. 1009, 4:43–50. In particular, Bird describes Ishii's light sensors as being peripheral to the sets of row and column waveguides which define at the intersections a planar

[15] From the context of Patent Owner's argument, we understand Patent Owner to be referring to lines 43–50 of column 4 of Ishii.

array of light sensing elements. *Id.* This is, in fact, what Ishii teaches. *See, e.g.*, Ex. 1010 ¶ 51 ("A photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions."), Fig. 9.

We also find unavailing Patent Owner's numerous arguments that incorrectly conflate *display* and *input area*. *See generally* PO Resp.; PO Sur-reply (weaving conflation of display and input area throughout many arguments). Simply put, arguments concerning a display (or display substrates) are inapposite to claim 1. *See supra* Section III.B (construing input area); *see also* Ex. 1001, 7:28–45 (reciting claim 1). For example, whether a device's display is coextensive with its input area is inapposite to claim 1. Ex. 1001, 7:28–45. Rather, claim 1 refers to "input area,"—not display—and the input area is of what "a sensor array [is] positioned outside." *Id.* at 7:32.

We also find unavailing Patent Owner's arguments concerning "parallax" problems. PO Resp. 28–29; PO Sur-reply 23–24. Patent Owner argues, for example, that "Ishii attempts to address parallax issues by disposing optical waveguides (and sensor portions), liquid crystal, picture element electrodes, and other circuitry *inside* its display substrates." PO Resp. 29 (citing Ex. 1010 ¶¶ 22–25, Fig. 9); *see also id.* (citing Ex. 2020 ¶ 87); Ex. 2020 ¶ 87 ("All of the structures shown in Figure 9 are clearly inside Ishii's display/input area itself."). Patent Owner adds that one of ordinary skill in the art "looking at Ishii's disclosures, Figure 5, and Figure 9 would have understood there is no clearance for the alleged 'peripheral sensors' to be anywhere but inside Ishii's display substrates or inside the input area." PO Resp. 29–30 (citing Ex. 2020 ¶¶ 85–86). These arguments are inapposite because they too relate to the "display" and Patent Owner's

incorrect conflating of input area and display to argue that the claims exclude having a coextensive display and input area. Again, as we discuss above, Patent Owner incorrectly excludes coextensive input areas and displays. *See supra* Section III.B (construing "input area"). Moreover, Ishii clearly teaches that the waveguides are within the display (hence addressing the parallax concerns) and that the photosensors are at the ends of the waveguides (i.e., outside the input area). Ex. 1010 ¶¶ 51, 53, 78–79, Fig. 9. Whether the photosensors are within the display substrates is immaterial.

Lastly, we agree with Patent Owner that Petitioner's reliance on the papers from the reexamination of the '994 patent is misplaced. PO Sur-reply 31 (citing Pet. Reply 4, 9, 12, 15; Ex. 1043 (Order Granting Request for *Ex Parte* Reexamination); Ex. 1045 (Office Action in *Ex Parte* Reexamination)). The reexamination process is ongoing and the office action is non-final. Ex. 1045, 1. Patent Owner submits that it is in the process of responding to the office action. PO Sur-reply 31–32. Accordingly, we do not rely on the papers from this reexamination.

We also do not rely on Patent Owner's definition of fiber-optic sensor obtained from Wikipedia, which Patent Owner provides for the first time by linking to the definition in its Sur-reply. *Id.* at 32. Such a link constitutes new evidence, which is not allowed for a Sur-reply. *See* CTPG 73 ("The sur-reply may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.").

In sum, we are persuaded by a preponderance of the evidence that Petitioner (i) demonstrates that the combination of Bird and Ishii teaches "a sensor array positioned outside said input area," and (ii) provides sufficiently articulated reasoning with rational underpinning to support Petitioner's combining of Bird's and Ishii's teachings for this limitation.

5. Operative to Sense and Provide an Output Indication

Claim 1 further recites that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object." Ex. 1001, 7:32–36. We agree with Petitioner and find that the combination of Bird and Ishii teaches this limitation. Pet. 31–34; Pet. Reply 14–15. First, we find that the combination of Bird and Ishii teaches that the sensor array is operative to sense and provide an output indication of a pattern's position. In particular, we find that Bird teaches sensing "[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen." Ex. 1009, 2:40–44. And we find that Ishii teaches that "X and Y coordinates of the [light incident to a] contact portion are determined by a photosensor located in each of X and Y positions of end portions of the optical waveguides." Ex. 1010 ¶ 53.

Second, we find that Bird teaches sensing orientation. More specifically, Bird teaches "rotation of the pen/light beam around its axis can readily be detected by virtue of different sensing elements 14 away from the centre of the spot becoming illuminated and non-illuminated during such rotation." Ex. 1009, 6:46–50; Fig. 5.

Third, we find that Bird teaches sensing the spot's "shape." *Id.* More specifically, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot if desired thus providing additional flexibility to an operator." *Id.* at 7:28–31.

Fourth, we find that Bird teaches sensing the "size" of the spot. More specifically, Bird teaches that "the size of the incident light spot on the array relative to the sensing elements may be varied." *Id.* at 8:25–26. Bird explains that the "spot size on the array could conceivably be such as to cover just two adjacent sensing elements in the row direction and one element in the column direction." *Id.* at 8:31–34.

We find unavailing Patent Owner's argument that Petitioner "divides [this] element . . . into three subparts and attempts to piecemeal together a collection of isolated prior art disclosures, without demonstrating the disparate features satisfy the entire claimed invention in a single embodiment." PO Resp. 41 (citing *F5, Inc. v. Sunstone Info. Defense, Inc.*, IPR2022-00484, Paper 11 at 22 (PTAB Aug. 9, 2022) (non-precedential)); *see also id.* (citing Ex. 2020 ¶ 115). More specifically, Patent Owner argues that Petitioner "divorces the claimed 'sens[ing] and provid[ing] an output indication of position' from the 'and at least two of orientation, shape and size' recitals." *Id.* (citing Pet. 30–34) (alterations in original).

Patent Owner's reliance on *F5* is misplaced. PO Resp. 41. In *F5*, the limitation at issue required "determining a prediction . . . based on" three parameters. IPR2022-00484, Paper 11 at 22. The panel in *F5* found that the petitioner alleged that (i) a reference taught making the determination based on two of the parameters, and (ii) another reference taught making the determination based on the third parameter. *Id.* Notably, the panel found that using all three parameters at once for the determination was not shown. *Id.* at 22–23. Furthermore, the panel found that the petitioner provided no explanation how the combination of references "results in satisfaction of all three . . . at the same time in a single embodiment." *Id.* at 22. In other words, in *F5*, none of the references taught the limitation (i.e., determining a

prediction based on three parameters), nor did the petitioner explain how the references together taught the limitation. *Id.* at 22–23.

In contrast, here Petitioner shows that the combination of Bird and Ishii teaches that the sensor array is operative to sense position, as well as orientation, shape, and size of the light spot. *See supra*. In other words, all aspects of the limitation are taught. Moreover, Bird's teaching about sensing position is within Bird's description of "the present invention," and is not limited to a particular embodiment. Ex. 1009, 2:18–64. Also the cited teachings in Bird about sensing the orientation, shape, and size of a light spot are described in connection with example shapes relating to Bird's invention, but not as relating to separate embodiments. *See id.* at 6:46–50, 7:28–31, 8:25–26, 8:31–34.

We also find unavailing Patent Owner's argument that Petitioner "fails to argue the claimed sensor array provides an output indication of shape and size." PO Resp. 41 (citing Pet. 30–34). Petitioner argues, for example, with respect to shape, that Bird's sensors "detect whether the shape of the illumination spot is 'elongated' to provide additional user flexibility," which we view as arguing an output indication so that additional user flexibility can be provided. Pet. 33 (citing Ex. 1009, 7:28–31). Similarly, we view Petitioner's discussion of Bird's teachings for determining size based on which adjacent sensing elements are illuminated as also relating to an output indication. *Id.* at 34 (citing Ex. 1009, 8:31–34).

In sum, we find that the combination of Bird and Ishii teaches that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object."

6. Input Circuitry

Petitioner argues that Bird teaches "input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object," as recited in claim 1. Pet. 34–37. More specifically, Petitioner argues that Bird's "Figure 10 discloses 'detection circuitry 40' as input circuitry." *Id.* at 34 (citing Ex. 1009, 8:2–7, Fig. 10). According to Petitioner, Bird states that the "[i]nput information to the light sensing array [] is detected by the associated detection circuit, here referenced at 40, which detects X-Y position and twist of the pen and provides outputs accordingly to a central processing unit 42 via an input/output interface 41." *Id.* at 34–35 (quoting Ex. 1009, 8:2–7). Petitioner adds that "Ishii similarly discloses circuit 61 for determining output indication and providing an input to character recognizing section 64." *Id.* at 35 (quoting Ex. 1010 ¶ 62, Fig. 11).

In addition, Petitioner argues that "Bird discloses an electronic input representing both a two-dimensional position and orientation of said input object." *Id.* (citing Ex. 1002 ¶ 127). Petitioner argues, for example, that "Bird discloses that '[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen are detectable." *Id.* at 35–36 (quoting Ex. 1009, 2:40–44).

In addition, Petitioner argues that "Bird also teaches determining 'orientation' when it senses that . . . 'the direction of rotation of the beam [is] determined' by monitoring the sensing elements outputs." *Id.* at 36 (quoting Ex. 1009, 5:65–6:5) (second alteration in original). According to Petitioner, "Bird explains that the sensing elements provide[] an output of the 'rotation of the pen/light beam around its axis' which 'can readily be

detected by virtue of different sensing elements 14.'" *Id.* (quoting Ex. 1009, 6:46–48). Petitioner argues that "[t]he Bird-Ishii combination also detects the X and Y positions of the light incident on the display surface and orientation, which is same as the position of the input object on the surface." *Id.* (citing Ex. 1010 ¶¶ 53, 58–60). According to Petitioner, one of ordinary skill in the art "would have adapted the input circuitry of Bird to respond to the sensor configuration of Ishii." *Id.* at 36–37 (citing Ex. 1002 ¶ 128).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that the combination of Bird and Ishii teaches "input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object."

7. Source of Said Electromagnetic Radiation

Petitioner argues that Bird teaches "wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area," as recited in claim 1. Pet. 37–40. In particular, Petitioner argues that "Bird discloses a light source of said electromagnetic radiation that produces a parallel beam which intersects in input area in an elliptical pattern." *Id.* at 37. Petitioner argues that Bird teaches "light pen 12 that includes a light source such as 'an LED' with the light source being a source of electromagnetic radiation." *Id.* at 37–38 (citing Ex. 1009, 4:51–52, Fig. 9).

In addition, Petitioner argues that Bird teaches that the beam is conical. *Id.* at 38 (citing Ex. 1009, Fig. 9 (annotating and labeling the figure showing a light path)). Petitioner argues that Bird teaches that "[t]he beam of light is directed through the pen tip 24 via an optical system 25 which includes an aperture 26 that determines the required shape of the light spot." *Id.* (quoting Ex. 1009, 7:40–43) (alteration in original). Petitioner adds that "[t]he beam has an elliptical shape." *Id.* (citing Ex. 1009, 6:38–46, 9:6–7 (claim 6)).

In addition, Petitioner argues that "as a matter of geometry, that elongating the ellipse increases it eccentricity, while contracting it decreases the eccentricity." *Id.* (citing Ex. 1002 ¶ 132). Petitioner argues that Bird teaches that "in the case of an elliptical spot, the spot may be distorted to approximate a circular spot." *Id.* at 38–39 (quoting Ex. 1009, 3:28–30). And "[a] circle is an ellipse of eccentricity zero," according to Petitioner. *Id.* at 39 (citing Ex. 1002 ¶ 132). Petitioner argues "[t]hus, the eccentricity of Bird's elliptical light spot depends on ('is a function' of) the light pen's ('input object') orientation." *Id.*

In addition, Petitioner argues that Bird teaches that "[i]t will be understood, of course, that if the pen is held inclined to that plane, the shape of the light spot produced is distorted." *Id.* at 38 (quoting Ex. 1009, 3:24–26) (alteration in original). In particular, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot," Petitioner argues. *Id.* (quoting Ex. 1009, 7:28–32); *see also id.* at 39 (Petitioner annotating Ex. 1009, Fig. 5).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that

Petitioner demonstrates by a preponderance of the evidence that Bird teaches "wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area."

8. Summary

In summary, we determine that Petitioner shows by a preponderance of the evidence that claim 1 would have been obvious to one of ordinary skill in the art in view of the combination of Bird and Ishii.

D. Challenged Claims 2, 20, and 22

Petitioner argues that the combination of Bird and Ishii teaches claims 2, 20, and 22. Pet. 28–40; Pet. Reply 5–18. Claim 2 depends from independent claim 1, and claims 20 and 22 are additional independent claims. Patent Owner does not separately address Petitioner's arguments directed to these claims, and instead relies on its arguments associated with independent claim 1. PO Resp. 22–37; PO Sur-reply 14–35. As we discuss above, we find these arguments unavailing. *See supra* Section V.C.

Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that claims 2, 20, and 22 would have been obvious to one of ordinary skill in the art over the combination of Bird and Ishii.

E. Challenged Claim 9

Claim 9 recites "[a]n electronic input device according to claim 1 and also comprising interface circuitry operative in response to said output indication for providing continuously variable user inputs based on at least one of said two-dimensional position, said three dimensional position; and said orientation of said input object." Ex. 1001, 8:12–17. We agree with

Petitioner and find that the combination of Bird and Ishii teaches claim 9. Pet. 34–37, 41; Pet. Reply 16.

In particular, Bird teaches that the "[i]nput information to the light sensing array . . . is detected by the associated detection circuit, here referenced at 40, which detects XY position and twist of the pen and provides outputs accordingly to a central processing unit 42 via an input/output interface 41." Ex. 1009, 8:2–7, Fig. 10; Pet. 34. In other words, Bird's "interface 41" teaches the claimed "interface circuitry." Ex. 1009, 8:2–7.

In addition, Bird teaches that "[a]s rotation of the pen is detected the display can be addressed to re-draw the knob rotated according to the amount of rotation of the pen to provide visual feedback in addition to the detection of the action being used by the system to perform the desired function." *Id.* at 6:10–15. We agree with Petitioner and find that these teachings from Bird evidence the interface providing continuously variable user inputs based on orientation of the input object (pen) in response to the detection. *Id.* at 6:10–15, 8:2–7, Fig. 10.

We find unavailing Patent Owner's argument that Petitioner does not "address the additional 'interface circuitry' or the entire recital in claim 9." PO Resp. 42–43; *see also id.* at 43 (citing Ex. 2020 ¶ 117) (Patent Owner arguing that it is left to guess what Petitioner intended). Rather, as shown above, we find that Petitioner sufficiently identifies Bird's and Ishii's teachings as they relate to claim 9. Pet. 34–37, 41.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 9 obvious.

F. Challenged Claim 10

Claim 10 recites "[a]n electronic input device according to claim 1 and wherein said sensor array is operative to provide an output indication of each of position, orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object." Ex. 1001, 8:18–22. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 10. Pet. 30–34, 41; Pet. Reply 16.

Claim 10 is similar to claim 1's limitation that recites that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object." *Compare* Ex. 1001, 8:18–22, *with id.* at 7:32–36. Except, claim 10 requires sensing and indicating all four of position, orientation, shape, and size. *Id.* at 8:18–22.

Above for claim 1, we already addressed the parties' arguments and found that Petitioner shows that the combination of Bird and Ishii teaches sensing and indicating for all four of position, orientation, shape, and size. *See supra* Section V.C.5. We also addressed and found unavailing Patent Owner's argument that Petitioner does not show that Bird and Ishii teach all four output indications in one embodiment. *Id.*; PO Resp. 43.

Accordingly, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 10 obvious.

G. Challenged Claims 12, 13, and 16

Claim 12 depends from claim 10, which depends from claim 1. Ex. 1001, 8:19–23, 8:29–31. Claim 13 depends from claim 12. *Id.* at 8:32–38. Claim 16 depends from claim 10. *Id.* at 8:50–52. We find above that Petitioner demonstrates by a preponderance of the evidence that the

combination of Bird and Ishii teaches claims 1 and 10. *See supra* Sections V.C, F.

Claim 12 recites that it depends from claim 10 (i.e., "[a]n electronic input device according to claim 10") and adds the additional limitation of "wherein said input object comprises a source of said electromagnetic radiation." Ex. 1001, 8:29–31. We agree with Petitioner and find that Bird teaches this additional limitation. Pet. 28–29, 41; Ex. 1009, 1:58–60, 3:62–63, 4:51–52, Fig. 1. Notably, Patent Owner does not dispute that Bird teaches this additional limitation. PO Resp. 45. Rather, Patent Owner faults Petitioner's showing for claim 12 for not cross-referencing Petitioner's showing for claim 10. *Id.* Patent Owner argues that Petitioner therefore "does not bear its burden or demonstrate [that claim 12 is] rendered unpatentable by Bird-Ishii." *Id.* We disagree. It is readily ascertainable where Petitioner argues that the combination of Bird and Ishii teaches claim 10, and it is also readily understandable that the showing applies to claim 12. Pet. 30–34, 41.

Similarly, Patent Owner faults Petitioner's showing (i) for claim 13 for not cross-referencing Petitioner's showing for claims 1, 10, and 12; and (ii) for claim 16 for not cross-referencing Petitioner's showing for claims 1 and 10. PO Resp. 45. We agree with Petitioner, however, and find that the combination of Bird and Ishii teaches the additional limitations of claims 13 and 16. Pet. 37–40, 42; Ex. 1009, 2:56–59, 3:24–26, 3:28–30, 4:51–52, 6:10–15, 6:38–46, 7:28–32, 7:40–43, 9:6–7, Figs. 1, 5, 7, 9; Ex. 1002 ¶¶ 132, 134–136. And we find that where Petitioner argues that the combination of Bird and Ishii teaches claims 1, 10, and 12 is readily ascertainable, and that it is readily understandable that the showings apply to claims 13 and 16. Pet. 28–42.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 12, 13, and 16 obvious.

H. Challenged Claim 18

Claim 18 recites "[a]n electronic input device according to claim 1 and wherein said conical beam widens in diameter as the distance from said input object to said input area increases." Ex. 1001, 8:57–59. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 18. Pet. 42–43; Pet. Reply 16–17. Below we show Bird's Figure 9, as annotated by Petitioner.

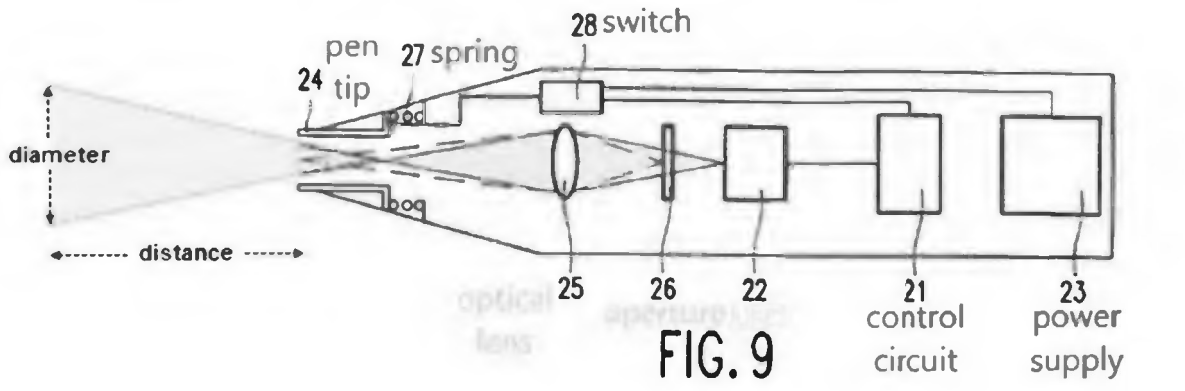


Figure 9 "shows schematically the components of a light pen of" a system in accordance with Bird's teachings. Ex. 1009, 3:40–41, 3:46–47. Petitioner annotates Figure 9 by labeling reference numeral 21 as "control circuit," 22 as "LED," 23 as "power supply," 24 as "pen tip," 25 as "optical lens," 26 as "aperture," 27 as "spring," and 28 as "switch." Pet. 43 (annotating Ex. 1009, Fig. 9); *see also* Ex. 1009, 7:36–64 (describing the components of Figure 9). Petitioner colors in yellow Figure 9's illustration of the beam of light emitted from light source 22 through aperture 26, lens 25, and the beam's focus point close to the end of the pen tip 24 to where the beam exits the pen. Pet. 43; Ex. 1009, 7:36–64. In addition, Petitioner extends the beam of

light exiting the pen, coloring that area yellow and labeling the horizontal dimension of this extended light "distance," and the vertical dimension "diameter." Pet. 43.

We agree with Petitioner and find that Figure 9 illustrates that as "a matter of basic geometry that, as the distance from the input area to input object increases, the conical beam of the light pen . . . widens in diameter." *Id.* at 42–43; Ex. 1009, Fig. 9. Figure 9 illustrates that the emitted light beam continues to diverge after passing through the point where lens 25 focuses the beam (which is inside the pen). Ex. 1009, Fig. 9, 7:36–64. Thus, the beam widens in diameter as the distance from the pen tip to the surface upon which the light falls increases. *Id.* We also find persuasive Dr. Bederson's testimony on this point. *See* Ex. 1002 ¶ 142.

We find unavailing Patent Owner's argument that Bird teaches that "lens 25" "focuses the aperture 26 to form an image" based on the "required shape of the light spot," and that "[t]he 'geometry' of a lens that 'focuses' an aperture teaches away from the claimed conical beam that widens in diameter over a distance." PO Resp. 44 (citing Ex. 1009, 7:36–45; Ex. 2020 ¶ 119). Patent Owner's argument fails to account for Bird's teaching that the light beam diverges after passing through the focal point of lens 25, which is inside the pen. Ex. 1001, Fig. 9. Moreover, Patent Owner does not explain why the geometry of lens 25 purportedly teaches away, nor provide any factual support for such an assertion. PO Resp. 44. Dr. Cairns testimony on this point also lacks any factual support and is conclusory. Ex. 2020 ¶ 119.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 18 obvious.

I. Challenged Claim 19

Claim 19 recites "[a]n electronic input device according to claim 1 and wherein said sensor array is positioned adjacent the perimeter of said input area." Ex. 1001, 8:60–62. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 19. Pet. 30–31, 43; Pet. Reply 17–18.

Claim 19 further defines where the sensor array is positioned. More specifically, claim 19 recites that the "sensor array is positioned adjacent the perimeter of said input area," while claim 1 positions the sensor array "outside said input area." *Compare* Ex. 1001, 8:61–62, *with id.* at 7:32. Petitioner's showing for claim 19 refers to its showing for claim 1, and refers to the "peripheral light sensors" teaching of the combination of Bird and Ishii. Pet. 43. As we discuss above, we find that Petitioner shows that Bird teaches an embodiment that "uses sets of row and column light waveguides . . . which conduct input light to peripheral light sensors." *See supra* Section V.C.4; Ex. 1009, 4:43–50; Pet. 30. We also find that Petitioner shows that Ishii teaches that its photosensors are positioned at the end of the waveguides for receiving leaked light. *See supra* Section V.C.4; Ex. 1010 ¶¶ 51, 53, 78–79, Fig. 9; Pet. 30–31. And we agree with Petitioner that the waveguides correspond to the input area. *See supra* Section V.C.3. Accordingly, we agree with Petitioner and find that the combination of Bird and Ishii teaches that the "sensor array is positioned adjacent the perimeter of said input area."

We find unavailing Patent Owner's arguments faulting Petitioner for cross-referencing Petitioner's showing for claim 1, and that Petitioner "failed to bear its burden and thus, claim 19 is not rendered obvious by Bird-Ishii." PO Resp. 44 (citing Ex. 2020 ¶ 120). As we discuss above,

Petitioner shows that Bird and Ishii teach claim 19. We find Petitioner's arguments are readily ascertained. Pet. 30–31, 43; Pet. Reply 17–18. Moreover, Patent Owner does not explain why the teachings from Bird and Ishii cited by Petitioner do not teach claim 19.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 19 obvious.

VI. ALLEGED OBVIOUSNESS OVER BIRD, ISHII, AND GEVA

Petitioner argues that the combination of Bird, Ishii, and Geva renders claims 3–8, 11, and 15 obvious. Pet. 3, 43–50. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders these claims obvious.

A. Summary of Geva

Geva relates to position-determining input devices, such as digitizing technologies for pen-based computer systems. Ex. 1011, 1:6–9. Figure 6, shown below, illustrates a position-determining input device. *Id.* at 8:32–34.

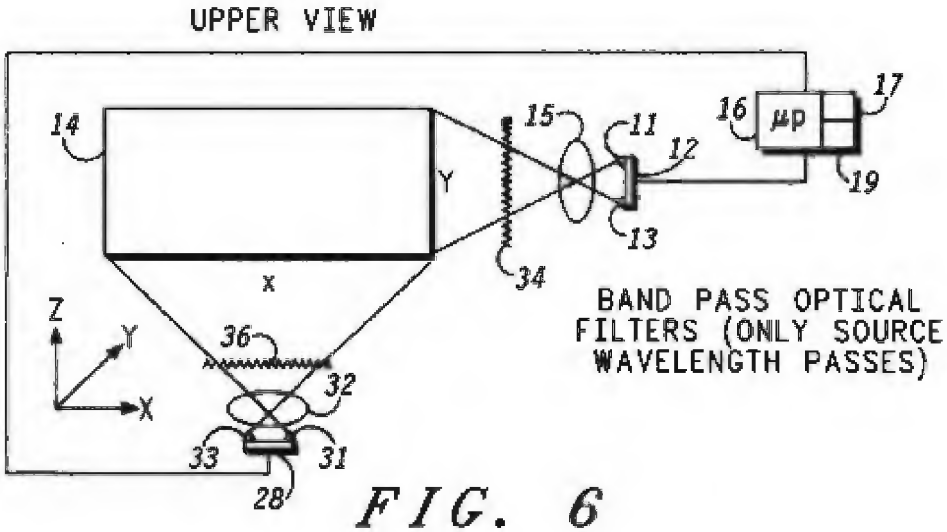


FIG. 6

Figure 6 is an upper view of a position-determining input device including planar element 14, two light sensor arrays 12 and 28, and processing device 16, among other things. *Id.* at 8:32–9:7.

Light sensor arrays 12 and 28 preferably comprise a multiplicity of light sensing elements and are disposed at first and second edges of the planar element 14. *Id.* at 8:36–38. As shown in Figure 6, light sensor arrays 12 and 28 comprise two light sensing elements 11 and 13, and 31 and 33, respectively. *Id.* at 8:38–9:1. Light sensor arrays 12 and 28 are coupled to optical lenses 15 and 32 through band-pass optical filters 34 and 36, which are arranged to select only the desired light source. *Id.* at 9:1–3. Light sensor arrays 12 and 28 also are operably coupled to a processing device 16, which comprises intensity/distance computation function 17 and memory element 19. *Id.* at 9:3–7.

Signals from each light sensing element in light sensor arrays 12 and 28 are transmitted to the processing device 16. *Id.* at 9:16–17. Intensity/distance computation function 17 of processing device 16 calculates the position of light emitting cursor device 10 according to the intensity of light incident on the first and second light sensor arrays 28 and 30. *Id.* at 9:23–31. The three-dimensional position is calculated. *Id.* at 9:35–10:2.

B. Combining Bird and Ishii with Geva

For the reasons that follow, we find that Petitioner has established a sufficient motivation to combine the teachings of Bird and Ishii with Geva. *See* Pet. 43–44, 46; Pet. Reply 18–19. First, we agree with Petitioner and find that one of ordinary skill in the art would have been motivated to combine Geva's teachings with Bird and Ishii because Geva's waveguides are similar to Ishii's and Bird expressly teaches "the light sensing array may

be of a kind which . . . uses sets of row and column waveguides . . . and which conduct input light to peripheral light sensors." Pet. 43 (emphasis omitted, alterations in original); Ex. 1009, 4:43–50. In particular, Geva teaches a planar element having an array of light sensing elements disposed at a first edge, and a second array of light sensing elements disposed at a second edge for providing signals responsive to light incident thereon for calculating the position of the light emitting device in the first and second dimensions. Ex. 1011, 3:1–4, 3:30–39. In addition, Geva teaches that "[p]referably the planar element is either a beam splitter or has light conducting and light reflecting properties." *Id.* at 3:10–11.

We find unavailing Patent Owner's argument that "Geva does not relate to the 'row and column' 'planar array of light sensing elements' discussed by Bird." PO Resp. 46; *see also id.* at 48 (citing Ex. 1009, 5:15–19, Fig. 2; Ex. 1010 ¶ 45, Fig. 9; Ex. 2020 ¶ 130) (making same argument). Rather, we find that Bird broadly teaches that its "light sensing device can be of any known kind having a row and column, planar, array of light sensing elements." Ex. 1009, 4:12–13. We also find that Geva's teachings of having a planar element with an array of light sensing elements at each of two of its edges, and having beam splitters or comprising light conducting properties so that two-dimensional positioning can be calculated teaches a known kind of a row and column, planar, array of light sensing elements. Ex. 1011, 3:1–4, 3:10–11, 3:30–39, Figs. 6, 8.

We also find unavailing Patent Owner's argument that one of ordinary skill in the art would not have been motivated to combine Geva with Bird and Ishii because "Geva's teachings relate to a fundamentally different type of X-Y position detection, which requires linear sensor arrays extending in one dimension/axis along an edge of the planar element." PO Resp. 47

(citing Ex. 1011, 3:1–19, 5:13–38, 8:6–17; Ex. 2020 ¶ 129); *see also id.* at 49 (arguing that Petitioner does not explain how to modify "Geva's single dimension/individual linear sensor array, to work with the X-Y row/column sensor arrays disposed inside Bird or Ishii's integrated display"). As we discuss above, Geva teaches having a planar element with an array of light sensing elements at each of two of its edges, as does Bird. *Compare* Ex. 1011, 3:1–4 *and* 3:30–39, *with* Ex. 1009, 4:43–50 (teaching peripheral light sensors).

We also find unavailing Patent Owner's argument that modifying Geva requires different approaches and calculations, which is not simple math. PO Resp. 49 (citing Ex. 2020 ¶ 132). Again, Geva teaches having a planar element with an array of light sensing elements at each of two of its edges, conducting light incident on the planar array to those elements, and determining the two-dimensional positioning of the light. Ex. 1011, 3:1–4, 3:10–11, 3:30–39, Figs. 6, 8. We find that one of ordinary skill in the art would have "be[en] able to fit the teachings of [Bird, Ishii, and Geva] . . . together like pieces of a puzzle" because the skilled artisan is "a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 420–21.

We also find unavailing Patent Owner's argument that Geva teaches away from the Bird and Ishii's teachings, and "explains significant *disadvantages* of the Bird-Ishii integrated displays and the trouble caused by disposing sensors inside the display itself." PO Resp. 46 (citing Ex. 1011, 1:26–2:21; Ex. 2020 ¶ 127). More specifically, Patent Owner quotes snippets from Geva in support of its argument, but each of these relate to a different technology than taught by Bird and Ishii and upon which Petitioner relies. For example, Patent Owner quotes "two conductive sheets reduce the brightness" from Geva. *Id.* (quoting Ex. 1011, 1:26–29). But this phrase

relates to a disadvantage involving resistive digitizers, where "[t]he pen causes the two sheets to make contact and the currents are measured to determine an 'x' and 'y' coordinate for the pen." *See* Ex. 1011, 1:19–29.

Patent Owner also quotes "'transparent conductive layers must also be deposited on the underside of the protective glass shield,' which 'reduce[s] optical transmissions of the LCD screen by a similar level to the single-layer resistive technique'" from Geva. PO Resp. 46 (quoting Ex. 1011, 1:37–38, 2:4–5) (alteration in original). But these phrases relate to "[e]lectrostatic (or capacitive) digitizers," in which "as the pen nears the surface of the glass, the electronic signal in the pen creates a capacitive effect with the conductive sheet on the underside of the glass." Ex. 1011, 1:36, 1:38–2:1.

Patent Owner also quotes "'light-pipe' design[] for backlighting 'requires that the light source is positioned at the side of the LCD screen rather than behind'" from Geva. PO Resp. 46 (quoting Ex. 1011, 2:13–16). But this phrase relates to "[e]lectromagnetic digitizers [which] rely on a series of looped coils on a sensor board beneath the LCD screen." Ex. 1011, 2:6–7.

Moreover, each of these three different digitizing technologies (i.e., resistive, electrostatic and electromagnetic) to which Patent Owner points are discussed in Geva's "Background of the Invention" section, and are described as currently existing technologies. *See id.* at 1:11–2:18. And Geva states that its "invention seeks to provide an improved alternative arrangement for determining the position of digitizer input elements such as computer pens." *Id.* at 2:19–21.

We also find unavailing Patent Owner's argument that one of ordinary skill in the art "would have understood that Geva's 'teachings' relate to an altogether different approach that requires a separate 'planar element'

positioned over its display," and that "Ishii expressly teaches away from this type of cover because it would increase parallax errors." PO Resp. 47 (citing Ex. 2020 ¶ 128; Ex. 1011, 1:17–18, 2:19–21, 3:1–16, Figs. 1–2, 5–6; Ex. 1010 ¶¶ 22–25). None of the challenged claims for this asserted ground involve a display, and thus this argument is inapposite. Pet. 3. Moreover, Patent Owner does not explain how Geva's planar array would increase parallax errors in the combination of Bird and Ishii that Petitioner advances. PO Resp. 47. Dr. Cairns' testimony on this point is conclusory and provides no explanation. *See* Ex. 2020 ¶ 128.

Second, Petitioner advances another rationale for combining Geva with Bird and Ishii. In particular, Petitioner argues that "Geva provides explicit teachings with respect to intensity of light on the waveguides of Ishii," and that one of ordinary skill in the art "would have combined the teachings of Geva with the teachings of Bird-Ishii to achieve the benefits of using light intensity as taught by Geva." Pet. 44 (citing Ex. 1002 ¶ 144). In particular, Petitioner argues that "Geva expressly teaches comparing sensed light intensity to intensity thresholds as a way to determining or quantifying the size, shape and orientation of light spot," and that one of ordinary skill in the art "would have been motivated to use these teaching[s] in conjunction with Ishii because it would have helped eliminate erroneous input signals from ambient light sources." Pet. Reply 19 (citing Ex. 1002 ¶ 144).

As the Federal Circuit has recently reminded us, "[t]he motivation-to-combine analysis is a flexible one." *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1379 (Fed. Cir. 2023). "*[A]ny* need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* (quoting *KSR*, 550 U.S. at 420) (alteration in original). We find that

eliminating erroneous input signals from ambient light sources is such a problem. Ex. 1002 ¶¶ 144, 146; Ex. 1010 ¶ 55.

In sum, we find that Petitioner shows by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to combine the teachings of the references as proposed by Petitioner with a reasonable expectation of success.

C. Challenged Claim 3

Claim 3 recites "[a]n electronic input device according to claim 1 and wherein said sensor array is also operative to sense and provide at least one output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern." Ex. 1001, 7:49–52. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 3. Pet. 44–46; Pet. Reply 19.

More specifically, we agree with Petitioner and find that Bird teaches sensing and providing an indication of the position, shape, and size of an incident light spot. Ex. 1009, 2:32–39; Ex. 1002 ¶ 146. We also agree with Petitioner and find that Geva teaches that its light sensor arrays sense the intensity of incident light to indicate the x and y positions of the light emitting device and provide an indication thereof. Ex. 1011, 4:25–26, 6:12–14, 9:1–3, 9:11–13, Figs. 3, 6. More specifically, Geva teaches

> In operation, the position of the 'y' dimension of the light emitting cursor device 10, of FIG. 1, is calculated from the beam-hit point on the light sensor array 12. In a preferred embodiment the light sensor array 12 comprises a multiplicity of light sensing elements, each transmitting a signal to the processing device 16. The intensity/distance computation function 17 of the processing device 16 calculates the position of the light emitting cursor device 10 in the first 'y' dimension substantially dependent on the position in the first 'y' dimension of the individual light sensing element on which incident light is most intense. The

> position of the 'x' dimension of the light emitting cursor device 10 of FIG. 1 is calculated using the graph of FIG. 3.

Id. at 6:10–20; Pet. 46. In other words, Geva teaches that the multiple sensing elements are operative for calculating the intensity of incident light on the planar element (i.e., a pattern) for an x and y dimension. Ex. 1011, 6:10–20. Geva also teaches having separate light sensor arrays disposed at each of two edges of the planar element to indicate the x and y positions of the light emitting cursor device 10. *Id.* at 9:1–3, 9:11–13, Fig. 6.

In view of these teachings, and Dr. Bederson's testimony, we are persuaded that one of ordinary skill in the art would have been motivated to use, with a reasonable expectation of success, Bird and Ishii's electronic input system with Geva's teachings for determining X-Y size, shape, and position of a light spot by providing at least one output indication of intensity. Ex. 1002 ¶ 149; Ex. 1011, 6:10–20.

We find unavailing Patent Owner's argument that Petitioner "does not reference any evidence to support its conclusion that [one of ordinary skill in the art] would or could modify Bird-Ishii to incorporate Geva's alleged 'intensity' teachings and every referenced disclosure in Geva relates to X-Y position detection, which already happens in the Bird-Ishii integrated display." As we discuss above, we find that Petitioner provides sufficient rationale to support that one of ordinary skill in the art would have been motivated to combine Bird, Ishii, and Geva's teachings. *See supra* Section VI.A. Moreover, we are persuaded by Dr. Bederson's testimony which relies on the portion of Geva we reproduced above. Ex. 1002 ¶ 149 (citing Ex. 1011, 6:10–22). We find that this portion supports his testimony.

In sum, we find that Petitioner demonstrates by a preponderance of the evidence that the combination of Ishii, Bird, and Geva renders claim 3 obvious.

D. Challenged Claim 4

Claim 4 recites "[a]n electronic input device according to claim 3 and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern." Ex. 1001, 7:53–57. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 4. Pet. 34–37, 44–46.

We find above that Petitioner shows that Bird teaches input circuitry that receives *an output indication* from the sensor array and provides an electronic input representing, *inter alia*, a two-dimensional position of the input object. *See supra* Section V.C.6 (finding that Petitioner shows that this element of claim 1 is taught).

We also find above that Petitioner shows that the combination of Bird, Ishii, and Geva teaches that the sensor array is operative to sense and provide at least one *output indication* of intensity of electromagnetic radiation in the electromagnetic radiation pattern. *See supra* Section VI.C (finding that Petitioner shows claim 3 is taught). For example, we find that the combination of Bird, Ishii, and Geva teaches that the sensor array provides an output indication of intensity of radiation in a light spot for determining X-Y size, shape, and position of the light spot. Ex. 1002 ¶ 149; Ex. 1011, 6:10–20.

Accordingly, the combination of Bird, Ishii, and Geva teaches that the input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in the

electromagnetic radiation pattern. *See supra* Sections V.C.6, VI.C; Ex. 1002 ¶ 149; Ex. 1011, 6:10–20.

We find unavailing Patent Owner's argument that "Bird's 'detection circuitry 40' only 'detects X-Y position and twist of the pen and provides outputs accordingly.'" PO Resp. 53 (citing Ex. 1009, 8:4–7). This argument incorrectly focuses on Bird individually, rather than the combined teachings of Bird, Ishii, and Geva. And as we discuss above, Petitioner shows that Bird teaches providing output indications for size and shape too. *See supra* Section V.C.5.

In sum, we find that Petitioner demonstrates that the combination of Bird, Ishii, and Geva teaches claim 4.

E. *Challenged Claim 5*

Claim 5 recites "[a]n electronic input device according to claim 3 and wherein said sensor array is operative to provide said output indication of intensity of electromagnetic radiation relative to a plurality of intensity thresholds." Ex. 1001, 7:58–61. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 5. Pet. 46–48; Pet. Reply 20.

More specifically, we agree with Petitioner and find that Geva provides "a graph of light intensity across one dimension of the position-determining input device." *E.g.*, Ex. 1011, 4:25–26, Fig. 3. We also find persuasive Dr. Bederson's testimony that one of ordinary skill in the art "would recognize the photosensors would provide some minimum intensity value or floor for an ambient light condition and would be motivated to choose a threshold that establishes the ambient 'reference' level and indicate intensity relative to that level." Ex. 1002 ¶ 152; *see also* Ex. 1010 ¶¶ 54–55 (recognizing ambient light concerns).

We also agree with Petitioner and find that "because the Geva-Ishii combination is sensing light along both the X and Y axes, there would be two minimum intensity level thresholds, one for the X axis and one for the Y axis, specifically calibrated to the reference level for each of those two axes" (i.e., an I_{minx} and I_{miny}). Ex. 1002 ¶ 153; *see also, e.g.*, Ex. 1011, 3:30–39, 6:10–20.

We find unavailing Patent Owner's argument that Petitioner "fabricates 'some minimum intensity value or floor for an ambient light condition' to argue Geva teaches the claimed intensity thresholds." PO Resp. 51 (citing Pet. 46–48). As we state above, we find persuasive Dr. Bederson's testimony on this point, and find it consistent with the combined teachings of the references, including Ishii which recognizes ambient light concerns. Ex. 1010 ¶¶ 54–55. Moreover, we find unavailing Patent Owner's argument that Geva does not use the terms "ambient" and "threshold" whatsoever. PO Resp. 51–52. We focus on what the references teach to one of ordinary skill in the art.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 5 obvious.

F. Challenged Claim 6

Claim 6 recites "[a]n electronic input device according to claim 3 and wherein said sensor array is also operative to provide an output indication of the area of the sensor array illuminated by said electromagnetic radiation pattern." Ex. 1001, 7:62–65. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 6. Pet. 30–34, 48–49.

We find above that Petitioner shows that Bird and Ishii teach a sensor array that is operative to provide an output indication of position,

orientation, shape, and size of an electromagnetic radiation pattern based on the sensing elements (area of the sensor array) illuminated. *See supra* Section V.C.5. For example, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot if desired thus providing additional flexibility to an operator." Ex. 1009, 7:28–31. Bird also teaches sensing the size of the incident light spot on the array relative to the sensing elements. *See id.* at 8:25–26, 8:31–34.

We agree with Petitioner and find that Petitioner's showing for size and shape indicates area, and thus also teaches that the sensor array is operative to provide an output indication of the area. *Id.* at 1009, 7:28–31, 8:25–26, 8:31–34. For example, sensing which sensing elements the light pattern falls on allows (e.g., "two adjacent sensing elements in the row direction and one element in the column direction") teaches area. *Id.* at 8:31–34.

We find unavailing Patent Owner's argument faulting Petitioner's showing for claim 6 for not also cross-referencing Petitioner's showing for claim 3. PO Resp. 53. Where Petitioner argues that claim 3 is taught is readily ascertained, and it is readily understood that the showing applies to claim 6. Pet. 44–46, 48.

We also find unavailing Patent Owner's argument that Petitioner's "'size and shape . . . indicates area' argument improperly reads the 'size and shape' limitations out of the claim." PO Resp. 54 (alteration in original). Although Petitioner's particular showing for size and shape also teaches area, it does not follow that size and shape are read out of the claim. Size, shape, and area are not the same. For example, patterns could be the same

shape (e.g., a circle), but be of different size and area. And two patterns could have the same area, but different shapes (e.g., a square and a rectangle). Similarly, two patterns could have the same area, but different sizes (i.e., dimensions).

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 6 obvious.

G. Challenged Claim 7

Claim 7 recites "[a]n electronic input device according to claim 6 and wherein: said area of the sensor array illuminated has a direct variable relationship with the distance from said input object to said input area; and said intensity of electromagnetic radiation has an inverse variable relationship with the distance from said input object to said input area." Ex. 1001, 7:66–8:6. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 7. Pet. 42–43, 49.

First, we agree with Petitioner and find that "Bird inherently discloses that the sensing elements (area of the sensor array) illuminated during the movement of the light spot has direct relationship with the distance of the input object." Ex. 1009, Fig. 9, 7:36–64; Ex. 1002 ¶ 142. Second, we also agree with Petitioner and find that one of ordinary skill in the art would have recognized that Bird inherently teaches that "the intensity of electromagnetic radiation (e.g., light) varies inversely with the square of the distance between the input object and input area." Ex. 1009, Fig. 9, 7:36–64; Ex. 1002 ¶ 155.

As Dr. Bederson explains, claim 7 repeats tenets of the inverse square law of light, and thus, we find it is appropriate to recognize that Bird inherently teaches claim 7. *See Par Pharm., Inc. v. TWi Pharm., Inc.*, 773 F.3d 1186, 1195–96 (Fed. Cir. 2014) ("[I]n order to rely on inherency to

establish the existence of a claim limitation in the prior art in an obviousness analysis[,] . . . the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art."); Ex. 1002 ¶¶ 142, 155 (explaining the inverse square law of light); *see also Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991) (finding that recourse to extrinsic evidence can be appropriate to show that a reference inherently discloses a feature).

We find unavailing Patent Owner's argument faulting Petitioner's showing for claim 7 for not also cross-referencing Petitioner's showing for claims 3 and 6. PO Resp. 54. Where Petitioner argues that claims 3 and 6 are taught is readily ascertained, and it is readily understood that the showings apply to claim 7. Pet. 44–46, 48–49.

We also find unavailing Patent Owner's argument that Petitioner's "basic physics" argument is akin to ordinary creativity that should be disregarded. PO Resp. 54. A law of nature is not a matter of creativity to be disregarded.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 7 obvious.

H. Challenged Claim 8

Claim 8 recites "[a]n electronic input device according to claim 7 and wherein the symmetry of at least one of said area of the sensor array illuminated and said intensity of electromagnetic radiation correlates with the orientation of said input object in at least one plane relative to said input area." Ex. 1001, 8:7–11. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claim 8. Pet. 30–34, 40, 42–43, 48–49.

For its showing for claim 8, Petitioner incorporates its showing for claim 7, which recites the tenets of the inverse square law of light. *See supra* Section VI.G. There we found that one of ordinary skill in the art would have recognized that Bird inherently teaches that "the intensity of electromagnetic radiation (e.g., light) varies inversely with the square of the distance between the input object and input area." Ex. 1009, Fig. 9, 7:36–64; Ex. 1002 ¶ 155 (explaining the inverse square law of light).

In addition, Petitioner argues that one of ordinary skill in the art "would recognize that tilting the input object would change the intensity in a way that correlates to its orientation." Pet. 49 (citing Ex. 1002 ¶ 156). We agree.

Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot." Ex. 1009, 7:28–32; Pet. 33. And thus tilting the object changes the distance that some of the pattern's light takes before falling on the input area, which changes its intensity under the inverse square law. *See* Ex. 1009, Fig. 9, 7:36–64; Ex. 1002 ¶ 155. Hence, Bird teaches that the symmetry of the intensity of electromagnetic radiation correlates with the orientation of the input object in at least one plane relative to the input area. *See* Ex. 1009, Fig. 9, 7:28–32, 7:36–64; Ex. 1002 ¶ 155.

We find unavailing Patent Owner's argument faulting Petitioner's showing for claim 8 for not also cross-referencing Petitioner's showings for claims 1 and 3. PO Resp. 54. Where Petitioner argues that claims 1 and 3 are taught is readily ascertained, and it is readily understood that the showings apply to claim 8. Pet. 28–40, 44–46, 49.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 8 obvious.

I. Challenged Claim 11

Claim 11 recites "[a]n electronic input device according to claim 10 and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern." Ex. 1001, 8:24–27. Petitioner argues that the combination of Bird, Ishii, and Geva teaches claim 11. Pet. 44–46, 50.

We already address above this limitation in the context of claim 3, and Petitioner relies on its arguments as presented there. *Id.* at 50; *supra* Section VI.C (finding Petitioner shows that the same limitation in substance is taught). Accordingly, for the reasons we provide above, we find that the combination of Bird, Ishii, and Geva teaches claim 11. *Supra* Section VI.C.

We find unavailing Patent Owner's argument faulting Petitioner's showing for claim 11 for not also cross-referencing Petitioner's showing for claim 10. PO Resp. 52. Where Petitioner argues that claim 10 is taught is readily ascertained, and it is readily understood that the showing applies to claim 11. Pet. 41, 50.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 11 obvious.

J. Challenged Claim 15

Claim 15 recites "[a]n electronic device according to claim 10 and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic

radiation pattern and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern." Ex. 1001, 8:43–49. Petitioner argues that the combination of Bird, Ishii, and Geva teaches claim 15. Pet. 44–46, 50.

We already address above this limitation in the context of claims 3 and 4, and Petitioner relies on its arguments as presented there. *Id.* at 50; *supra* Sections VI.C–D (finding Petitioner shows that the same limitations, in substance, are taught). Accordingly, for the reasons we provide above, we find that the combination of Bird, Ishii, and Geva teaches claim 15. *See supra* Sections VI.C–D.

We find unavailing Patent Owner's argument faulting Petitioner's showing for claim 15 for not also cross-referencing Petitioner's showing for claim 10. PO Resp. 52. Where Petitioner argues that claim 10 is taught is readily ascertained, and it is readily understood that the showing applies to claim 15. Pet. 41, 50. Moreover, we also find unavailing Patent Owner's argument concerning the capability of Bird's "detection circuitry" to provide an output of intensity, position, shape, size, and orientation. PO Resp. 52. This argument incorrectly focuses on Bird individually, rather than the combined teachings of Bird, Ishii, and Geva, discussed above. And as we discuss above, Petitioner shows that Bird teaches providing output indications for position, shape, size, and orientation. *See supra* Section V.C.5.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Geva renders claim 15 obvious.

VII. ALLEGED OBVIOUSNESS OVER BIRD, ISHII, AND KAMEYAMA

Petitioner argues that the combination of Bird, Ishii, and Kameyama renders claims 14 and 17 obvious. Pet. 3, 50–52. Claim 14 depends from claim 13, which depends from claim 12, which depends from claim 10, which depends from claim 1. Ex. 1001, 8:19–23, 8:28–42. Claim 17 depends from claim 1. *Id.* at 8:53–56. Patent Owner does not separately address Petitioner's arguments directed to claims 14 and 17. PO Resp. 22–37; PO Sur-reply 14–35. As we discuss above, we find unavailing Patent Owner's arguments directed to claims from which claims 14 and 17 depend. *See supra* Sections V.C, F–G. And we are persuaded by Petitioner's showings for claims 14 and 17. Pet. 50–52.

Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that claims 14 and 17 would have been obvious to one of ordinary skill in the art over the combination of Bird, Ishii, and Kameyama.

VIII. REMAINING GROUNDS

Petitioner argues that the combination of (i) Geaghan and Ishii renders claims 1–12, 15–20, and 22 obvious and (ii) Geaghan, Ishii, and Kameyama renders claims 13 and 14 obvious. Pet. 3, 52–73. Thus, these grounds of unpatentability challenge claims which we already determine are unpatentable. *See supra* Sections V.C–I, VI.C–J (determining Petitioner shows claims 1–20 and 22 are unpatentable). Under the circumstances of this case, analyzing additional grounds challenging the same claims, which we have determined to be unpatentable, would not be an efficient use of the Board's time and resources. *See Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*,

809 F. App'x 984, 990 (Fed. Cir. 2020) ("We agree that the Board need not address issues that are not necessary to the resolution of the proceeding.").

Accordingly, we do not reach these remaining grounds. *Cf. In re Gleave*, 560 F.3d at 1338 (not reaching other grounds of unpatentability after affirming the anticipation ground); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (determining once a dispositive issue is decided, there is no need to decide other issues).

IX. CONCLUSION[16]

Based on the full record, we determine that Petitioner shows by a preponderance of the evidence that (i) claims 1, 2, 9, 10, 12, 13, 16, 18–20, and 22 are unpatentable over Bird and Ishii; (ii) claims 3–8, 11, and 15 are unpatentable over Bird, Ishii, and Geva; and (iii) claims 14 and 17 are unpatentable over Bird, Ishii, and Kameyama.

Claim(s)	**35 U.S.C. §**	**Reference(s) /Basis**	**Claims Shown Unpatentable**	**Claims Not Shown Unpatentable**
1, 2, 9, 10, 12, 13, 16, 18–20, 22	103(a)	Bird, Ishii	1, 2, 9, 10, 12, 13, 16, 18–20, 22	
3–8, 11, 15	103(a)	Bird, Ishii, Geva	3–8, 11, 15	
14, 17	103(a)	Bird, Ishii, Kameyama	14, 17	

[16] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

1–12, 15–20, 22	103(a)[17]	Geaghan, Ishii		
13, 14	103(a)[18]	Geaghan, Ishii, Kameyama		
Overall Outcome			1–20, 22	

X. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has shown by a preponderance of the evidence that claims 1–20 and 22 of the '570 patent are unpatentable; and

FURTHER ORDERED that parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

[17] Because we determine that the challenged claims are unpatentable on other grounds, we decline to address them for this ground.
[18] Because we determine that the challenged claims are unpatentable on other grounds, we decline to address them for this ground.

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Date: July 14, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

IPR2022-00405
Patent 8,547,364 B2

Before BARBARA A. PARVIS, JOHN D. HAMANN, and JASON W. MELVIN, *Administrative Patent Judges*.

Opinion for the Board filed by HAMANN, *Administrative Patent Judge*.

Opinion dissenting in part filed by MELVIN, *Administrative Patent Judge*.

HAMANN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively "Petitioner") challenge the patentability of claims 1–21 ("the challenged claims") of U.S. Patent No. 8,547,364 B2 (Ex. 1001, "the '364 patent"), owned by Power2B, Inc. ("Patent Owner"). We have jurisdiction under 35 U.S.C. § 6 (2018). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 (2022).

For the reasons discussed herein, we determine that Petitioner by a preponderance of the evidence (i) shows that claims 1–19 and 21 are unpatentable, and (ii) does not show that claim 20 is unpatentable.

A. Procedural History

Petitioner filed a Petition requesting *inter partes* review of the challenged claims of the '364 patent. Paper 3 ("Pet."). Patent Owner filed a Preliminary Response. Paper 7. With our authorization, Petitioner filed a Preliminary Reply (Paper 9) relating to whether Petitioner correctly identified an exhibit, and Patent Owner filed a Preliminary Sur-reply (Paper 10) in response to the Preliminary Reply. We instituted *inter partes* review of the challenged claims of the '364 patent on all of the grounds raised in the Petition. Paper 12 ("Dec. on Inst."), 32.

Following institution, Patent Owner filed a Response to the Petition. Paper 15 ("PO Resp."). Petitioner filed a Reply to Patent Owner's Response. Paper 19 ("Pet. Reply"). Patent Owner filed a Sur-reply to Petitioner's Reply. Paper 24 ("PO Sur-reply").

An oral hearing was held on March 29, 2023. A transcript of the oral hearing is included in the record. Paper 36. After the hearing, we authorized the parties to file additional briefing relating to claim

construction. Paper 28. With this authorization, Petitioner and Patent Owner simultaneously filed opening claim construction briefs ((Paper 29, "Pet. Open. Br.") and (Paper 30, "PO Open. Br.")), and simultaneously filed responsive claim construction briefs ((Paper 32, "Pet. Resp. Br.") and (Paper 31, "PO Resp. Br.")).

B. Real Parties-in-Interest

The parties identify themselves as the real parties-in-interest. Pet. 2; Paper 5, 2.

C. Related Matters

The parties identify *Power2B Inc. v. Samsung Electronics Co.*, Case No. 2:21-cv-00348 (E.D. Tex.) as a matter that may affect, or be affected by, a decision in this proceeding. Paper 33, 1; Paper 17, 1. In addition, Petitioner has filed five petitions for *inter partes* review covering four additional patents that are related to the '364 patent: (i) U.S. Patent No. 7,952,570 B2 ("the '570 patent") (IPR2022-00300); (ii) U.S. Patent No. 10,664,070 B2 (IPR2022-00315); (iii) U.S. Patent No. 9,946,369 B2 (IPR2022-00325); and (iv) U.S. Patent No. 8,816,994 B2 ("the '994 patent") (IPR2022-00334 and IPR2022-01378). Paper 17, 1.

D. The Challenged Patent

The '364 patent relates to computer navigation and particularly, to facilitating navigation of software stored on an apparatus where its display is small. Ex. 1001, 1:17–20. According to the '364 patent, "[i]t is known to provide small, hand-held computer devices such as pocket organisers, Personal Digital Assistants . . ., cellular phones or the like." *Id.* at 1:21–23. "Smaller devices are more easily carried and generally require a reduced power supply," however, "the reduced size forces a reduction in the size of the user interface, and particularly in the size of the screen or display used to

display information or data stored on or processed by the device." *Id.* at 1:25–31. "Those familiar with such pocket devices will appreciate the problem of displaying all of the necessary information on a relatively small display, particularly where the user is able to select specific functions from a large number of options." *Id.* at 1:38–41.

The '364 patent discloses that "[c]onventionally, the selection of one option, for example, results in a new 'window' opening which displays further options and sub options." *Id.* at 1:42–44. And "devices having smaller screens tend to use data 'layers' or 'levels' whereby the selection of one option having a number of sub options causes the full screen to display the sub options fully eclipsing the original menu." *Id.* at 1:46–50. According to the '364 patent, "[i]t would be advantageous to provide a pocket computer or hand held device which incorporates means for enabling easier access to data on the device and improves the user interface of the device." *Id.* at 1:53–56. The '364 patent therefore discloses embodiments directed to enabling easier access. *See, e.g.*, *id.* at 1:60–65.

Figure 4, shown below, illustrates an embodiment of the '364 patent. *Id.* at 2:28–31.

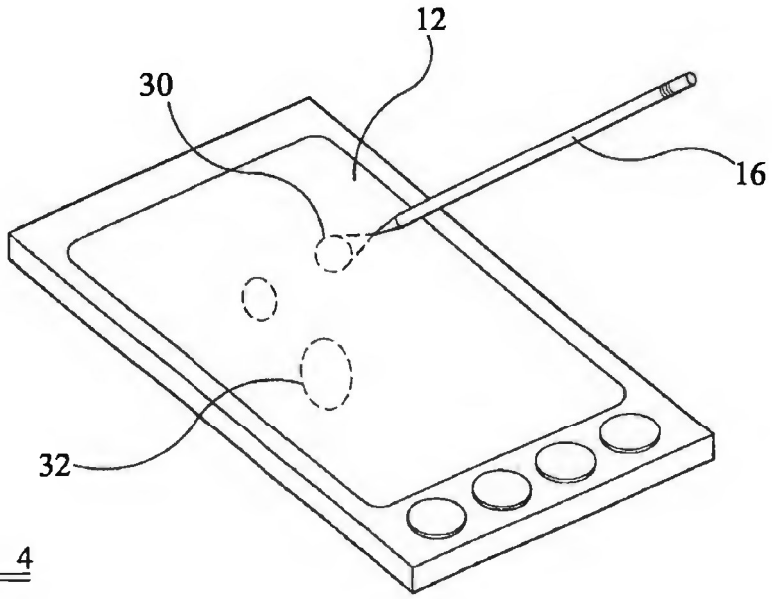

FIG 4

Figure 4, above, "shows illustratively one embodiment in which the stylus when moved closer to the display produces a circle or ellipse of smaller dimensions than the circle or ellipse formed when the stylus is moved away." *Id.* As illustrated, "the stylus 16 is a so-called 'smart stylus' which contains a source of electromagnetic radiation," and "emits a beam of light, for example infrared or other spectrum light, from a circular, spherical, or other shaped tip." *Id.* at 4:41–46. "The light is sensed by a sensitive layer (not shown) positioned over, or incorporate[d] in, the display 12." *Id.* at 4:46–48. The '364 patent discloses that "[a]s the stylus 16 is moved across the display 12, only certain parts of the sensitive layer will be illuminated by the beam of light emitted by the stylus 16 and this will be detected by the sensitive layer." *Id.* at 4:50–53. "The sensitive layer determines the appropriate X-Y coordinates of the stylus 16 . . . ." *Id.* at 4:53–54.

In addition, as illustrated, "[t]he stylus 16 when moved closer to the display produces a circle or ellipse 30 of smaller dimensions than the circle or ellipse 32 formed when the stylus is moved away." *Id.* at 4:57–60. According to the '364 patent, "[t]he same eccentricity of the ellipse means

that the input stylus is at the same angle to the display and the size of the area indicates the distance of the stylus from the display." *Id.* at 4:60–63. "In a different embodiment, . . . the device 10 is provided with a plurality of light sensors 20 positioned around the perimeter of the display 12 . . . such that as the stylus 16 moves towards or away from the display 12, different or segments or layers of the light sensors will be illuminated by the conical beam emitted by the stylus 16." *Id.* at 6:15–17.

E. Illustrative Claim

Among the challenged claims, claims 1, 10, and 17 are independent. We reproduce below the independent claims as they are illustrative of the challenged claims:

> 1. An electronic input device, comprising:
> an input object projecting a conical beam of electromagnetic radiation;
> an input area having a periphery receiving the conical beam of electromagnetic radiation thereon;
> wherein the input object is spaced apart from and not in contact with the input area;
> a pattern produced on the input area by the input object;
> a sensor array positioned at the periphery of the input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of the electromagnetic radiation pattern;
> wherein the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and
> input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

Ex. 1001, 7:52–8:4.

> 10. An electronic input device, comprising:
> a physical input area;

an input object projecting an electromagnetic radiation pattern on the input area;

a sensor array at least partially circumscribing and immediately proximate the input area, wherein the sensor array senses the electromagnetic radiation pattern thereon and provides an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area;

wherein the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and

input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

Id. at 8:38–55.

17. A method for making an electronic input device, comprising:

providing an input object and a physical input area;

providing a sensor array positioned partially circumscribing and immediately proximate the input area;

projecting an electromagnetic radiation pattern from the input object on to the input area;

sensing a portion of the electromagnetic radiation pattern by the sensor array;

providing an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area, based on the electromagnetic radiation pattern, which pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and

providing input circuitry that receives the output indication, which input circuitry provides an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

Id. at 9:17–10:8.

F. Instituted Grounds of Unpatentability

We instituted trial based on the following grounds of unpatentability, which are all the grounds of unpatentability raised in the Petition:

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)/Basis
1–5, 8–11, 14–17, 21	103(a)	Bird,[2] Ishii[3]
12	103(a)	Bird, Ishii, Kameyama[4]
6, 7, 13, 20	103(a)	Bird, Ishii, Geva[5]
18, 19	103(a)	Bird, Ishii, Mulla[6]
1–11, 13–17, 20, 21	103(a)	Geaghan,[7] Ishii
12	103(a)	Geaghan, Ishii, Kameyama
18, 19	103(a)	Geaghan, Ishii, Mulla

Pet. 3–4, 27–86. Petitioner submits in support of its arguments the Declaration of Benjamin B. Bederson (Ex. 1002). Patent Owner submits in support of its arguments the Declaration of Darran R. Cairns, Ph.D. (Ex. 2020).

II. LEVEL OF ORDINARY SKILL IN THE ART

To determine whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). In assessing the level of ordinary skill in the art, various factors may

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[1] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '364 patent issued from an application having a filing date before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability.
[2] US 5,959,617, issued Sept. 28, 1999 (Ex. 1009, "Bird").
[3] EP 0572182 B1, issued Sept. 20, 2000 (Ex. 1010, "Ishii").
[4] JP H05-265637, published Oct. 15, 1993 (Ex. 1012, "Kameyama").
[5] GB 2299856 A, published Oct. 16, 1996 (Ex. 1011, "Geva").
[6] US 6,935,566 B1, issued Aug. 30, 2005 (Ex. 1016, "Mulla").
[7] US 2005/0110781 A1, published May 26, 2005 (Ex. 1013, "Geaghan").

be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citing *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962–63 (Fed. Cir. 1986)). "[O]ne or more factors may predominate." *Id.*

In our Decision on Institution, we adopted the following definition for one having ordinary skill in the art at the time of the invention of the '364 patent: one who "would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field[,] and . . . two years of experience in the research, design, development, and/or testing of touch and/or proximity sensors, human-machine interaction and interfaces, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa." Dec. on Inst. 12 (quoting Pet. 6 (citing Ex. 1002 ¶ 32)). This definition mirrors what Petitioner proposed, except we excised the phrase "at least" which modified the years of experience as that language is vague and open-ended. *Id.*

Patent Owner proposes a different definition for one of ordinary skill in the art, but does not specifically address any deficiencies in Petitioner's proposed definition. PO Resp. 19.

Because Petitioner's definition of the level of skill in the art (excluding "at least") is consistent with the '364 patent and the asserted prior art, we maintain it for purposes of this Final Written Decision. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *GPAC*, 57 F.3d at 1579; *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978). Our analysis herein, however, does not turn on which of the parties' definitions we adopt.

III. CLAIM CONSTRUCTION

Because the Petition was filed after November 13, 2018, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). In applying such standard, claim terms are generally given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art, at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

The parties agree for this proceeding that the terms of the claims have their plain and ordinary meaning. *See, e.g.*, Pet. 14; PO Resp. 19. However, the parties' arguments about whether the prior art teaches the challenged claims show that the parties dispute what is the plain and ordinary meaning of "input area," as recited in independent claims 1, 10, and 17. *See, e.g.*, Pet. 31–32; PO Resp. 28–49; Pet. Reply 1–5; PO Sur-reply 10–23. Thus, we need to resolve this dispute. *See Eon Corp. IP Holdings v. Silver Spring Networks*, 815 F.3d 1314, 1318 (Fed. Cir. 2016) (finding that disputes between the parties over the plain and ordinary meaning of a term should be resolved as a matter of claim construction). To that end, after the oral hearing, we authorized additional briefing concerning how to construe "input area." Paper 28, 2–3.

Below, we address (i) Patent Owner's arguments that authorizing this additional briefing was improper, and (ii) the parties' arguments concerning how to construe "input area."

A. Authorizing Additional Briefing

In our Order authorizing additional briefing, we provided our reasoning for doing so. Paper 28, 2. In particular, we stated the following:

> In their initial papers, the parties submitted that no terms require an express construction. Paper 3 (Pet.) 1[4]; Paper 1[5] (PO Resp.) 1[9].
>
> The parties' responsive papers, however, dispute what is the plain and ordinary meaning of "input area," when used in the challenged claims. *E.g.*, Paper [19] (Pet. Reply) 1–5; Paper 2[4] (PO Sur-reply) [10–24]. In light of this dispute, and based on arguments presented at the oral hearing, we determine that additional briefing may be helpful to the Board. Specifically, we authorize additional briefing for the parties to address what is the plain and ordinary meaning of "input area," in the context of the challenged claims.

Id. By allowing additional briefing regarding claim construction we better ensured that the parties would be afforded an opportunity to fully address their dispute as to the plain and ordinary meaning of "input area" before we issued this Final Written Decision. *See Belden, Inc. v Berk-Tek LLC*, 805 F.3d 1064, 1080–82 (Fed. Cir. 2015); *TQ Delta, LLC v. DISH Network LLC*, 929 F.3d 1350, 1355–56 (Fed. Cir. 2019).

And we agree with Petitioner that additional briefing "is routine Board practice to resolve claim construction disputes that become apparent from the parties' papers or the hearing." Pet. Resp. Br. 2–3 (citing *Microsoft Corp. v. D3D Techs.*, IPR2021-00878, Paper 39 at 2–3 (PTAB Nov. 8, 2022); *Volkswagen Gp. of Am., Inc. v. Stratosaudio, Inc.*, IPR2021-00721,

Paper 63 at 40 (PTAB Jan. 24, 2023); *Dell Techs. Inc. v. WSOU Invests., LLC*, IPR2021-00272, Paper 30 at 2 (PTAB June 27, 2022)).

We find unavailing Patent Owner's argument that "Petitioner failed at the outset to bear its burden to identify with particularity how to construe" input area. PO Open. Br. 1. Rather, Petitioner states that it "interprets the claims of the '364 [p]atent according to the *Phillips* claim construction standard," and that "[t]o resolve the particular grounds presented in this Petition, Petitioner does not believe that any term requires explicit construction." Pet. 14. This is sufficient, and is consistent with our Consolidated Trial Practice Guide (Nov. 2019) ("CTPG").[8]

> If a petitioner believes that a claim term requires an express construction, the petitioner must include a statement identifying a proposed construction of the particular term and where the intrinsic and/or extrinsic evidence supports that meaning. On the other hand, a petitioner may include a statement that the claim terms require no express construction.

CTPG, 44. In other words, by stating that no terms require an explicit construction, Petitioner complied with 37 C.F.R. § 42.104(b)(3) as to "[h]ow the challenged claim[s are] to be construed."

In sum, we determine that allowing additional briefing on the construction of "input area" was appropriate.

B. Plain Meaning of Input Area

Petitioner provides two constructions for "input area." First, Petitioner argues that the plain and ordinary meaning of "input area" "is the *area onto which the input object directs electromagnetic radiation*." Pet. Open. Br. 1. Second, Petitioner argues that "an 'input area' is an area for

[8] *Available at* https://www.uspto.gov/TrialPracticeGuideConsolidated.

input, regardless of any relationship that it may or may not have with a 'display.'" Pet. Reply 2.

Patent Owner argues that "in the relevant context, the plain meaning of the claimed 'input area' refers to the coextensive display input area or the integrated display itself." PO Resp. Br. 1–2, 4; *see also id.* at 4 (same). Patent Owner also argues that one of ordinary skill in the art "would have understood the plain meaning of the standalone 'input area' term refers to an integrated or coextensive display itself." PO Open. Br. 6. From what we can gather from how Patent Owner uses these terms in its papers, (i) "coextensive display input area," (ii) "integrated display itself," and (iii) "coextensive display itself" all mean having an input area and display that are coextensive—which we gather is synonymous with integrated—without having sensors therein.[9] PO Open. Br. 6; PO Resp. Br. 1–2, 4. Patent Owner does not explain what, if any, difference there is in these terms for input area.

In addition, Patent Owner argues that "[t]he relevant context for construing the claimed 'input area' relates to integrated or coextensive input displays." PO Open. Br. 4. Patent Owner faults Petitioner for "not explain[ing] why it would be incorrect, 'contrary to claim construction principles,' 'confusing,' 'irreconcilable,' 'an unproductive side-show,' or 'not necessary' to interpret the meaning of the 'input area' in the relevant

[9] In contrast, Patent Owner appears to use the terms "integrated input display" and "coextensive input display" to mean that the input area and display are coextensive, and sensors *are* contained within their area. PO Open. Br. 7; PO Resp. Br. 1–2, 4. We find that these terms are confusingly similar to the terms Patent Owner uses for "input area," which does not have sensors therein.

context of the asserted integrated display teachings." PO Resp. Br. 3 (citing Pet. Open. Br. 1, 3, 5–6).

We find Patent Owner's arguments about the relevant context unavailing. The meaning of a claim term should not change based on what art is asserted against it. Below we apply a *Phillips* based analysis in construing "input area." And we address the parties' arguments, starting with the intrinsic evidence.

1. Claim Language

Petitioner argues that "'[i]nput area' is not defined, but the surrounding claim limitations make plain its meaning." Pet. Open. Br. 1–2 (citing *Phillips*, 415 F.3d at 1314). More specifically, Petitioner argues that claim 10 recites: (i) an "input object projecting an electromagnetic radiation pattern on the input area," (ii) "'an input area' and 'a sensor array' outside of it," and (iii) that "[t]he sensor array 'senses' the 'electromagnetic radiation pattern *thereon*.'" *Id.* at 2 (quoting Ex. 1001, 8:38–55). Petitioner argues "[t]he input object thus directs radiation onto a specific area—the 'input area' is this 'area onto which the radiation is directed.'" *Id.* "Thus, the claims are plain, unambiguous, and internally consistent: the 'input object' directs input radiation onto an area (the 'input area'), a sensor array outside the input area senses the input radiation on the input area." *Id.*

Patent Owner does not explain specifically how the language of the claims supports its proposed construction that input area means "coextensive display input area," "integrated display itself," and "coextensive display itself." Rather, Patent Owner argues that Petitioner's first proposed meaning for "input area" has "an unbounded *radiation area*." PO Resp. Br. 4. In particular, Patent Owner argues that "this radiation/'input area' is ambiguous or 'variable' as a matter of 'basic physics' because the area changes

according to the distance from the radiation source." *Id.* (citing Ex. 1002 ¶¶ 58–60; Ex. 1001, 9:10–12).

We agree with Petitioner that the language of claim 10 supports its proposed construction of the "area onto which the input object directs electromagnetic radiation." In particular, claim 10 recites (i) an input object that projects an electromagnetic radiation pattern, (ii) an input area, and (iii) a sensor array that senses the electromagnetic radiation pattern projected on the input area by the input object. Ex. 1001, 8:38–55. Taken together, this claim language is consistent with this proposed meaning for input area. *Id.*

We agree, however, with Patent Owner that this proposed meaning has ambiguity, but not for the reason Patent Owner advances.[10] Rather, Petitioner leaves unstated that this area is "for input." PO Open. Br. 1. Thus, any area—including areas away from the device—onto which the input object directs electromagnetic radiation arguably falls within its scope.

The language of claim 10 that we discuss above also supports the first part of Petitioner's second proposed construction (i.e., "an 'input area' is an area for input"). Ex. 1001, 8:38–55; Pet. Reply 2. We find that this meaning is sufficient for purposes of this Final Written Decision, and we now turn to the parties' dispute over whether "input area" must include a display. *See Realtime Data, LLC v. Iancu,* 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'"

[10] Patent Owner's argument that the area changes according to the distance from the radiation source incorrectly is directed to particular instances of the input object being used, rather than the total area of the device available for use for input by the input object. PO Resp. Br. 4.

(quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner argues that "claim 10 has no 'display'; a display is only added in dependent claim 3, which depends from claim 1." Pet. Open. Br. 3; Pet. Reply 2. Claim 3 recites "[a]n electronic input device according to claim 1, wherein the device further comprises a display providing a visually sensible output which is responsive to the electronic input." Ex. 1001, 8:8–10. Petitioner adds that "[d]isplay areas and input areas are two distinctly described and claimed concepts," and that "[a] construction that couples displays and input areas is contrary to claim construction principles." Pet. Open. Br. 3–4.

We agree with Petitioner and find that the language of the independent claims does not recite a display. *See* Ex. 1001, 7:52–8:4, 8:38–55, 9:17–10:8. Rather, a display is added to independent claim 1 by dependent claim 3. *Compare id.* 7:52–8:4, *with id.* at 8:8–10. Hence, we determine that the language of the claims also supports that the meaning of input area is not impacted by "any relationship that 'input area' may or may not have with a 'display.'" *See* Pet. Reply 2; *Phillips*, 415 F.3d at 1315 ("[T]he presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim."); *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004) ("[W]here the limitation that is sought to be 'read into' an independent claim already appears in a dependent claim, the doctrine of claim differentiation is at its strongest.").

2. The '364 Patent Specification

The parties agree that the Specification does not use the term "input area." The parties also agree that the '364 patent discloses embodiments

having a coextensive input area and display. *E.g.*, Pet. Reply 4; Pet. Open. Br. 2–3; PO Sur-reply 11–13. And some of these embodiments have sensors within the coextensive input area and display (e.g., Fig. 4), and some have the sensors positioned outside of the coextensive input area and display (e.g., Fig. 3). Ex. 1001, Figs. 3–4; Pet. Reply 3–5.

Notably, the '364 patent also teaches an embodiment having an input area and no display. In particular, the '364 patent discloses the following:

> While the above described embodiments talk of sensing the position of the stylus 16 relative to the display 12 of the device 10, it will be appreciated that the three-dimensional position of the stylus 16 relative to any other part of the device 10 or relative to any fixed location could be used for the same purpose. In this regard, the invention may provide only a stylus 16 and a sensing "pad" or the like which is able to determine the three-dimensional position of the stylus 16 relative thereto. The pad could be connected for communication with the electronic device 10 by any suitable means which will be well understood. Such an embodiment may enable the stylus 16 and "pad" to be used with conventional desk top or laptop computers in place of the more conventional mouse, scratch pad or tracker ball.

Ex. 1001, 7:15–7:28. In other words, the '364 patent discloses, in accordance with its invention, providing only a stylus and a sensing pad—without a display—to determine the three-dimensional position of the stylus for uses such as a mouse. *Id.*

Patent Owner's proposed construction for input area, which includes a display, would exclude embodiments following this sensing pad teaching, which cuts against Patent Owner's proposed construction. *See SynQor, Inc. v. Artesyn Techs., Inc.*, 709 F.3d 1365, 1378–79 (Fed. Cir. 2013) ("A claim construction that 'excludes the preferred embodiment is rarely, if ever, correct and would require highly persuasive evidentiary support.'").

In sum, we determine that the '364 patent Specification supports Petitioner's proposed construction that whether there is a display is immaterial to the meaning of input area. In other words, "input area" does not require, nor preclude, a display, coextensive or otherwise.

3. Prosecution History

We now turn to the prosecution history of the '570 patent—which is the parent of the '364 patent (Ex. 1001, code (63))—and discuss portions thereof relevant to the construction of input area. The prosecution history "can often inform the meaning of the claim language by demonstrating how the inventor understood the invention." *Phillips*, 415 F.3d at 1317. Such is the case here.

The claims as filed in the '570 patent did not recite an "input area." Ex. 2022 ('570 file history), 14. Rather, claim 1 recited, in relevant part, a "sensor array operative to sense . . . an electromagnetic radiation pattern on said sensor array." *Id.* The Examiner rejected claim 1 as being anticipated by Bird. *Id.* at 342. As reflected by the Examiner in an interview summary, the Examiner and the applicant discussed amending claim 1 to "include a sensor array outside the display area." *Id.* at 387.

The applicant instead amended claim 1 by (i) adding "an input area," (ii) changing "radiation pattern on said sensor array" to "radiation pattern on said input area," and (iii) adding "said sensor array comprising at least one sensor positioned outside said input area." *Id.* at 390. The applicant stated that "[s]upport for the amendment is found, inter-alia, in Fig. 3 and the description thereof, specifically on page 9, lines 8–9 and in the paragraph bridging pages 10 and 11 of the application as filed." *Id.* at 396. Notably, this bridging paragraph is the paragraph we quote above that describes the sensing pad embodiment that has no display. *Compare id.* at 12–13, *with*

Ex. 1001, 7:15–7:28; *see also* Pet. Resp. Br. 7. Hence, this supports that the input area need not include a display, contrary to Patent Owner's arguments.

In addition, we find unavailing Patent Owner's argument that the applicant canceling claim 4 at the same time as amending claim 1 to recite a sensor positioned outside the input area confirms that "input area" must include a display. *E.g.*, PO Sur-reply 14–15; *see also* PO Resp. 17–18 (citing Ex. 2023 ('364 file history), 239, 242) (making similar argument in the context of the amending of the independent claims in the '364 patent prosecution); PO Sur-reply 15–16 (same). Claim 4 recited "[a]n electronic input device according to claim 3 and wherein said display is generally coextensive with said sensor array." Ex. 2022, 14. We do not find this argument persuasive, especially because claim 5 was canceled at the same time. *Id.* at 390. Claim 5 recited "[a]n electronic input device according to claim 3 and wherein said display is generally non-coextensive with said sensor array." *Id.* at 14. There would have been no reason to cancel claim 5 if the concern was over the sensor array location not being outside a coextensive display and input area because claim 5 already recited that the sensor array was "non-coextensive" with the display. *Id.* Simply put, whether a display is coextensive with an input area has nothing to do with where the sensors are located.

In sum, we determine that the prosecution history supports Petitioner's proposed construction that whether there is a display is immaterial to the meaning of input area.

4. Extrinsic Evidence

Patent Owner extensively cites to the testimony of Dr. Cairns in support of its arguments throughout its papers. We have reviewed the expert testimony Patent Owner cites, but we give it little, if any, weight in light of

the clear disclosure of the intrinsic evidence. *See Wi-LAN, Inc. v. Apple Inc.*, 811 F.3d 455, 462 (Fed. Cir. 2016) (finding extrinsic evidence "is generally of less significance than the intrinsic record" in matters of claim construction); *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996) (finding that when "an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term[,] . . . it is improper to rely on extrinsic evidence").

In addition, we find unavailing Patent Owner's numerous arguments concerning purported admissions or agreements by Petitioner. First, we view these arguments as directed to extrinsic evidence, which is of less significance given the clear intrinsic evidence. *See Wi-LAN,* 811 F.3d at 462; *Vitronics Corp.*, 90 F.3d at 1583. Second, we agree with Petitioner and find that there were no such admissions or agreements. *See, e.g.*, Pet. Resp. Br. 3–5 (refuting purported admissions and agreements).

5. Summary

We conclude that "input area" means an area for input, regardless of any relationship that input area may or may not have with a display.

IV. PRINCIPLES OF LAW

"In an [inter partes review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring inter partes review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of non-obviousness, if present.[11] *See Graham*, 383 U.S. at 17–18. When evaluating a claim for obviousness, we also must "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

V. ALLEGED OBVIOUSNESS OVER BIRD AND ISHII

Petitioner argues that the combination of Bird and Ishii renders claims 1–5, 8–11, 14–17, and 21 obvious. Pet. 3, 27–50. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders these claims obvious.

A. Summary of Bird

Bird "relates to a light pen input system comprising a light pen which emits a light beam and a light sensing device comprising a planar array of light sensing elements in rows and columns over which the light pen is moved, the light beam emitted from the light pen producing a light spot on

[11] Patent Owner does not present arguments or evidence of such objective evidence of non-obviousness. *See generally* PO Resp.

the array which is sensed by the sensing elements." Ex. 1009, 1:4–10. Bird teaches that objects of its invention are "to provide a light pen input system which is capable of offering greater flexibility in use," and "in which the light pen offers more functionality." *Id.* at 2:13–18. Figure 1, shown below, illustrates an embodiment of Bird's invention. *Id.* at 3:40–41.

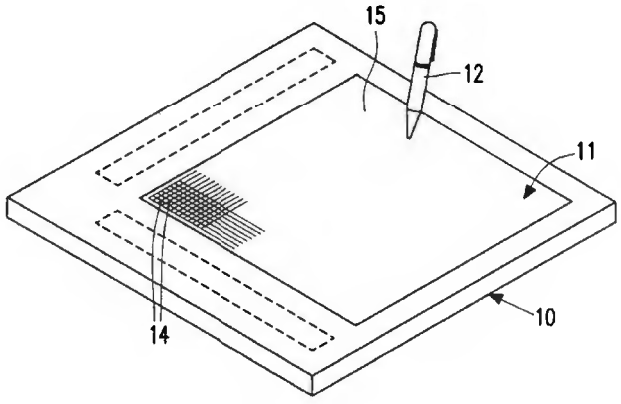

FIG. 1

Figure 1 "shows schematically an embodiment of a light pen input system according to the invention" of Bird. *Id.* As shown in Figure 1, Bird teaches a "system [which] comprises a light sensing device 10 which consists of a large area two-dimensional X-Y array of light sensing elements 14 defining a sensing area 11 having a writing surface over the surface of which a light pen 12 can be moved by a user to input information." *Id.* at 3:59–63. Bird teaches that "[t]he light sensing device can be of any known kind having a row and column, planar, array of light sensing elements." *Id.* at 4:12–13.

"In this particular embodiment [of Figure 1], the device 10 is of the type in which the light sensing element array is integrated in a liquid crystal display panel to form a single unit 15 providing input and display output functions." *Id.* at 4:15–19. "The sensing elements may comprise any suitable photosensitive device such as a photoresistor or photodiode." *Id.* at

4:14–15. Bird also teaches that instead "the light sensing element array may be of a kind which does not use a photoelectric device at each sensing element location but instead uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." *Id.* at 4:43–49.

Bird teaches that "light pen 12 includes a light source, for example an LED or a semiconductor laser." *Id.* at 4:51–52. "Light from the light source, which may be visible or non-visible, for example, infra-red light, is emitted from the pen in the form of a shaped light beam by optical means contained in the pen." *Id.* at 4:59–62. "The light beam emitted from the pen is such that with the pen, and thus the main optical axis of the emitted beam, perpendicular to the plane of the array, the light spot produced on the array by the beam in operation is substantially non-circular." *Id.* at 4:63–67. Bird teaches, for example, that "the shapes of the spots [can be] rectangular, elliptical, elongated (isosceles) triangular, ovoid, and non-rectangular parallelogram." *Id.* at 6:38–40.

Bird teaches that "[t]he light beam emitted by the light pen 12 causes a response in the sensing elements." *Id.* at 3:64–66. "The X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen are detectable . . . ." *Id.* at 2:40–44. Moreover, "[b]y monitoring the sensing elements outputs the changing pattern of illuminated elements can be detected and the direction of rotation of the beam determined, which information can then be used to provide functionality in addition to that obtained in the conventional manner of use merely by moving the light pen over the array and sensing the pen's position on the array in two coordinates." *Id.* at 5:65–6:5.

B. Summary of Ishii

Ishii "relates to a display unit of an input integral type for a handwriting input used in an office automation (OA) equipment and an audio visual device." Ex. 1010 ¶ 1. Ishii's invention provides "a display unit having a liquid crystal display panel and an input means[,] the liquid crystal display panel comprising two substrates, . . . wherein the input means comprises signal conductors arranged in a matrix of X-conductors and Y-conductors . . . [that] are optical waveguides for guiding light parallel to the surfaces of the substrates." *Id.* ¶ 23. The waveguides are "formed in the shape of a matrix and approximately guide[] light having a predetermined wavelength in parallel with a surface of a display substrate," and thus, "the position of an optical pen can be detected by an inputting operation thereof." *Id.* ¶ 24.

C. Challenged Claim 1

1. Electronic Input Device (Preamble)

Petitioner argues that Bird teaches "[a]n electronic input device," as recited in the preamble of claim 1. Pet. 28–29. More specifically, Petitioner argues that Bird teaches an electronic input device as "light sensing device 10." *Id.* (citing Ex. 1009, 3:59–60, Fig. 1; Ex. 1002 ¶ 91).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Bird teaches "[a]n electronic input device." In light of our finding, we need not, and thus do not, reach whether claim 1's preamble is limiting.

2. Input Object

Petitioner argues that Bird teaches "an input object projecting a conical beam of electromagnetic radiation," as recited in claim 1. Pet. 29–

30. More specifically, Petitioner argues that Bird's "'light pen 12' is an input object." *Id.* at 29 (citing Ex. 1009, 3:62–63). Petitioner argues that "[t]he light pen includes a light source such as 'an LED.'" *Id.* at 29–30 (citing Ex. 1009, 4:51–52). According to Petitioner, Bird teaches that "[a] light source is a source of electromagnetic radiation." *Id.* at 30 (citing Ex. 1009, 1:58–60). Petitioner argues that Bird teaches that a "beam of light is directed through the pen tip 24 via an optical system 25 which includes an aperture 26 that determines the required shape of the light spot." *Id.* (quoting Ex. 1009, 7:40–43, citing Fig. 9). Petitioner argues that Bird teaches that the beam is conical. *Id.* (citing Ex. 1009, Fig. 9). Petitioner argues that Bird teaches that "[t]he light is projected onto an input area, specifically sensing area 11." *Id.* (citing Ex. 1009, 3:62, 6:38–46, 9:6–7).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Bird teaches "an input object projecting a conical beam of electromagnetic radiation."

3. Input Area

Claim 1 further recites "an input area having a periphery receiving the conical beam of electromagnetic radiation thereon." Ex. 1001, 7:55–56. We agree with Petitioner and find that Bird and Ishii teach this limitation. Pet. 31–35; Pet. Reply 6–13.

In particular, we agree with Petitioner and find that Bird teaches "a large area two-dimensional X-Y array of light sensing elements 14 defining a sensing area 11 having a writing surface over the surface of which a light pen 12 can be moved by a user to input information." Ex. 1009, 3:59–63, Fig. 1; Pet. 31; *see also supra* Section V.C.2 (finding that the input object projects a conical beam of electromagnetic radiation). We also agree with

Petitioner and find that Bird teaches that "[t]he light sensing element array may be of a kind which . . . uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements," as described in Ishii. Ex. 1009, 4:43–50; Pet. 32.

And we find that Ishii teaches forming optical waveguides in an X direction on a substrate and in a Y direction on another substrate such that the waveguides cross. *E.g.*, Ex. 1010 ¶ 47, Fig. 9. Put differently, Ishii teaches providing "input means compris[ing] signal conductors arranged in a matrix of X-conductors and Y-conductors," where "the signal conductors are optical waveguides for guiding light parallel to the surfaces of the substrates." *Id.* ¶ 23; Pet. Reply 10–11.

In addition, we agree with Petitioner and find that in view of Bird's and Ishii's teachings, one of ordinary skill in the art would have understood that the waveguides[12] define the extent of the input area. Pet. 35; Ex. 1009, 3:59–63, 4:43–50; Ex. 1010 ¶¶ 23, 47, Fig. 9; Ex. 1002 ¶ 99. In addition, we find persuasive Dr. Bederson's testimony on this point as it is consistent with the references' teachings. *Compare* Ex. 1009, 3:59–63, 4:43–50 *and* Ex. 1010 ¶¶ 23, 47, Fig. 9, *with* Ex. 1002 ¶ 99. We also agree with

[12] To be abundantly clear, we refer to waveguides as Petitioner does, meaning only those portions of the waveguides that conduct light to their ends. As we discuss below, we view Bird's peripheral light sensors and photosensing circuits connected to the waveguides to be separate from, and not a part of, the waveguides. *See infra* Section V.C.4. Likewise, we view Ishii's photosensors and sensor portions as being separate from, and not a part of the waveguides, for purposes of the claim limitations. *Id.* In addition, certain of the parties' arguments implicate both the "input area" and "a sensor array positioned at the periphery of the input area" limitations, and we address such arguments below in that section addressing the latter limitation. *Id.*

Petitioner and find that both Bird and Ishii teach that the input area has a periphery and receives the conical beam of electromagnetic radiation. Ex. 1009, 4:44–50; Ex. 1010 ¶ 45; Pet. 32.

We find unavailing Patent Owner's argument that Ishii's integrated input display is the input area. PO Sur-reply 20 & n.7. Arguments regarding a display—and whether the input area is coextensive with the display—are inapposite. *See supra* Section III.B (construing "input area").

We also find unavailing Patent Owner's argument that Petitioner's argument that "Ishii's 'optical waveguides define the extent of the input area'" is based on Dr. Bederson's testimony that copies/pastes attorney argument. PO Resp. 30 (comparing Pet. 35, with Ex. 1002 ¶ 99); *see also id.* (citing Ex. 2020 ¶ 86) (arguing no evidence supports Petitioner's arguments). As we discuss above, we find that this testimony from Dr. Bederson is consistent with Bird's and Ishii's teachings. Moreover, Dr. Bederson further supports this testimony by citing to portions of Ishii that discuss, *inter alia*, waveguides and how they relate to the sensor portions. *See* Ex. 1002 ¶ 99 (citing Ex. 1010 ¶¶ 45, 51, Fig. 9).

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii teaches "an input area having a periphery receiving the conical beam of electromagnetic radiation thereon."

4. Input Object is Spaced Apart

Claim 1 further recites "wherein the input object is spaced apart from and not in contact with the input area." Ex. 1001, 7:57–58. We agree with Petitioner and find that Bird teaches this limitation. Pet. 33; Pet. Reply 16–17.

In particular, we agree with Petitioner and find that Bird teaches that "[t]he light pen 12 includes a light source . . . and a power supply for powering the light source, with electrical power to the light source being controlled by a switch operable either manually by a user or indirectly in response to pressure upon the pen being brought into contact with the writing surface of the sensing element array." Ex. 1009, 4:51–57.

In addition, we find persuasive the testimony of Dr. Bederson that one of ordinary skill in the art "would have understood that the switch-based stylus does not have to make contact with the input area, but instead a user can manually activate the light source without contact to the input area as an alternative to 'pressure upon the pen being brought into contact with the writing surface.'" Ex. 1002 ¶ 96 (quoting Ex. 1009, 4:55–56; citing *id.* at 4:51–55). We also find persuasive Dr. Bederson's testimony that "Bird expressly teaches to sense changes to a radiation pattern's size, shape, and orientation, . . . so [one of ordinary skill in the art] would have been motivated to accommodate an input object spaced apart from the surface because such a configuration allows size, shape, and orientation to vary over a wider range and thus increase sensitivity and user-input flexibility." *Id.* We find that this testimony is consistent with Bird's teachings. *Compare* Ex. 1002 ¶ 96, *with* Ex. 1009, 4:51–57.

We find unavailing Patent Owner's arguments that Bird requires contact between the input object and input area. PO Resp. 57–58; PO Sur-reply 35. In particular, we find unavailing Patent Owner's argument that Bird teaches embodiments where the light pen is pressed against the input area. PO Resp. 57 (citing Ex. 1009, 1:47–56, 1:61–2:2, 7:47–53; Ex. 2020 ¶ 141). Such teachings do not negate that Bird also teaches alternative

embodiments having the light source being controlled by a switch operable manually by a user. *See* Ex. 1009, 4:51–56.

We also find unavailing Patent Owner's argument that Bird's purported "inability to detect or sense z-distances between the input object and input area also confirms it does teach or suggest the claimed 'input object [] spaced apart from and not in contact with the input area.'" PO Resp. 57. This argument is contrary to Bird's explicit teaching that the light source can be controlled by a switch operable manually by a user. *See* Ex. 1009, 4:51–56. And for the same reason we find unpersuasive Dr. Cairns's testimony that one of ordinary skill in the art "would have understood Bird requires contact between the pen and the input area," which is the opposite of the claim language. *Id.*; Ex. 2020 ¶ 142.

In sum, we find that Petitioner shows by a preponderance of the evidence that Bird teaches "wherein the input object is spaced apart from and not in contact with the input area."

5. Pattern Produced on the Input Area

Petitioner argues that Bird teaches "a pattern produced on the input area by the input object," as recited in claim 1. Pet. 29–30, 34. More specifically, Petitioner argues that Bird's light pen 12 (i.e., input object) produces a beam of light having a particular light spot shape, which is projected onto sensing area 11 (i.e., input area). *Id.* at 29–30 (citing Ex. 1009, 3:62–63, 4:51–52, 6:38–46, 7:40–43, Fig. 9).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that Bird teaches "a pattern produced on the input area by the input object."

6. Sensor Array Positioned at the Periphery

Claim 1 further recites "a sensor array positioned at the periphery of the input area." Ex. 1001, 7:60. We agree with Petitioner and find that the combination of Bird and Ishii teaches this limitation. Pet. 34–36; Pet. Reply 6–13.

In particular, we agree with Petitioner and find that Bird teaches an embodiment that has a light sensing element array that "uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." Ex. 1009, 4:43–50. In other words, Bird teaches a sensor array (i.e., the peripheral light sensors) that is positioned at the periphery of the input area (i.e., the rows and columns of waveguides whose intersections constitute a planar array of light sensing elements). *Id.* Bird also teaches that an example of this light sensing element array is described by Ishii. *Id.*

Petitioner annotates Ishii's Figure 9, shown below, to address Ishii's teachings. Pet. 36.

Fig. 9

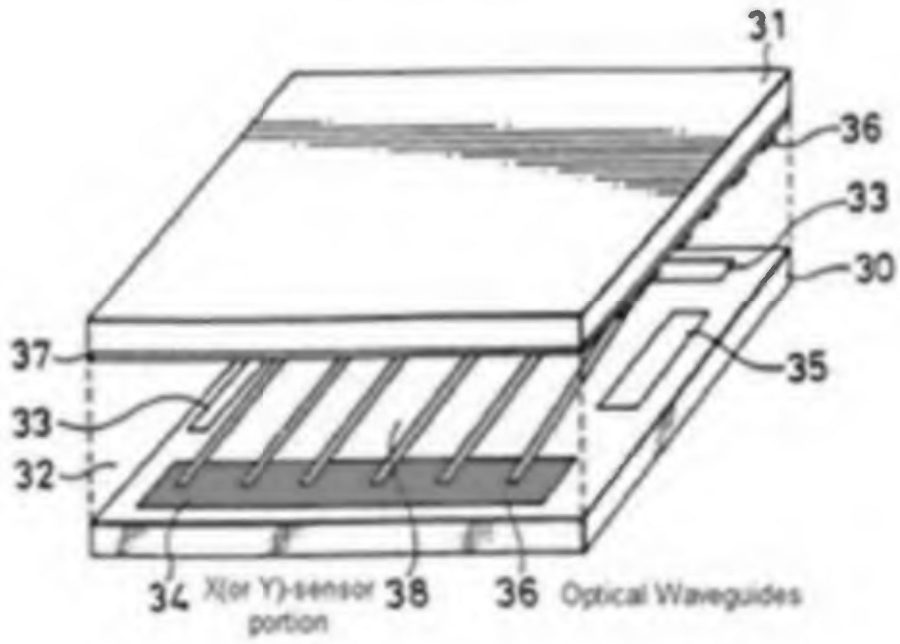

Figure 9 "is a perspective view showing a display unit of an input integral type in accordance with" Ishii's teachings. Ex. 1010 ¶ 27. As illustrated, "a silicon monocrystal substrate 30 and a glass substrate 31 are opposed to each other and a liquid crystal 32 is sealed into a clearance between the silicon monocrystal substrate 30 and the glass substrate 31." *Id.* ¶ 44. Ishii teaches that "[a]n optical waveguide in the Y or X direction is formed in the glass substrate 31 opposed to the silicon monocrystal substrate 30 such that this optical waveguide crosses the optical waveguide of the silicon monocrystal substrate 30." *Id.* ¶ 47. Figure 9 further illustrates "[a]n optical waveguide 36, an X(or Y)-sensor portion 34 and a Y(or X)-sensor portion 35 [which] are formed in an X or Y direction between the picture element electrode portions 38." *Id.* ¶ 45. Petitioner annotates the figure by (i) labeling reference numeral 34 with "X (or Y)-sensor portion" and coloring the portion in red, and (ii) coloring in orange the illustrated optical waveguides

on the silicon monocrystal substrate 30 and labeling the corresponding reference numeral 36 with "Optical Waveguides." Pet. 36 (annotating Ex. 1010, Fig. 9).

We agree with Petitioner and find that Ishii teaches that the sensor portions are positioned at the periphery of the input area.[13] *Id.* at 35–36; Pet. Reply 7–12. In particular, Ishii teaches the following:

> A photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions. An end portion of the optical waveguide formed on the glass substrate in the Y or X direction is recessed or projected to leak light onto the silicon substrate. The photosensor on the silicon substrate is formed in a position for receiving this leaked light.

Ex. 1010 ¶ 51. In other words, Ishii teaches a sensor array (i.e., the photosensors in the X direction (sensor portion 34) and the photosensors in the Y direction (sensor portion 35)), which is positioned at the periphery of the input area (i.e., the photosensors are positioned at the end of the waveguides for receiving leaked light from the ends of the waveguides). *Id.* ¶¶ 45, 51, 53, 76–79, Fig. 9. Again, we find that the waveguides in Ishii correspond to the input area, and the sensor portions 34 and 35 are positioned at the end of the waveguides so that they can receive light that is

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[13] We agree with Patent Owner that the plain meaning of "periphery" and "circumscribing" refer to different types of being "outside" the input area as these terms are used for the claimed positional sensor array recitals in the '570 and '364 patents. *E.g.*, PO Resp. 16–17. The parties here do not argue separately the positional sensor array recitals of the challenged claims. We find that Petitioner's showing for the sensor array being "at the periphery" of the input area also applies to show that Bird and Ishii teach the sensor array being "at least partially circumscribing and immediately proximate" (claim 10) and "partially circumscribing and immediately proximate" (claim 17) the input area.

leaked from the ends of the waveguides. *See supra* Section V.C.3 (finding that Bird and Ishii's waveguides teach the claimed input area); Ex. 1010 ¶¶ 51, 53, 76–79, Fig. 9.

We find persuasive the testimony of Dr. Bederson that one of ordinary skill in the art "would have understood that Ishii's photosensors . . . are at the end of each optical waveguides," and that "[t]hey are thus positioned both at the 'periphery' and 'partially circumscribing and immediately proximate to' the input area," as we find this testimony is consistent with Ishii's teachings. *Compare* Ex. 1002 ¶ 99, *with* Ex. 1010 ¶¶ 45, 51, 78 ("A photosensor is formed on the silicon substrate in an end portion of the optical waveguide and is connected to the optical waveguide on the silicon substrate in the X-axis direction through a light leaking portion."), 79 ("[A] light leaking portion is also formed by etching in an end portion of the optical waveguide on the glass substrate in the Y-axis direction," and "[a] photosensor on the silicon substrate is arranged below this light leaking portion and is opposed to this light leaking portion"), Fig. 9.

In addition, we find that Petitioner has provided sufficiently articulated reasoning with rational underpinning to support Petitioner's modifications of Bird with Ishii. *See Kahn*, 441 F.3d at 988. In particular, we agree with Petitioner and find that Bird expressly teaches employing Ishii's teaching of having sets of waveguides which conduct input light to peripheral light sensors. Ex. 1009, 4:46–50; Pet. 36. Hence, we also agree with Petitioner and find that one of ordinary skill in the art "would have found it obvious to follow this express teaching." Ex. 1002 ¶ 100.

We find unavailing Patent Owner's argument that "Petitioner argues waveguides are not sensors based on an incorrect distinction between electrical/optical components." PO Sur-reply 26 (citing Pet. Reply 7–8, 11–

13). And we disagree with Patent Owner that "lightguides or waveguides *are* indeed sensors" in the context of the '364 patent. *Id.* As Bird and Ishii teach, "waveguides" and "light guides" just "conduct" or "guide" light to their ends. Ex. 1009, 1:28–31, 4:44–50; Ex. 1010 ¶¶ 23–24, 53, 58; *see also* Ex. 1042 (Cairns Depo.), 77:11–78:1 (testifying that light guides are "useful for moving light around"). In particular, Bird teaches that "[t]he sets of light guides are connected at their ends to respective photosensing circuits which produce an electrical signal in response to light being conducted thereto by the light guides." Ex. 1009, 1:28–31. Bird also teaches that the "sets of row and column light waveguides . . . conduct input light to *peripheral light sensors*." *Id.* at 4:43–50 (emphasis added). Similarly, Ishii teaches that a photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in a position for receiving leaked light. Ex. 1010 ¶ 51. In other words, Bird's and Ishii's photosensing circuits or sensors sense the light, while the light guides or waveguides convey the light to the sensors. Ex. 1009, 1:28–31, 4:43–50; Ex. 1010 ¶¶ 51, 53.

This finding is consistent with the '364 patent's disclosures. For example, the '364 patent discloses that "light is sensed by a sensitive layer," which "may, for example, be in the form of a CCD or CMOS infrared sensitive array or the like." Ex. 1001, 4:46–50. We view this as teaching an array of CCD sensors or CMOS sensors forms the sensitive layer. *Id.* And CCD sensors and CMOS sensors produce an electrical signal in response to light. *See* Ex. 1025, 32 (explaining that a CMOS sensor is based on a transistor that is "inherently light sensitive" and that "the current through the transistor will be proportional to the light incident on it"); *see also id.* (explaining that a CCD sensor "work[s] by accumulating charge, proportional to the incident light, in an electronic 'bucket[,' which] must

accumulate (or integrate) charge before it can be read out"). The '364 patent also discloses that a photodiode can be used to sense light—a photodiode is a photoelectric element. Ex. 1001, 4:64–67; Ex. 1009, 1:16–21 (stating that a photodiode is a photoelectric element for light sensing).

We also find unavailing Patent Owner's argument that "Petitioner fails to provide any evidence or testimony demonstrating the claimed 'sensor array' structure cannot include multiple components." PO Sur-reply 31 (citing Pet. Reply 7 n.10; Ex. 2020 ¶ 113; Ex. 1042, 75:12–14, 79:14–23, 74:19–24). Patent Owner's attempt to create a broader "structure" to add components to the claimed sensor array is misplaced. As we find above, Bird's peripheral light sensors and Ishii's sensor portions, which constitute the array of photosensors at the end of the waveguides, teach the claimed sensor array. Ex. 1009, 4:44–50; Ex. 1010 ¶¶ 51, 53, 78–79, Fig. 9. As we also find above, the waveguides are distinct from the sensor array, and simply guide light to the sensor array. Ex. 1009, 1:28–31, 4:44–50; Ex. 1010 ¶¶ 53, 58, 78–79. Moreover, the claims use "comprising" as the transitional phrase, and thus, do not exclude having additional components from their scope. *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997). That the claims allow for additional components (e.g., waveguides, traces, electrical wires) does not mean that those additional components are part of the claimed components (e.g., a sensor array).

We also find unavailing Patent Owner's argument that Ishii teaches that "the photosensor portions/circuits are part of the same sensor array structure (optical waveguide) and are created during the waveguide fabrication process." PO Sur-reply 33 (citing Ex. 1010 ¶ 78; Ex. 1042, 79:10–12, 79:14–23); *see also id.* at 25 (citing Ex. 1010 ¶¶ 71, 76–78; Ex. 1042, 72:6–73:14, 79:14–23, 75:12–14, 113:14–22, 114:4–15; Ex. 2020

¶ 48; Ex. 2011) (making same argument). In particular, Patent Owner argues that Ishii "teaches forming X-Y direction waveguides in between picture elements and then forming a 'photosensor' 'in an end portion of the optical waveguide' and connecting it 'to the optical waveguide on the silicon substrate . . . through a light leaking portion.'" *Id.* at 32 (quoting Ex. 1010 ¶ 78; citing Ex. 1010 ¶¶ 76–79) (alteration in original). In other words, Ishii "teaches forming unique photosensor circuits '***in*** ' ***each respective waveguide itself***," according to Patent Owner. PO Resp. Br. 6 (citing Ex. 1010 ¶¶ 43, 51, 53, 78). Patent Owner argues that "[t]he relative positions of these sub-structures inside respective waveguides do not matter," and that "Ishii's photosensing circuitry is an internal part of its waveguides/'sensor array.'" *Id.* at 7.

We disagree with Patent Owner. Ishii clearly refers to the photosensors as being "portions," which teaches that the photosensors are distinct from the other portions of the waveguide. Ex. 1010 ¶ 45 ("An optical waveguide 36, an X(or Y)-sensor portion 34 and a Y(or X)-sensor portion 35 are formed in an X or Y direction . . . ."). Moreover, as we discuss above, waveguides conduct light to their ends and the photosensors sense the light—two separate functions. *E.g.*, *id.* ¶ 58.

In addition, although Ishii teaches that "[a] photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions," Ishii also teaches that waveguides for a direction (e.g., the Y direction) are formed in the glass substrate, which is above the silicon substrate. *Id.* ¶¶ 47, 51, 78, Fig. 9. For these glass substrate waveguides, Ishii teaches that an end portion of the waveguide "is recessed or projected to leak light onto the silicon substrate" with "[a] photosensor on the silicon substrate . . . arranged below," and opposed to, this light leaking

portion. *Id.* ¶¶ 51, 79. Hence, Ishii teaches that a waveguide's photosensor need not be physically part of the waveguide, which evidences that waveguides and photosensors are separate and distinct, and evidences that Ishii uses "formed in an end portion" broadly. *Id.* Moreover, Ishii teaches for the waveguides formed on the silicon substrate that their photosensors are formed in an end portion of the waveguides and are "connected" to the waveguides through a light leaking portion. *Id.* ¶ 78. Having a connection and an intervening portion also evidences that the photosensors and waveguides are separate. *Id.*

We also find unavailing Patent Owner's argument that Petitioner incorrectly "excludes the ends of Ishii's optical waveguides/photosensor circuits as if they would be prevented from receiving light over the corresponding portion of the display." PO Resp. Br. 7 (citing Pet. Open. Br. 7). According to Patent Owner, "Ishii's waveguide structure, including photosensor circuitry . . . directly receives and senses light over the entire coextensive display input area." *Id.* (citing Ex. 1010 ¶¶ 1, 62). Patent Owner, however, does not point to any portion of Bird or Ishii that teaches that the photosensor circuitry or photosensors directly receive incident light. *Id.* To the contrary, Bird teaches that in Ishii the photosensing circuits sense light "conducted thereto by the light guides," rather than receiving incident light directly. Ex. 1009, 1:24–35; 4:43–50. Likewise, Ishii teaches that its photosensors received light leaked from the ends of the waveguides, rather than receiving incident light directly. Ex. 1010 ¶¶ 51, 78–79.

Regardless, Petitioner identifies the sets of waveguides as the input area, and Bird and Ishii teach that the photosensors are outside the waveguides. *See supra* Section V.C.3 (finding that Petitioner shows the claimed input area is taught); Ex. 1010 ¶¶ 51, 53, 78–79. This identification

is consistent with Bird's and Ishii's teachings of sensing the light that falls on the waveguides' intersections (which represent two dimensions) to identify a lighted area. Ex. 1009, 1:24–35; Ex. 1010 ¶ 53. Purported light that falls directly on a photosensor would provide for identification of only one dimension, rather than an area.

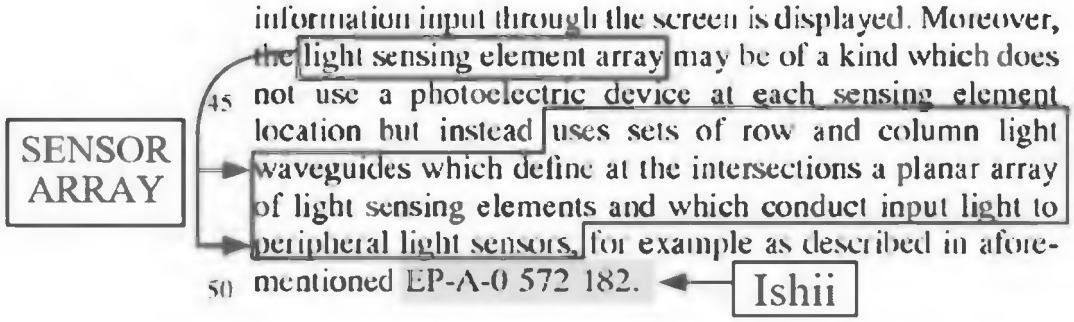
We also find unavailing Patent Owner's argument that Bird's waveguides are sensors because "Bird states optical waveguides define '*sensing* elements' multiple times." PO Sur-reply 26 (citing Ex. 1009, 1:25–34, 4:43–50). Patent Owner overreads Bird's use of the phrase "sensing elements." *Id.* For Bird's embodiment employing peripheral sensors, the phrase "sensing elements"[14] refers to a matrix or array of the intersections of the rows and columns of the waveguides. Ex. 1009, 1:25–34, 4:43–50. Bird referring to these intersections as sensing elements does not alter Bird's teaching that the waveguides conduct incident light to their ends for the peripheral light sensors to sense. *Id.* We focus on what Bird and Ishii teach as to functionality and structure of the waveguides (and their intersections), rather than what Bird calls the intersections (i.e., "sensing elements"). *Cf. In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a reference does not have to satisfy an *ipsis verbis* test to disclose a claimed element).

[14] Bird also uses the term "sensing elements" in referring to other embodiments that instead use photosensitive devices (e.g., photoresistors or photodiodes) "arranged regularly-spaced in a row and column matrix array." *See, e.g.*, Ex. 1009, 3:59–4:6, 4:12–15, Fig. 1. Hence, in light of Bird's varied embodiments, we view Bird as using the term "sensing elements" broadly to teach arrays having elements for the light sensing devices, rather than teaching for all embodiments that the elements themselves are "sensing."

We also find unavailing Patent Owner's argument that waveguides are sensors in view of Ishii's teaching that "the position of an optical pen can be *detected by forming an optical waveguide* within a display panel." PO Sur-reply 26 (quoting Ex. 1010 ¶ 64; citing *id.* at code (54), ¶¶ 23, 77–79); *see also id.* at 32 (making same argument). This teaching relates to a handwritten character recognizing device, and the cited portion of Ishii does not explain how detection specifically occurs. Ex. 1010 ¶¶ 61–64. Moreover, for this embodiment, Ishii teaches "[a]n optical pen position detecting section 61 [which] detects a position of the optical pen on the display panel 60 on the basis of a signal transmitted from the display panel 60 in accordance with light from the optical pen." *Id.* ¶ 62. Patent Owner does not address this teaching. PO Sur-reply 26, 32. In sum, Patent Owner overreads "detected by forming an optical waveguide" in arguing that this phrase teaches that waveguides are sensors. *Id.*

We also find unavailing Patent Owner's argument that Dr. Cairns explains that "lightguides or 'optical fibers' are well known sensors, were widely used as sensors, 'certainly [one of ordinary skill in the art] would consider that optical fibers acted as sensors,' and 'people often call optical fiber "optical fiber sensors."'" *Id.* at 26–27 (quoting Ex. 1042, 72:6–73:14, 79:10–23; 75:12–14). We find this testimony unpersuasive because it is inconsistent with Bird's and Ishii's teachings of having the light guides guide light to photosensing circuits or sensors, which do the sensing. *See* Ex. 1009, 1:28–31, 4:43–50; Ex. 1010 ¶¶ 51, 53. This testimony also is inconsistent with the '364 patent's disclosures of employing an array of CCD sensors or CMOS sensors, or a photodiode, which produce an electrical signal in response to sensing the light. *See* Ex. 1001, 4:46–50, 4:64–67.

We also find unavailing Patent Owner's argument that "Ishii's 'peripheral sensors' are actually part-of its planar array." PO Resp. 39 (citing Ex. 1009, 4:46–50; Ex. 2020 ¶ 105); *see also id.* at 46 (making same argument). Similarly, Patent Owner argues that "Bird states Ishii's waveguides define 'a planar array of light sensing elements [] which conduct input light to peripheral light sensors,' where Ishii's peripheral sensors *are part-of the planar array*." *Id.* at 37 (citing Ex. 1009, 4:42–50) (emphasis added). Patent Owner illustrates these arguments by annotating a passage from Bird, as shown below.



As illustrated, Patent Owner has excerpted lines 43–50 of column 4 from Bird, drawing a red outline around "light sensing element array" and a red outline around "uses sets of row and column light waveguides which define at the intersections a planar array of light sensing elements and which conduct input light to peripheral light sensors." PO Sur-reply 25 (annotating Ex. 1009, 4:43–50). Patent Owner also draws in red an arrow from "light sensing array" to both "waveguides" and "peripheral light sensors," and labels such "sensor array." *Id.*

We disagree with Patent Owner and find that this passage does not teach that the peripheral light sensors are part of Bird's planar array. Rather, this passage clearly teaches that the "light sensing element array" is a planar array of light sensing elements, where each element is an intersection of a

row and column of the sets of light waveguides. Ex. 1009, 4:43–50. The way the passage is structured (i.e., the sets of waveguides "which define" and "which conduct") shows that the passage teaches that the waveguides also "conduct input light to peripheral light sensors," rather than including the peripheral light sensors as part of the planar array. *Id.* Our reading of this passage is further supported by Bird's earlier description of Ishii:

> In [Ishii] two sets of optical light guides are provided extending in X and Y directions respectively, which define at their intersections a two-dimensional, X-Y, matrix of sensing elements. The sets of light guides are connected at their ends to respective photosensing circuits which produce an electrical signal in response to light being conducted thereto by the light guides.

Id. at 1:24–32. This description shows that defining a matrix (an array) of sensing elements, and teaching that light guides also are connected to photosensing circuits (sensors) are two separate concepts that should not be conflated, as Patent Owner does. *Id.*

We also find unavailing Patent Owner's arguments that relate to Bird's embodiments that have the sensors positioned in the input area. PO Resp. 46–48. Petitioner acknowledges that Bird teaches such embodiments, but Petitioner clearly relies on Bird's embodiment that employs peripheral sensors. *See, e.g.*, Pet. 34–35 (contrasting Bird's embodiment illustrated in Figure 1 with photosensitive devices as the matrix array's elements—which Petitioner does not rely on—with Bird's embodiment employing peripheral sensors, such as taught in Ishii). Thus, these arguments from Patent Owner are inapposite.

We also find unavailing Patent Owner's argument that Petitioner "repeats the words 'peripheral sensors' mentioned in Bird throughout its Petition," but these words only appear in Bird, not in Ishii, and attempts to

make it appear that the sensors are not part of Ishii's planar array by "omit[ting] any mention of critical 'planar array' language." PO Resp. 38–39 (citing Ex. 1009, 4:12–50; Ex. 2020 ¶¶ 99, 104; Pet. 15, 23, 27, 32, 35–36, 53). Rather, we find Bird's description of Ishii teaching distinct peripheral light sensors to be correct. Ex. 1009, 4:43–50. In particular, Bird describes Ishii's light sensors as being peripheral to the sets of row and column waveguides, which define at the intersections a planar array of light sensing elements. *Id.* This is, in fact, what Ishii teaches. *See, e.g.*, Ex. 1010 ¶ 51 ("A photosensor is formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions."), Fig. 9.

We also find unavailing Patent Owner's numerous arguments that incorrectly conflate *display* and *input area*. *See generally* PO Resp.; PO Sur-reply (weaving conflation of display and input area throughout many arguments). Simply put, arguments concerning a display (or display substrates) are inapposite to claim 1. *See supra* Section III.B (construing input area); *see also* Ex. 1001, 7:52–8:4 (reciting claim 1). For example, whether a device's display is coextensive with its input area is inapposite to claim 1. Ex. 1001, 7:52–8:4. Rather, claim 1 refers to "input area,"—not display—and the input area's periphery is where "a sensor array [is] positioned." *Id.* at 7:55–56, 60.

We also find unavailing Patent Owner's arguments concerning "parallax" problems. PO Resp. 41; PO Sur-reply 21. Patent Owner argues, for example, that "Ishii attempts to address parallax issues by disposing optical waveguides (and sensor portions), liquid crystal, picture element electrodes, and other circuitry *inside* its display substrates." PO Resp. 41 (citing Ex. 1010 ¶¶ 22–25, Fig. 9); *see also id.* (citing Ex. 2020 ¶ 108), 31 (making same argument). Patent Owner adds that one of ordinary skill in

the art "would have understood that Ishii's integrated display provides no clearance for [Petitioner's] alleged 'peripheral sensors' to be anywhere but inside Ishii's display input area." PO Resp. 42 (citing Ex. 2020 ¶ 110). These arguments are inapposite because they too relate to the "display" and Patent Owner's incorrect conflating of input area and display to argue that the claims exclude having a coextensive display and input area. Again, as we discuss above, Patent Owner incorrectly excludes coextensive input areas and displays. *See supra* Section III.B (construing "input area"). Moreover, Ishii clearly teaches that the waveguides are within the display (hence addressing the parallax concerns) and that the photosensors are at the ends of the waveguides (i.e., outside at the periphery (and at least partially circumscribing and immediately proximate) of the input area). Ex. 1010 ¶¶ 51, 53, 78–79, Fig. 9. Whether the photosensors are within the display substrates is immaterial.

Lastly, we agree with Patent Owner that Petitioner's reliance on the papers from the reexamination of the '994 patent is misplaced. PO Sur-reply 29–30 (citing Pet. Reply 5, 7, 10, 13, 16; Ex. 1043 (Office Action in *Ex Parte* Reexamination); Ex. 1045 (Order Granting Request for *Ex Parte* Reexamination)). The reexamination process is ongoing and the office action is non-final. Ex. 1043, 1. Patent Owner submits that it is in the process of responding to the office action. PO Sur-reply 29–30. Accordingly, we do not rely on the papers from this reexamination.

We also do not rely on Patent Owner's definition of fiber-optic sensor obtained from Wikipedia, which Patent Owner provides for the first time by linking to the definition in its Sur-reply. *Id.* Such a link constitutes new evidence, which is not allowed for a Sur-reply. *See* CTPG 73 ("The

sur-reply may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.").

In sum, we are persuaded by a preponderance of the evidence that Petitioner (i) demonstrates that the combination of Bird and Ishii teaches "a sensor array positioned at the periphery of the input area," and (ii) provides sufficiently articulated reasoning with rational underpinning to support Petitioner's combining of Bird's and Ishii's teachings for this limitation.

7. Operative to Sense and Provide an Output Indication

Claim 1 further recites that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of the electromagnetic radiation pattern." Ex. 1001, 7:61–63. We agree with Petitioner and find that the combination of Bird and Ishii teaches this limitation. Pet. 37–40; Pet. Reply 15–16. First, we find that the combination of Bird and Ishii teaches that the sensor array is operative to sense and provide an output indication of a pattern's position. In particular, we find that Bird teaches sensing "[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen." Ex. 1009, 2:40–44. And we find that Ishii teaches that "X and Y coordinates of the [light incident to a] contact portion are determined by a photosensor located in each of X and Y positions of end portions of the optical waveguides." Ex. 1010 ¶ 53.

Second, we find that Bird teaches sensing and indicating orientation. More specifically, Bird teaches "rotation of the pen/light beam around its axis can readily be detected by virtue of different sensing elements 14 away from the centre of the spot becoming illuminated and non-illuminated during such rotation." Ex. 1009, 6:46–50; Fig. 5.

Third, we find that Bird teaches sensing and indicating the spot's "shape." *Id.* More specifically, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot if desired thus providing additional flexibility to an operator." *Id.* at 7:28–31.

Fourth, we find that Bird teaches sensing and indicating the "size" of the spot. More specifically, Bird teaches that "the size of the incident light spot on the array relative to the sensing elements may be varied." *Id.* at 8:25–26. Bird explains that the "spot size on the array could conceivably be such as to cover just two adjacent sensing elements in the row direction and one element in the column direction." *Id.* at 8:31–34.

We find unavailing Patent Owner's argument that Petitioner "divides [this] element . . . into three subparts and attempts to piecemeal together a collection of isolated disclosures without demonstrating the disparate features satisfy the entire claimed invention in a single embodiment." PO Resp. 54 (citing *F5, Inc. v. Sunstone Info. Defense, Inc.*, IPR2022-00484, Paper 11 at 22 (PTAB Aug. 9, 2022) (non-precedential)); *see also id.* (citing Ex. 2020 ¶ 134). More specifically, Patent Owner argues that Petitioner "divorces the claimed 'sens[ing] and provid[ing] an output indication of position' . . . from the 'and at least two of orientation, shape and size' . . . recitals." *Id.* (citing Pet. 37–40) (alterations in original).

Patent Owner's reliance on *F5* is misplaced. PO Resp. 54. In *F5*, the limitation at issue required "determining a prediction . . . based on" three parameters. IPR2022-00484, Paper 11 at 22. The panel in *F5* found that the petitioner alleged that (i) a reference taught making the determination based on two of the parameters, and (ii) another reference taught making the

determination based on the third parameter. *Id.* Notably, the panel found that using all three parameters at once for the determination was not shown. *Id.* at 22–23. Furthermore, the panel found that the petitioner provided no explanation how the combination of references "results in satisfaction of all three . . . at the same time in a single embodiment." *Id.* at 22. In other words, in *F5*, none of the references taught the limitation (i.e., determining a prediction based on three parameters), nor did the petitioner explain how the references together taught the limitation. *Id.* at 22–23.

In contrast, here Petitioner shows that the combination of Bird and Ishii teaches that the sensor array is operative to sense and provide an output indication of position, as well as orientation, shape, and size of the light spot. *See supra*. In other words, all aspects of the limitation are taught. Moreover, Bird's teaching about sensing position is within Bird's description of "the present invention," and is not limited to a particular embodiment. Ex. 1009, 2:18–64. Also, the cited teachings in Bird about sensing the orientation, shape, and size of a light spot are described in connection with example shapes relating to Bird's invention, but not as relating to separate embodiments. *See id.* at 6:46–50, 7:28–31, 8:25–26, 8:31–34.

In sum, we find that the combination of Bird and Ishii teaches that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of the electromagnetic radiation pattern."

8. Electromagnetic Radiation Pattern Includes an Elliptical Shape

Petitioner argues that Bird teaches "wherein the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area," as

recited in claim 1. Pet. 40–41. In particular, Petitioner argues that Bird teaches that "[t]he beam of light is directed through the pen tip 24 via an optical system 25 which includes an aperture 26 that determines the required shape of the light spot." *Id.* (quoting Ex. 1009, 7:40–43). Petitioner adds that "[t]he beam has an elliptical shape." *Id.* at 41 (citing Ex. 1009, 6:38–46).

In addition, Petitioner argues that Bird teaches that "[i]t will be understood, of course, that if the pen is held inclined to that plane, the shape of the light spot produced is distorted." *Id.* (quoting Ex. 1009, 3:24–26) (alteration in original). In particular, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot," Petitioner argues. *Id.* (quoting Ex. 1009, 7:28–32) (alteration in original); *see also id.* (Petitioner annotating Ex. 1009, Fig. 5).

In addition, Petitioner argues that "as a matter of geometry, that elongating the ellipse increases it eccentricity, while contracting it decreases the eccentricity." *Id.* (citing Ex. 1002 ¶ 108). Petitioner argues that Bird teaches that "in the case of an elliptical spot, the spot may be distorted to approximate a circular spot." *Id.* (quoting Ex. 1009, 3:28–30). And "[a] circle is an ellipse of eccentricity zero," according to Petitioner. *Id.* (citing Ex. 1002 ¶ 108). Petitioner argues "[t]hus, the eccentricity of Bird's elliptical light spot 'is a function' of the 'input object's' orientation." *Id.*

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that the combination of Bird and Ishii teaches "wherein the electromagnetic radiation

pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area."

9. Input Circuitry

Petitioner argues that Bird teaches "input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of the input object," as recited in claim 1. Pet. 42–44. More specifically, Petitioner argues that Bird's "Figure 10 discloses 'detection circuitry 40' as input circuitry." *Id.* at 42 (citing Ex. 1009, 8:2–7, Fig. 10). According to Petitioner, Bird states that the "[i]nput information to the light sensing array [] is detected by the associated detection circuit, here referenced at 40, which detects X-Y position and twist of the pen and provides outputs accordingly to a central processing unit 42 via an input/output interface 41." *Id.* (quoting Ex. 1009, 8:2–7). Petitioner adds that "Ishii similarly discloses circuit 61 for determining output indication and providing an input to character- recognizing section 64." *Id.* (quoting Ex. 1010 ¶ 62, citing Fig. 11).

In addition, Petitioner argues that "Bird discloses an electronic input representing both a two-dimensional position and orientation of said input object." *Id.* at 43 (citing Ex. 1002 ¶ 111). Petitioner argues, for example, that "Bird discloses that '[t]he X-Y position of the light spot on the array . . . [is] detectable." *Id.* (quoting Ex. 1009, 2:40–44).

In addition, Petitioner argues that "Bird also teaches determining 'orientation' when it senses that . . . 'the direction of rotation of the beam [is] determined' by monitoring the sensing elements outputs." *Id.* at 44 (quoting Ex. 1009, 5:65–6:5) (second alteration in original). According to Petitioner, "Bird explains that the sensing elements provide[] an output of

the 'rotation of the pen/light beam around its axis' which 'can readily be detected by virtue of different sensing elements 14.'" *Id.* (quoting Ex. 1009, 6:46–48). Petitioner argues that "[t]he Bird-Ishii combination also detects the X and Y positions of the light incident on the display surface and orientation, which is same as the position of the input object on the surface." *Id.* (citing Ex. 1010 ¶¶ 53, 58–60). According to Petitioner, one of ordinary skill in the art "would have adapted the input circuitry of Bird to respond to the sensor configuration of Ishii." *Id.* (citing Ex. 1002 ¶ 113).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner (*see generally* PO Resp.), we determine that Petitioner demonstrates by a preponderance of the evidence that the combination of Bird and Ishii teaches "input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of the input object."

10. Summary

In summary, we determine that Petitioner shows by a preponderance of the evidence that claim 1 would have been obvious to one of ordinary skill in the art in view of the combination of Bird and Ishii.

D. Challenged Claims 2–5, 17, and 21

Petitioner argues that the combination of Bird and Ishii teaches claims 2–5, 17, and 21. Pet. 45–46; 48–50. Claims 2–5 depend from independent claim 1, and claim 17 is an additional independent claim from which claim 21 depends. Patent Owner does not separately address Petitioner's arguments directed to these claims, and for claim 17 relies on its same arguments as for claim 1. As we discuss above, we find these arguments unavailing. *See supra* Section V.C (finding the combination of Bird and

Ishii teaches claim 1). And we have reviewed Petitioner's showings for claims 2–5, 17, and 21 and find them persuasive.

Based on the evidence and arguments of record, we determine that Petitioner shows by a preponderance of the evidence that claims 2–5, 17, and 21 would have been obvious to one of ordinary skill in the art over the combination of Bird and Ishii.

E. Challenged Claim 8

Claim 8 recites "[a]n electronic input device according to claim 1, wherein the device further comprises interface circuitry operative in response to the output indication for providing continuously variable user inputs based on at least one of the two-dimensional position, three-dimensional position, and the orientation of the input object." Ex. 1001, 8:27–32. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 8. Pet. 42–44, 46; Pet. Reply 17.

In particular, Bird teaches that the "[i]nput information to the light sensing array . . . is detected by the associated detection circuit, here referenced at 40, which detects XY position and twist of the pen and provides outputs accordingly to a central processing unit 42 via an input/output interface 41." Ex. 1009, 8:2–7, Fig. 10. In other words, Bird's "interface 41" teaches the claimed "interface circuitry." Ex. 1009, 8:2–7.

In addition, Bird teaches that "[a]s rotation of the pen is detected the display can be addressed to re-draw the knob rotated according to the amount of rotation of the pen to provide visual feedback in addition to the detection of the action being used by the system to perform the desired function." *Id.* at 6:10–15. We agree with Petitioner and find that these teachings from Bird evidence the interface providing continuously variable

user inputs based on orientation of the input object (pen) in response to the detection and outputs. *Id.* at 6:10–15, 8:2–7, Fig. 10.

We find unavailing Patent Owner's argument that Petitioner does not "address the additional 'interface circuitry' or the entire recital." PO Resp. 68. Rather, as we discuss above, we find that Petitioner sufficiently identifies Bird's and Ishii's teachings as they relate to claim 8. Pet. 42–44, 46; Pet. Reply 17.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 8 obvious.

F. Challenged Claim 9

Claim 9 recites "[a]n electronic input device according to claim 1, wherein the sensor array is operative to provide an output indication of each of position, orientation, shape and size of the electromagnetic radiation pattern on the input area produced by the input object." Ex. 1001, 8:33–37. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 9. Pet. 34–40, 47; Pet. Reply 18.

Claim 9 is similar to claim 1's limitation that recites that the sensor array is "operative to sense and provide an output indication of position and at least two of orientation, shape and size of the electromagnetic radiation pattern." *Compare* Ex. 1001, 8:33–37, *with id.* at 7:60–63. Except, claim 9 requires a sensor array operative for sensing and indicating all four of position, orientation, shape, and size. *Id.* at 8:33–37.

Above for claim 1, we already addressed the parties' arguments and found that Petitioner shows that the combination of Bird and Ishii teaches a sensor array sensing and indicating for all four of position, orientation, shape, and size. *See supra* Section V.C.7. We also addressed and found unavailing Patent Owner's argument that Petitioner does not show that Bird

and Ishii teach all four output indications in one embodiment. *Id.*; PO Resp. 69.

Accordingly, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 9 obvious.

G. Challenged Claims 10 and 16

Claim 10 is an independent claim. Among its limitations is the following: "a sensor array at least partially circumscribing and immediately proximate the input area, wherein *the sensor array senses the electromagnetic radiation pattern thereon* and provides an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area." Ex. 1001, 8:42–47 (emphasis added).

Patent Owner focuses on "the sensor array senses the electromagnetic radiation pattern *thereon*" portion of the limitation. PO Resp. 55 (alteration in original). In particular, Patent Owner argues that "thereon" refers to the sensor array, rather than the input area, and thus, Bird's and Ishii's peripheral sensors do not teach this limitation. *Id.*; PO Sur-reply 34.

We agree with Petitioner and conclude that Patent Owner misreads to what "thereon" refers. Pet. Reply 13 n.14. Instead, a plain reading of claim 10's language shows that "thereon" refers to the "input area." Ex. 1001, 8:40–47. First, reading "thereon" in the context of the whole limitation from which Patent Owner's portion is plucked shows that "thereon" refers to the recitation of "input area" immediately preceding the plucked portion. *Id.* And looking at the portion of the limitation that follows, claim 10 recites that the sensor array "provides an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area." *Id.* To provide such an output indication of "the

electromagnetic radiation pattern on the input area," the sensor array needs to sense the pattern as projected on the input area. *Id.* Moreover, claim 10 expressly recites that the "input object project[s] an electromagnetic radiation pattern on the *input area*." Ex. 1001, 8:40–41 (emphasis added). Reading claim 10's limitations together it is clear that the sensor array is operative to sense the electromagnetic radiation pattern where the pattern is projected (i.e., the input area). *See id.* at 8:40–47. Moreover, claim 10 reciting that the sensor array is at least partially circumscribing and immediately proximate (i.e., outside) the input area (and thus is not in the input area for the pattern to be projected on) reinforces that "thereon" refers to the input area. *Id.* Hence, we agree with Petitioner and conclude that claim 10 does not require that the sensors directly receive incident light. Pet. Reply 13 n.14; Ex. 1001, 8:38–55. Rather, Bird's and Ishii's peripheral sensors teach this limitation as we discuss above. *See supra* Sections V.C.6–7.

Claim 16 depends from claim 10. Ex. 1001, 9:13–15. Patent Owner does not provide separate arguments for claim 16. We have reviewed Petitioner's arguments and evidence for claims 10 and 16 and find them persuasive.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claims 10 and 16 obvious.

H. Challenged Claims 11 and 14

Claim 11 recites "[a]n electronic input device according to claim 10, wherein the projected electromagnetic radiation produces a conical beam that intersects the input area in an elliptical pattern having an elliptical

eccentricity which is a function of the orientation of the input object in a plane perpendicular to the input area." Ex. 1001, 8:56–61.

Claim 14 recites "[a]n electronic input device according to claim 10, wherein the electromagnetic radiation produces a conical beam that impinges on the input area, producing the electromagnetic radiation pattern on the input area in the form of an ellipse having an eccentricity which is a function of the orientation of the input object in a plane other than a plane parallel to the input area." Ex. 1001, 9:3–9.

We agree with Petitioner and find that the combination of Bird and Ishii teaches claims 11 and 14. Pet. 29–30, 40–41, 47. As we find above, Bird teaches an input object projecting a conical beam of electromagnetic radiation. *See supra* Section V.C.2; Ex. 1009, 1:58–60, 3:62–63, 4:51–52, 7:40–43, Fig. 9. And, Bird teaches that the beam is projected onto the input area. *See, e.g.*, Ex. 1009, 3:62–63, 6:38–46.

We also find above that Bird teaches that the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area. *See supra* Section V.C.8; Ex. 1009, 3:24–30, 6:38–46, 7:28–32, 7:40–43, Fig. 5; Ex. 1002 ¶ 108. For example, Bird teaches that the light spot shapes "relate to the light pen, and more particularly, the optical axis of the emitted light beam, being orientated perpendicularly to the plane of the sensing element array," and that "[i]t will be understood, of course, that if the pen is held inclined to that plane, the shape of the light spot produced is distorted." Ex. 1009, 3:21–26. Put differently, Bird teaches that "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot." *Id.* at 7:28–32. Bird also teaches that "in the case of an

elliptical spot, the spot may be distorted to approximate a circular spot." *Id.* at 3:28–30; Ex. 1002 ¶ 108 ("A circle is an ellipse of eccentricity zero."). These teachings from Bird teach that the elliptical eccentricity is a function of the orientation of the input object in a plane perpendicular to the input area, which is not a plane parallel to the input area. Ex. 1009, 3:21–30. 7:28–32; Ex. 1002 ¶ 108.

We also find persuasive Dr. Bederson's testimony that "as a matter of geometry, that elongating the ellipse increases it[s] eccentricity, while contracting it decreases the eccentricity." Ex. 1002 ¶ 108. We find that this testimony is consistent with Bird's teachings. *Compare id.*, with Ex-1009, 3:24–30, 6:38–46, 7:28–32.

We find unavailing Patent Owner's argument that Petitioner does not show that the combination of Bird and Ishii teaches these claims. PO Resp. 70. As we find above, these claims are taught.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claims 11 and 14 obvious.

I. Challenged Claim 15

Claim 15 recites "[a]n electronic input device according to claim 14, wherein the conical beam widens in diameter as the distance from the input object to the input area increases." Ex. 1001, 9:10–12. We agree with Petitioner and find that the combination of Bird and Ishii teaches claim 15. Pet. 29–30, 40–41, 47–48; Pet. Reply 18. Below we show Bird's Figure 9, as annotated by Petitioner.

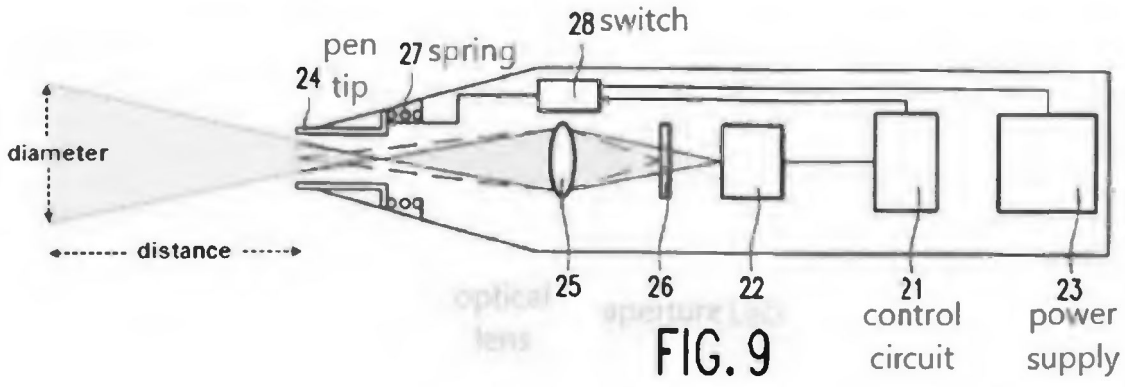


FIG. 9

Pet. 48 (annotating Ex. 1009, Fig. 9). Figure 9 "shows schematically the components of a light pen of" a system in accordance with Bird's teachings. Ex. 1009, 3:40–41, 3:46–47. Petitioner annotates Figure 9 by labeling reference numeral 21 as "control circuit," 22 as "LED," 23 as "power supply," 24 as "pen tip," 25 as "optical lens," 26 as "aperture," 27 as "spring," and 28 as "switch." Pet. 48; *see also* Ex. 1009, 7:36–64 (describing the components of Figure 9). Petitioner colors in yellow Figure 9's illustration of the beam of light emitted from light source 22 through aperture 26, lens 25, and the beam's focus point close to the end of the pen tip 24 to where the beam exits the pen. Pet. 48; Ex. 1009, 7:36–64. In addition, Petitioner extends the beam of light exiting the pen, coloring that area yellow and labeling the horizontal dimension of this extended light "distance," and the vertical dimension "diameter." Pet. 48.

We agree with Petitioner and find that Figure 9 illustrates that as "a matter of basic geometry that, as the distance from the input area to input object increases, the conical beam of the light pen . . . widens in diameter." *Id.* at 47–48; Ex. 1009, Fig. 9. Figure 9 illustrates that the emitted light beam continues to diverge after passing through the point where lens 25 focuses the beam (which is inside the pen). Ex. 1009, Fig. 9, 7:36–64. Thus, the beam widens in diameter as the distance from the pen tip to the

surface upon which the light falls increases. *Id.* We also find persuasive Dr. Bederson's testimony on this point. *See* Ex. 1002 ¶¶ 122–123.

We find unavailing Patent Owner's argument that Bird teaches that lens 25 "'focuses the aperture 26 to form an image' based on the 'required shape of the light spot,' which teaches the opposite of the claim language." PO Resp. 71 (citing Ex. 1009, 7:36–45; Ex. 2020 ¶ 119). Patent Owner's argument fails to account for Bird's teaching that the light beam diverges after passing through the focal point of lens 25, which is inside the pen. Ex. 1009, Fig. 9. Moreover, we find persuasive Dr. Bederson's testimony that "as the distance from a light source doubles, the area covered by that same illumination quadruples (the square of the increased distance)," as it is consistent with the inverse square law of light. Ex. 1002 ¶ 123. Hence, we find the geometry follows a law of nature, rather than being a matter of ordinary creativity to be disregarded, as Patent Owner argues. *Id.*; PO Resp. 71.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird and Ishii renders claim 15 obvious.

VI. ALLEGED OBVIOUSNESS OVER BIRD, ISHII, AND KAMEYAMA

Petitioner argues that the combination of Bird, Ishii, and Kameyama renders claim 12 obvious. Pet. 50–52. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Kameyama renders claim 12 obvious.

A. Summary of Kameyama

Kameyama relates to a three-dimensional pointing device for inputting or outputting position or posture data of a three-dimensional space into and from a computer in a simulation. Ex. 1012 ¶ 1. Kameyama teaches that a position or posture of a light source can be derived based on light

reception information received by light receiving elements of a light receiving surface. *Id.* ¶ 9.

B. Challenged Claim 12

Claim 12 recites "[a]n electronic input device according to claim 10, wherein the input circuitry is operative to calculate the orientation of the input object from the elliptical eccentricity based on the output indication from the sensor array." Ex. 1001, 8:62–65. We agree with Petitioner and find that the combination of Bird, Ishii, and Kameyama teaches claim 12. Pet. 50–52; Pet. Reply 19.

We agree with Petitioner and find that "Bird-Ishii teaches outputting a size and shape, and recognizes that eccentricity is a function of orientation." Pet. 51; *supra* Sections V.C.7 (finding that the combination of Bird and Ishii teaches that the sensor array senses and provides an output indication of size, shape, and orientation of the electromagnetic radiation pattern), V.C.8 (finding that Bird teaches an elliptical shaped pattern having an eccentricity that is a function of the orientation of the input object); *see also supra* Section V.C.9 (finding that Bird teaches providing an input representing orientation of the input object).

We also agree with Petitioner and find that Kameyama teaches calculating the orientation of an input object from the elliptical eccentricity of an incident spot. Ex. 1012 ¶¶ 9, 19–20, 47, Fig. 2; Pet. 51. In particular, Kameyama's Figure 2 illustrates "irradiat[ing] conical shaped light from the light source 4 of the light generator 1 from any position onto the light receiving surface 5 on which the light receiving elements of the photodetector 2 are arranged." Ex. 1012 ¶ 19. Figure 2 is reproduced below.

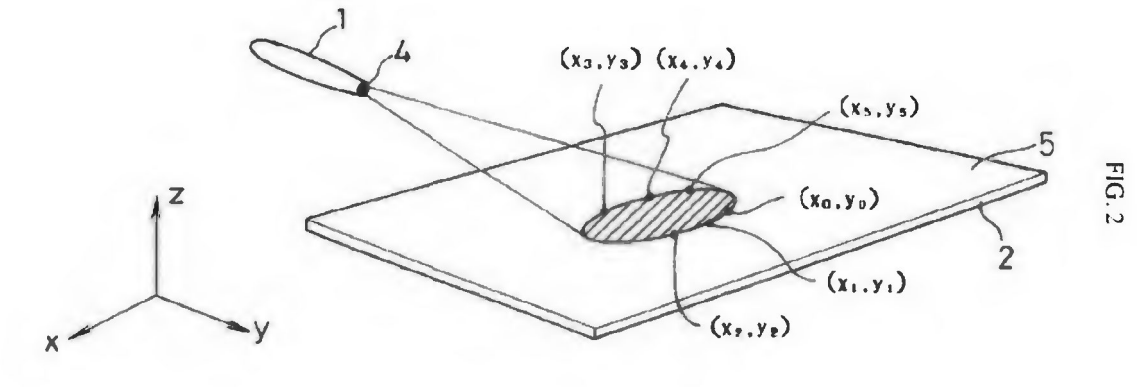


FIG. 2

Figure 2 "is a schematic diagram illustrating a state where light from a light generator of the 3D pointing device illustrated in FIG. 1 is irradiated in a conical shape on a photodetector." *Id.* at 14. Kameyama teaches "capturing six coordinate points, (x0, y0), (x1, y1), (x2, y2), (x3, y3), (x4, y4), and (x5, y5), on a boundary line between a portion irradiated (diagonal part) by, and a portion not irradiated by, light of the light receiving surface 5 on which the light receiving elements of the photodetector 2 are arranged"—these points are shown on Figure 2. *Id.* ¶ 19, Fig. 2.

Kameyama teaches that these points can be used to determine "position and posture data of the light source 4 of the light generator 1 derived through a calculation process by the arithmetic device 3 [which] are output to a computer as position and posture data of a 3D space." *Id.* ¶ 47; Pet. 52. In other words, Kameyama teaches "a calculation process . . . to derive a position and/or posture in a 3D space of light generating means based on predetermined information of light when light emitted by the light generating means irradiates a light receiving surface of light detecting means." Ex. 1012 ¶ 9. We also find persuasive Dr. Bederson's testimony that one of ordinary skill in the art "would have understood that Kameyama determines an input object's orientation based on the light spot's elliptical eccentricity by using [Kameyama's] formulas," as this testimony is

consistent with Kameyama's teachings. *Compare* Ex. 1002 ¶ 129, *with* Ex. 1012 ¶¶ 9, 19–28, 47, Fig. 2.

We find persuasive Petitioner's argument that one of ordinary skill in the art "would have been motivated to combine the teachings of Kameyama with Bird-Ishii, because they provide solutions to improve light sensing devices using a light pen in similar and predictable ways." Pet. 50–51 (citing Ex. 1002 ¶ 126). More specifically, as we discuss above, the combination of Bird and Ishii teaches that the sensor array senses and provides an output indication of size, shape, and orientation of an incident elliptical-shaped pattern having an eccentricity that is a function of the orientation of the input object, and circuitry that receives the indication and provides an input of the orientation of the input object. *See supra* Sections V.C.7–9. Kameyama expressly discloses formulas for calculating this input, as we discuss above. Ex. 1012 ¶¶ 9, 19–28, 47, Fig. 2; Ex. 1002 ¶ 129. We find persuasive Dr. Bederson's testimony that one of ordinary skill in the art "would have been motivated to make this determination to provide for additional user interface features." Ex. 1002 ¶ 129. In light of the above discussed teachings from Bird, Ishii, and Kameyama, we also find persuasive Dr. Bederson's testimony that one of ordinary skill in the art "would have had a reasonable expectation of success combining the teachings of Kameyama with Bird-Ishii to achieve the additional benefits of using orientation measurements taught by Kameyama." Ex. 1002 ¶ 126.

We find unavailing Patent Owner's argument that one of ordinary skill in the art "would not have combined Kameyama's formulas with Bird-Ishii, because Kameyama[] requires a fundamentally different complex set of equations relating to quadratic curves, orthogonal coordinate systems, coordinate points on a boundary of irradiated/non-irradiated coordinates, and

so on." PO Resp. 60 (citing Ex. 1012, ¶¶ 15, 19–28, 52, Figs. 1, 3, 5; Ex. 2020 ¶ 148). As we discuss above, Bird teaches, *inter alia*, sensing and providing an indication of the size and shape of the spot on the input area. And the starting point of Kameyama's formulas are six points on the edge of the ellipse-shaped spot. Ex. 1012 ¶¶ 19–28, 47. We do not view capturing points from the ellipse-shaped spot for which Bird has sensed and provided an output indication, and applying formulas thereto, as being a fundamentally different complex approach. Rather, we view Kameyama as teaching "a technique [that] 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" (*KSR*, 550 U.S. at 417), making using the technique here obvious. We also find that Dr. Cairns does not explain why Kameyama's set of equations are so fundamentally different and complex that one of ordinary skill would not apply them to Bird and Ishii's teachings.

Accordingly, we find that Petitioner shows that the combination of Bird, Ishii, and Kameyama teaches "input circuitry [that] is operative to calculate the orientation of the input object from the elliptical eccentricity based on the output indication from the sensor array." And we find that Petitioner has provided sufficiently articulated reasoning with rational underpinning to support Petitioner's modifications of Bird and Ishii with Kameyama. *See Kahn*, 441 F.3d at 988.

In sum, we find that Petitioner shows by a preponderance of the evidence that the combination of Bird, Ishii, and Kameyama renders claim 12 obvious.

VII. ALLEGED OBVIOUSNESS OVER BIRD, ISHII, AND GEVA

Petitioner argues that the combination of Bird, Ishii, and Geva renders claims 6, 7, 13, and 20 obvious. Pet. 3, 52–56. For the reasons that follow,

we determine that for the combination of Bird, Ishii, and Geva, Petitioner by a preponderance of the evidence (i) shows that claims 6, 7, and 13 would have been obvious, and (ii) does not show that claim 20 would have been obvious.

A. Summary of Geva

Geva relates to position-determining input devices, such as digitizing technologies for pen-based computer systems. Ex. 1011, 1:6–9. Figure 6, shown below, illustrates a position-determining input device. *Id.* at 8:32–34.

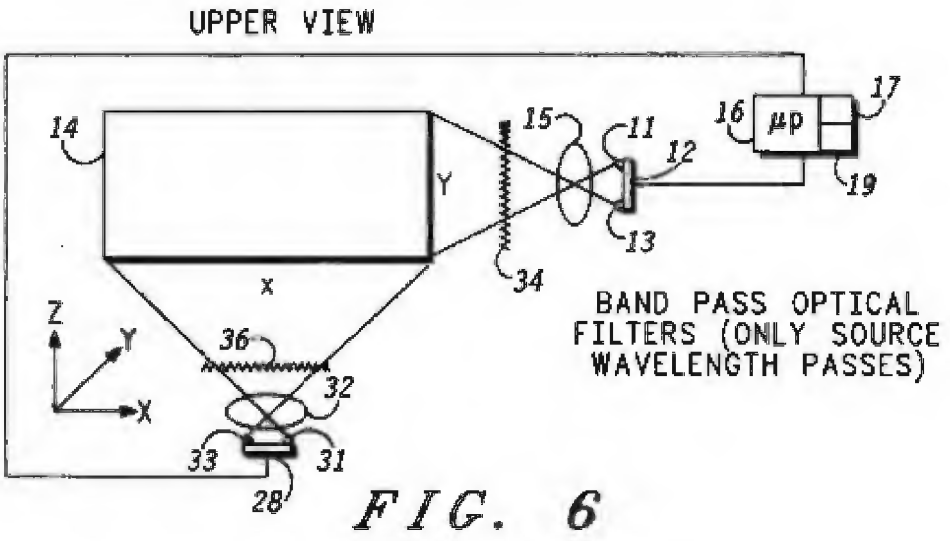


FIG. 6

Figure 6 is an upper view of a position-determining input device including planar element 14, two light sensor arrays 12 and 28, and processing device 16, among other things. *Id.* at 8:32–9:7.

Light sensor arrays 12 and 28 preferably comprise a multiplicity of light sensing elements and are disposed at first and second edges of the planar element 14. *Id.* at 8:36–38. As shown in Figure 6, light sensor arrays 12 and 28 comprise two light sensing elements 11 and 13, and 31 and 33, respectively. *Id.* at 8:38–9:1. Light sensor arrays 12 and 28 are coupled to optical lenses 15 and 32 through band-pass optical filters 34 and 36, which

are arranged to select only the desired light source. *Id.* at 9:1–3. Light sensor arrays 12 and 28 also are operably coupled to a processing device 16, which comprises intensity/distance computation function 17 and memory element 19. *Id.* at 9:3–7.

Signals from each light sensing element in light sensor arrays 12 and 28 are transmitted to the processing device 16. *Id.* at 9:16–17. Intensity/distance computation function 17 of processing device 16 calculates the position of light emitting cursor device 10 according to the intensity of light incident on the first and second light sensor arrays 28 and 30. *Id.* at 9:23–31. The three-dimensional position is calculated. *Id.* at 9:35–10:2.

B. Combining Bird and Ishii with Geva

For the reasons that follow, we find that Petitioner has established a sufficient motivation to combine the teachings of Bird and Ishii with Geva. *See* Pet. 52–53, 55; Pet. Reply 19–20. First, we agree with Petitioner and find that one of ordinary skill in the art would have been motivated to combine Geva's teachings with Bird and Ishii "because Geva's waveguides are similar to Ishii's and Bird expressly teaches 'the light sensing array may be of a kind which . . . uses sets of row and column waveguides . . . and which conduct input light to peripheral light sensors.'" Pet. 52–53 (quoting Ex. 1009, 4:43–50) (emphasis omitted, alterations in original). In particular, Geva teaches a planar element having an array of light sensing elements disposed at a first edge, and a second array of light sensing elements disposed at a second edge for providing signals responsive to light incident thereon for calculating the position of the light emitting device in the first and second dimensions. Ex. 1011, 3:1–4, 3:30–39. In addition, Geva

teaches that "[p]referably the planar element is either a beam splitter or has light conducting and light reflecting properties." *Id.* at 3:10–11.

We find unavailing Patent Owner's argument that Petitioner's "motivation to combine Bird-Ishii and Geva rests on a carefully parsed quote from Bird that omits key language regarding 'row and column light waveguides which define at their intersections *a planar array* of light sensing elements.'" PO Resp. 62 (citing Pet. 52–53; quoting Ex. 1009, 4:43–50) (alteration in original). Rather, we find that Bird broadly teaches that its "light sensing device can be of any known kind having a row and column, planar, array of light sensing elements." Ex. 1009, 4:12–13. We also find that Geva's teachings of having a planar element with an array of light sensing elements at each of two of its edges, and having beam splitters or comprising light conducting properties so that two-dimensional positioning can be calculated teaches a known kind of a row and column, planar, array of light sensing elements. Ex. 1011, 3:1–4, 3:10–11, 3:30–39, Figs. 6, 8.

We also find unavailing Patent Owner's argument that one of ordinary skill in the art "would have understood Geva's 'teachings' relate to an altogether different approach that requires a separate 'planar element' positioned over its display," and that "Ishii expressly teaches away from this type of cover because it would increase parallax errors." PO Resp. 63 (citing Ex. 2020 ¶ 153; Ex. 1011, 1:17–18, 2:19–21, 3:1–16, Figs. 1–2, 5–6; Ex. 1010 ¶¶ 22–25). None of the challenged claims for this asserted ground involve a display, and thus this argument is inapposite. Pet. 3. Moreover, Patent Owner does not explain how Geva's planar array would increase parallax errors in the combination of Bird and Ishii that Petitioner advances.

PO Resp. 63. Dr. Cairns' testimony on this point is conclusory and provides no explanation. *See* Ex. 2020 ¶ 153.

We also find unavailing Patent Owner's argument that one of ordinary skill in the art would not have been motivated to combine Geva with Bird and Ishii because "Geva expressly teaches its linear array detects light in a single dimension along the edges of the planar element." PO Resp. 63 (citing Ex. 1011, 3:14–19, 3:30–39, Figs. 1, 5). As we discuss above, Geva teaches having a planar element with an array of light sensing elements at each of two of its edges, as does Bird. *Compare* Ex. 1011, 3:1–4 *and* 3:30–39, *with* Ex. 1009, 4:43–50 (teaching peripheral light sensors).

We also find unavailing Patent Owner's argument that "Geva's different approach requires different considerations, different calculations, and altogether different environment than the light detection required by Bird or Ishii's integrated displays." PO Resp. 64 (citing Ex. 2020 ¶ 155). In particular, Patent Owner argues that Petitioner does not explain how one of ordinary skill in the art "would or could implement Geva's light detection 'teachings' or calculations for a linear single dimension sensor array with Bird-Ishii's X-Y row/column sensor arrays disposed inside an integrated display," which is not simple math. *Id.* However, as we discuss above, Geva teaches having a planar element with an array of light sensing elements at each of two of its edges, conducting light incident on the planar array to those elements, and determining the two-dimensional positioning of the light. *See* Ex. 1011, 3:1–4, 3:10–11, 3:30–39, Figs. 6, 8; *see also, e.g.*, Ex. 1009, 4:43–50 (teaching peripheral light sensors); Ex. 1010 ¶¶ 51, 53, Fig. 9 (teaching peripheral light sensors in the X and Y directions). We find that one of ordinary skill in the art would have "be[en] able to fit the teachings of [Bird, Ishii, and Geva] . . . together like pieces of a puzzle"

because the skilled artisan is "a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 420–21.

We also find unavailing Patent Owner's argument that Geva teaches away from the Bird and Ishii's teachings, and "explains significant *disadvantages* of the Bird-Ishii integrated displays and the trouble caused by disposing sensors inside the display itself." PO Resp. 62 (citing Ex. 1011, 1:26–29, 1:36–2:5, 2:13–16; Ex. 2020 ¶ 152). The disadvantages Patent Owner cites relate to different technologies than taught by Bird and Ishii, and upon which Petitioner relies. For example, Geva discusses disadvantages of resistive digitizers, where a "pen causes . . . two sheets to make contact and the currents are measured to determine an 'x' and 'y' coordinate for the pen." *See* Ex. 1011, 1:19–29. Geva also discusses disadvantages of "[e]lectrostatic (or capacitive) digitizers," in which "as the pen nears the surface of the glass, the electronic signal in the pen creates a capacitive effect with the conductive sheet on the underside of the glass." Ex. 1011, 1:36, 1:38–2:1. And Geva discusses disadvantages of "[e]lectromagnetic digitizers [which] rely on a series of looped coils on a sensor board beneath the LCD screen." Ex. 1011, 2:6–7. Again, Bird and Ishii teach a different technology. *See, e.g.*, *supra* Sections V.A–B.

Moreover, each of these three different digitizing technologies (i.e., resistive, electrostatic and electromagnetic) to which Patent Owner points are discussed in Geva's "Background of the Invention" section, and are described as currently existing technologies. Ex. 1011, 1:11–2:18. And Geva states that its "invention seeks to provide an improved alternative arrangement for determining the position of digitizer input elements such as computer pens." *Id.* at 2:19–21.

Second, Petitioner advances an additional rationale for combining Geva with Bird and Ishii. In particular, Petitioner argues that "Geva provides teachings with respect to intensity of light on the waveguides like Ishii's," and that one of ordinary skill in the art "would have combined the teachings of Geva with Bird-Ishii to achieve the benefits of using light intensity." Pet. 53 (citing Ex. 1002 ¶ 130). In particular, Petitioner argues that "Geva expressly teaches comparing sensed light intensity to intensity thresholds for determining or quantifying the size, shape and orientation of [a] light spot," and that one of ordinary skill in the art "would have been motivated to use these teaching[s] with Ishii because it would have helped eliminate erroneous input signals from ambient light sources." Pet. Reply 20 (citing Ex. 1002 ¶ 130).

As the Federal Circuit has recently reminded us, "[t]he motivation-to-combine analysis is a flexible one." *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1379 (Fed. Cir. 2023). "*[A]ny* need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* (quoting *KSR*, 550 U.S. at 420) (alteration in original). We find that eliminating erroneous input signals from ambient light sources is such a problem. Ex. 1002 ¶ 130; Ex. 1010 ¶ 55.

In sum, we find that Petitioner shows by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to combine the teachings of the references as proposed by Petitioner with a reasonable expectation of success.

C. Challenged Claims 6 and 13

Claim 6 recites "[a]n electronic input device according to claim 1, wherein the sensor array senses and provides at least one output indication

of intensity of the electromagnetic radiation in the electromagnetic radiation pattern." Ex. 1001, 8:19–22. Claim 13 depends from independent claim 10, and otherwise, largely is the same as claim 6. Claim 13 recites "[a]n electronic input device according to claim 10, wherein the sensor array is also operative to sense and provide an output indication of intensity of the electromagnetic radiation in the electromagnetic radiation pattern." *Id.* at 8:66–9:2. We agree with Petitioner and find that the combination of Bird, Ishii, and Geva teaches claims 6 and 13. Pet. 53–54; Pet. Reply 20–21.

More specifically, we agree with Petitioner and find that Bird teaches sensing an electromagnetic radiation pattern. *See supra* Section V.C.7 (finding that Bird teaches that the sensor array is operative to sense and provide an output indication of a pattern's position. shape, orientation, and size); Ex. 1009, 2:32–39 (teaching deducing a light spot's projected shape).

We also agree with Petitioner and find that Ishii teaches an optical pen that outputs light with specified light intensity. Ex. 1010 ¶ 55. Hence, Ishii teaches that light intensity is a measurable characteristic, as it is specified. And we also agree with Petitioner that Geva teaches about sensing intensity with peripheral light sensors. Ex. 1011, 4:25–26, 6:12–14 ("[T]he light sensor array 12 comprises a multiplicity of light sensing elements, each transmitting a signal to the processing device 16."), Fig. 3; Pet. 53–54. For example, Geva's Figure 3 shows "a graph of light intensity across one dimension of the position-determining input device." Ex. 1011, 4:25–26. In other words, Geva teaches that its sensor array senses intensity of the incident light spot and outputs a signal for determining position. *Id.* at 4:25–26, 6:12–14, Fig. 3.

In view of these teachings, we are persuaded that one of ordinary skill in the art would have been motivated to use, with a reasonable expectation

of success, Bird's and Ishii's input system with Geva's teachings for determining position of a light spot by providing an output indication of intensity. *See supra*; Ex. 1002 ¶¶ 131–133. And, we thus find that the combination of Bird, Ishii, and Geva teaches a sensor array that senses and provides an output indication of intensity of the electromagnetic radiation in the pattern.

We find unavailing Patent Owner's argument that Petitioner fails to provide any argument or analysis regarding how to modify the combination of Bird and Ishii with Geva's teachings, and does not address the plain claim language or demonstrate unpatentability. PO Resp. 66. As we discuss above, we find that Petitioner's showing is sufficient. For example, as we discuss above, Bird teaches a sensor array that senses and provides an output of, *inter alia*, a pattern's position, Ishii teaches an optical pen that outputs light with specified light intensity, and Geva teaches a sensor array that senses intensity of a spot for determining position. And we find that one of ordinary skill in the art would have been able to fit the teachings of Bird, Ishii, and Geva together like pieces of a puzzle because the skilled artisan is "a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 420–21.

We also find unavailing Patent Owner's argument that one of ordinary skill in the art "would not attempt to modify Bird-Ishii's integrated display with Geva's single-dimension linear array teachings because the teachings provide no improvement or benefit and relate to fundamentally different contexts." PO Resp. 66 (citing Ex. 2020 ¶ 161). As we discuss above, we find that Petitioner provides sufficient rationale to support that one of ordinary skill in the art would have been motivated to combine Bird, Ishii, and Geva's teachings. *See supra* Section VII.B. Moreover, we find

Dr. Cairns's testimony on this point is conclusory, including in that it does not explain why the combined teachings would provide "no improvement or benefit and relate to fundamentally different contexts." Ex. 2020 ¶ 161.

In sum, we find that Petitioner demonstrates by a preponderance of the evidence that the combination of Ishii, Bird, and Geva renders claims 6 and 13 obvious.

D. Challenged Claim 7

Petitioner argues that the combination of Bird, Ishii, and Geva teaches claim 7. Pet. 54. Claim 7 depends from claim 6, which depends from independent claim 1. Patent Owner does not separately address Petitioner's arguments directed to claim 7, and as we discuss above, we find Patent Owner's arguments unavailing for claims 1 and 6. *See supra* Sections V.C, VII.C. And we have reviewed Petitioner's showing for claim 7 and find it persuasive.

Based on the evidence and arguments of record, we determine that Petitioner shows by a preponderance of the evidence that claim 7 would have been obvious to one of ordinary skill in the art over the combination of Bird, Ishii, and Geva.

E. Challenged Claim 20

Claim 20 recites "[a] method for making an electronic input device according to claim 17, the method further comprising detecting thresholds of intensity of the electromagnetic radiation pattern on the input area, and generating control signals by the input circuitry." Ex. 1001, 10:20–24.

Patent Owner argues that Petitioner ignores the "generating control signals by the input circuitry" claim language, and "does not reference, discuss, or argue any disclosure of Bird, Ishii, or Geva discloses or suggests this recital." PO Resp. 67 (citing Pet. 54–56).

We agree with Patent Owner. Petitioner does not address where "generating control signals by the input circuitry" is taught in Bird, Ishii, or Geva, or by their combination. *See* Pet. 54–56; Pet. Reply 21–22. Hence, the Petition is deficient as to claim 20 for this ground. 37 C.F.R. § 42.104(b)(4) ("The petition must specify where each element of the claim is found in the prior art patents or printed publications relied upon for each ground.").

Accordingly, we determine that Petitioner does not show by a preponderance of the evidence that claim 20 would have been obvious to one of ordinary skill in the art over the combination of Bird, Ishii, and Geva.

VIII. ALLEGED OBVIOUSNESS OVER BIRD, ISHII, AND MULLA

Petitioner argues that the combination of Bird, Ishii, and Mulla renders claims 18 and 19 obvious. Pet. 3, 56–58. Claims 18 and 19 depend from independent claim 17. Ex. 1001, 10:9–20. Patent Owner does not separately address Petitioner's arguments directed to claims 18 and 19. Nor does patent Owner separately address claim 17, and instead relies on its arguments for claim 1. As we discuss above, we find unavailing Patent Owner's arguments directed to claim 1. *See supra* Sections V.C. And we are persuaded by Petitioner's showings for claims 18 and 19, and Petitioner's provided reasoning for combining the references. Pet. 56–58.

Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that claims 18 and 19 would have been obvious to one of ordinary skill in the art over the combination of Bird, Ishii, and Mulla.

IX. REMAINING GROUNDS

Petitioner argues that the combination of (i) Geaghan and Ishii renders claims 1–11, 13–17, 20, and 21 obvious; (ii) Geaghan, Ishii, and Kameyama

renders claim 12 obvious; and (iii) Geaghan, Ishii, and Mulla renders claims 18 and 19 obvious. Pet. 58–86. Thus, these grounds of unpatentability also challenge claims 1–19 and 21, which we already determine are unpatentable. *See supra* Sections V.C–I, VI.B, VII.C–D (determining Petitioner shows claims 1–19 and 21 are unpatentable).

Under the circumstances of this case, analyzing additional grounds challenging the same claims, which we have determined to be unpatentable, would not be an efficient use of the Board's time and resources. *See Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) ("We agree that the Board need not address issues that are not necessary to the resolution of the proceeding."). Accordingly, we do not reach these remaining grounds for claims 1–19 and 21. *Cf. In re Gleave*, 560 F.3d at 1338 (not reaching other grounds of unpatentability after affirming the anticipation ground); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (determining once a dispositive issue is decided, there is no need to decide other issues).

We now turn to Petitioner's arguments that the combination of Geaghan and Ishii renders claim 20 unpatentable.[15] We agree with Patent Owner that Petitioner does not address where "generating control signals by the input circuitry" is taught by the combination of Geaghan and Ishii. *See* Pet. 77–78, 81–83; Pet. Reply 28. Hence, the Petition is deficient as to claim 20 for this ground. 37 C.F.R. § 42.104(b)(4).

[15] The parties dispute whether Geaghan is prior art. We do not reach that issue because even if Geaghan is prior art, Petitioner fails to show that the combination of Geaghan and Ishii renders claim 20 unpatentable.

Accordingly, we determine that Petitioner does not show by a preponderance of the evidence that claim 20 would have been obvious to one of ordinary skill in the art over the combination of Geaghan and Ishii.

X. CONCLUSION[16]

Based on the full record, we determine that Petitioner shows by a preponderance of the evidence that (i) claims 1–5, 8–11, 14–17, and 21 are unpatentable over Bird and Ishii; (ii) claim 12 is unpatentable over Bird, Ishii, and Kameyama; (iii) claims 6, 7, and 13 are unpatentable over Bird, Ishii, and Geva; and (iv) claims 18 and 19 are unpatentable over Bird, Ishii, and Mulla. We also determine that Petitioner does not show by a preponderance of the evidence that 20 is unpatentable.

Claim(s)	**35 U.S.C. §**	**Reference(s) /Basis**	**Claims Shown Unpatentable**	**Claims Not Shown Unpatentable**
1–5, 8–11, 14–17, 21	103(a)	Bird, Ishii	1–5, 8–11, 14–17, 21	
12	103(a)	Bird, Ishii, Kameyama	12	
6, 7, 13, 20	103(a)	Bird, Ishii, Geva	6, 7, 13	20
18, 19	103(a)	Bird, Ishii, Mulla	18, 19	

[16] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

1–11, 13–17, 20, 21	103(a)[17]	Geaghan, Ishii		20
12	103(a)[18]	Geaghan, Ishii, Kameyama		
18, 19	103(a)[19]	Geaghan, Ishii, Mulla		
Overall Outcome			1–19, 21	20

XI. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has shown by a preponderance of the evidence that claims 1–19 and 21 of the '364 patent are unpatentable;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has not shown by a preponderance of the evidence that claim 20 of the '364 patent is unpatentable; and

FURTHER ORDERED that parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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[17] Because we determine that claims 1–11, 13–17, and 21 are unpatentable on other grounds, we decline to address these claims for this ground.
[18] Because we determine that claim 12 is unpatentable on another ground, we decline to address it for this ground.
[19] Because we determine that claims 18 and 19 are unpatentable on another ground, we decline to address them for this ground.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

IPR2022-00405
Patent 8,547,364 B2

Before BARBARA A. PARVIS, JOHN D. HAMANN, and JASON W. MELVIN, *Administrative Patent Judges*.

MELVIN, *Administrative Patent Judge*, dissenting.

I respectfully dissent. The majority concludes that the Petition fails to show claim 20's "generating control signals by the input circuitry." *See supra* 71 (§ VII.E). The specification does not restrict "control signals" to any particular meaning. Thus, I do not read claim 20's "control signals" as anything beyond claim 17's recitation that the input circuitry provides "an electronic input." Ex. 1001, 10:4–8. I do not believe claim 20's unpatentability should turn on a vague and nonrestrictive term that does not

appear to limit claim 20 beyond the independent claim from which it depends.

Even if claim 20's "generating control signals" does further limit the claim, I believe the Petition adequately addresses the limitation. For claim 20 under Bird, Ishii, and Geva, the Petition references its contentions for claim 13. Pet. 54 ("as above for Claim 13"). And the claim 13 contentions assert that Geva's array includes sensing element, "each transmitting a signal to the processing device 16." Pet. 53 (quoting Ex. 1011, 6:12–14). Thus, Petitioner asserts that information regarding intensity is used by the asserted combinations. Moreover, the Petition asserts that the combinations would detect intensity thresholds as in claim 20 "and indicate intensity relative to that level." Pet. 54–56.

In my view, applying a threshold and indicating intensity relative to the threshold sufficiently addresses the broad claim language requiring "generating control signals by the input circuitry." Because the asserted prior art teaches the limitation, I would conclude that Petitioner has met its burden for claim 20's obviousness over Bird, Ishii, and Geva.

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US007952570B2

(12) **United States Patent**
Lipman et al.

(10) **Patent No.: US 7,952,570 B2**
(45) **Date of Patent: May 31, 2011**

(54) **COMPUTER NAVIGATION**

(75) Inventors: **Robert M. Lipman**, Jerusalem (IL); **Sarah M. Lipman**, Jerusalem (IL)

(73) Assignee: **Power2B, Inc.**, Santa Monica, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 953 days.

(21) Appl. No.: **11/006,486**

(22) Filed: **Dec. 6, 2004**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. PCT/GB03/02533, filed on Jun. 9, 2003.

(30) **Foreign Application Priority Data**

Jun. 8, 2002 (GB) 0213215.7

(51) **Int. Cl.**
G09G 3/28 (2006.01)
G06F 3/033 (2006.01)

(52) **U.S. Cl.** **345/182**; 178/19.05

(58) **Field of Classification Search** 345/156–184
See application file for complete search history.

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Primary Examiner — Chanh Nguyen
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(57) **ABSTRACT**

An electronic device comprises a display for displaying data stored on said electronic device; input means; sensing means for sensing the three-dimensional position of the input means relative to said device; and control means for controlling the data displayed on said display in dependence on the three-dimensional position of the input means relative to said device. The input means includes a source of electromagnetic radiation for directing an infrared conical beam onto the display. The sensing means can sense the elliptical eccentricity of the electromagnetic radiation incident on the display to determine the angle at which it strikes the display, and can sense the area of the electromagnetic radiation incident on the display to determine the distance of the input means from the display.

22 Claims, 2 Drawing Sheets

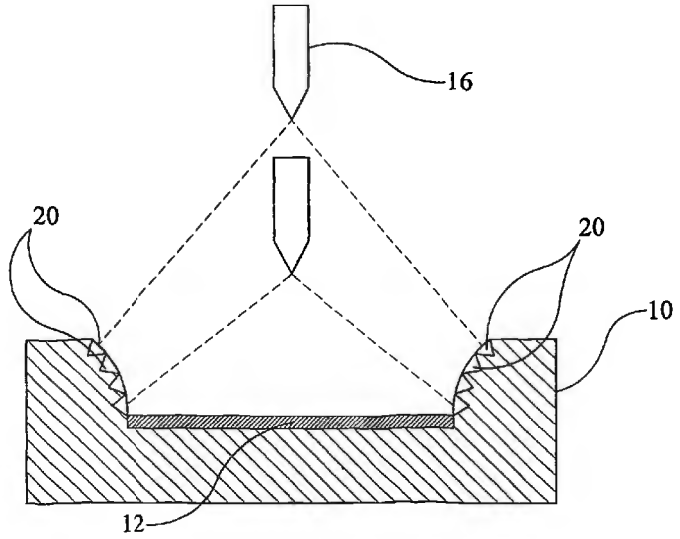

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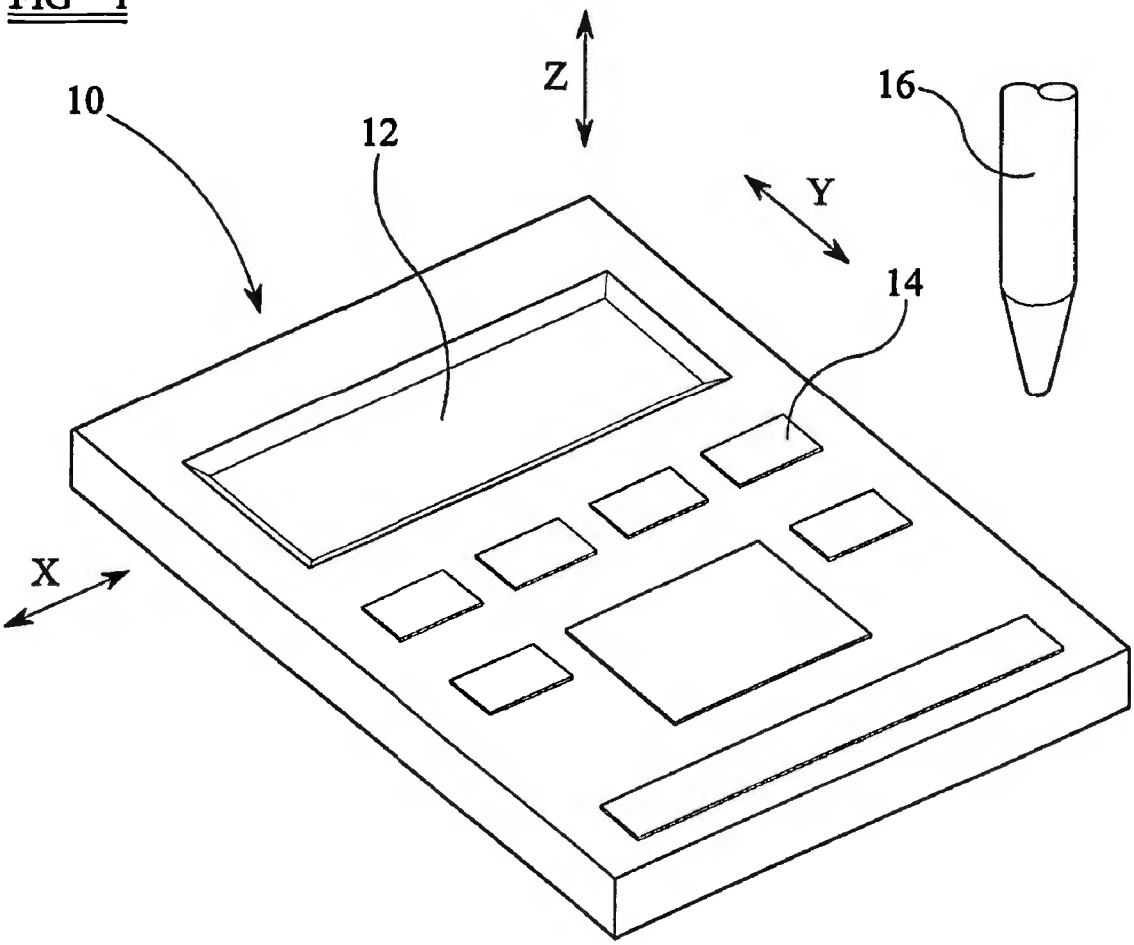
FIG 1



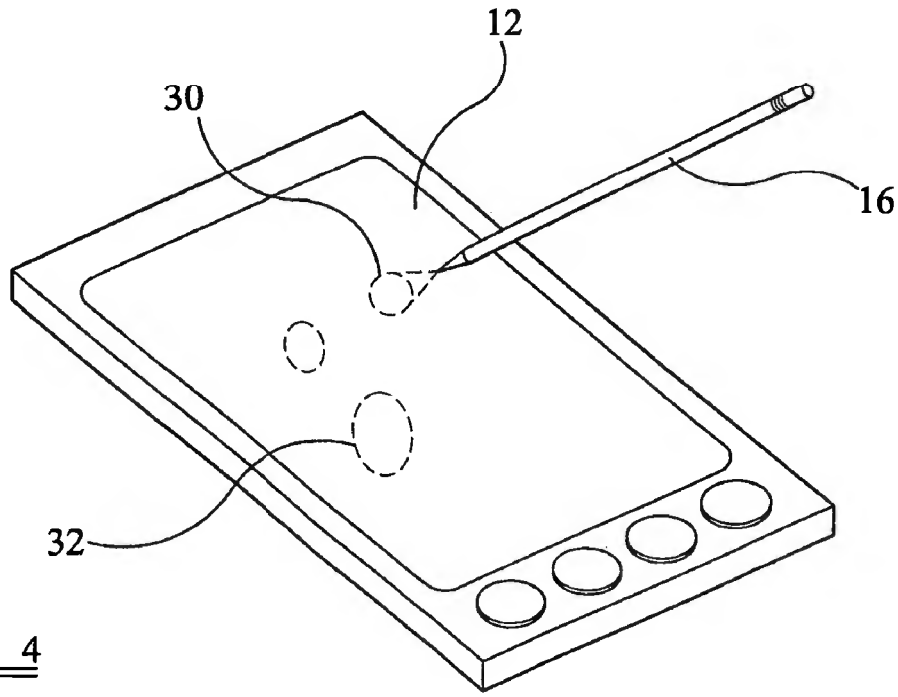


FIG 4

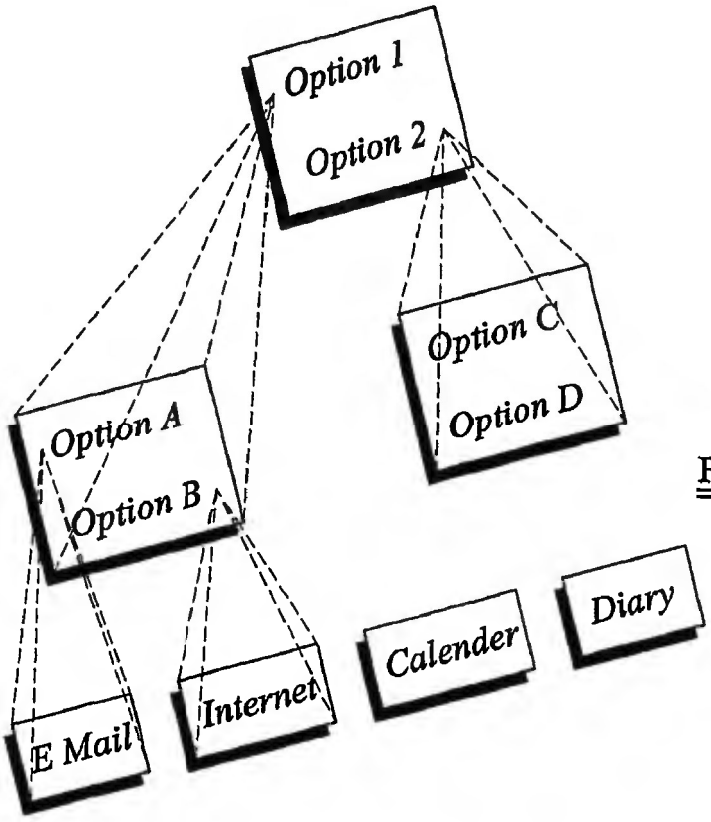

Option 1
Option 2
Option C
Option D
Option A
Option B
E Mail
Internet
Calender
Diary

FIG 2

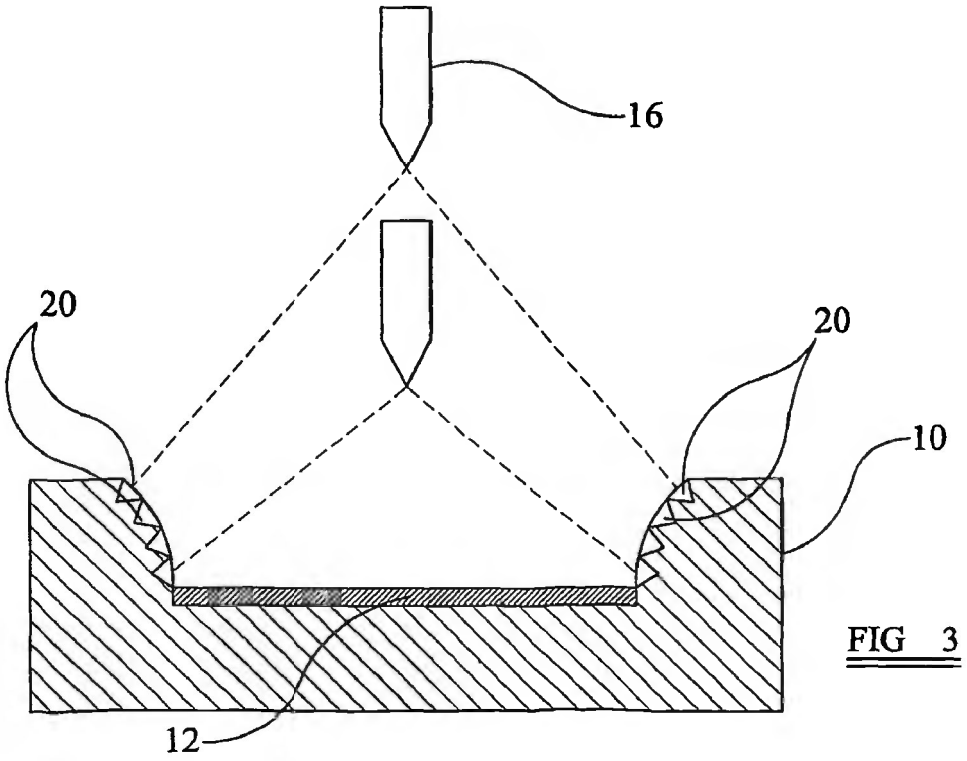

16
20
20
10
12

FIG 3

COMPUTER NAVIGATION

The present invention relates to computer navigation and particularly, but not exclusively, to an apparatus which facilitates navigation of software stored on the apparatus even where the display for the apparatus is small.

It is known to provide small, hand-held computer devices such as pocket organisers, Personal Digital Assistants (PDA's), cellular phones or the like. The current trend is to manufacture such devices to be as small in size as possible. Smaller devices are more easily carried and generally require a reduced power supply.

However, a significant disadvantage of such devices is that the reduced size forces a reduction in the size of the user interface, and particularly in the size of the screen or display used to display information or data stored on or processed by the device.

Many such devices have the processing power of conventional desktop or laptop computers or of similar devices many times their size and a number of products, such as the WACOM® and SONY® VAIO® pocket computers, are fully operable portable computers which use operating systems such as MICROSOFT® WINDOWS® or the like.

Those familiar with such pocket devices will appreciate the problem of displaying all of the necessary information on a relatively small display, particularly where the user is able to select specific functions from a large number of options. Conventionally, the selection of one option, for example, results in a new "window" opening which displays further options and sub options. Whilst devices having large displays are able to organise the data so that it is displayed in a more easily understood manner, devices having smaller screens tend to use data "layers" or "levels" whereby the selection of one option having a number of sub options causes the full screen to display the sub options fully eclipsing the original menu. The accidental selection of the wrong option requires a number of steps to return the display to the original list of options.

It would be advantageous to provide a pocket computer or hand held device which incorporates means for enabling easier access to data on the device and improves the user interface of the device.

According to one aspect of the present invention, therefore, there is provided an electronic device having a display for displaying data stored thereon, input means and control means for controlling the data displayed on said display in dependence on the three-dimensional position of the input means with respect to said device.

Preferably, the device includes means for sensing or monitoring the position of the input means relative to the device.

In one embodiment, the input means includes a transmitter for transmitting a signal and the display includes sensing means for sensing the position at which the signal strikes the display. The signal may be in the form of a conical or circular infrared beam and the sensing means may be operable to sense the area and/or the intensity of the beam as it strikes the display thereby to determine the three dimensional position of the input device relative to the display.

According to another aspect of the invention there is provided an input device for a computer or the like having a display for displaying data stored thereon, the input device comprising input means, and sensing means for sensing the three dimensional position of the input means relative thereto and applying a position signal to said computer or the like in dependence on said three dimensional position thereby to control the data displayed on said display.

The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. **1** shows illustratively a device according to the invention;

FIG. **2** shows illustratively the concept of data "levels";

FIG. **3** shows illustratively a cross-section through a device according to one embodiment of the invention; and

FIG. **4** shows illustratively one embodiment in which the stylus when moved closer to the display produces a circle or ellipse of smaller dimensions than the circle or ellipse formed when the stylus is moved away.

Referring to FIG. **1**, an electronic device according to the invention is shown generally at **10**. The device **10** may be, for example, a hand-held or "palm-top" computer, a personal digital assistant (PDA) or a mobile communication device such as a mobile telephone. The device **10** is capable of storing and displaying data from a display or screen **12** which may be a liquid crystal display, a dot matrix display or a TFT (thin film transistor) display.

Conventionally, the user of the device **10** controls the data displayed on the display **12** by means of a number of buttons **14** located on the device or by an input device such as a scratch pad or tracker ball. Alternatively, many such devices incorporate touch-sensitive displays which permit the user to select options or to change the data on the display **12** by means of a pencil-shaped pointing device which is physically pressed against the display at the required position thereby to select the required option. Such touch sensitive displays are able only to determine the two-dimensional, X-Y position of the pointing device relative to the display **12** when the pointing device is pressed against the surface of the display.

A disadvantage of such devices is that in order to achieve the required reduction in size to enable the device to be used as a hand-held device or pocket computer, the display **12** is made correspondingly smaller in size. However, depending on the application for which the device is intended, the display **12** may be required to display similar amounts of data to that of a conventional desktop or lap-top computer having a display which may be an order of magnitude larger in size. The small size of the display **12** reduces the amount of data which can be displayed at any given time.

To minimise the effects of this, the device is programmed to display data in a number of "levels" whereby the display **12** initially displays, for example, four options which are selectable by the user. Selecting one of these options, by means of the pointing device for example, may cause the display **12** to display a second "level" of options, for example in the form of a drop down list or menu commonly used in conventional computers. Each option displayed in the list may produce a further drop down list.

It will be appreciated that the number of levels used by the device is generally proportional to the number of options available to the user and inversely proportional to the size of the display. It is therefore quite common to find that a user may be required to select several options in order to activate a particular function of the device. This is time consuming and can be irritating to the user. Moreover, the generating of a drop down list or the like may obscure completely the original list so that an erroneous selection may require the user to manually exit from the current list in order to return to the original set of options. This may significantly increase the number of operations required to be made by the user.

According to the preferred form of the invention, the device **10** has a display **12** for displaying data stored on the device **10** which can be controlled by input means in the form of an input device **16**. In the preferred embodiment, the input

device **16** takes the form of a pen-shaped instrument, hereafter termed a "stylus" which allows the user to select various options displayed on the display **12**. The concept of the invention is that the electronic device **10** is able to detect or monitor the three dimensional position of the stylus **16** relative to the device **10**, and in particular relative to the display. This permits, effectively "three-dimensional control" of the display **12** which can be used, for example, to achieve the following control functions.

Movement of the stylus **16** in the X or Y directions relative to the display **12** causes the cursor on the display **12** (for example the mouse pointer or equivalent) to move accordingly, in the manner of a conventional mouse. Importantly, however, movement of the stylus **16** in the Z direction, i.e. in a direction generally perpendicular to the display **12**, performs a "zoom" function which, depending on the direction of movement of the stylus **16**, either towards or away from the display, causes the display **12** either to zoom in or to zoom out.

In one embodiment, for example, movement of the stylus **16** in a direction towards the display **12** causes the data in the region of the display **12** corresponding to the X-Y position of the stylus **16** to be magnified in a manner similar to that achieved by the "zoom in" function of conventional computers and computer programs. Thus, the data in the region of the display **12** corresponding to the X-Y position of the stylus **16** is enlarged as the stylus **16** is moved closer to the display **12**. This zooming in of the display **12** permits data relating to sub options to be displayed in place of the original option. However, whereas conventional software offers an "incremental zoom" with each discrete selection, the device described with reference to the drawings provides continuous zoom through constantly refreshed information based on the computed trajectory of the stylus. Continuous zoom makes possible an intuitive and responsive user interface.

When "zoom in" or "zoom out" reaches a pre-determined threshold, data relating to sub-options is displayed in addition to, or in place of (or first one then the other), the original option.

FIG. **2** illustrates the concept of "levels" of information to be displayed by the display **12**. Initially, the displays "level **1**" data which, as illustrated in FIG. **3**, may give the user two choices, OPTION **1** and OPTION **2**, which are selectable by the user. OPTION **1** represents specific "level **2**" data which may, for example, include a further two choices, OPTION A and OPTION B. OPTIONs A and B represent respective "level **3**" data which may, for example, represent different functions which the device **10** can perform, for example to send an e-mail or to access the internet.

Similarly, OPTION **2** in the level **1** data may correspond to OPTIONS C and D in the second level data, each of which represents different functions which may be performed by the device **10**, for example opening a calendar or opening a diary.

In conventional devices, to select the internet function from the above example, the user would be required to press the stylus **16** onto the screen at OPTION **1** and then again at OPTION B and finally on the internet option. Thus, three separate operations are required. An incorrect selection, for example selection of OPTION A instead of OPTION B requires the user to select an "exit" option (not shown) in order to return to the level **1** data.

The present invention, on the other hand, permits the user to select, for example, the internet, with a minimum of individual operations. For example, in one embodiment, the user moves the stylus **16** over the part of the display **12** containing OPTION **1** and then moves the stylus **16** towards the display. The device **10** interprets the movement of the stylus **16** towards the screen as a "zoom in" operation which zooms the display **12** through the level **1** data towards the level **2** data until OPTION A and OPTION B are displayed on the screen. The user then alters the position of the stylus **16** in the X-Y plane until the stylus **16** is positioned over the OPTION B icon and again moves the stylus **16** towards the display. This movement "zooms in" through the level **2** data towards the level **3** data until the internet icon appears on the screen. This can then be selected by the user in the conventional manner, for example, by pressing the stylus **16** onto the screen at the required location.

It will be understood that the present invention relies on the ability of the device **10** to monitor, track or otherwise detect the X-Y-Z, three-dimensional position of the stylus **16** relative to the display **12** whilst the stylus **16** is not in contact with the display **12** itself, unlike conventional touch-sensitive displays. This may be achieved in a number of ways.

In one embodiment, the stylus **16** is a so-called "smart stylus" which contains a source of electromagnetic radiation, for example an infrared emitter, an LED or other such light emitting device (not shown). The stylus **16** emits a beam of light, for example infrared or other spectrum light, from a circular, spherical, or other shaped tip. The light is sensed by a sensitive layer (not shown) positioned over, or incorporate in, the display **12**. The light sensitive layer may, for example, be in the form of a CCD or CMOS infrared sensitive array or the like. As the stylus **16** is moved across the display **12**, only certain parts of the sensitive layer will be illuminated by the beam of light emitted by the stylus **16** and this will be detected by the sensitive layer. The sensitive layer determines the appropriate X-Y coordinates of the stylus **16** and sends a corresponding position signal to the central processing unit or similar of the device **10** which adjusts the display **12** accordingly. FIG. **4** is an example of this embodiment. The stylus **16** when moved closer to the display produces a circle or ellipse **30** of smaller dimensions than the circle or ellipse **32** formed when the stylus is moved away. The same eccentricity of the ellipse means that the input stylus is at the same angle to the display and the size of the area indicates the distance of the stylus from the display.

In an alternative embodiment, the stylus **16** operates in the manner of a conventional light pen and contains a light sensor or photodiode therein which senses the light given off by the display. The display **12** is scanned as in a conventional television screen so that the image is continually refreshed across and down the display **12** in a so-called raster scan. This continual refreshing causes the pixels in the display **12** to alternatively brighten and then dim at a very high frequency such that the effect is invisible to the naked eye.

However, the photodiode is able to detect this bright/dim effect and when the light received by the photodiode steps from dim to light, the stylus **16** sends a signal to the display controller in the device **10**. Since the display controller creates the display signal, it knows the position of the current raster line and so it can determine which pixel on the display **12** is being refreshed when the stylus **16** sends the signal to the controller. The display controller then sets a latch which feeds two numbers, representative of the X and Y coordinates of the pixel, to the central processing unit or similar of the device **10** which is therefore able to determine where on the screen the stylus **16** is pointed.

The above examples describe only how the device **10** determines the X-Y coordinates of the stylus **16** relative to the display **12**. It will be understood that the device **10** must also determine the Z-coordinate, i.e. the distance of the stylus **16** from the display. Again this can be achieved in a number of ways.

In one embodiment, the stylus **16** emits a beam of electromagnetic radiation, for example infrared or other spectrum light which is transmitted in a conical beam which widens in diameter with distance from the tip of the stylus **16**.

The light incident on the display **12** and hence the sensitive layer is in the form of an ellipse, the eccentricity of which depends on the angle at which the light strikes the display **12** and hence the stylus **16** is being held. An eccentricity of 1, for example, is indicative of a circle of incident light and a vertically held stylus **16**.

The distribution of the light incident on the sensitive layer will vary with distance from the light source in the stylus **16**. When the stylus **16** is positioned at a distance from the sensitive layer of the display, the total area of the sensitive layer illuminated will be relatively large but the intensity of the incident light will be low. As the stylus **16** is moved closer to the display, the area the light incident upon the sensitive layer will decrease but the intensity will increase. At very short distances from the display, the area of the display **12** illuminated by the light from the stylus **16** will be small but the intensity will be high.

In order to measure the intensity of the incident light the continuous range of possible intensities may be divided into a number of thresholds of stimulation. Hence, the intensity of the light may be calculated according to which thresholds it falls between.

In operation, the sensitive layer detects the light incident on the display **12** and sends appropriate signals to the processing unit of the device **10**. The elliptical eccentricity of the light incident on the display **12** is then calculated and from this the angle at which the stylus **16** is determined. The total area of light incident on the display **12** may also be calculated and from this the distance of the stylus **16** from the display **12** may be determined. Alternatively or additionally, the intensity of the incident light may be measured and used either to independently determine the distance of the stylus **16** from the display **12** or to refine the result of the calculation based on the measured area.

The angle of the stylus **16**, in conjunction with the distance of the stylus **16** from the display **12** are then used to determine the vertical height of the stylus **16** above the display **12**. Hence the position of the stylus **16**, in the Z-dimension, is determined by the device **10**.

Repetitive calculation of the stylus position, several times a second, as the stylus **16** is moved allows a stylus trajectory to be recorded. The stylus trajectory may then be used to assist in anticipating the intentions of the user.

The location and angle of the stylus **16** may also be used to determine when the user makes a selection without physical contact between the stylus **16** and the display. A simple dipping motion, for example, could be used to represent the selection. Alternatively or additionally the area and/or intensity of the light may also be used to represent a contactless selection. Such a selection may be indicated, for example, by the area of incident light falling below a certain minimum threshold and/or the intensity rising above a certain maximum threshold.

In a different embodiment, illustrated in FIG. **3**, the device **10** is provided with a plurality of light sensors **20** positioned around the perimeter of the display **12**. The light sensors are segmented or layered in the Z-direction such that as the stylus **16** moves towards or away from the display **12**, different or segments or layers of the light sensors will be illuminated by the conical beam emitted by the stylus **16**. In particular, as the stylus **16** moves closer to the screen, fewer of the light sensors around the display **12** will be illuminated, as illustrated in FIG. **3**. The signals from the sensors are interpreted by the processing unit of the device **10**, which thus calculates the distance of the stylus **16** from the display **12**.

In yet a further embodiment, not shown, the display **12** is inset or sunk into the body of the device **10** to provide a surrounding wall. The wall is provided on two faces with a plurality of light emitting devices and on the other two faces by a corresponding number of light sensing devices. The light emitted by the light emitters are sensed by the opposing light sensors such that if the stylus **16** is moved towards the display **12**, it will interrupt the light transmitted between some of the light emitters and the corresponding light sensors which will indicate to the device **10** that the stylus **16** has moved closer to the display. If the light emitters and sensors are layered in the Z-direction, this can provide an indication of the distance of the stylus **16** from the display.

It will be clear to those skilled in the art that there are a number of possible ways of sensing the X-Y-Z, three-dimensional position of the stylus **16** relative to the display, the above examples representing particularly simple and advantageous techniques. The important feature of the invention is that the user is able to alter the data displayed by the device **10** by moving the stylus **16** or other input device in three dimensions relative to the device **10** or the display **12** of the device **10**.

It will be further understood that there are a number of modifications or improvements or variations on the above described invention which may provide particular advantages. Where the stylus **16** incorporates a light emitting device to produce a conical beam, the power of the device may be selected to produce a beam which is of a predetermined length and conical angle to restrict the amount of movement in the Z-direction required by the user to perform the zoom in or zoom out functions. The type of light emitter can be selected as desired to provide infrared or visible light or other forms of electromagnetic radiation may be used. The stylus **16** may alternatively include both a photodiode, to enable its use similar to a light pen, and a light emitter for establishing the Z-coordinate information. The stylus **16** may be connected to the device **10** by means of a cable for transmitting or receiving signals to and from the electronic device **10**. Alternatively, the stylus **16** may be remotely linked to the device **10** or no data link may be provided at all. The latter situation is possible where a light emitting device is employed in the stylus **16**.

The stylus could optionally be attached to the device with a simple tether (spiral plastic cord, etc.) simply to prevent its loss from a place where many people might use it often, such as a refrigerator, computer or a commercial site.

The device **10** may incorporate a touch-sensitive screen or a conventional screen by which a selection is achieved by means of a button or the like located on the stylus **16** which causes a signal to be sent to the electronic device **10**, similar to conventional light guns or the like. Where a sensitive layer is used, this may be formed of any suitable material, which may additionally or alternatively be heat-sensitive. The sensitive layer may be layered above or below the screen of the display **12** or integrated therewith. The sensitivity and qualities of the material chosen can be selected as desired.

While the above described embodiments talk of sensing the position of the stylus **16** relative to the display **12** of the device **10**, it will be appreciated that the three dimensional position of the stylus **16** relative to any other part of the device **10** or relative to any fixed location could be used for the same purpose. In this regard, the invention may provide only a stylus **16** and a sensing "pad" or the like which is able to determine the three dimensional position of the stylus **16** relative thereto. The pad could be connected for communication with the electronic device **10** by any suitable means

which will be well understood. Such an embodiment may enable the stylus **16** and "pad" to be used with conventional desk top or laptop computers in place of the more conventional mouse, scratch pad or tracker ball.

It will be appreciated that the device **10** of the invention provides a number of advantages over existing systems. In particular, depth/height coordinates of the stylus **16** can be calculated from the device **10** and enable software on the device **10** to adapt the contents of the display **12** as the distance from the display **12** or device **10** changes. When the stylus **16** is brought closer to the display, the device **10** interprets this movement as an intention to select a coordinate within a specific range and zoom all of the information displayed within that coordinate to fill a larger part of the display. This enables the information display to intuitively come "closer" to meet the intention of the user. In addition, more space becomes available on the display **12** because fewer of the level **1** choices are shown and additional layers of choices, such as contextual menus, could be selectively added permitting more selections to be made with fewer "clicks" or selections of the stylus **16**. Where two or more levels of selection are required, movement of the stylus **16** may permit the device **10** to anticipate the selection required by the user to allow the selection to be made with only a single operation of the stylus **16**.

The invention claimed is:

1. An electronic input device comprising:

an input object wherein said input object includes a source of said electromagnetic radiation;

an input area;

a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object; and

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object; and

wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

2. An electronic input device according to claim **1** and also comprising a display providing a visually sensible output which is responsive to said electronic input.

3. An electronic input device according to claim **1** and wherein said sensor array is also operative to sense and provide at least one output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern.

4. An electronic input device according to claim **3** and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern.

5. An electronic input device according to claim **3** and wherein said sensor array is operative to provide said output indication of intensity of electromagnetic radiation relative to a plurality of intensity thresholds.

6. An electronic input device according to claim **3** and wherein said sensor array is also operative to provide an output indication of the area of the sensor array illuminated by said electromagnetic radiation pattern.

7. An electronic input device according to claim **6** and wherein:

said area of the sensor array illuminated has a direct variable relationship with the distance from said input object to said input area; and

said intensity of electromagnetic radiation has an inverse variable relationship with the distance from said input object to said input area.

8. An electronic input device according to claim **7** and wherein the symmetry of at least one of said area of the sensor array illuminated and said intensity of electromagnetic radiation correlates with the orientation of said input object in at least one plane relative to said input area.

9. An electronic input device according to claim **1** and also comprising interface circuitry operative in response to said output indication for providing continuously variable user inputs based on at least one of said two-dimensional position, said three dimensional position; and said orientation of said input object.

10. An electronic input device according to claim **1** and wherein said sensor array is operative to provide an output indication of each of position, orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object.

11. An electronic input device according to claim **10** and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern.

12. An electronic input device according to claim **10** and wherein said input object comprises a source of said electromagnetic radiation.

13. An electronic input device according to claim **12** and wherein said source of said electromagnetic radiation produces a conical beam which impinges on said input area, producing said electromagnetic radiation pattern on said input area in the form of an ellipse having elliptical eccentricity which is a function of orientation of said input object in a plane other than a plane parallel to said input area.

14. An electronic device according to claim **13** and wherein said input circuitry is operative to calculate said orientation of said input object from said elliptical eccentricity, based on said output indication from said sensor array.

15. An electronic device according to claim **10** and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern.

16. An electronic input device according to claim **10** and also comprising a display providing a visually sensible output which is responsive to said electronic input.

17. An electronic input device according to claim **1** and wherein said input circuitry is operative to calculate said orientation of said input object from said elliptical eccentricity, based on said output indication from said sensor array.

18. An electronic input device according to claim **1** and wherein said conical beam widens in diameter as the distance from said input object to said input area increases.

19. An electronic input device according to claim **1** and wherein said sensor array is positioned adjacent the perimeter of said input area.

20. An electronic input device comprising:

an input object;

an input area;

a sensor array positioned outside said input area operative to sense and provide an output indication of position and

at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object;

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object, said electronic input representing orientation includes an electronic input representing angular orientation of said input object relative to said input area; and

said input object includes a source of said electromagnetic radiation, and wherein said sensing array senses an electromagnetic radiation pattern which correlates with but is not itself representational of an elliptical pattern produced by a conical beam which intersects said input area in a pattern forming an ellipse having properties which are a function of at least one of position, distance and orientation of said input.

21. An electronic input device comprising:

a physical input area;

an input stylus projecting an electromagnetic radiation pattern on said input area;

a sensor array at least partially circumscribing and immediately proximate said input area, said sensor array operative to sense said electromagnetic radiation pattern on said input area and to provide an output indication of position and at least two of orientation, shape and size of said electromagnetic radiation pattern on said input area;

wherein said electromagnetic radiation pattern includes an elliptical pattern having elliptical eccentricity that is a function of the orientation of said input stylus relative to said input area; and

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input stylus.

22. An electronic input device comprising:

an input object;

an input area;

a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object;

wherein said input object produces a beam of electromagnetic radiation that intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area; and

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,952,570 B2
APPLICATION NO. : 11/006486
DATED : May 31, 2011
INVENTOR(S) : Lipman et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims:

Column 8, line 39 (Claim 14, line 1) please insert the word --input-- after "electronic."

Column 8, line 43 (Claim 15, line 1) please insert the word --input-- after "electronic."

Signed and Sealed this
Sixteenth Day of August, 2011

David J. Kappos
Director of the United States Patent and Trademark Office

US008547364B2

(12) **United States Patent**
Lipman et al.

(10) **Patent No.: US 8,547,364 B2**
(45) **Date of Patent: *Oct. 1, 2013**

(54) **INPUT SYSTEM FOR CONTROLLING ELECTRONIC DEVICE**

(75) Inventors: **Robert Michael Lipman**, Jerusalem (IL); **Sarah Michelle Lipman**, Jerusalem (IL)

(73) Assignee: **Power2B, Inc.**, Santa Monica, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/114,580**

(22) Filed: **May 24, 2011**

(65) **Prior Publication Data**

US 2011/0241832 A1 Oct. 6, 2011

Related U.S. Application Data

(63) Continuation of application No. 11/006,486, filed on Dec. 6, 2004, now Pat. No. 7,952,570, which is a continuation of application No. PCT/GB03/02533, filed on Jun. 9, 2003.

(30) **Foreign Application Priority Data**

Jun. 8, 2002 (GB) 0213215.7

(51) **Int. Cl.**
G09G 3/28 (2013.01)
G06F 3/033 (2013.01)

(52) **U.S. Cl.**
USPC **345/182**; 178/19.05

(58) **Field of Classification Search**
USPC 345/183, 182; 178/19.05
See application file for complete search history.

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(57) **ABSTRACT**

An electronic device comprises a display for displaying data stored on said electronic device; input means; sensing means for sensing the three-dimensional position of the input means relative to said device; and control means for controlling the data displayed on said display in dependence on the three-dimensional position of the input means relative to said device. The input means includes a source of electromagnetic radiation for directing an infrared conical beam onto the display. The sensing means can sense the elliptical eccentricity of the electromagnetic radiation incident on the display to determine the angle at which it strikes the display, and can sense the area of the electromagnetic radiation incident on the display to determine the distance of the input means from the display.

21 Claims, 2 Drawing Sheets

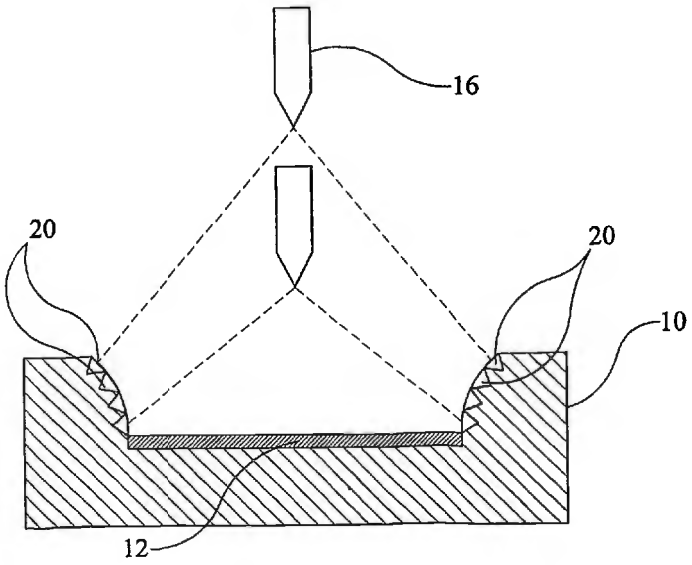

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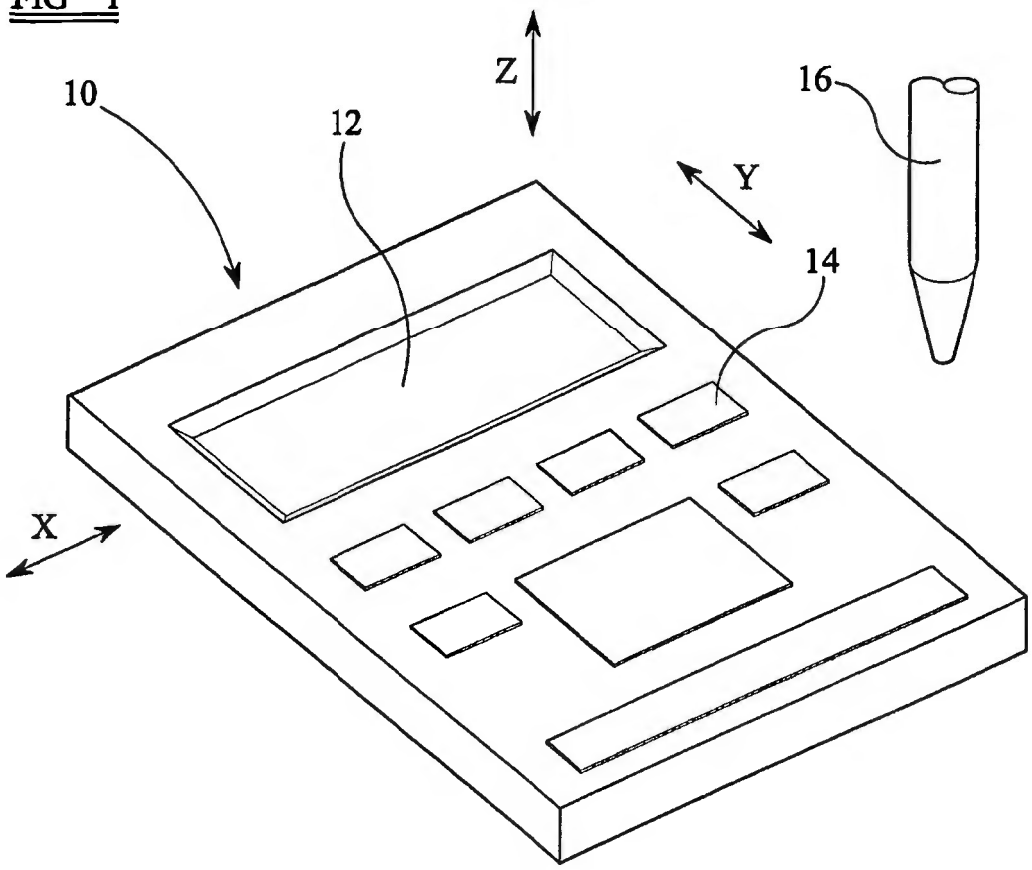
FIG 1



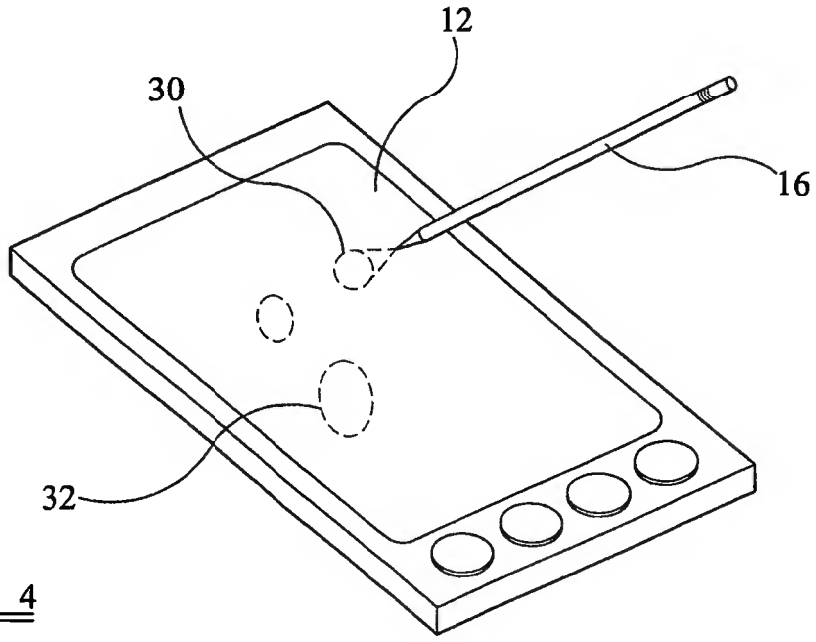


FIG 4

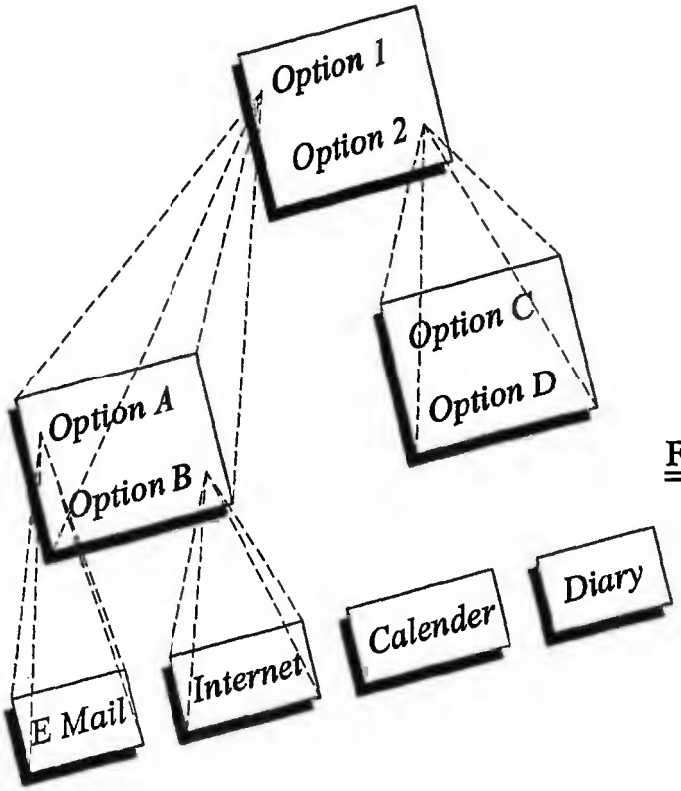

Option 1
Option 2
Option C
Option D
Option A
Option B
E Mail
Internet
Calender
Diary

FIG 2

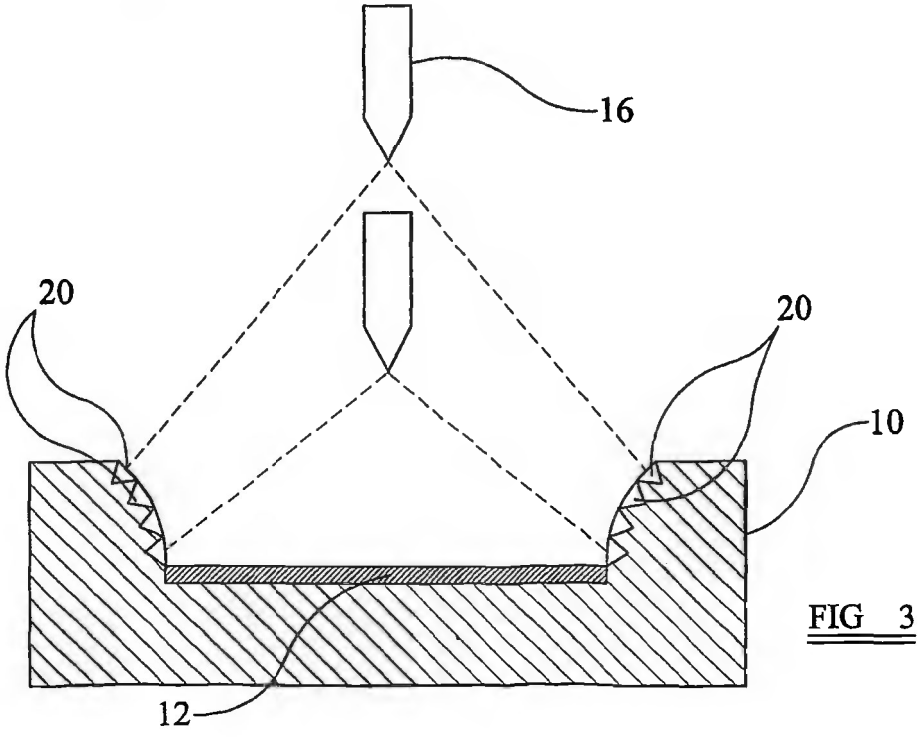

16
20
20
10
12

FIG 3

INPUT SYSTEM FOR CONTROLLING ELECTRONIC DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of parent application having application Ser. No. 11/006,486, filed Dec. 6, 2004, now U.S. Pat. No. 7,952,570, which is a continuation of International Application No. PCT/GB03/02533, filed Jun. 9, 2003, which claims priority to United Kingdom Application No. 0213215.7, filed Jun. 8, 2002, all of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

The present invention relates to computer navigation and particularly, but not exclusively, to an apparatus which facilitates navigation of software stored on the apparatus even where the display for the apparatus is small.

It is known to provide small, hand-held computer devices such as pocket organisers, Personal Digital Assistants (PDA's), cellular phones or the like. The current trend is to manufacture such devices to be as small in size as possible. Smaller devices are more easily carried and generally require a reduced power supply.

However, a significant disadvantage of such devices is that the reduced size forces a reduction in the size of the user interface, and particularly in the size of the screen or display used to display information or data stored on or processed by the device.

Many such devices have the processing power of conventional desktop or laptop computers or of similar devices many times their size and a number of products, such as the WACOM® and SONY® VAIO® pocket computers, are fully operable portable computers which use operating systems such as MICROSOFT® WINDOWS® or the like.

Those familiar with such pocket devices will appreciate the problem of displaying all of the necessary information on a relatively small display, particularly where the user is able to select specific functions from a large number of options. Conventionally, the selection of one option, for example, results in a new "window" opening which displays further options and sub options. Whilst devices having large displays are able to organise the data so that it is displayed in a more easily understood manner, devices having smaller screens tend to use data "layers" or "levels" whereby the selection of one option having a number of sub options causes the full screen to display the sub options fully eclipsing the original menu. The accidental selection of the wrong option requires a number of steps to return the display to the original list of options.

It would be advantageous to provide a pocket computer or hand held device which incorporates means for enabling easier access to data on the device and improves the user interface of the device.

BRIEF SUMMARY OF THE INVENTION

According to one aspect of the present invention, therefore, there is provided an electronic device having a display for displaying data stored thereon, input means and control means for controlling the data displayed on said display in dependence on the three-dimensional position of the input means with respect to said device.

Preferably, the device includes means for sensing or monitoring the position of the input means relative to the device.

In one embodiment, the input means includes a transmitter for transmitting a signal and the display includes sensing means for sensing the position at which the signal strikes the display. The signal may be in the form of a conical or circular infrared beam and the sensing means may be operable to sense the area and/or the intensity of the beam as it strikes the display thereby to determine the three-dimensional position of the input device relative to the display.

According to another aspect of the invention there is provided an input device for a computer or the like having a display for displaying data stored thereon, the input device comprising input means, and sensing means for sensing the three-dimensional position of the input means relative thereto and applying a position signal to said computer or the like in dependence on said three-dimensional position thereby to control the data displayed on said display.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. **1** shows illustratively a device according to the invention;

FIG. **2** shows illustratively the concept of data "levels";

FIG. **3** shows illustratively a cross-section through a device according to one embodiment of the invention; and

FIG. **4** shows illustratively one embodiment in which the stylus when moved closer to the display produces a circle or ellipse of smaller dimensions than the circle or ellipse formed when the stylus is moved away.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, an electronic device according to the invention is shown generally at **10**. The device **10** may be, for example, a hand-held or "palm-top" computer, a personal digital assistant (PDA) or a mobile communication device such as a mobile telephone. The device **10** is capable of storing and displaying data from a display or screen **12** which may be a liquid crystal display, a dot matrix display or a TFT (thin film transistor) display.

Conventionally, the user of the device **10** controls the data displayed on the display **12** by means of a number of buttons **14** located on the device or by an input device such as a scratch pad or tracker ball. Alternatively, many such devices incorporate touch-sensitive displays which permit the user to select options or to change the data on the display **12** by means of a pencil-shaped pointing device which is physically pressed against the display at the required position thereby to select the required option. Such touch sensitive displays are able only to determine the two-dimensional, X-Y position of the pointing device relative to the display **12** when the pointing device is pressed against the surface of the display.

A disadvantage of such devices is that in order to achieve the required reduction in size to enable the device to be used as a hand-held device or pocket computer, the display **12** is made correspondingly smaller in size. However, depending on the application for which the device is intended, the display **12** may be required to display similar amounts of data to that of a conventional desktop or lap-top computer having a display which may be an order of magnitude larger in size. The small size of the display **12** reduces the amount of data which can be displayed at any given time.

To minimise the effects of this, the device is programmed to display data in a number of "levels" whereby the display **12**

initially displays, for example, four options which are selectable by the user. Selecting one of these options, by means of the pointing device for example, may cause the display **12** to display a second "level" of options, for example in the form of a drop down list or menu commonly used in conventional computers. Each option displayed in the list may produce a further drop down list.

It will be appreciated that the number of levels used by the device is generally proportional to the number of options available to the user and inversely proportional to the size of the display. It is therefore quite common to find that a user may be required to select several options in order to activate a particular function of the device. This is time consuming and can be irritating to the user. Moreover, the generating of a drop down list or the like may obscure completely the original list so that an erroneous selection may require the user to manually exit from the current list in order to return to the original set of options. This may significantly increase the number of operations required to be made by the user.

According to the preferred form of the invention, the device **10** has a display **12** for displaying data stored on the device **10** which can be controlled by input means in the form of an input device **16**. In the preferred embodiment, the input device **16** takes the form of a pen-shaped instrument, hereafter termed a "stylus" which allows the user to select various options displayed on the display **12**. The concept of the invention is that the electronic device **10** is able to detect or monitor the three-dimensional position of the stylus **16** relative to the device **10**, and in particular relative to the display. This permits, effectively "three-dimensional control" of the display **12** which can be used, for example, to achieve the following control functions.

Movement of the stylus **16** in the X or Y directions relative to the display **12** causes the cursor on the display **12** (for example the mouse pointer or equivalent) to move accordingly, in the manner of a conventional mouse. Importantly, however, movement of the stylus **16** in the Z direction, i.e. in a direction generally perpendicular to the display **12**, performs a "zoom" function which, depending on the direction of movement of the stylus **16**, either towards or away from the display, causes the display **12** either to zoom in or to zoom out.

In one embodiment, for example, movement of the stylus **16** in a direction towards the display **12** causes the data in the region of the display **12** corresponding to the X-Y position of the stylus **16** to be magnified in a manner similar to that achieved by the "zoom in" function of conventional computers and computer programs. Thus, the data in the region of the display **12** corresponding to the X-Y position of the stylus **16** is enlarged as the stylus **16** is moved closer to the display **12**. This zooming in of the display **12** permits data relating to sub options to be displayed in place of the original option. However, whereas conventional software offers an "incremental zoom" with each discrete selection, the device described with reference to the drawings provides continuous zoom through constantly refreshed information based on the computed trajectory of the stylus. Continuous zoom makes possible an intuitive and responsive user interface.

When "zoom in" or "zoom out" reaches a pre-determined threshold, data relating to sub-options is displayed in addition to, or in place of (or first one then the other), the original option.

FIG. **2** illustrates the concept of "levels" of information to be displayed by the display **12**. Initially, the displays "level **1**" data which, as illustrated in FIG. **3**, may give the user two choices, OPTION **1** and OPTION **2**, which are selectable by the user. OPTION **1** represents specific "level **2**" data which may, for example, include a further two choices, OPTION A and OPTION B. OPTIONs A and B represent respective "level **3**" data which may, for example, represent different functions which the device **10** can perform, for example to send an e-mail or to access the internet.

Similarly, OPTION **2** in the level **1** data may correspond to OPTIONS C and D in the second level data, each of which represents different functions which may be performed by the device **10**, for example opening a calendar or opening a diary.

In conventional devices, to select the internet function from the above example, the user would be required to press the stylus **16** onto the screen at OPTION **1** and then again at OPTION B and finally on the internet option. Thus, three separate operations are required. An incorrect selection, for example selection of OPTION A instead of OPTION B requires the user to select an "exit" option (not shown) in order to return to the level **1** data.

The present invention, on the other hand, permits the user to select, for example, the internet, with a minimum of individual operations. For example, in one embodiment, the user moves the stylus **16** over the part of the display **12** containing OPTION **1** and then moves the stylus **16** towards the display. The device **10** interprets the movement of the stylus **16** towards the screen as a "zoom in" operation which zooms the display **12** through the level **1** data towards the level **2** data until OPTION A and OPTION B are displayed on the screen. The user then alters the position of the stylus **16** in the X-Y plane until the stylus **16** is positioned over the OPTION B icon and again moves the stylus **16** towards the display. This movement "zooms in" through the level **2** data towards the level **3** data until the internet icon appears on the screen. This can then be selected by the user in the conventional manner, for example, by pressing the stylus **16** onto the screen at the required location.

It will be understood that the present invention relies on the ability of the device **10** to monitor, track or otherwise detect the X-Y-Z, three-dimensional position of the stylus **16** relative to the display **12** whilst the stylus **16** is not in contact with the display **12** itself, unlike conventional touch-sensitive displays. This may be achieved in a number of ways.

In one embodiment, the stylus **16** is a so-called "smart stylus" which contains a source of electromagnetic radiation, for example an infrared emitter, an LED or other such light emitting device (not shown). The stylus **16** emits a beam of light, for example infrared or other spectrum light, from a circular, spherical, or other shaped tip. The light is sensed by a sensitive layer (not shown) positioned over, or incorporate in, the display **12**. The light sensitive layer may, for example, be in the form of a CCD or CMOS infrared sensitive array or the like. As the stylus **16** is moved across the display **12**, only certain parts of the sensitive layer will be illuminated by the beam of light emitted by the stylus **16** and this will be detected by the sensitive layer. The sensitive layer determines the appropriate X-Y coordinates of the stylus **16** and sends a corresponding position signal to the central processing unit or similar of the device **10** which adjusts the display **12** accordingly. FIG. **4** is an example of this embodiment. The stylus **16** when moved closer to the display produces a circle or ellipse **30** of smaller dimensions than the circle or ellipse **32** formed when the stylus is moved away. The same eccentricity of the ellipse means that the input stylus is at the same angle to the display and the size of the area indicates the distance of the stylus from the display.

In an alternative embodiment, the stylus **16** operates in the manner of a conventional light pen and contains a light sensor or photodiode therein which senses the light given off by the display. The display **12** is scanned as in a conventional tele-

vision screen so that the image is continually refreshed across and down the display **12** in a so-called raster scan. This continual refreshing causes the pixels in the display **12** to alternatively brighten and then dim at a very high frequency such that the effect is invisible to the naked eye.

However, the photodiode is able to detect this bright/dim effect and when the light received by the photodiode steps from dim to light, the stylus **16** sends a signal to the display controller in the device **10**. Since the display controller creates the display signal, it knows the position of the current raster line and so it can determine which pixel on the display **12** is being refreshed when the stylus **16** sends the signal to the controller. The display controller then sets a latch which feeds two numbers, representative of the X and Y coordinates of the pixel, to the central processing unit or similar of the device **10** which is therefore able to determine where on the screen the stylus **16** is pointed.

The above examples describe only how the device **10** determines the X-Y coordinates of the stylus **16** relative to the display **12**. It will be understood that the device **10** must also determine the Z-coordinate, i.e. the distance of the stylus **16** from the display. Again this can be achieved in a number of ways.

In one embodiment, the stylus **16** emits a beam of electromagnetic radiation, for example infrared or other spectrum light which is transmitted in a conical beam which widens in diameter with distance from the tip of the stylus **16**.

The light incident on the display **12** and hence the sensitive layer is in the form of an ellipse, the eccentricity of which depends on the angle at which the light strikes the display **12** and hence the stylus **16** is being held. An eccentricity of 1, for example, is indicative of a circle of incident light and a vertically held stylus **16**.

The distribution of the light incident on the sensitive layer will vary with distance from the light source in the stylus **16**. When the stylus **16** is positioned at a distance from the sensitive layer of the display, the total area of the sensitive layer illuminated will be relatively large but the intensity of the incident light will be low. As the stylus **16** is moved closer to the display, the area the light incident upon the sensitive layer will decrease but the intensity will increase. At very short distances from the display, the area of the display **12** illuminated by the light from the stylus **16** will be small but the intensity will be high.

In order to measure the intensity of the incident light the continuous range of possible intensities may be divided into a number of thresholds of stimulation. Hence, the intensity of the light may be calculated according to which thresholds it falls between.

In operation, the sensitive layer detects the light incident on the display **12** and sends appropriate signals to the processing unit of the device **10**. The elliptical eccentricity of the light incident on the display **12** is then calculated and from this the angle at which the stylus **16** is determined. The total area of light incident on the display **12** may also be calculated and from this the distance of the stylus **16** from the display **12** may be determined. Alternatively or additionally, the intensity of the incident light may be measured and used either to independently determine the distance of the stylus **16** from the display **12** or to refine the result of the calculation based on the measured area.

The angle of the stylus **16**, in conjunction with the distance of the stylus **16** from the display **12** are then used to determine the vertical height of the stylus **16** above the display **12**. Hence the position of the stylus **16**, in the Z-dimension, is determined by the device **10**.

Repetitive calculation of the stylus position, several times a second, as the stylus **16** is moved allows a stylus trajectory to be recorded. The stylus trajectory may then be used to assist in anticipating the intentions of the user.

The location and angle of the stylus **16** may also be used to determine when the user makes a selection without physical contact between the stylus **16** and the display. A simple dipping motion, for example, could be used to represent the selection. Alternatively or additionally the area and/or intensity of the light may also be used to represent a contactless selection. Such a selection may be indicated, for example, by the area of incident light falling below a certain minimum threshold and/or the intensity rising above a certain maximum threshold.

In a different embodiment, illustrated in FIG. **3**, the device **10** is provided with a plurality of light sensors **20** positioned around the perimeter of the display **12**. The light sensors are segmented or layered in the Z-direction such that as the stylus **16** moves towards or away from the display **12**, different or segments or layers of the light sensors will be illuminated by the conical beam emitted by the stylus **16**. In particular, as the stylus **16** moves closer to the screen, fewer of the light sensors around the display **12** will be illuminated, as illustrated in FIG. **3**. The signals from the sensors are interpreted by the processing unit of the device **10**, which thus calculates the distance of the stylus **16** from the display **12**.

In yet a further embodiment, not shown, the display **12** is inset or sunk into the body of the device **10** to provide a surrounding wall. The wall is provided on two faces with a plurality of light emitting devices and on the other two faces by a corresponding number of light sensing devices. The light emitted by the light emitters are sensed by the opposing light sensors such that if the stylus **16** is moved towards the display **12**, it will interrupt the light transmitted between some of the light emitters and the corresponding light sensors which will indicate to the device **10** that the stylus **16** has moved closer to the display. If the light emitters and sensors are layered in the Z-direction, this can provide an indication of the distance of the stylus **16** from the display.

It will be clear to those skilled in the art that there are a number of possible ways of sensing the X-Y-Z, three-dimensional position of the stylus **16** relative to the display, the above examples representing particularly simple and advantageous techniques. The important feature of the invention is that the user is able to alter the data displayed by the device **10** by moving the stylus **16** or other input device in three dimensions relative to the device **10** or the display **12** of the device **10**.

It will be further understood that there are a number of modifications or improvements or variations on the above described invention which may provide particular advantages. Where the stylus **16** incorporates a light emitting device to produce a conical beam, the power of the device may be selected to produce a beam which is of a predetermined length and conical angle to restrict the amount of movement in the Z-direction required by the user to perform the zoom in or zoom out functions. The type of light emitter can be selected as desired to provide infrared or visible light or other forms of electromagnetic radiation may be used. The stylus **16** may alternatively include both a photodiode, to enable its use similar to a light pen, and a light emitter for establishing the Z-coordinate information. The stylus **16** may be connected to the device **10** by means of a cable for transmitting or receiving signals to and from the electronic device **10**. Alternatively, the stylus **16** may be remotely linked to the device **10** or no data link may be provided at all. The latter situation is possible where a light emitting device is employed in the stylus **16**.

The stylus could optionally be attached to the device with a simple tether (spiral plastic cord, etc.) simply to prevent its loss from a place where many people might use it often, such as a refrigerator, computer or a commercial site.

The device **10** may incorporate a touch-sensitive screen or a conventional screen by which a selection is achieved by means of a button or the like located on the stylus **16** which causes a signal to be sent to the electronic device **10**, similar to conventional light guns or the like. Where a sensitive layer is used, this may be formed of any suitable material, which may additionally or alternatively be heat-sensitive. The sensitive layer may be layered above or below the screen of the display **12** or integrated therewith. The sensitivity and qualities of the material chosen can be selected as desired.

While the above described embodiments talk of sensing the position of the stylus **16** relative to the display **12** of the device **10**, it will be appreciated that the three-dimensional position of the stylus **16** relative to any other part of the device **10** or relative to any fixed location could be used for the same purpose. In this regard, the invention may provide only a stylus **16** and a sensing "pad" or the like which is able to determine the three-dimensional position of the stylus **16** relative thereto. The pad could be connected for communication with the electronic device **10** by any suitable means which will be well understood. Such an embodiment may enable the stylus **16** and "pad" to be used with conventional desk top or laptop computers in place of the more conventional mouse, scratch pad or tracker ball.

It will be appreciated that the device **10** of the invention provides a number of advantages over existing systems. In particular, depth/height coordinates of the stylus **16** can be calculated from the device **10** and enable software on the device **10** to adapt the contents of the display **12** as the distance from the display **12** or device **10** changes. When the stylus **16** is brought closer to the display, the device **10** interprets this movement as an intention to select a coordinate within a specific range and zoom all of the information displayed within that coordinate to fill a larger part of the display. This enables the information display to intuitively come "closer" to meet the intention of the user. In addition, more space becomes available on the display **12** because fewer of the level **1** choices are shown and additional layers of choices, such as contextual menus, could be selectively added permitting more selections to be made with fewer "clicks" or selections of the stylus **16**. Where two or more levels of selection are required, movement of the stylus **16** may permit the device **10** to anticipate the selection required by the user to allow the selection to be made with only a single operation of the stylus **16**.

The invention claimed is:

1. An electronic input device, comprising:

an input object projecting a conical beam of electromagnetic radiation;

an input area having a periphery receiving the conical beam of electromagnetic radiation thereon;

wherein the input object is spaced apart from and not in contact with the input area;

a pattern produced on the input area by the input object;

a sensor array positioned at the periphery of the input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of the electromagnetic radiation pattern;

wherein the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and

input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

2. An electronic input device according to claim **1**, wherein the orientation of the input object represents an angular orientation of the input object relative to the input area.

3. An electronic input device according to claim **1**, wherein the device further comprises a display providing a visually sensible output which is responsive to the electronic input.

4. An electronic input device according to claim **1**, wherein the input object includes a stylus having a cylindrical shape with an end that emits the electromagnetic radiation.

5. An electronic input device according to claim **1**, wherein the electromagnetic radiation includes radiation selected from the group consisting of infra red light, ultraviolet light, visible light, and collimated light.

6. An electronic input device according to claim **1**, wherein the sensor array senses and provides at least one output indication of intensity of the electromagnetic radiation in the electromagnetic radiation pattern.

7. An electronic input device according to claim **6**, wherein the input circuitry provides an electronic input that is at least partially based on the sensed intensity of the electromagnetic radiation in the electromagnetic radiation pattern.

8. An electronic input device according to claim **1**, wherein the device further comprises interface circuitry operative in response to the output indication for providing continuously variable user inputs based on at least one of the two-dimensional position, three-dimensional position, and the orientation of the input object.

9. An electronic input device according to claim **1**, wherein the sensor array is operative to provide an output indication of each of position, orientation, shape and size of the electromagnetic radiation pattern on the input area produced by the input object.

10. An electronic input device, comprising:

a physical input area;

an input object projecting an electromagnetic radiation pattern on the input area;

a sensor array at least partially circumscribing and immediately proximate the input area, wherein the sensor array senses the electromagnetic radiation pattern thereon and provides an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area;

wherein the electromagnetic radiation pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and

input circuitry receiving the output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

11. An electronic input device according to claim **10**, wherein the projected electromagnetic radiation produces a conical beam that intersects the input area in an elliptical pattern having an elliptical eccentricity which is a function of the orientation of the input object in a plane perpendicular to the input area.

12. An electronic input device according to claim **10**, wherein the input circuitry is operative to calculate the orientation of the input object from the elliptical eccentricity based on the output indication from the sensor array.

13. An electronic input device according to claim **10**, wherein the sensor array is also operative to sense and provide

an output indication of intensity of the electromagnetic radiation in the electromagnetic radiation pattern.

14. An electronic input device according to claim **10**, wherein the electromagnetic radiation produces a conical beam that impinges on the input area, producing the electromagnetic radiation pattern on the input area in the form of an ellipse having an eccentricity which is a function of the orientation of the input object in a plane other than a plane parallel to the input area.

15. An electronic input device according to claim **14**, wherein the conical beam widens in diameter as the distance from the input object to the input area increases.

16. An electronic input device according to claim **10**, wherein the electromagnetic radiation pattern includes an asymmetrical shape.

17. A method for making an electronic input device, comprising:

providing an input object and a physical input area;

providing a sensor array positioned partially circumscribing and immediately proximate the input area;

projecting an electromagnetic radiation pattern from the input object on to the input area;

sensing a portion of the electromagnetic radiation pattern by the sensor array;

providing an output indication of position, and at least two of orientation, shape and size of the electromagnetic radiation pattern on the input area, based on the electromagnetic radiation pattern, which pattern includes an elliptical shape having an eccentricity that is a function of the orientation of the input object relative to the input area; and

providing input circuitry that receives the output indication, which input circuitry provides an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of the input object.

18. A method for making an electronic input device according to claim **17**, the method further comprising moving the input object closer to and farther away from the input area, detecting the changes in three-dimensional positions of the input object relative to the input area, and generating zoom in and zoom out operations.

19. A method for making an electronic input device according to claim **17**, the method further comprising moving the input object closer to and farther away from the input area, detecting the changes in intensity of the electromagnetic pattern on the input area, and generating zoom in and zoom out operations.

20. A method for making an electronic input device according to claim **17**, the method further comprising detecting thresholds of intensity of the electromagnetic radiation pattern on the input area, and generating control signals by the input circuitry.

21. A method for making an electronic input device according to claim **17**, wherein the sensor array is positioned at least partially circumscribing the input area and at least partially coextensive with the input area.

* * * * *

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner/Appellants

v. **Appeal No. 2023-2184**

POWER2B, INC,
Patent Owner/Appellee

Proceeding No.: IPR2022-00405

NOTICE FORWARDING CERTIFIED LIST

A Notice of Appeal to the United States Court of Appeals for the Federal Circuit was timely filed by the Appellants on July 17, 2023, in the United States Patent and Trademark Office in connection with the above-identified *Inter Partes Review* (IPR) proceeding. Pursuant to 35 U.S.C. § 143, a Certified List is this day being forwarded to the Federal Circuit.

Date: September 5, 2023

Respectfully submitted,

Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office

By: Orchideh Rushenas

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of the foregoing NOTICE FORWARDING CERTIFIED LIST has been served, via electronic mail, on counsel for Appellants and Appellee on this 5th day of September, 2023, as follows:

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U.S. DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

September 5, 2023

THIS IS TO CERTIFY that the attached document is a list of the papers that comprise the record before the Patent Trial and Appeal Board (PTAB) for the *Inter Partes Review* proceeding identified below:

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

Case: IPR2022-00405
Patent 8,547,364 B2

By authority of the
DIRECTOR OF THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Orchideh Rushenas
Certifying Officer

Prosecution History for IPR2022-00405

Date	Document
01/05/2022	Petition for *Inter Partes* Review of U.S. Patent No. 8,547,364
01/05/2022	Petitioner's Power of Attorney for Samsung Electronics Co., Ltd.
01/05/2022	Petitioner's Power of Attorney for Samsung Electronics America, Inc.
01/20/2022	Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner Preliminary Response
01/31/2022	Patent Owner's Mandatory Notices
01/31/2022	Patent Owner's Power of Attorney
04/20/2022	Patent Owner's Preliminary Response
05/03/2022	Order – Conduct of the Proceeding – *37 C.F.R. § 42.5*
05/10/2022	Petitioner's Preliminary Reply to Preliminary Response
05/17/2022	Patent Owner's Preliminary Sur-Reply
06/15/2022	Panel Change Order, Conduct of the Proceedings – *37 C.F.R. § 42.5*
07/18/2022	Decision – Institute *Inter Partes* Review
07/18/2022	Scheduling Order
08/09/2022	Patent Owner's Joint Stipulation to Modify Due Dates 1 Through 3
10/31/2022	Patent Owner's Response
11/15/2022	Patent Owner's Power of Attorney and Designation of Counsel
11/15/2022	Patent Owner's Updated Mandatory Notices
12/02/2022	Petitioner's Notice of Deposition of Darran R. Cairns, Ph.D.
01/30/2023	Petitioner's Reply
02/01/2023	Patent Owner's Objections to Evidence
02/01/2023	Patent Owner's Request for Oral Argument
02/03/2023	Petitioner's Request for Oral Argument
02/15/2023	Panel Change Order – Conduct of the Proceedings – *37 C.F.R. § 42.5*
03/01/2023	Patent Owner Sur-Reply
03/03/2023	Order Setting Oral Argument – *37 C.F.R. § 42.70*
03/24/2023	Petitioner's Updated List of Exhibits
03/24/2023	Patent Owner's Updated List of Exhibits
04/18/2023	Order – Conduct of the Proceeding Authorizing Additional Briefing – *37 C.F.R. § 42.5*
04/28/2023	Petitioner's Additional Briefing Relating to "Input Area"
04/28/2023	Patent Owner's Opening Claim Construction Brief
05/08/2023	Patent Owner's Responsive Claim Construction Brief
05/08/2023	Petitioner's Responsive Briefing Relating to "Input Area"
05/10/2023	Petitioner's Updated Mandatory Notices

Date	Document
05/10/2023	Petitioner Samsung Electronics America, Inc.'s Updated Power of Attorney
05/10/2023	Petitioner Samsung Electronics Co., Ltd.'s Updated Power of Attorney
05/24/2023	Oral Hearing Transcript
07/14/2023	Final Written Decision
07/17/2023	Petitioners' Notice of Appeal to the U.S. Court of Appeals for the Federal Circuit
07/25/2023	Patent Owner's Request for Director Review

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

POWER2B, INC.,
Patent Owner/Appellant

v.

Appeal Nos. 2024-1399[1]
2024-1400

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners/Appellees

Proceeding Nos: IPR2022-00300 and IPR2022-00405

NOTICE FORWARDING CERTIFIED LIST

A **Notice of Cross-Appeal** was timely filed by **Appellant, Power2B, Inc.**, on December 21, 2023, and **Appellees, Samsung Electronics Co., Ltd.** and **Samsung Electronics America, Inc.**, on December 21, 2023, in the United States Patent and Trademark Office in connection with the above identified *Inter Partes Review* (IPR) proceedings. Pursuant to 35 U.S.C. § 143, a Certified List is this day being forwarded to the Federal Circuit.

Respectfully submitted,

Date: March 11, 2024

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Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

[1] Appeal No. 2024-1399 (Cross-Appeal) and Appeal No. 2024-1400 are consolidated with Appeal No. 2023-2184 (Lead) pursuant to Court Order (Dkt. No. 11) and Note to File (Dkt. No. 12) dated February 13, 2024. Certified List for Appeal No. 2023-2184 (Lead) was filed September 5, 2023.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of the foregoing NOTICE FORWARDING CERTIFIED LIST has been served, via electronic mail, on counsel for Appellant and Appellees this 11th day of March, 2024, as follows:

PATENT OWNER:	PETITIONERS:
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U.S. DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

March 11, 2024
(Date)

THIS IS TO CERTIFY that the attached document is a list of the papers that comprise the record before the Patent Trial and Appeal Board (PTAB) for the *Inter Partes Review* proceeding identified below.

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

Case: IPR2022-00300
Patent No. 7,952,570 B2
By authority of the

DIRECTOR OF THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Macia L. Fletcher

Certifying Officer

Prosecution History ~ IPR2022-00300

Date	Document
12/9/2021	Petition for Inter Partes Review
12/9/2021	Petitioner's Power of Attorney (Samsung Electronics America)
12/9/2021	Petitioner's Power of Attorney (Samsung Electronics Co.)
12/21/2021	Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner's Preliminary Response
1/7/2022	Patent Owner's Power of Attorney and Designation of Counsel
1/7/2022	Patent Owner's Mandatory Notices
3/21/2022	Patent Owner's Preliminary Response
5/3/2022	Order - Conduct of the Proceeding
5/10/2022	Petitioners' Preliminary Reply in Support of Its Petition for Inter Partes Review
5/17/2022	Patent Owner's Preliminary Sur-Reply
6/16/2022	Scheduling Order
6/16/2022	Decision - Institution of Inter Partes Review
8/9/2022	Joint Stipulation to Modify Due Dates 1-3
10/11/2022	Patent Owner's Response
11/1/2022	Patent Owner's Updated Exhibit List
11/15/2022	Patent Owner's Updated Mandatory Notices
11/15/2022	Patent Owner's Power of Attorney and Designation of Counsel
12/2/2022	Notice of Deposition - Cairns, Ph.D.
1/6/2023	Joint Stipulation to Modify Due Date 2
1/17/2023	Petitioners' Reply in Support of Its Petition for Inter Partes Review
1/24/2023	Patent Owner's Objections to Evidence
2/1/2023	Patent Owner's Request for Oral Argument
2/3/2023	Petitioners' Request for Oral Argument
2/20/2023	Patent Owner's Sur-Reply
2/24/2023	Patent Owner's Corrected Sur-Reply
3/3/2023	Order - Setting Oral Argument
3/24/2023	Patent Owner's Updated List of Exhibits
3/24/2023	Petitioners' Updated List of Exhibits
4/18/2023	Order - Conduct of the Proceeding Authorizing Additional Briefing
4/28/2023	Patent Owner's Opening Claim Construction Brief
4/28/2023	Petitioners' Additional Briefing Relating to "Input Area" in Support of Its Petition for Inter Partes Review
5/8/2023	Patent Owner's Responsive Claim Construction Brief
5/8/2023	Petitioners' Responsive Briefing Relating to "Input Area" in Support of Its Petition for Inter Partes Review
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics Co.)
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics America)
5/10/2023	Petitioners' Updated Mandatory Notices
5/24/2023	Oral Hearing Transcript
6/15/2023	Final Written Decision
7/17/2023	Patent Owner's Request for Director Review

Prosecution History ~ IPR2022-00300

Date	Document
10/25/2023	Order Request for Director Review

U.S. DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

March 11, 2024
(Date)

THIS IS TO CERTIFY that the attached document is a list of the papers that comprise the record before the Patent Trial and Appeal Board (PTAB) for the *Inter Partes Review* proceeding identified below.

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

Case: IPR2022-00405
Patent No. 8,547,364 B2
By authority of the

DIRECTOR OF THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Macia L. Fletcher

Certifying Officer

Prosecution History ~ IPR2022-00405

Date	Document
1/5/2022	Petition for Inter Partes Review
1/5/2022	Petitioner's Power of Attorney (Samsung Electronics America)
1/5/2022	Petitioner's Power of Attorney (Samsung Electronics Co.)
1/20/2022	Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner's Preliminary Response
1/31/2022	Patent Owner's Power of Attorney
1/31/2022	Patent Owner's Mandatory Notices
4/20/2022	Patent Owner's Preliminary Response
5/3/2022	Order - Conduct of the Proceeding
5/10/2022	Petitioners' Preliminary Reply in Support of Its Petition for Inter Partes Review
5/17/2022	Patent Owner's Preliminary Sur-Reply
6/15/2022	Panel Change Order - Conduct of the Proceedings
7/18/2022	Scheduling Order
7/18/2022	Decision - Institution of Inter Partes Review
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1/30/2023	Petitioners' Reply in Support of Its Petition for Inter Partes Review
2/1/2023	Patent Owner's Request for Oral Argument
2/1/2023	Patent Owner's Objections to Evidence
2/3/2023	Petitioners' Request for Oral Argument
2/15/2023	Panel Change Order - Conduct of the Proceedings
3/1/2023	Patent Owner's Sur-Reply
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5/8/2023	Petitioners' Responsive Briefing Relating to "Input Area" in Support of Its Petition for Inter Partes Review
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics Co.)
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics America)
5/10/2023	Petitioners' Updated Mandatory Notices
5/24/2023	Oral Hearing Transcript
7/14/2023	Final Written Decision
7/17/2023	Petitioners' Notice of Appeal
7/25/2023	Patent Owner's Request for Director Review

Prosecution History ~ IPR2022-00405

Date	Document
10/25/2023	Order Request for Director Review

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

POWER2B, INC.,
Patent Owner/Appellant

v.

Appeal Nos. 2024-1399[1]
2024-1400

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners/Appellees

Proceeding Nos: IPR2022-00300 and IPR2022-00405

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Respectfully submitted,

Date: March 11, 2024

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Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

[1] Appeal No. 2024-1399 (Cross-Appeal) and Appeal No. 2024-1400 are consolidated with Appeal No. 2023-2184 (Lead) pursuant to Court Order (Dkt. No. 11) and Note to File (Dkt. No. 12) dated February 13, 2024. Certified List for Appeal No. 2023-2184 (Lead) was filed September 5, 2023.

CERTIFICATE OF SERVICE

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PATENT OWNER:	PETITIONERS:
Jason Wietjes Adam Peter Daniels Mark Thomas Deming POLSINELLI PC jwietjes@polsinelli.com adaniels@polsinelli.com mdeming@polsinelli.com	Ryan Ken Yagura William Fink Benjamin Haber Coke Morgan Stewart Nicholas Whilt O'MELVENY & MYERS LLP ryagura@omm.com tfink@omm.com bhaber@omm.com Cokestewart@omm.com nwhilt@omm.com

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U.S. DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

March 11, 2024
(Date)

THIS IS TO CERTIFY that the attached document is a list of the papers that comprise the record before the Patent Trial and Appeal Board (PTAB) for the *Inter Partes Review* proceeding identified below.

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POWER2B INC.,
Patent Owner.

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Patent No. 7,952,570 B2
By authority of the

DIRECTOR OF THE UNITED STATES
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Macia L. Fletcher

Certifying Officer

Prosecution History ~ IPR2022-00300

Date	Document
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12/9/2021	Petitioner's Power of Attorney (Samsung Electronics Co.)
12/21/2021	Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner's Preliminary Response
1/7/2022	Patent Owner's Power of Attorney and Designation of Counsel
1/7/2022	Patent Owner's Mandatory Notices
3/21/2022	Patent Owner's Preliminary Response
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5/8/2023	Petitioners' Responsive Briefing Relating to "Input Area" in Support of Its Petition for Inter Partes Review
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5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics America)
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Date	Document
10/25/2023	Order Request for Director Review

U.S. DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

March 11, 2024
(Date)

THIS IS TO CERTIFY that the attached document is a list of the papers that comprise the record before the Patent Trial and Appeal Board (PTAB) for the *Inter Partes Review* proceeding identified below.

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

POWER2B INC.,
Patent Owner.

Case: IPR2022-00405
Patent No. 8,547,364 B2
By authority of the

DIRECTOR OF THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Macia L. Fletcher
Certifying Officer

Prosecution History ~ IPR2022-00405

Date	Document
1/5/2022	Petition for Inter Partes Review
1/5/2022	Petitioner's Power of Attorney (Samsung Electronics America)
1/5/2022	Petitioner's Power of Attorney (Samsung Electronics Co.)
1/20/2022	Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner's Preliminary Response
1/31/2022	Patent Owner's Power of Attorney
1/31/2022	Patent Owner's Mandatory Notices
4/20/2022	Patent Owner's Preliminary Response
5/3/2022	Order - Conduct of the Proceeding
5/10/2022	Petitioners' Preliminary Reply in Support of Its Petition for Inter Partes Review
5/17/2022	Patent Owner's Preliminary Sur-Reply
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7/18/2022	Scheduling Order
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10/31/2022	Patent Owner's Response
11/15/2022	Patent Owner's Updated Mandatory Notices
11/15/2022	Patent Owner's Power of Attorney and Designation of Counsel
12/2/2022	Notice of Deposition - Cairns, Ph.D.
1/30/2023	Petitioners' Reply in Support of Its Petition for Inter Partes Review
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3/3/2023	Order - Setting Oral Argument
3/24/2023	Patent Owner's Updated List of Exhibits
3/24/2023	Petitioners' Updated List of Exhibits
4/18/2023	Order - Conduct of the Proceeding Authorizing Additional Briefing
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5/8/2023	Patent Owner's Responsive Claim Construction Brief
5/8/2023	Petitioners' Responsive Briefing Relating to "Input Area" in Support of Its Petition for Inter Partes Review
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics Co.)
5/10/2023	Petitioner's Updated Power of Attorney (Samsung Electronics America)
5/10/2023	Petitioners' Updated Mandatory Notices
5/24/2023	Oral Hearing Transcript
7/14/2023	Final Written Decision
7/17/2023	Petitioners' Notice of Appeal
7/25/2023	Patent Owner's Request for Director Review

Prosecution History ~ IPR2022-00405

Date	Document
10/25/2023	Order Request for Director Review

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.; AND
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

Power2B Inc.
Patent Owner.

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,952,570

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LIST OF EXHIBITS[1]

Ex-1001	U.S. Patent No. 7,952,570
Ex-1002	Declaration of Dr. Ben Bederson
Ex-1003	Curriculum Vitae of Dr. Ben Bederson
Ex-1004	Condensed Prosecution History of U.S. Patent No. 7,952,570
Ex-1005	U.S. Patent No. 5,502,568, issued on March 26, 1996 ("Ogawa")
Ex-1006	U.S. Patent No. 6,337,698, issued on January 8, 2002 ("Keely")
Ex-1007	INTENTIONALLY LEFT BLANK
Ex-1008	U.S. Patent No. 6,441,362, filed on October 28, 1999 ("Ogawa II")
Ex-1009	U.S. Patent No. 5,959,617 to Bird ("Bird")
Ex-1010	EP0572182 to Ishii ("Ishii")
Ex-1011	GB Published Patent Application GB 2299856 to Geva ("Geva")
Ex-1012	Japanese Published Patent Application, JPH05-265637 to Kameyama, with certified translation ("Kameyama")
Ex-1013	U.S. Patent Publication No. 20050110781 to Geaghan ("Geaghan")
Ex-1014	U.S. Patent No. 5,993,135, issued Aug. 3, 1999 ("Martin")
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK
Ex-1019	INTENTIONALLY LEFT BLANK

[1] Four-digit pin citations that begin with 0 are to the page stamps added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex-1020	Claim Mapping Table
Ex-1021	Petitioner's Stipulation Letter to Patent Owner, dated Dec. 9, 2021
Ex-1022	Full Prosecution History of U.S. Patent No. 7,952,570
Ex-1023	INTENTIONALLY LEFT BLANK
Ex-1024	Certified Foreign Priority Application PCT/GB03/02533
Ex-1025	Bederson, A Miniature Space-Variant Active Vision System: Cortex-I (June 1992) (Ph.D. dissertation, New York University)
Ex-1026	Bederson, Benjamin B., and Hollan, James D., Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics, UIST '94, pp. 17-26, November 2-4, 1994
Ex-1027	Bederson, Benjamin B., Audio Augmented Reality: A Prototype Automated Tour Guide, Chi '95 Mosaic of Creativity, pp. 210-211, May 7-11, 1995
Ex-1028	Baudisch, et al., Drag-and-Pop and Drag-and-Pick: techniques for accessing remote screen content on touch- and pen-operated systems, Conference: Human-Computer Interaction INTERACT '03: IFIP TC13 International Conference on Human-Computer Interaction, 1st-5th September 2003, January 2003
Ex-1029	Ben Shneiderman, Designing the User Interface, Third Ed., Addison-Wesley Longman, Inc. (1998)
Ex-1030	PA3D: Early zoomable user interface (ZUI), https://www.youtube.com/watch?v=5JzaEUJ7IbE (Dec. 8, 2021)
Ex-1031	Holloway, Richard and Lastra, Anselmo, Virtual Environments: A Survey of the Technology, TR93-033 (September 1993)
Ex-1032	CHM Revolution, Spaceball controller, https://www.computerhistory.org/revolution/input-output/14/352/1816
Ex-1033	Polhemus, 3Space Fastrak User's Manual, 2002 Ed. Rev. C (Nov. 2002)
Ex-1034	Basic Optics and Optical Instruments, Prepared by the Bureau of

	Naval Personnel, Dover Publications (1969)
Ex-1035	Philipp, Hal, Microprocessor Based on Light Bridge Sensors, SPIE Vol. 961 Industrial Optical Sensing, pp. 28-34 (1988)
Ex-1036	U.S. Patent No. 6,172,668, issued on Jan. 9, 2001
Ex-1037	U.S. Patent No. 6,377,249, issued on Apr. 23, 2002
Ex-1038	U.S. Patent No. 5,515,079, issued on May 7, 1996
Ex-1039	U.S. Patent 8,261,211, issued Sep. 4, 2012

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Petitioner") request inter partes review ("IPR") of Claims 1–22 of U.S. Patent No. 7,952,570 ("the '570 Patent") (Ex-1001), currently assigned to Power2B Inc. ("Patent Owner").

The '570 patent relates to an electronic device, such as a touch screen computer, and a light emitting stylus. The device has a user interface that is able to detect or monitor the position of the stylus relative to the device to control various software functions of the user interface.

The prior art in this Petition demonstrates that Claims 1-22 of the '570 Patent involved well-known hardware and software components, and predictable design choices in the art. This prior art also shows that a POSITA would have used these components to address well-known issues relating to a touch screen displays and associated styluses. Thus, Claims 1-22 of the '570 Patent would have been obvious over the prior art.

The grounds presented in this Petition are more than reasonably likely to prevail, this Petition should be granted, a trial should be instituted, and the challenged claims should be cancelled.

II. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

Real Parties-in-Interest: Petitioner identifies the following real parties-in-

interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

Related Matters: Patent Owner has asserted the '570 Patent against Petitioner in *Power2B Inc. v. Samsung Elecs. Co., Ltd., et al.*, No. 2:21-cv-00348 (E.D. Tex.).

Lead and Back-Up Counsel:

- Lead Counsel: Ryan Yagura (Reg. No. 47,191), O'Melveny & Myers LLP, 400 South Hope Street, 18th Floor, Los Angeles, CA 90071. (Telephone: 213-430-6000; E-Mail: ryagura@omm.com.)
- First Backup Counsel: Ben Haber (Reg. No. 67,129), O'Melveny & Myers LLP, 400 South Hope Street, 18th Floor, Los Angeles, CA 90071. (Telephone: 213-430-6000; E-Mail: bhaber@omm.com.)
- Backup Counsel: Nicholas J. Whilt (Reg. No. 72,081), O'Melveny & Myers LLP, 400 South Hope Street, 18th Floor, Los Angeles, CA 90071. (Telephone: 213-430-6000; E-Mail: nwhilt@omm.com).

Service Information: Petitioner consents to electronic service by email to OMMSAMSUNGPOWER2BIPR@omm.com. Please address all postal and hand-delivery correspondence to lead counsel at O'Melveny & Myers LLP, 400 South Hope St., Los Angeles CA, with courtesy copies to the email address identified above.

III. FEE AUTHORIZATION

Pursuant to 37 C.F.R. §42.15(a) and §42.103(a), the PTO is authorized to charge any and all fees to Deposit Account No. LA500639.

IV. GROUNDS FOR STANDING

Petitioner certifies that the '570 Patent is available for IPR, this Petition is timely filed, and Petitioner is not barred or estopped from requesting IPR on the grounds presented.

V. PRECISE RELIEF REQUESTED

Petitioner requests cancellation of Claims 1-22 of the '570 Patent under 35 U.S.C. § 103 on the following grounds:

- **Ground 1:** Claims 1, 2, 9, 10, 12, 13, 16, and 18-22 are rendered obvious by U.S. Patent No. 5,959,617 ("Bird," Ex-1009) in view of EP0572182 ("Ishii," Ex-1010).
- **Ground 2:** Claims 3-8, 11, and 15 are obvious over Bird and Ishii, in further view of GB Published Patent Application, GB 2299856 ("Geva," Ex-1011).
- **Ground 3:** Claims 14 and 17 are obvious over Bird and Ishii, in further view of Japanese Published Patent Application, JPH05-265637 ("Kameyama," Ex-1012).
- **Ground 4:** Claims 1-12, and 15-22 are obvious over U.S. Patent Publication No. 20050110781 ("Geaghan", Ex-1013) in view of Ishii.

- **Ground 5:** Claims 13 and 14 are obvious over Geaghan and Ishii in further view of Kameyama.

The Petition discusses rationales for each of the above enumerated grounds and is supported by a declaration from Dr. Bederson. Ex-1002.

VI. THE CHALLENGED PATENT

The '570 Patent relates to a device 10 that "has a display 12 for displaying data stored on the device 10 which can be controlled by input means in the form of an input device 16," which is a stylus. Ex-1001, 2:64-3:3, Fig. 4. Device 10 determines "X-Y coordinates of the stylus [] and sends a corresponding position," and "adjusts the display 12 accordingly." *Id*. at 4:30-34.

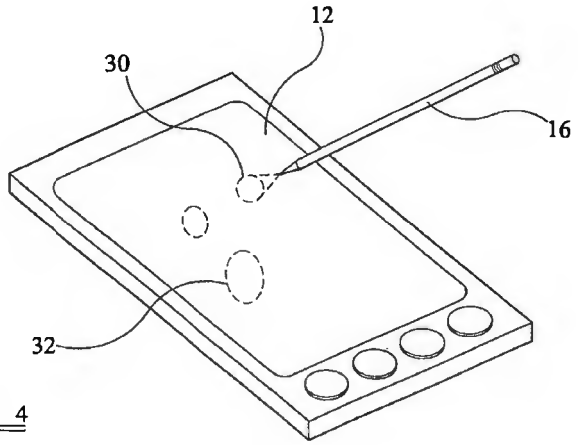


FIG 4

"In a different embodiment, illustrated in FIG. 3, the device 10 is provided with a plurality of light sensors 20 positioned around the perimeter of the display 12 … such that as the stylus 16 moves towards or away from the display 12, different or segments or layers of the light sensors will be illuminated." Ex-1001,

5:58-63. "[T]he device … thus calculates the distance of the stylus 16 from the display 12." *Id*. at 6:1-2.

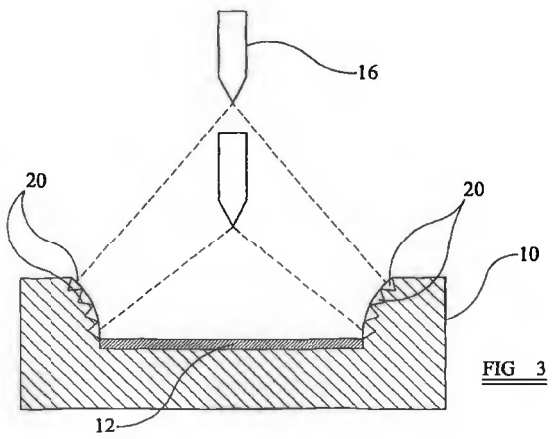


FIG 3

As explained in detail below, the '570 Patent claims are obvious in view of the prior art. Ex-1002 ¶¶43-45.

VII. LEVEL OF ORDINARY SKILL IN THE ART

One of ordinary skill in the art would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and at least two years of experience in the research, design, development, and/or testing of touch and/or proximity sensors, human-machine interaction and interfaces, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa. Ex-1002 ¶¶46, 72-82.

VIII. PATENT PROSECUTION HISTORY

For convenience, a condensed '570 file history is submitted as Ex-1004.[2] Prosecution took seven years and at least six rounds of actions and amendments, a number of which are highly relevant to the patentability challenges in this and related Petitions challenging claims that are obvious variations on the claims challenged herein. Ex-1002 ¶¶47-54.

The Examiner rejected original Claim 1 ***as anticipated***, finding that Bird disclosed all of the limitations:

Original Claim 1	Ex-1004, 0026 (Jan. 9, 2008 Non-Final Rej.)
1. An electronic input device comprising:	Claim 1, Bird discloses an electronic input device (Abstract; Fig. 1, el. 12; Col. 3, Lines 59-67) comprising:
an input object;	an input object (Fig. 2-8, el. 20 and 20'; Col. 5, Lines 41-47);
a sensor array operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said sensor array produced by said input object; and	a sensor array (Fig. 1-8, el. 14; Col. 3, Lines 59-67) operative to sense and provide an output indication of position (Col. 3, Lines 59-67) and at least two of orientation; shape and size (Fig. 2-8; Col. 6, Lines 38-47; Col. 8, Lines 25-41) of an electromagnetic radiation pattern (Col. 1, Lines 58-60; Col. 4, Lines 59-62) on said sensor array produced (Fig. 1-8, el. 14; Col. 3, Lines 59-67) by said input object (Fig. 2-8, el. 20 and 20'; Col. 5, Lines 41-47); and
input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position,	input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and

[2] The full '570 file history is submitted as Ex-1022.

three-dimensional position, and orientation of said input object.	orientation of said input object (Col. 7, Lines 65-67; Col. 8, Lines 1-24).

Significantly, the original "sensor array" limitation did not have a specific position requirement within the claimed "electronic input device." After an Examiner interview, the applicant added a new "input area" and amended the sensor array "to recite 'said sensor array comprising ***at least one sensor positioned outside*** said input area.'" Ex-1004, 0047 (Apr. 9, 2008 Amend.) (emphasis added). This version was also rejected. *Id.* at 0070. After another interview, "Applicant proposes to amend claim to specify the ***sensor array is positioned outside the input area.***" Ex-1004, 0087 (Interview Summary) (emphasis added)). That amendment resulted in the sensor array of challenged Claim 1:

> a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object, ~~said sensor array comprising at least one sensor positioned outside said input area~~; and

Ex-1004, 0090 (June 15, 2009 Amend.).

The Examiner continued to reject the claims, but eventually determined that if dependent Claim 12 incorporated the limitations of Claim 1, the subject matter would be allowable. Ex-1004, 0192 (Dec. 21, 2010 Final Rej.). Thus, Claim 1 took its final form:

1. (Currently Amended) An electronic input device comprising:

an input object wherein said input object includes a source of said electromagnetic radiation;

an input area;

a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object; and

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position and orientation of said input object; and

wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

Id. at 0196 (Feb. 18, 2011 Resp.).

A comparison shows how little Claim 1 changed during the course of many office actions and years of prosecution:

Original Claim 1	Ex-1001, Final Claim 1 (underlining-strikethrough added)
1. An electronic input device comprising:	1. An electronic input device comprising:
an input object;	an input object wherein said input object includes a source of said electromagnetic radiation;
	an input area;
a sensor array operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said sensor array produced by said input object; and	a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation, shape and size of an electromagnetic radiation pattern on said ~~sensor array~~ input area produced by said input object; and

input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of said input object.	input circuitry receiving said output indication and providing an electronic input representing at least one of two-dimensional position, three-dimensional position, and orientation of said input object; and
	wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

Compared to the claim that was found anticipated by Bird, the only material changes were to (1) add "an input area" and position the "sensor array" "outside said input area," and (2) add the "wherein clause" that a conical beam that intersects the input area produces an elliptical pattern having an eccentricity as a function of orientation of the input object.

As discussed below, ***the Examiner materially erred in two respects by not recognizing express disclosures in Bird that indisputably teach these additional limitations.*** Ex-1002 ¶54, 59-69. Furthermore, as discussed in the next section, the amendments are unsupported by the priority applications.

IX. PRIORITY DATE

A. The earliest claimed priority date

The '570 Patent claims priority to GB 0213215.7, filed on June 8, 2002, through PCT/GB03/02533, filed on June 9, 2003 ("The PCT Application") (Ex-1024).

B. The claims are not entitled to the '570 Patent PCT priority claim

Notwithstanding the priority applications, the claims are entitled to a priority date no earlier than December 6, 2004, the filing of US application 11/006,486 ("The US Application"). The PCT Application does not provide written description support for the challenged claims. Grounds 5-6 depend on a reference (Geaghan) that is Section 102(e) prior art based on the US filing date of December 6, 2004.[3] Specifically, neither the final "sensor array" limitation nor the "wherein" clause are supported by the PCT Application.

1. There is no described sensor array that is both *outside* the input area *and* operative to indicate anything about the position, size, shape, and orientation of the electromagnetic radiation pattern *on* said input area

As discussed above, the independent claims were amended during U.S. prosecution to require the "sensor array" be "positioned outside said input area"

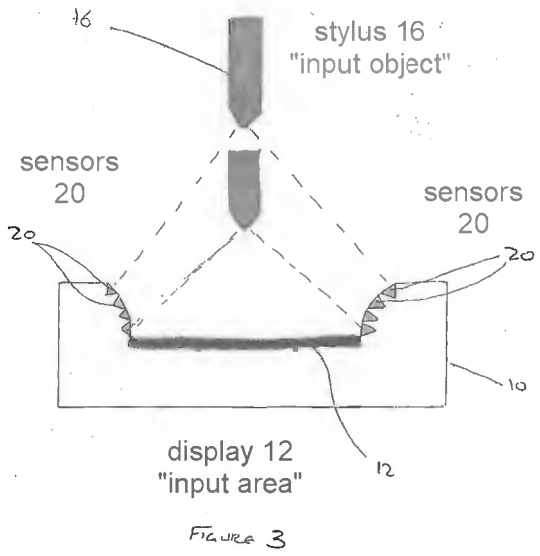
[3] Except Geaghan, all other prior art is §102(b) art against the earlier foreign priority date.

(Claims 1, 20, 22) or "at least partially circumscribing and immediately proximate said input area" (Claim 21):

> a sensor array positioned outside said input area operative to sense and provide an output indication of position and at least two of orientation,; shape and size of an electromagnetic radiation pattern on said input area produced by said input object, ~~said sensor array comprising at least one sensor positioned outside said input area~~; and

Ex-1004, 0090. The applicant argued "[s]upport for the amendment is found, inter-alia, in Fig. 3 and the description thereof." *Id.* at 96.

Figure 3 and its entire PCT Application description is reproduced below:

Ex-1024, 0018 (annotated Fig. 3) (sensors in orange)	Ex-1024, 0013 (7:20-27) (emphasis added)
 FIGURE 3 Figure 3 shows illustratively a cross-section through a device according to one embodiment of the invention. Ex-1024, 0009 (3:2-3)	In a different embodiment, illustrated in Figure 3, the device is provided with a plurality of ***light sensors 20 positioned around the perimeter of the display 12.*** The light sensors are segmented or layered in the Z-direction such that as the stylus 16 moves towards or away from the display, different or segments or layers of the light sensors will be illuminated by the conical beam emitted by the stylus. In particular, ***as the stylus moves closer to the screen, fewer of the light sensors around the display will be illuminated, as illustrated in Figure 3.*** The signals from the sensors are interpreted by the processing unit of the device which thus calculates the distance of the stylus 16 from the display 12.

The embodiment describes light sensors "around the perimeter of the display 12" ("input area") illuminated by the beam emitted by the stylus 16 ("input object") as it "moves closer to the screen." Thus, while these Figure 3 sensors are "outside the input area" or "partially circumscribing and immediately proximate" to it, there is ***no description*** of determining or providing the recited "output position and at least two of orientation, shape and size of an electromagnetic radiation pattern ***on said input area*** produced by said input object," as the amended claim recites.

An adequate written description must "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). Here, not only is there no description to indicate the applicant possessed the claimed subject matter, a POSITA reading the description of ***Figure 3*** would not have known how to determine ***anything about the electromagnetic radiation pattern on the input area***, display 12, much less its position, size, shape, and orientation. Ex-1002 ¶63. The sensors in Figure 3 are positioned outside the input area and can detect only that radiation incident on the sensors themselves and operative only to sense the "Z-direction … as the stylus 16 moves towards or away from the display 12." Ex-1024, 0063.

There are other embodiments for sensing position and two of orientation, shape, or size of the radiation pattern on the input area:

> The stylus 16 emits a beam of light, ... which is ***sensed by a light-sensitive film or membrane (not shown) positioned over, or incorporate in, the display 12.*** As the stylus 16 is moved across the display 12, only certain parts of the light sensitive membrane will be illuminated by the beam of light emitted by the stylus.

Ex-1024, 0012 (6:8-16) (emphasis added); *see also id.* at 0013 (7:8-18) (sensing a distribution and intensity from a light beam emitted by the stylus). These embodiments, however, do not have sensors "positioned outside said input area" or "at least partially circumscribing and immediately proximate said input area"–they are "over, or incorporate[d] in, the display 12." The PCT Application, therefore, does not describe the claimed invention with "all its limitations." *See Hyatt v. Dudas*, 492 F.3d 1365, 1371 (Fed. Cir. 2007) ("[E]ach element may be *individually* described in the specification, [but] the deficiency was the lack of adequate description of [the] combination") (emphasis original)

Nor can the claims rely on vague statements suggesting that various embodiments can be combined. *See Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997) ("A description which renders obvious the invention… is not sufficient."). Regardless, as noted above, there is no obvious combination of disclosures of sensor arrays disclosed that can be both outside the

input area and determine anything about the electromagnetic radiation pattern on the input area. Ex-1002 ¶66.

2. There is no described conical beam, which intersects said input area in an elliptical pattern having elliptical eccentricity, which is a function of the orientation of the input object

To finally gain allowance, independent Claim 1 was also amended during U.S. prosecution to incorporate Claim 12's recitation of "wherein said source of said electromagnetic radiation produces a conical beam which intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area." *See* Section VIII.

The PCT Application does not provide written description support for this limitation. *See generally* Ex-1024. A conical beam is mentioned only in the context that the beam's diameter widens in relation to the distance from the tip of the stylus. Ex-1024, 0013 (7:8-19) ("In one embodiment, the stylus emits a beam of electromagnetic radiation, for example, infra-red light or visible light which is transmitted in a conical beam which widens in diameter with distance from the tip of the stylus."). This sole disclosure does not provide any indication that changing the orientation of the input object results in an elliptical pattern having elliptical eccentricity, which is a function of the orientation of the input object. The first

time such language appears is the as-filed U.S. specification. *See* Ex-1022, 0009 (7:2-4), 0014 (cl. 12).

As with the sensor array limitation, the PCT Application's does not "reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad*, 598 F.3d at 1351; Ex-1002 ¶¶67-69.

3. The priority date is December 6, 2004

Because the claims of the '570 Patent are unsupported by the PCT Application, the claims can rely only on the December 6, 2004, US filing date. *Google LLC,* et al. *v. Parus Holdings, Inc.*, IPR2020-00846, Paper 31 at 53-61 (PTAB Oct. 19, 2021) (finding no written description in the specification of priority applications and, therefore, can rely only on the filing date of the instant application).

X. CLAIM CONSTRUCTION

Petitioner interprets the claims of the '570 Patent according to the *Phillips* claim construction standard. 37 C.F.R. § 42.100(b). To resolve the particular grounds presented in this Petition, Petitioner does not believe that any other term requires explicit construction.[4] Ex-1002 ¶71.

[4] Claim construction proceedings have not yet begun in district court. Petitioner respectfully reserves the right to revisit and address constructions determined by the court. Additionally, Petitioner will request leave to submit the district court's

XI. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART REFERENCES

A. Bird (Ex-1009)

Bird, titled "Light Pen Input Systems," is U.S. Patent No. 5,959,617, issued on September 28, 1999. Bird is §102(b) prior art. Ex-1002 ¶¶83-87.

As shown in Figure 1, Bird discloses "a light pen and light sensing device [, which] can be used, for example as a graphics tablet type input device for a computer system." Ex-1009, 1:40-42. The system includes "a large area two-dimensional X-Y array of light sensing elements 14 defining a sensing area 11 having a writing surface over the surface of which a light pen 12 can be moved by a user to input information." *Id.* at 3:59-63, Fig. 1.

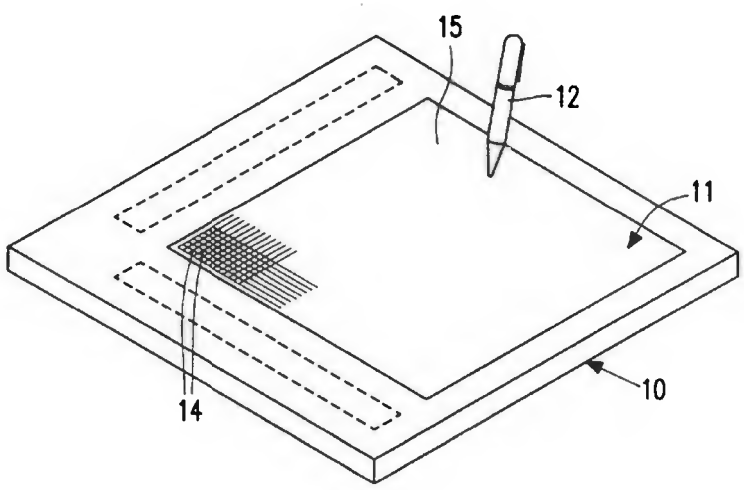


FIG. 1

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claim construction as soon as it becomes available, so that it is timely made of record and can be considered.

"[L]ight pen 12 includes a light source," which may be "an LED" emitting "visible or non-visible" light. Ex-1009, 4:51-62. "The light beam emitted by the light pen 12 causes a response in the sensing elements." *Id*. at 3:64-66. "[T]he light sensing element array is integrated in a liquid crystal display panel to form a single unit 15," or the light sensing element array may use "sets of row and column light waveguides which conduct input light to peripheral light sensors." *Id*. at 4:17-19, 4:46-50.

Bird also discloses that "[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen are detectable." Ex-1009, 2:40-44. Figure 5 shows radiation patterns 20 sensed by sensing area 11. "By monitoring the sensing elements outputs the changing pattern of illuminated elements can be detected." *Id*. at 5:65-67. In the same way "the direction of rotation of the beam [is] determined." *Id*. at 5:65-6:1.

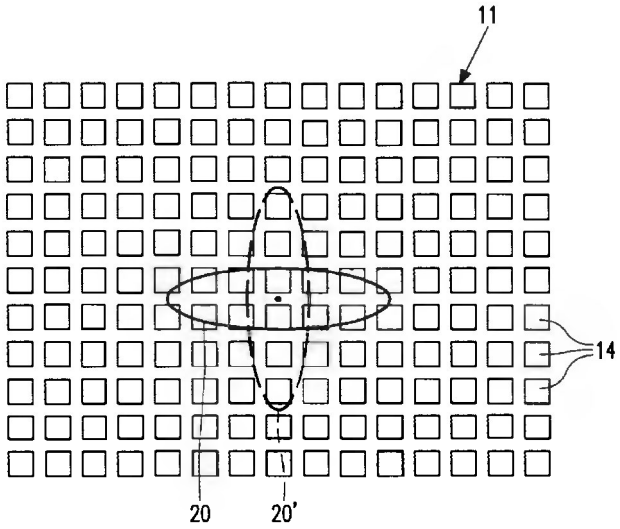


FIG. 5

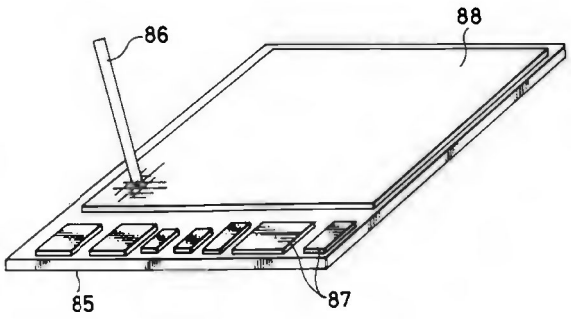
As shown in Figure 5, the light spot may be elliptical. "[B]y appropriately inclining the pen, the spot produced could be further elongated or, contrarily, could be made less elongated." Ex-1009, 3:26-30.

B. Ishii (Ex-1010)

Ishii, titled "Display unit with integral optical input apparatus," is EP Patent Publication No. EP0572182, published on December 1, 1993. Ishii is §102(b) prior art. Ex-1002 ¶¶88-90.

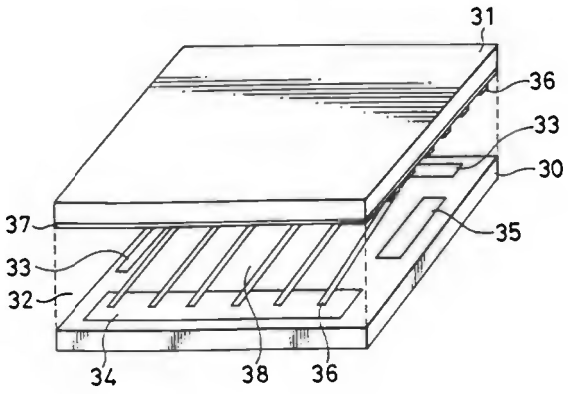
As shown in Figure 5, Ishii "relates to a display unit of an input integral type for a handwriting input used in an office automation (OA) equipment and an audio visual device." Ex-1010 ¶1. "Fig. 5, reference numerals 85, 86 and 88 respectively designate a silicon monocrystal substrate, an optical pen and a glass substrate." *Id.* ¶79.

Fig. 5



Ishii discloses that "an input device as a pen can be set to be wireless and optical waveguides in X-axis and Y-axis directions are formed on a substrate." Ex-1010 ¶43. As shown in Figure 9, Ishii discloses "[a]n optical waveguide 36, an X (or Y)-sensor portion 34 and a Y (or X)-sensor portion 35 formed in an end portion." *Id.* ¶45.

Fig. 9



C. Geva (Ex-1011)

Geva, titled "Position-Determining Input Device," is UK Patent Application GB 2299856 published on October 16, 1996. Geva is §102(b) prior art. Ex-1002 ¶¶91-92.

Geva relates to position-determining input devices comprising a light emitting input device, at least two light sensing elements, and a processing device coupled to the sensing elements. Ex-1011, 2:25-32. Geva's processing device "comprises an intensity/distance computation function 17 and a memory element 19." *Id.* at 5:19-20. As shown in Figure 4, Geva discloses that the level of intensity of the light emitting stylus is measured by the light sensing elements which "varies in the 'x' dimension between a minimum 'x' value and a maximum 'x' value." *Id.* at 6:33-36; Fig. 4. Geva also discloses that "[t]he intensity of light corresponding to the y_0 position [20] is measured as I_0 22." *Id.* at 7:3-4.

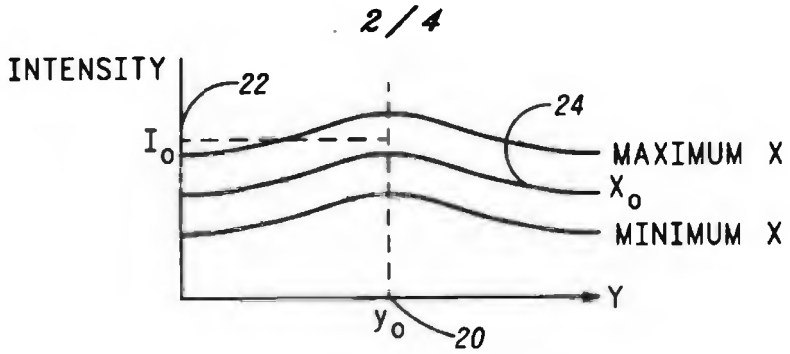
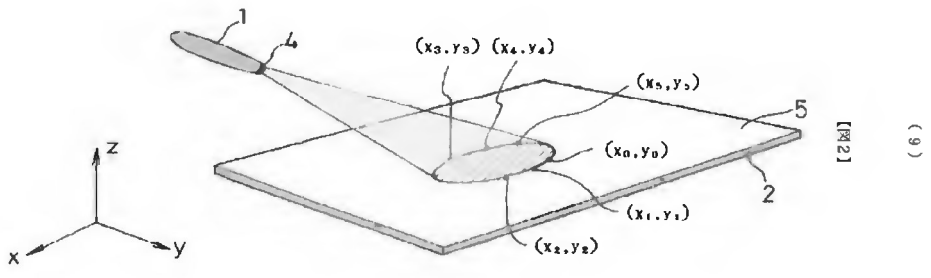


FIG. 4

D. Kameyama (Ex-1012)

Kameyama, titled "3D Pointing Device," is Japanese Patent Application Publication No. JPH05-265637, published on October 15, 1993. Kameyama is §102(b) prior art. A certified translation is included in Ex-1012. Ex-1002 ¶¶93-95.

Kameyama discloses a "[three-dimensional] pointing device for inputting/outputting position and orientation data in a [three-dimensional] space." Ex-1012 ¶1. Specifically, Kameyama discloses using a light generating means for emitting light and a light receiving surface for receiving light emitted from the light generating means. *Id.* ¶6. As shown in Figure 2, light source 4 of light generator 1, emits light in a conical shape from any position onto light receiving surface 5. *Id.* ¶19.



[図2]

Kameyama captures "six coordinate points (x0, y0) . . . on the boundary line between a portion irradiated (diagonal part) by, and a portion not irradiated by, light of the light receiving surface 5." Ex-1019 ¶20. The "position and posture data

of the light source 4 of the light generator 1 derived through a calculation process" are then "output to a computer as position and posture data of a 3D space." *Id.* ¶47.

E. Geaghan (Ex-1013)

Geaghan titled "Light Emitting Stylus and User Input Device Using Same," is U.S. Patent Publication No. 2005/0110781, published May 26, 2005. Geaghan was filed November 25, 2003, and is §102(e) prior art. Ex-1002 ¶¶96-97.

Geaghan discloses "a user input device that includes an array of light detectors and a light emitting stylus configured to emit a beam of light detectable by the light detectors." Ex-1013, Abstract. Geaghan discloses that "styli 120 and 121 emit conical beams, spreading light in spot patterns over a wider area." *Id.* ¶37. Geaghan explains that "[a]ctive styli include those that send or receive radio frequency signals (RF pens), those that use magnetic fields for inductive signal capture (inductive pens), and those that emit or receive light (light pens)." *Id.* ¶2. Geaghan also discloses that "sensor array 119" "can detect light in an amount proportional to their proximity to the center of the beam" *Id.* ¶¶19, 37.

XII. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION UNDER 325(d) TO DENY HEARING THESE INVALIDITY ISSUES FOR THE FIRST TIME IN THIS PETITION

In considering its discretion under §325(d), "the Board uses the following two-part framework: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same

arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims." *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential).

A. Grounds 1-3: The Examiner materially erred by not considering Bird and Ishii together

Petitioner acknowledges that the first *Advanced Bionics* prong is met as to Grounds 1-3, based on the Bird-Ishii combination, because Bird was previously applied by the examiner in certain claim rejections, as discussed above in Section VIII, and Ishii and Geva were cited on an IDS. Ex-1022, 0378.

Under the second *Advanced Bionics* prong, institution should not be denied under 325(d) because the examiner materially erred—***twice***—by overlooking Bird's express disclosures and teachings of the claim limitations added to distinguish Bird. Specifically, Applicant added limitations that the sensor array must by "outside" or on the "periphery" of the input area and the "wherein clause." *See* Section VIII. Ex-1002 ¶¶98-102.

In the first material error, the Examiner stated "Bird does not expressly disclose said sensor array comprising at least one sensor positioned outside said input area." Ex-1004, 0071-0072 (citing Bird, 3:59-67 (sensor array)). But this feature is indisputably and unambiguously taught by Bird in the very next column.

Ex-1009, 4:43-50 ("[T]he light sensing element array may be of a kind … which conduct input light to ***peripheral light sensors,*** for example as described in aforementioned EP-A0 572 182."). EP-A0572182 is Ishii. Thus, Bird states the peripheral light sensors of Ishii may be used. Ishii, was indicated as considered on an IDS, but was never applied by the examiner. Ishii unambiguously describes a light sensing display with peripheral light sensors. *See infra* Section XIII.A.2.d. Overlooking Bird's express teaching to use Ishii was material error. *See Advanced Bionics,* IPR2019-01469, Paper 6 at 8 n.9("[A]n 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."). This is not a case of where "reasonable minds can disagree." *Id.* at 9.

As to the second material error, concerning the "wherein" clause, the Examiner correctly found that Bird's input object was a "source of said electromagnetic radiation [that] produces a conical beam, which is sensed by said sensor array, producing said electromagnetic radiation pattern on said sensor array, which is a function of orientation of said input object in a plane perpendicular to said sensor array." Ex-1004, 0032 (citations to Bird omitted).

The Examiner materially erred, however, in stating that "Bird does not expressly disclose radiation pattern on said sensor array in the form of an ellipse having elliptical eccentricity which is a function of orientation of said input object

in a plane perpendicular to said sensor array." *Id.* at 33. This too is explicitly and unambiguously disclosed by Bird, which states that the "shapes of the spots are, respectively, rectangular, ***elliptical,*** … assuming [in the Figures] the beam axis is perpendicular to the plane of the array." Ex-1009, 6:38-43, Fig. 5 (elliptical spot). And "by appropriately inclining the pen [from the perpendicular axis], the spot produced could be further elongated or, contrarily, could be made less elongated. For example, in the case of an elliptical spot, the spot may be distorted to approximate a circular spot." *Id.* at 3:26-30. Because the elongation of the ellipse changes as the pen is inclined from the perpendicular, its "elliptical eccentricity … is a function orientation of said input object in a plane perpendicular to said sensor array." Ex-1002 ¶101; Ex-1001, 5:8-10 ("[E]ccentricity of 1 … is indicative of a circle"). It was a material error to overlook this disclosure as well. Taken together, it was a mistake not to reject the independent claims over the Bird-Ishii combination.

B. Grounds 4-5: The Examiner did not consider the Geaghan-Ishii combination

Geaghan was not presented to the Office at all, and, as discussed above, Ishii's express disclosures of peripheral light sensors were overlooked. Because grounds 4 and 5 were not presented to the Office, it is unnecessary to show material error under the second prong.

Where, as here, the Petition presents two sets of grounds, one of which arguably implicates section 325(d), and one of which does not, the Board's approach has been to "evaluate the challenges and determine whether § 325(d) is sufficiently implicated that its statutory purpose would be undermined by instituting on all challenges." *See Verizon Bus. Network Servs. v. Huawei Techs. Co., Ltd.*, IPR2020-01079, Paper 10 at 29 (PTAB Jan. 14, 2021) (quoting SAS Q&A's, Part D, Effect of SAS on Future Challenges that Could Be Denied for Statutory Reasons, D1 (June 5, 2018), available at https://www.uspto.gov/sites/default/files/documents/sas_qas_20180605.pdf). In making this determination the Board evaluates the "Petition as a whole." *Verizon*, Paper 10 at 30; *Axioma*, Paper 10 at 10.

Here, section 325(d)'s purpose is not undermined by instituting the Petition as a whole. Although Bird was considered, the Examiner materially erred by not considering it in conjunction with Ishii (only initialed on an IDS) given the express disclosures and teachings discussed above. When coupled with Geaghan-Ishii, the statutory purpose of § 325(d) is not undermined, and the Petition should not be denied.

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

The '570 Patent contains 22 claims. Independent Claims 1 and 20-22 are largely the same. Like claim elements are discussed together in the below element-

by-element analysis. *See* Exhibit 1020 (summary table). To the extent there are meaningful differences, such differences are individually identified and discussed. As explained below, the challenged claims are disclosed and/or taught by the prior art.

A. Ground 1: Claims 1, 2, 9, 10, 12, 13, 16, and 18-22 are obvious over Bird in view of Ishii

1. Bird includes an express teaching to combine with Ishii

Bird in view of Ishii (Bird-Ishii) teaches Claims 1, 2, 9, 10, 12, 13, 16, and 18-22. Bird and Ishii are from the same field of use and relate to the same well-known issues, namely the combination of a light pen and a light sensing device. Ex-1009, Abstract; Ex-1010 ¶¶52-53. A POSITA would have been motivated to combine the teachings of Bird and Ishii, and would have had a reasonable expectation of doing so, because Bird expressly teaches "the light sensing array may be of a kind which …uses sets of row and column waveguides … and which conduct input light to peripheral light sensors, for example as described in aforementioned EP-A-0572 182 [Ishii]." Ex-1009, 4:44-50; Ex-1002 ¶104. Thus, a POSITA would have simply followed Bird's express teaching to substitute the peripheral light sensors of Ishii for the light sensing elements of Bird, as Bird itself explains. *See SIBIA Neurosciences, Inc. v. Cadus Pharm., Corp.*, 225 F.3d 1349, 1358-59 (Fed. Cir. 2000) ("express teachings" to modify provide strong case of obviousness and "within a hairsbreadth of anticipation").

2. Independent Claims 1 and 20-22

a. 1[pre]/20-22[pre] An electronic input device comprising:

Bird-Ishii teaches the preambles of Claims 1 and 20-22, to the extent they are limiting. Ex-1002 ¶¶105-106. As shown in Figure 1 (annotated with claim mappings), Bird discloses an electronic input device as "light sensing device 10." Ex-1009, 3:59-60; *see* Section VIII (Examiner's undisputed findings).

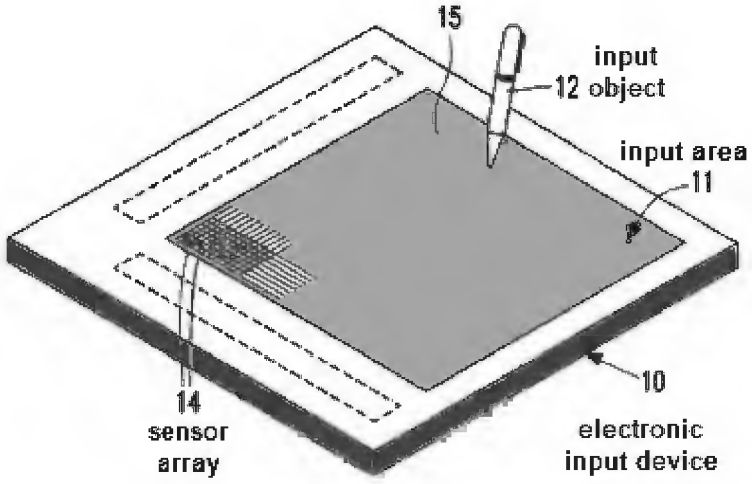


FIG. 1

b. 1[A] an input object wherein said input object includes a source of said electromagnetic radiation;

20[A]/22[A] an input object;

21[A] an input stylus projecting an electromagnetic radiation pattern on said input area;

Bird-Ishii teaches elements 1[A] and 20-22[A]. Ex-1002 ¶¶107-108. As shown in Figure 1, Bird discloses "light pen 12" that is an input object used by a

user to input information. Ex-1009, 3:62-63. The light pen includes a light source such as "an LED or a semiconductor laser" and a power supply for the light source. *Id.* at 4:51-52; *see* Section VIII (Examiner's undisputed findings). A light source is a source of electromagnetic radiation. *Id.* at 1:58-60 ("[T]he term light … include[s] both visible and non-visible, e.g. infra-red, electromagnetic radiation."). The light is projected onto an input area, sensing area 11. *Id.* at 3:62.

c. 1[B]/20-22[B] a/an [physical] input area;

Bird-Ishii teaches elements 1[B] and 20-22[B]. Ex-1002 ¶¶109-110. As shown in Figure 1, Bird discloses "sensing area 11" (orange) with a writing surface in which the user can move light pen 12 to input information. Ex-1009, 3:61-63; *see* Section VIII (Examiner's undisputed findings).

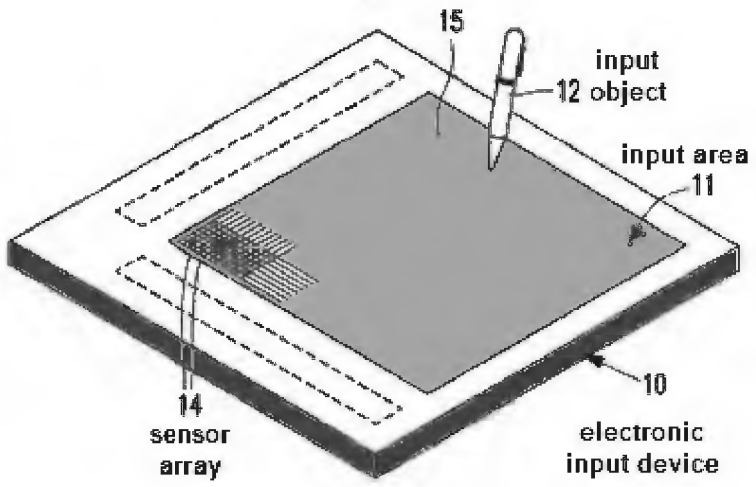


FIG. 1

d. 1[C]/20-22[C] "a sensor array…"

(1) 1[Ci]/20[Ci]/22[Ci] a sensor array positioned outside said input area…;

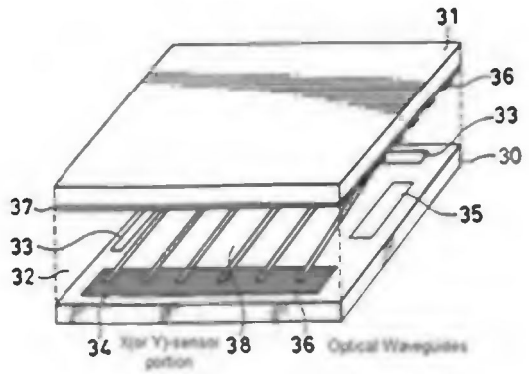
21[Ci] a sensor array at least partially circumscribing and immediately proximate said input area…

Bird-Ishii teaches elements 1[Ci] and 20-22[Ci]. Ex-1002 ¶¶111-114. As shown in Figure 1, Bird discloses a sensor array that is a "large area two-dimensional X-Y array of light sensing elements 14." Ex-1009, 3:60-61. Bird explains that the sensing elements are "arranged regularly-spaced in a row and column matrix array." *Id.* at 3:66-4:4. This array shown in Figure 1 is not positioned outside the input area. But, *and this is where the Examiner erred,* Bird also states that states "the light sensing element array may be of a kind which …uses sets of row and column waveguides … and ***which conduct input light to peripheral light sensors, for example as described in aforementioned EP-A-0572 182 [Ishii].***" *Id.* at 4:44-50 (emphasis added).

Ishii discloses "[a] photosensor [] formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions." Ex-1010 ¶51. As shown in Figure 9 (annotated), Ishii discloses "[a]n optical waveguide 36, an X (or Y)-sensor portion 34 and a Y (or X)-sensor potion 35 formed in an end portion." *Id.* ¶45. A POSITA would have understood that Ishii's photosensors (red) are at the end of each optical waveguides (orange) and the optical waveguides

define the extent of the input area. Ex-1002 ¶¶113-114. They are thus positioned both "outside" and "least partially circumscribing and immediately proximate to" the input area. *Id*.

Fig. 9



A POSITA would have found it obvious to include such positioning of Ishii's photosensor display in Bird's light input system because Bird expressly teaches using Ishii's "sets of row and column light waveguides" "which conduct input light to peripheral light sensors." Ex-1009, 4:46-50. A POSITA would have found it obvious to follow this express teaching. Ex-1002 ¶114.

(2) 1[Cii]/20[Cii]/22[Cii] operative to sense and provide an output indication of position and;

21[Cii] said sensor array operative to sense said electromagnetic radiation pattern on said input area and to provide an output indication of position;

Bird-Ishii teaches elements 1[Cii] and 20-22[Cii]. Ex-1002 ¶115-116. Bird senses the electromagnetic radiation and provides an output of the stylus position.

For example, Bird senses "[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y directions over the sensing element array corresponding to movement of the light pen are detectable." Ex-1009, 2:40-44; *see* Section VIII (Examiner's undisputed findings). By incorporating the alternative peripheral light sensor array of Ishii, the Bird-Ishii combination also detects the X and Y positions of the light incident on the display surface. Ex-1010 ¶53.

(3) 1[Ciii]/20-22[Ciii] at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area [produced by said input object];

Bird-Ishii teaches elements 1[Ciii] and 20-22[Ciii]. Ex-1002 ¶¶117-122. Bird discloses sensing at least two of orientation, shape, and size of an electromagnetic radiation pattern, as the Examiner found. *See* Section VIII (Examiner's undisputed findings). In fact, Bird discloses all three, as shown in Figure 5.

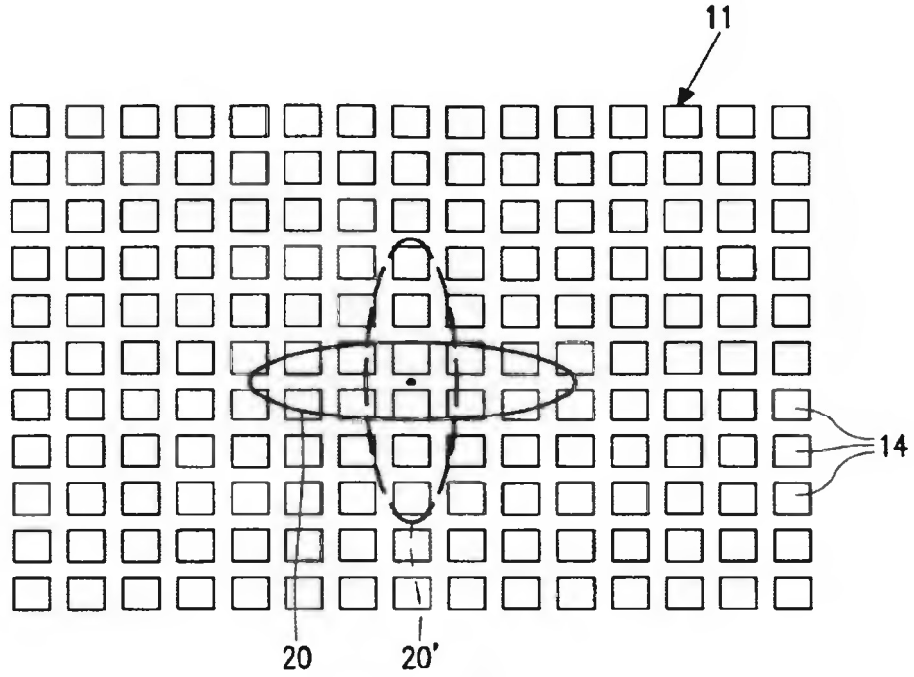


FIG. 5

Bird discloses sensing the "orientation" of the beam. Bird explains that the sensor array provides an output of the "rotation of the pen/light beam around its axis" which "can readily be detected by virtue of different sensing elements 14." Ex-1009, 6:46-48.

Bird also discloses sensing the "shape." "By tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot if desired thus providing additional flexibility to an operator." Ex-1009, 7:28-31. The sensors thus detect whether the shape of the illumination spot is "elongated" to provide additional user flexibility.

Bird also discloses sensing the "size" of the spot. For example, "the size of the incident light spot on the array relative to the sensing elements may be varied." Ex-1009, 8:25-26. Bird explains that the "spot size on the array could conceivably be such as to cover just two adjacent sensing elements in the row direction and one element in the column direction." *Id*. at 8:31-34.

By incorporating the peripheral light sensor array of Ishii, which Bird teaches as an alternative, the Bird-Ishii combination also detects orientation, shape, and size of the light incident on the display surface. Ex-1010 ¶¶58-60, Fig 11 (64) (character recognizing section).[5]

e. 1[D]/20[D]/21-22[E] "input circuitry…"

(1) 1[Di]/20[Di]/21-22[Ei] input circuitry receiving said output indication and providing an electronic input;

Bird-Ishii teaches elements 1[Di], 20[Di], and 21-22[Ei]. Ex-1002 ¶¶123-124. Bird Figure 10 discloses "detection circuitry 40" as input circuitry. Ex-1009, 8:2-7. Bird explains that the "[i]nput information to the light sensing array [] is detected by the associated detection circuit, here referenced at 40, which detects X-Y position and twist of the pen and provides outputs accordingly to a central

[5] Although Ishii's light pen expands the beam by using pressure to widen the aperture of the light emitting pen, the beam can be expanded using Bird's pen by pulling it away from the surface. *See* Ex-1002 ¶122, n.2. The Bird-Ishii combination uses the pen from Bird as the input object. Moreover, the claims do not require any specific technique for changing the beam shape.

processing unit 42 via an input/output interface 41." *Id.*; *see* Section VIII. Ishii similarly discloses circuit 61 for determining output indication and providing an input to character recognizing section 64. Ex-1010 ¶62, Fig. 11.

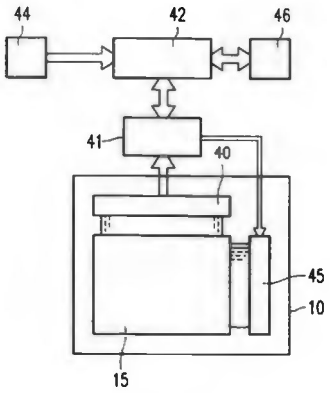
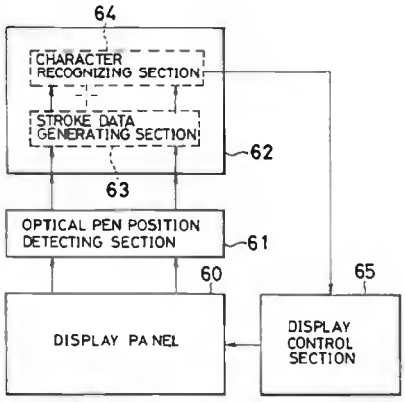


FIG. 10

Fig. 11



(2) 1[Dii]/20[Dii]/21-22[Eii] representing at least one of two-dimensional position, three-dimensional position and orientation of said input object [said electronic input representing orientation includes an electronic input representing angular orientation of said input object relative to said input area];

Bird-Ishii teaches elements 1[Dii], 20[Dii], and 21-22[Eii]. Ex-1002 ¶¶125-128. Bird discloses an electronic input representing both a two-dimensional position and orientation of said input object.

Specifically, Bird teaches an electronic input representing at least a two-dimensional position. Ex-1002 ¶127. For example, Bird discloses that "[t]he X-Y position of the light spot on the array and movement of the light spot in X-Y

directions over the sensing element array corresponding to movement of the light pen are detectable." Ex-1009, 2:40-44.

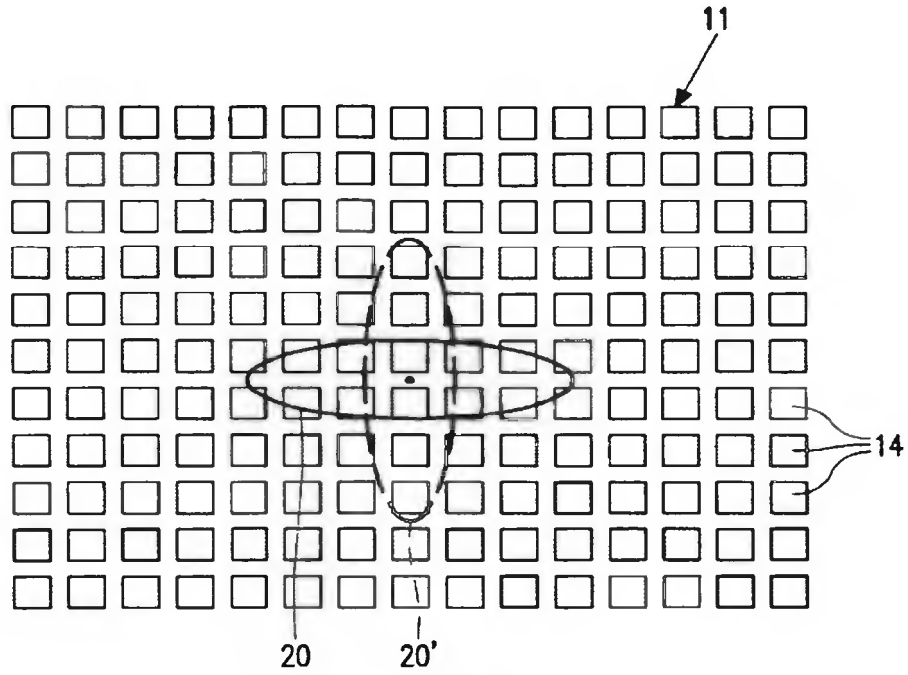


FIG. 5

Bird also teaches determining "orientation" when it senses that the "the direction of rotation of the beam [is] determined" by monitoring the sensing elements outputs. Ex-1009, 5:65-6:5. Bird explains that the sensing elements provides an output of the "rotation of the pen/light beam around its axis" which "can readily be detected by virtue of different sensing elements 14." *Id*. at 6:46-48; *see* Section VIII. The Bird-Ishii combination also detects the X and Y positions of the light incident on the display surface and orientation, which is same as the position of the input object on the surface. Ex-1010 ¶¶53, 58-60. A POSITA would

have adapted the input circuitry of Bird to respond to the sensor configuration of Ishii. Ex-1002 ¶128.

f. 1[E]/22[D] wherein said [source of said electromagnetic radiation produces a conical beam which/input object] produces a beam of electromagnetic radiation that intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

21[D] wherein said electromagnetic radiation pattern includes an elliptical pattern having elliptical eccentricity that is a function of the orientation of said input stylus relative to said input area; and

20[E] said input object includes a source of said electromagnetic radiation, and wherein said sensing array senses an electromagnetic radiation pattern which correlates with but is not itself representational of an elliptical pattern produced by a conical beam which intersects said input area in a pattern forming an ellipse having properties which are a function of at least one of position, distance and orientation of said input; and

Bird-Ishii teaches elements 1[E], 20[E], and 21-22[D]. Ex-1002 ¶¶129-134. Bird discloses a light source of said electromagnetic radiation that produces a parallel beam which intersects in input area in an elliptical pattern.

As shown in Figure 9 (annotated), Bird discloses light pen 12 that includes a light source such as "an LED" with the light source being a source of

electromagnetic radiation. Ex-1009, 4:51-52. The beam in Figure 9 is conical. *See* Section VIII (Examiner's undisputed findings).

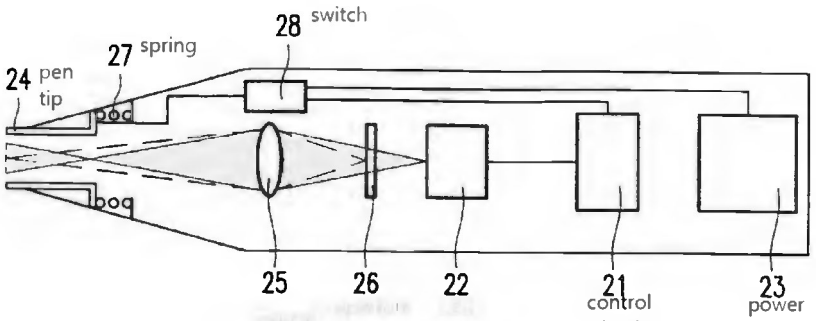
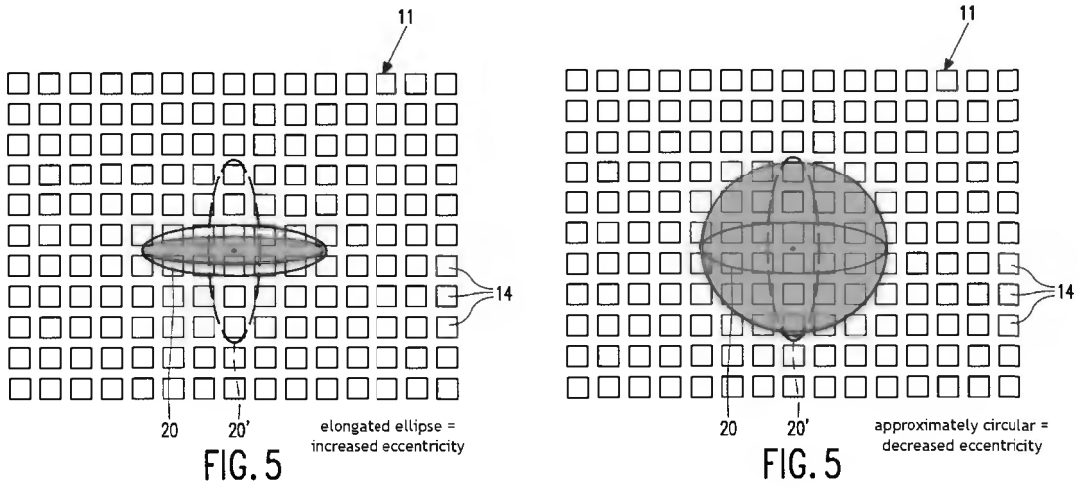


FIG. 9

Bird discloses that "[t]he beam of light is directed through the pen tip 24 via an optical system 25 which includes an aperture 26 that determines the required shape of the light spot." Ex-1009, 7:40-43. The beam has an elliptical shape. *Id.* at 6:38-46; *see id.* at Claim 6. Bird explains that "[i]t will be understood, of course, that if the pen is held inclined to that plane, the shape of the light spot produced is distorted." *Id.* at 3:24-26. As shown in Figure 5 (annotated), "[b]y tilting the light pen away from the perpendicular, the shape of the light spot produced on the array can be distorted so as to elongate (or further elongate) the spot or contract the spot." *Id.* at 7:28-32. The Examiner's ***second material error*** was not recognizing, as a matter of geometry, that elongating the ellipse increases it eccentricity, while contracting it decreases the eccentricity. *See* Ex-1002 ¶132. "[I]n the case of an elliptical spot, the spot may be distorted to approximate a circular spot." Ex-1009,

3:28-30. A circle is an ellipse of eccentricity zero. *See* Ex-1002 ¶132; Ex-1001, 5:8-10 (eccentricity of 0 is indicative of a circle).



Thus, the eccentricity of Bird's elliptical light spot depends on ("is a function" of) the light pen's ("input object") orientation.

In addition to the above features, Claim element 20[E] also requires "an electromagnetic radiation pattern which correlates with but is not itself representational of an elliptical pattern produced by a conical beam." Bird-Ishii also teaches this feature. For example, as shown in Figure 7, the radiation pattern may be "ovoid." Ex-1009, Fig 7, 6:40. A POSITA would have understood that egg-shaped, ovoid beam pattern, correlates to an asymmetrical ellipse, but is not itself an ellipse (one half of the "ovoid" is a semi-circle with eccentricity of 0, and the other half is an ellipse with eccentricity between 0 and 1). Ex-1002 ¶134.

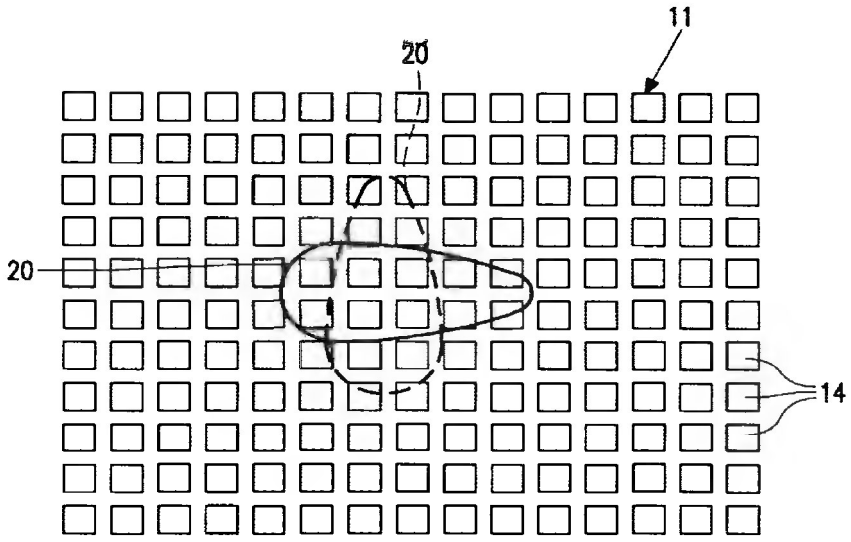


FIG. 7

3. Dependent Claims 2, 9, 10, 12, 13, 16, 18, and 19

a. Claim 2 – An electronic input device according to claim 1 and also comprising a display providing a visually sensible output which is responsive to said electronic input

Bird-Ishii teaches Claim 2. Ex-1002 ¶¶135-136. As shown in Figure 1, Bird discloses that the light pen device is also used to control the position of a cursor on a display screen. Ex-1009, 2:56-59. For example, "[a]s rotation of the pen is detected the display can be addressed to re-draw the knob rotated according to the amount of rotation of the pen to provide visual feedback." *Id.* at 6:10-15; Ex-1004, 0073 (Claim 3: Examiner finding same).

b. Claim 9 – An electronic input device according to claim 1 and also comprising interface circuitry operative in response to said output indication for providing continuously variable user inputs based on at least one of said two-dimensional position, said three dimensional position; and said orientation of said input object.

Bird-Ishii teaches Claim 9, as discussed in Section XIII.A.2.e. It provides for continuously variable user inputs because "[a]s rotation of the pen is detected the display can be addressed to re-draw the knob." Ex-1009, 6:10-15; Ex-1002 ¶137; Ex-1004, 0073 (Claim 8: Examiner finding same).

c. Claim 10 – An electronic input device according to claim 1 and wherein said sensor array is operative to provide an output indication of each of position, orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object.

Bird-Ishii teaches Claim 10, as discussed in Section XIII.A.2.d (explaining how each of position, orientation, shape, and size is taught). Ex-1002 ¶138; Ex-1004, 0074 (Claim 10: Examiner finding same).

d. Claim 12 – An electronic input device according to claim 10 and wherein said input object comprises a source of said electromagnetic radiation.

Bird-Ishii teaches Claim 12, for the same reasons as it teaches the same limitation of Claim 1[a] discussed in Section XIII.A.2.b. Ex-1002 ¶139; Ex-1004, 0074 (Claim 11: Examiner finding same).

e. Claim 13 – An electronic input device according to claim 12 and wherein said source of said electromagnetic radiation produces a conical beam which impinges on said input area, producing said electromagnetic radiation pattern on said input area in the form of an ellipse having elliptical eccentricity which is a function of orientation of said input object in a plane other than a plane parallel to said input area.

Bird-Ishii teaches Claim 13, for the same reasons as it teaches the same limitation of Claim 1[E] (conical beam producing an ellipse) discussed in Section XIII.A.2.f. Ex-1002 ¶140.

f. Claim 16 – An electronic input device according to claim 10 and also comprising a display providing a visually sensible output which is responsive to said electronic input.

Bird-Ishii teaches Claim 16, for the same reasons as it teaches the same limitation of Claim 2 discussed in Section XIII.A.3.a. Ex-1002 ¶141; Ex-1004, 0075 (Claim 19: Examiner finding same).

g. Claim 18 – An electronic input device according to claim 1 and wherein said conical beam widens in diameter as the distance from said input object to said input area increases.

Bird-Ishii teaches the "conical beam" limitations of Claim 18, as discussed in Section XIII.A.2.f. Ex-1002 ¶142. It is a matter of basic geometry that, as the distance from the input area to input object increases, the conical beam of the light

pen (like that of a flashlight) widens in diameter. *Id.* This is demonstrated by Figure 9, annotated with the conical beam extended to an arbitrary distance.[6]

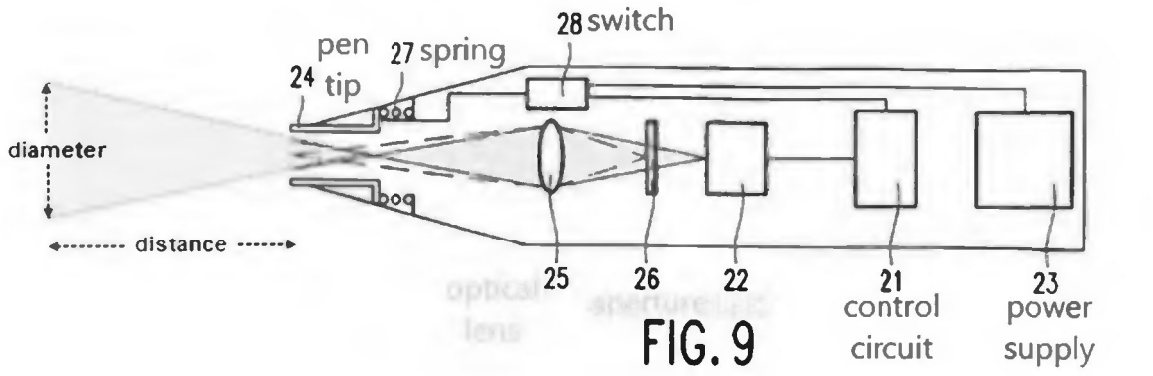


FIG. 9

h. Claim 19 – An electronic input device according to claim 1 and wherein said sensor array is positioned adjacent the perimeter of said input area.

Bird-Ishii teaches Claim 19, as discussed in Section XIII.A.2.d ("peripheral light sensors"). Ex-1002 ¶143.

B. Ground 2: Claims 3-8, 11, and 15 are obvious over Bird and Ishii in further view of Geva, Ex-1011

1. Bird includes an express teaching to combine Ishii and systems like Geva

Bird-Ishii in view of Geva (Bird-Ishii-Geva) teaches all the limitations of Claims 3-8, 11, and 15. Geva, like Bird and Ishii, relates to a combination of a light pen and a light sensing device. Ex-1011, Abstract. A POSITA would have been motivated to combine the teachings of Geva with the teachings of Bird and Ishii,

[6] This property of a conical beam of light is also exemplified by Kameyama, Ex-1012 ¶19.

because Geva's waveguides are similar to Ishii's and Bird expressly teaches "the light sensing array may be ***of a kind*** which …uses sets of row and column waveguides … and which conduct input light to peripheral light sensors." Ex-1009, 4:43-50 (emphasis added). Geva provides explicit teachings with respect to intensity of light on the waveguides of Ishii. A POSITA would have combined the teachings of Geva with the teachings of Bird-Ishii to achieve the benefits of using light intensity as taught by Geva. Ex-1002 ¶144.

2. Dependent Claims 3-8, 11, and 15

a. Claim 3 – An electronic input device according to claim 1 and wherein said sensor array is also operative to sense and provide at least one output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern

Bird-Ishii-Geva teaches Claim 3. Ex-1002 ¶145-149. Bird discloses a sensor array that is operative to sense electromagnetic radiation pattern. *Id*.

Ishii discloses that its waveguides with peripheral light sensors provide "a light output of the optical pen [that] attains turning-on and turning-off states in accordance with specified frequency and light intensity." Ex-1010 ¶55. Thus, Bird, when using the peripheral sensors of Ishii senses and provides an output of the indication of the intensity based on deducing the centroid of the spot to determine its position, so as to determine the position, shape, and size of the spot. Ex-1009, 2:32-39; Ex-1002 ¶146.

Geva provides additional teachings regarding use of intensity by peripheral light sensors. Geva discloses a light sensor array that comprises "a multiplicity of light sensing elements, each transmitting a signal to the processing device 16." Ex-1011, 0011 at 6:12-14. "Figure 3 is a graph of ***light intensity*** across one dimension," (*id.*, 0009 at 4:25-26), of "planer element 14" is depicted in Figure 3:

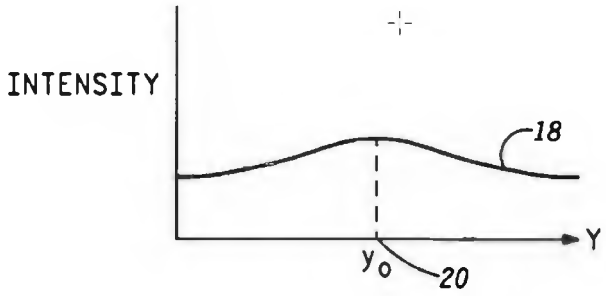


FIG. 3

In Figure 6, where "light sensor arrays 12 and 28" are disposed "at first and second edges of the planar element 14" to "indicate the 'x' and 'y' positions of the light emitting cursor device 10," (Ex-1011, 00014 at 9:1-3, 9:11-13), there is a comparable distribution of intensities along the x-axis as well. This is depicted in a modified Fig. 3 (Fig. 3'). Ex-1002 ¶¶147-148.

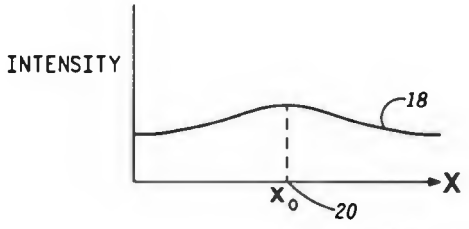


FIG. 3'

A POSITA would have been motivated to use, with a reasonable expectation of success, Bird-Ishii's electronic input system with Geva's teaching of techniques for determining X-Y size, shape, and position of a light spot by providing at least one output indication of intensity. Ex-1002 ¶149; Ex-1011, 6:10-20.

b. Claim 4 – An electronic input device according to claim 3 and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern

Bird-Ishii-Geva teaches Claim 4 for the reasons discussed above for Claim 3 and for the input circuitry, Section XIII.A.2.e, to provide the intensity as the electronic input. Ex-1002 ¶150.

c. Claim 5 – An electronic input device according to claim 3 and wherein said sensor array is operative to provide said output indication of intensity of electromagnetic radiation relative to a plurality of intensity thresholds.

Bird-Ishii-Geva teaches Claim 5, as discussed for Claim 3, using the intensity profile of Figure 3 along each of the X and Y axes. Ex-1002 ¶¶151-153.

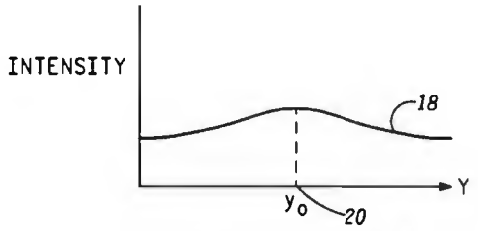


FIG. 3

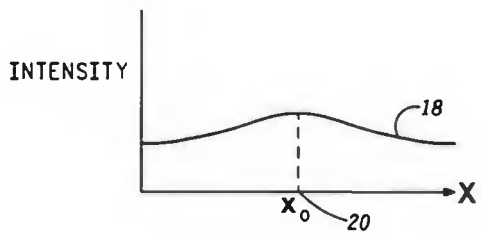


FIG. 3'

Moreover, as shown in modified Fig. 3 below, a POSITA would recognize the photosensors would provide some minimum intensity value or floor for an ambient light condition and would be motivated to choose a threshold that establishes the ambient "reference" level and indicate intensity relative to that level. Ex-1002 ¶152.

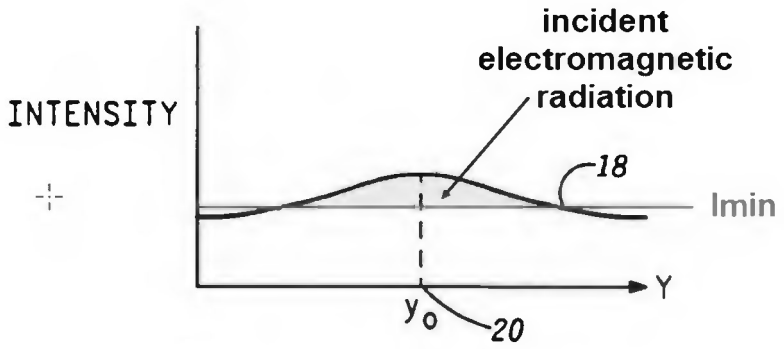
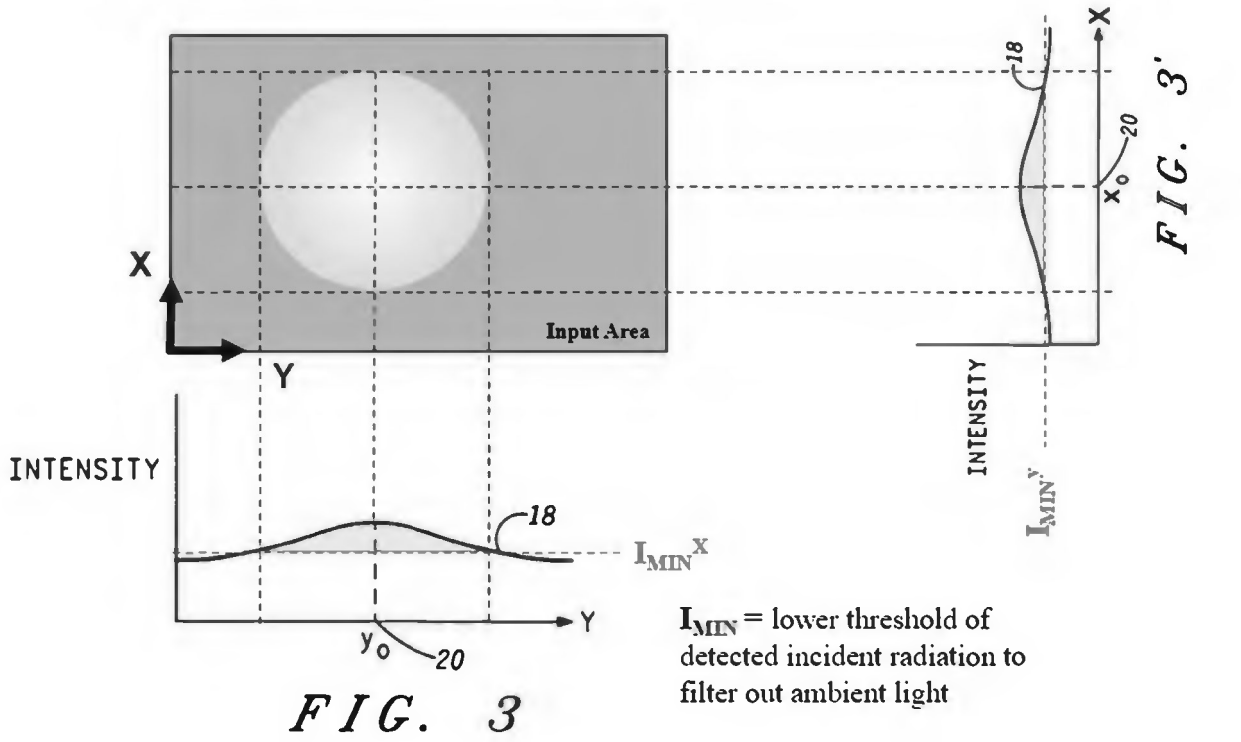


FIG. 3

And, because the Geva-Ishii combination is sensing light along both the X and Y axes, there would be two minimum intensity level thresholds, one for the X axis and one for the Y axis, specifically calibrated to the reference level for each of those two axes as shown below and indicated as I_{min}^{x} and I_{min}^{y}. Ex-1002 ¶153.



d. Claim 6 – An electronic input device according to claim 3 and wherein said sensor array is also operative to provide an output indication of the area of the sensor array illuminated by said electromagnetic radiation pattern.

Bird-Ishii-Geva teaches Claim 6. Ex-1002 ¶154. Bird-Ishii teaches the sensor array is operative to provide an output indication of the area because, as discussed in Section XIII.A.2.d, it determines a size and shape of the electromagnetic radiation pattern which indicates area.

e. Claim 7 – An electronic input device according to claim 6 and wherein: said area of the sensor array illuminated has a direct variable relationship with the distance from said input object to said input area; and said intensity of electromagnetic radiation has an inverse variable relationship with the distance from said input object to said input area

Bird-Ishii-Geva teaches Claim 7. Ex-1002 ¶155. As discussed in Section XIII.A.3.g, Bird inherently discloses that the sensing elements (area of the sensor array) illuminated during the movement of the light spot has direct relationship with the distance of the input object. A POSITA would have recognized as a matter of basic physics that intensity of electromagnetic radiation (e.g., light) varies inversely with the square of the distance between the input object and input area. Ex-1002 ¶155 (explaining inverse square law); Ex-1001, 5:11-21 (explaining relationship between distance, area, and intensity).

f. Claim 8 – An electronic input device according to claim 7 and wherein the symmetry of at least one of said area of the sensor array illuminated and said intensity of electromagnetic radiation correlates with the orientation of said input object in at least one plane relative to said input area

Bird-Ishii-Geva teaches Claim 8, as discussed in Section XIII.B.2.d-e, Claims 6 and 7. A POSITA would recognize that tilting the input object would change the intensity in a way that correlates to its orientation. Ex-1002 ¶156.

g. Claim 11 – An electronic input device according to claim 10 and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern

Bird-Ishii-Geva teaches Claim 11, as discussed with respect to the same limitation of Claim 3 in Section XIII.B.2.a.

h. Claim 15 – An electronic input device according to claim 10 and wherein said sensor array is also operative to sense and provide an output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern

Bird-Ishii-Geva teaches Claim 15, as discussed with respect to Claims 3-4 in Section XIII.B.2.a-b.

C. Ground 3: Claims 14 and 17 are obvious over Bird and Ishii in further view Kameyama, Ex-1012

1. A POSITA would be motivated to combine the teachings of Kameyama with the teachings of Bird and Ishii

Bird and Ishii in view of Kameyama (Bird-Ishii-Kameyama) teaches all the limitations of Claims 14 and 17. Kameyama, like Bird and Ishii, relates to a combination of a light pen and a light sensing device. Ex-1012 ¶1. A POSITA would have been motivated to combine the teachings of Kameyama with the teachings of Bird and Ishii, because Bird and Ishii provide solutions to improve the function of the light sensing device sensing a light pen in similar and predictable

ways, and Kameyama further provides "a calculation process able to derive position and/or posture [of a light pen] in a 3D space of light. . . when light emitted by the light generating means irradiates a light receiving surface of light detecting means." *Id*. ¶9. A POSITA would have combined the teachings of Kameyama with the teachings of Bird and Ishii with a reasonable expectation of success to achieve the additional benefits of using light emitting stylus as taught by Kameyama. Ex-1002 ¶159.

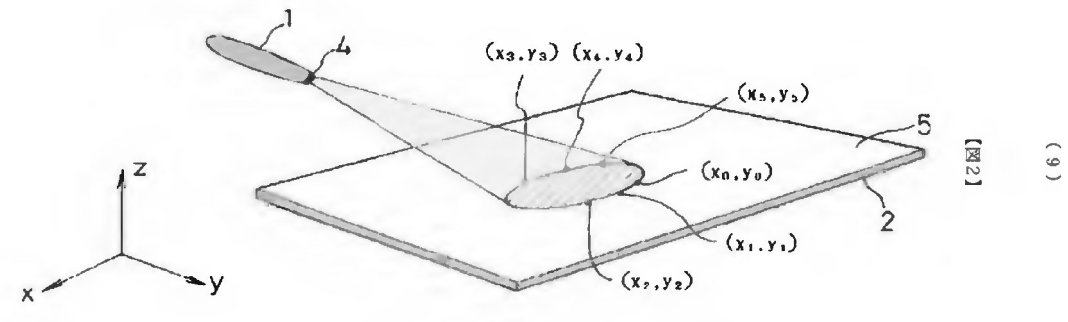
2. Dependent Claims 14 and 17

a. Claim 14/17 – An electronic input device according to claim 13/1 and wherein said input circuitry is operative to calculate said orientation of said input object from said elliptical eccentricity, based on said output indication from said sensor array

Bird-Ishii-Kameyama teaches Claims 14 and 17, as discussed in Section XIII.A.2.e. Ex-1002 ¶160-163. That is, Bird-Ishii teaches outputting a size and shape, and recognizes that eccentricity is a function of orientation, but do not explicitly disclose that the input circuitry is operative to calculate said orientation of said input object from said elliptical eccentricity, as disclosed by Kameyama.

As shown in Figure 2 (annotated), Kameyama discloses a "conical shaped light from the light source 4 of the [pen] from any position onto the light receiving surface 5." Ex-1012 ¶19. Kameyama captures "six coordinate points (x0, y0), (x1, y1), (x2, y2), (x3, y3), (x4, y4) and (x5, y5), on a boundary line between a portion

irradiated portion (diagonal part) by, and a portion not irradiated by, light of the light-receiving surface 5." *Id.* ¶20. Kameyama also includes formulas used to determine "position and posture data of the light source 4 of the light generator 1 derived through a calculation process" which are then "output to a computer as position and posture data of a 3D space." *Id.* ¶47.



A POSITA would have understood that Kameyama would determine the orientation of said input object based on the light spot's elliptical eccentricity by using the formulas provided in Kameyama and would have been motivated to make this determination to provide for additional user interface features. Ex-1002 ¶163.

D. Ground 4: Claims 1-12 and 15-22 are obvious over Geaghan, Ex-1013, in view of Ishii, Ex-1010

1. A POSITA would be motivated to combine the teachings of Geaghan with the teachings of Ishii

Geaghan in view of Ishii (Geaghan-Ishii) teaches all the limitations of Claims 1-12 and 15-22. Geaghan, like Ishii, relates to a combination of a light pen

and a light sensing device. Ex-1010 ¶5; Ex-1013, Abstract. Specifically, as mentioned above, Ishii discloses "[a] photosensor [] formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions." Ex-1010 ¶51. A POSITA would have understood that Ishii discloses an alternative display for use with light pens in which the sensing arrays are located at the ends of light conducting wave guides. Thus, a POSITA would have combined the teachings of Geaghan to use peripheral light sensors of Ishii (as suggested by Bird) with a reasonable expectation of success as an alternative design choice. Ex-1002 ¶164.

2. Independent claims 1 and 20-22

a. 1[pre]/20-22[pre] An electronic input device comprising:

Geaghan-Ishii teaches the preambles of Claims 1 and 20-22, to the extent limiting. Ex-1002 ¶165-166. As shown below, Geaghan discloses an electronic input device as "input device 10" and "input device 110."[7] Ex-1013 ¶¶20, 37.

[7] Many structural elements are described with respect to Fig. 1, but have corresponding elements in Fig. 3. The embodiment relied on here is based on Fig. 3.

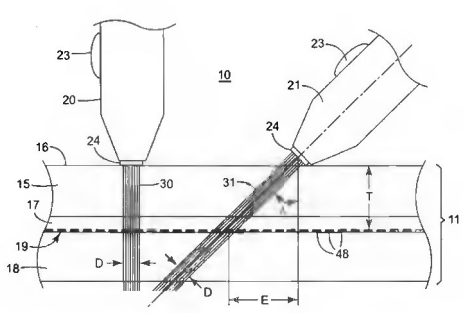


FIG. 1

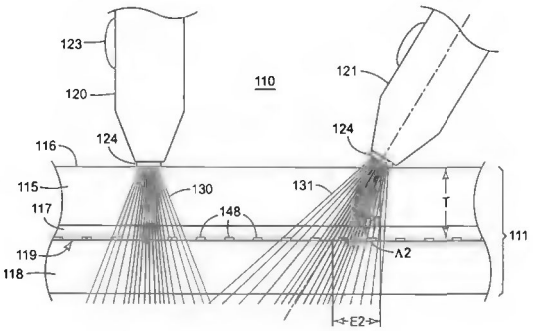


FIG. 3

b. 1[A] an input object wherein said input object includes a source of said electromagnetic radiation;

20[A]/22[A] an input object;

21[A] an input stylus projecting an electromagnetic radiation pattern on said input area;

Geaghan-Ishii teaches elements 1[A] and 20-22[A]. Ex-1002 ¶¶167-168. As shown in Figure 3 (annotated), Geaghan discloses that "styli 120 and 121 emit conical beams, spreading light in spot patterns over a wider area." Ex-1013 ¶37. "Because the intersection of beam 130 with array 119 is wider, the light irradiates several detectors 148." *Id*. ¶40.

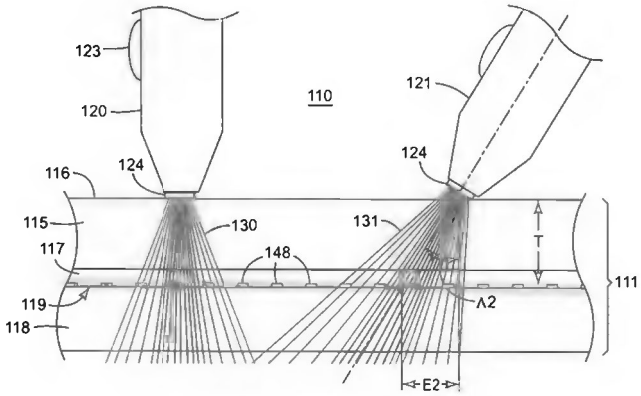


FIG. 3

c. 1[B]/20-22[B] a/an [physical] input area;

Geaghan-Ishii teaches elements 1[B] and 20-22[B]. Ex-1002 ¶¶169-170. As shown in Figure 1, Geaghan discloses an "input surface 16" which determines the position of a light beam. Ex-1013 ¶¶4, 20; Fig. 3 (116).

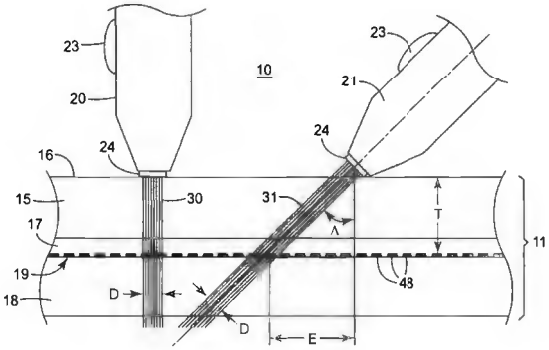


FIG. 1

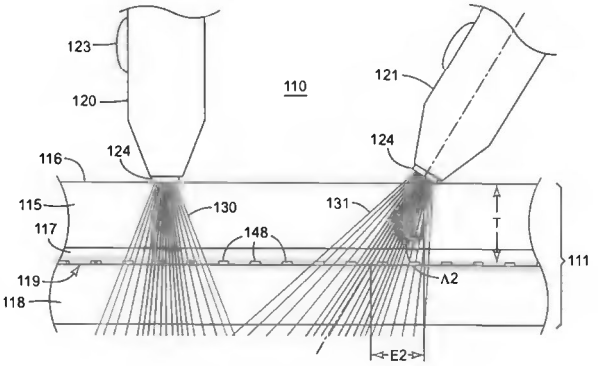


FIG. 3

d. 1[C]/20-22[C] "sensor array…"

(1) 1[Ci]/20[Ci]/22[Ci] a sensor array positioned outside said input area…;

21[Ci] a sensor array at least partially circumscribing and immediately proximate said input area…

Geaghan-Ishii teaches elements 1[Ci] and 20-22[Ci]. Ex-1002 ¶¶171-174. Figure 3 discloses that "sensor array 119 has fewer detectors 148 that are more widely spaced." Ex-1013 ¶37. Geaghan explains that "two or more adjacent optical sensors can detect light in an amount proportional to their proximity to the center of the beam." *Id.* ¶19.

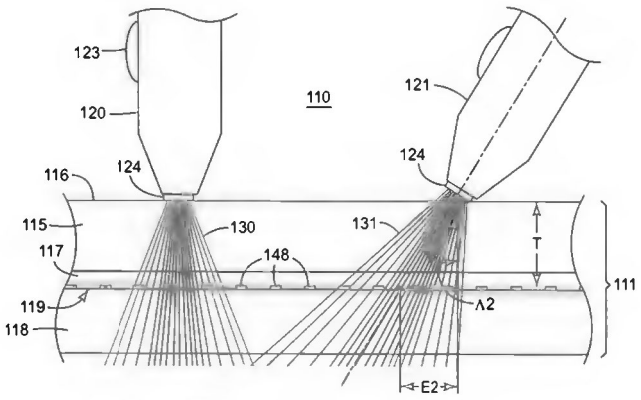
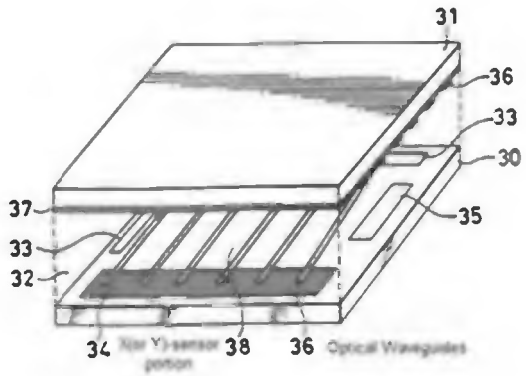


FIG. 3

Ishii discloses "[a] photosensor [] formed in an end portion of each of the optical waveguides on the silicon substrate in the X and Y directions." Ex-1010 ¶51. As shown in Figure 9 (annotated), Ishii discloses "[a]n optical waveguide 36, an X(or Y)-sensor portion 34 and a Y (or X)-sensor potion 35 formed in an end portion." *Id*. ¶45. A POSITA would have understood that Ishii's photosensors (red) are positioned both "outside" and "least partially circumscribing and immediately proximate to" the input area. Ex-1002 ¶173.

Fig. 9



A POSITA would have been motivated to include such positioning because Ishii discloses an alternative display for use with light pens in which the sensing arrays are located at the ends of light conducting wave guides, and with its configuration, "it is possible to solve the problems with respect to thickness, weight and power consumption of the display unit." Ex-1010 ¶25. Also, a POSITA would have had a reasonable expectation of success of combining Geaghan and Ishii as a simple design choice. Ex-1002 ¶174.

(2) 1[Cii]/20[Cii]/22[Cii] operative to sense and provide an output indication of position and;

21[Cii] said sensor array operative to sense said electromagnetic radiation pattern on said input area and to provide an output indication of position;

Geaghan-Ishii teaches elements 1[Cii] and 20-22[Cii]. Ex-1002 ¶175-176. Geaghan senses the radiation pattern and outputs a position of the stylus. Geaghan discloses that "angle, and the location of the center of the beam, can be used to locate the position of the stylus." Ex-1013 ¶19. Geaghan does so by "measuring the position of the spot of light intersecting with detector array 19." *Id*. ¶21.

(3) 1[Ciii]/20-22[Ciii] at least two of orientation, shape and size of an electromagnetic radiation pattern on said input area [produced by said input object];

Geaghan-Ishii teaches elements 1[Ciii] and 20-22[Ciii]. Ex-1002 ¶177-181. Geaghan discloses sensing at least two of orientation, shape, and size of an

electromagnetic radiation pattern. All of size, shape, and orientation are shown, for example in Figure 2:

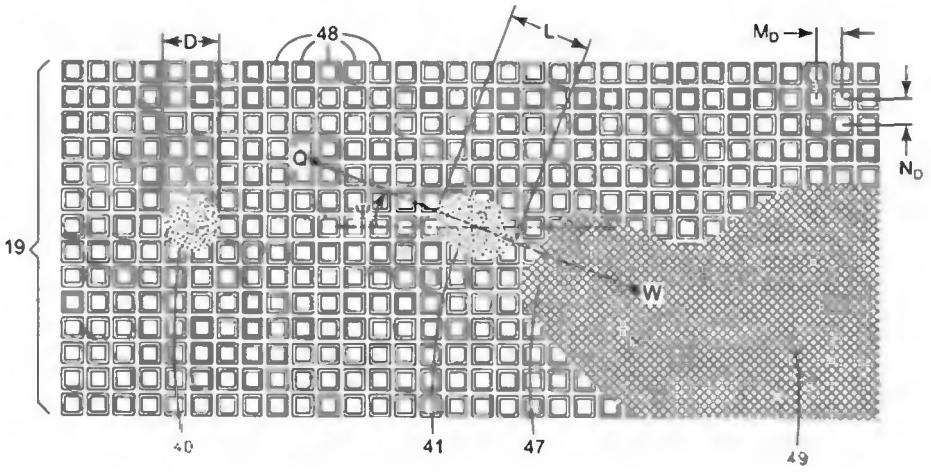


FIG. 2

Geaghan discloses determining "orientation" when "[t]he length to width ratio and orientation of the longer dimension of elliptical spot 41" are "used to measure the tilt angle Λ and tilt axis of stylus 21." Ex-1013 ¶29.

Geaghan discloses determining "shape" of the beam. Geaghan explains that "beam spot 40 is shown to be round, it will be appreciated that any spot shape can be used, particularly when the spot shape and intensity distribution are known." Ex-1013 ¶26.

Geaghan discloses determining "size" of the beam. Geaghan explains that the "[t]he long dimension L of the ellipse is determined by the equation [2]." Ex-1013 ¶¶27-28.

e. 1[D]/20[D]/21-22[E] "input circuitry"

(1) 1[Di]/20[Di]/21-22[Ei] input circuitry receiving said output indication and providing an electronic input;

Geaghan-Ishii teaches elements 1[Di], 20[Di], and 21-22[Ei]. Ex-1002 ¶182-183. As shown in Figure 8, Geaghan discloses system controller 214 that "calculates the position of light patterns on photo detector array 212, measured by photo detector measurement system 213." Ex-1013 ¶48. Ishii similarly discloses a circuit for determining output indication and providing an input to character recognizing section 64. Ex-1010 ¶62, Fig. 11.

Fig. 11

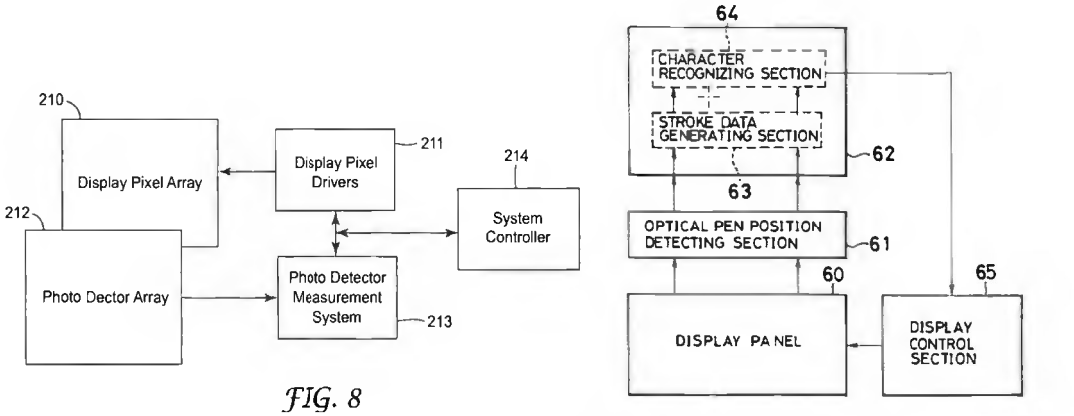


FIG. 8

(2) 1[Dii]/20[Dii]/21-22[Eii] representing at least one of two-dimensional position, three-dimensional position and orientation of said input object [said electronic input representing orientation includes an electronic input representing angular orientation of said input object relative to said input area];

Geaghan-Ishii teaches elements 1[Dii], 20[Dii], and 21-22[Eii]. Ex-1002 ¶¶184-185.

Geaghan discloses an electronic input representing at least a two-dimensional position of the input object. Geaghan discloses that "spot 41 may result from a stylus 21 at position Q, or at position W." Ex-1013 ¶30; *id.* ¶31 (orientation: "tilt angle Λ of stylus 21"). Geaghan explains that "[s]ince the user and hand are typically oriented toward the bottom of digitizer array 19, it may be assumed that the hand, and (generally) stylus 21 are located nearer to point W than to point Q." *Id.* ¶31. Ishii also detects the X and Y positions of the light incident on the display surface and orientation, which is also X-Y position of the input object on the surface. Ex-1010 ¶¶53, 58-60. A POSITA would have adapted the input circuitry of Geaghan to respond to the sensor configuration of Ishii. Ex-1002 ¶185.

f. 1[E]/22[D] wherein said [source of said electromagnetic radiation produces a conical beam which/input object produces a beam of electromagnetic radiation that] intersects said input area in an elliptical pattern having elliptical eccentricity which is a function of the orientation of said input object in a plane perpendicular to said input area.

21[D] wherein said electromagnetic radiation pattern includes an elliptical pattern having elliptical eccentricity that is a function of the orientation of said input stylus relative to said input area; and

20[E] said input object includes a source of said electromagnetic radiation, and wherein said sensing array senses an electromagnetic radiation pattern which correlates with but is not itself representational of an elliptical pattern produced by a conical beam which intersects said input area in a pattern forming an ellipse having properties which are a function of at least one of position, distance and orientation of said input; and

Geaghan-Ishii teaches elements 1[E], 20[E], and 21-22[D]. Ex-1002 ¶¶186-187. As shown in Figure 3 (annotated), Geaghan "shows an input device 110 similar to device 10 shown in FIG. 1, except that styli 120 and 121 emit conical beams, spreading light in spot patterns over a wider area." Ex-1013 ¶37.

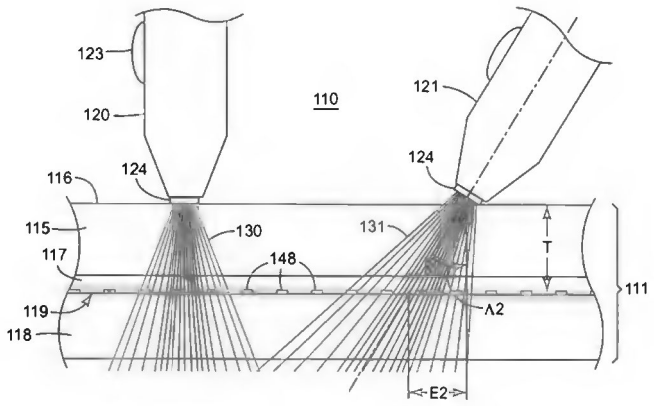


FIG. 3

Geaghan explains that "a conical light distribution, illuminates the sensor array at an angle, an elliptical spot will be formed such as spot 41 in FIG. 2 (and, analogously, as shown in FIGS. 5 [] with respect to spots 141 and 341, respectively)." Ex-1013 ¶35. Geaghan discloses that "[s]pot 41 is made by a round beam of light from stylus 21 that is oriented at an angle of Λ degrees from the plane of detector array 19." *Id.* ¶27. Geaghan also discloses that "spot 41 is an elliptical shape with minimum width D, equal to the diameter of beam 31" and the long dimension L of the ellipse can be determined by an equation. *Id.* ¶¶27-28. Geaghan explains that "[a] stylus beam angle of 45° results in [the long dimension] L=l.41 *D" of the ellipse. *Id.* ¶29. Thus, the eccentricity of Geaghan's elliptical spot depends on ("is a function" of) the light pen's ("input object") orientation.

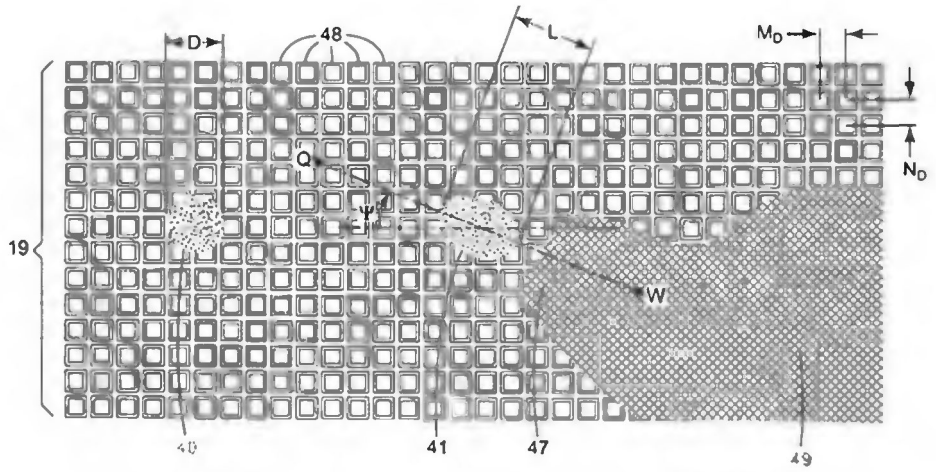


FIG. 2

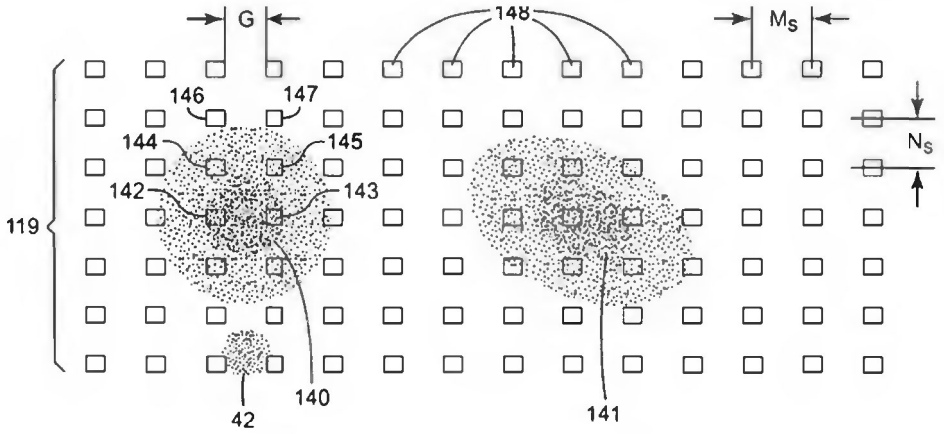


FIG. 5

In addition to the above features, Claim element 20[E] also requires "an electromagnetic radiation pattern which correlates with but is not itself representational of an elliptical pattern produced by a conical beam." Geaghan also teaches this feature. For example, as shown in Figure 4(a), the radiation pattern may be asymmetrical shapes with different "half intensity angles." Ex-1013, Fig 7, ¶¶38-40. A POSITA would have understood that these beam patterns, generally

correlate to an asymmetrical ellipse, but is not itself an ellipse (the shapes have different eccentricities on each side of the minor axis). Ex-1002 ¶189.

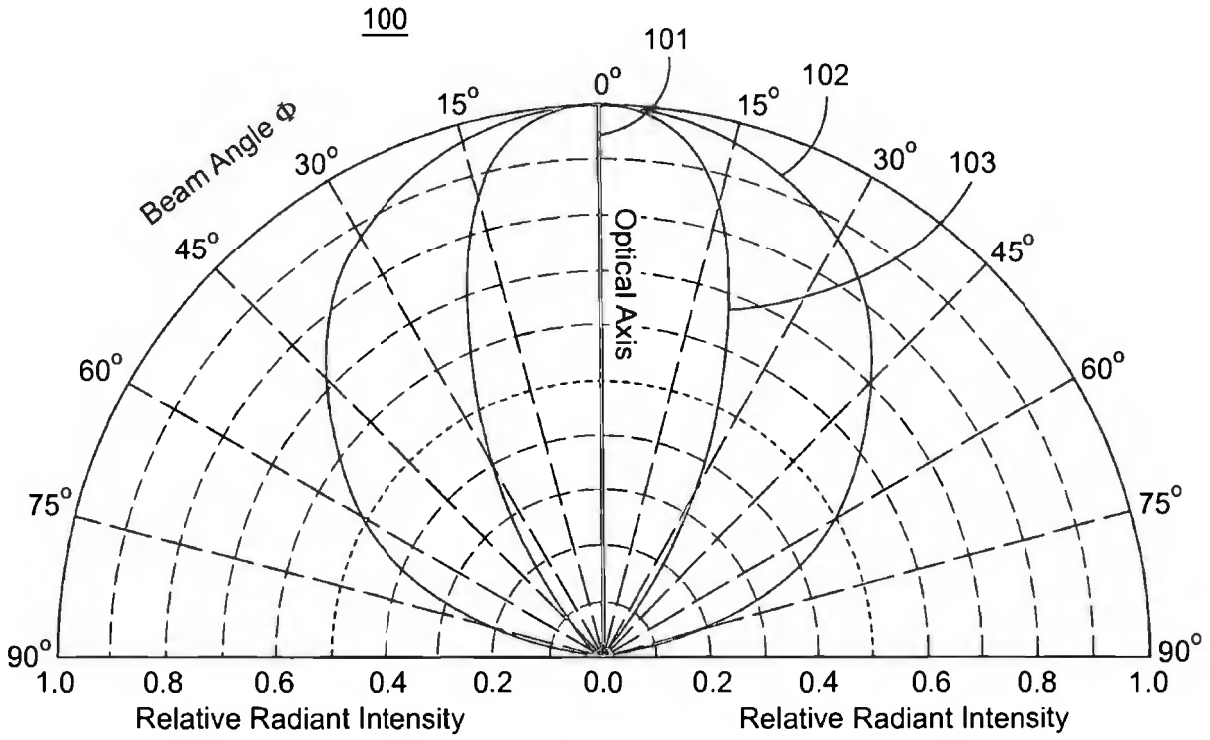


FIG. 4a

3. Dependent Claims 2-12, and 15-19

a. Claim 2 – An electronic input device according to claim 1 and also comprising a display providing a visually sensible output which is responsive to said electronic input

Geaghan-Ishii teaches Claim 2. Ex-1002 ¶¶190-191. As shown in Figure 1, Geaghan discloses input device 10 that include digitizer 11. Ex-1013 ¶20. Geaghan explains that digitizer 11 may also function as a display, which produces a "visually sensible output." *Id.*

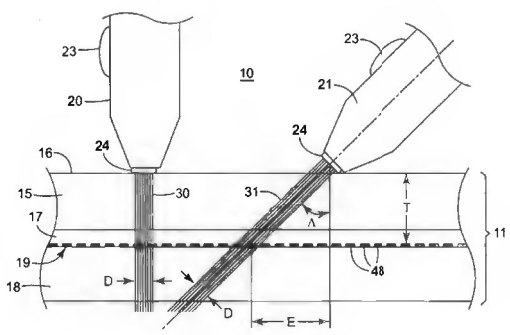


FIG. 1

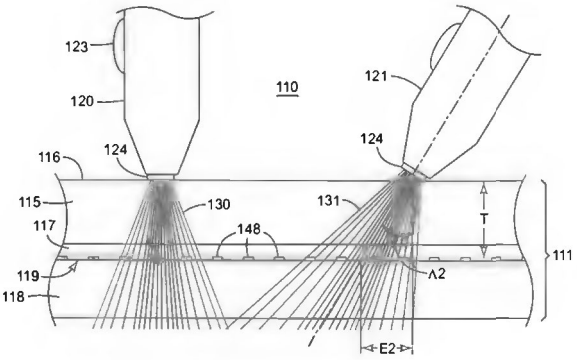


FIG. 3

b. Claim 3 – An electronic input device according to claim 1 and wherein said sensor array is also operative to sense and provide at least one output indication of intensity of electromagnetic radiation in said electromagnetic radiation pattern

Geaghan-Ishii teaches Claim 3. Ex-1002 ¶¶192-193. Geaghan discloses a "method of determining stylus orientation includes additional analysis of the light distribution of the spot formed on the detectors." Ex-1013 ¶35. As shown in Figure 2 (annotated) and Figure 5 (annotated), when "a light beam having a know[n] cross-sectional intensity distribution . . . illuminates the sensor array at an angle, an elliptical spot will be formed" such as spot 41 in FIG. 2 and spots 141 and 341 in Figure 5. *Id*. Geaghan states that "[t]he elliptical spot will generally exhibit an intensity distribution." *Id*. "Thus, comparing the integrated intensity contribution from different halves, quadrants, or other selected sections of the spot can be used to indicate stylus tilt direction." *Id*.

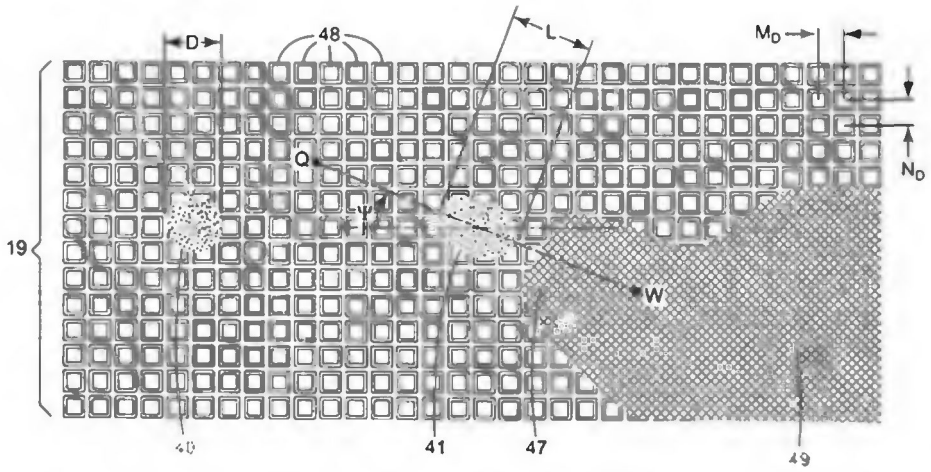


FIG. 2

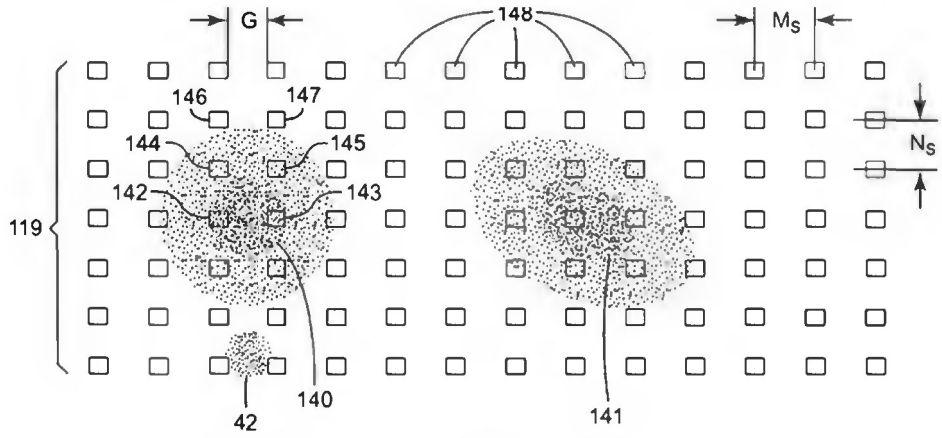


FIG. 5

c. Claim 4 – An electronic input device according to claim 3 and wherein said input circuitry is operative to provide an electronic input which is at least partially based on the sensed intensity of electromagnetic radiation in said electromagnetic radiation pattern

Geaghan-Ishii teaches Claim 4, for the reasons discussed above for Claim 3 and for the input circuitry, Section XIII.D.2.e, to provide the intensity as the electronic input. Ex-1002 ¶194.

d. Claim 5 – An electronic input device according to claim 3 and wherein said sensor array is operative to provide said output indication of intensity of electromagnetic radiation relative to a plurality of intensity thresholds.

Geaghan-Ishii teaches Claim 5, as discussed for Claim 3. Additionally, Geaghan explains that "FIGS. 4(a) and (b) can be used to demonstrate various representative beam intensity profiles." Ex-1013 ¶38. Ex-1002 ¶¶195-196.

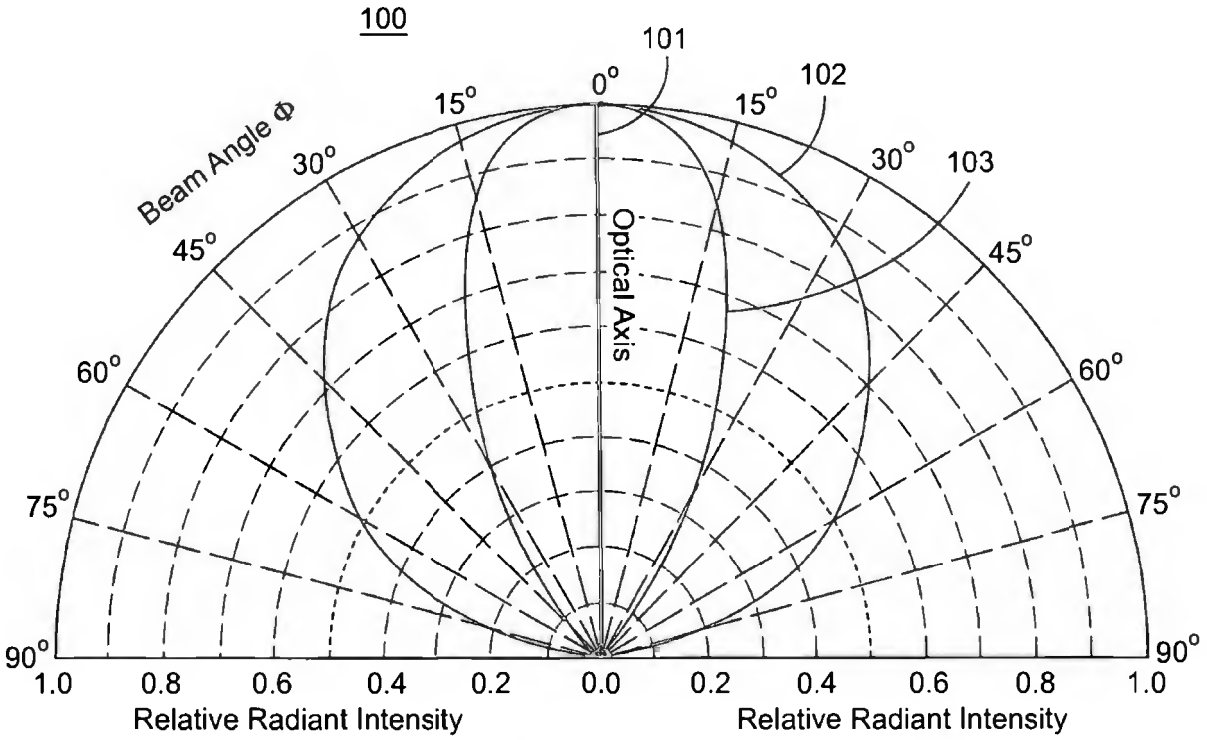


FIG. 4a

"The range of the optical angle within which the radiant intensity is greater than or equal to 50% of the maximum value is referred to as the half intensity value." A POSITA would thus have understood that Geaghan's "half intensity value" as a 50% threshold from the maximum intensity. Using these "half intensity values" as

thresholds to which the received signals is compared, "[t]hese light intensities and intensity differences among adjacent detectors allow high resolution interpolation between the detectors in that the beam intensity profile and overall shape are known and can be compared to the detected signals. The detected signals can be mapped onto the known profile and shape to pinpoint the location of the center of the beam." Ex-1013 ¶42. Ex-1002 ¶196.

e. Claim 6 – An electronic input device according to claim 3 and wherein said sensor array is also operative to provide an output indication of the area of the sensor array illuminated by said electromagnetic radiation pattern.

Geaghan-Ishii teaches Claim 6. Ex-1002 ¶197. Geaghan-Ishii teaches the sensor array is operative to provide an output indication of the area because, as discussed in Section XIII.D.2.d, it determines a size and shape of the electromagnetic radiation pattern, which indicates area.

f. Claim 7 – An electronic input device according to claim 6 and wherein: said area of the sensor array illuminated has a direct variable relationship with the distance from said input object to said input area; and said intensity of electromagnetic radiation has an inverse variable relationship with the distance from said input object to said input area

Geaghan-Ishii teaches Claim 7, as discussed in Section XIII.B.2.e, Claim 7 (citing inverse square law and Ex-1001, 5:11-21).

g. Claim 8 – An electronic input device according to claim 7 and wherein the symmetry of at least one of said area of the sensor array illuminated and said intensity of electromagnetic radiation correlates with the orientation of said input object in at least one plane relative to said input area.

Geaghan-Ishii teaches Claim 8, as discussed in Section XIII.D.3.d-e, Claims 6 and 7. A POSITA would recognize that tilting the input object would change the intensity in a way that correlates to the orientation. Ex-1002 ¶199.

h. Claim 9 – An electronic input device according to claim 1 and also comprising interface circuitry operative in response to said output indication for providing continuously variable user inputs based on at least one of said two-dimensional position, said three dimensional position; and said orientation of said input object.

Geaghan-Ishii teaches Claim 9, as discussed in Section XIII.D.2.e. Ex-1002 ¶200. It provides for continuously variable user inputs because Geaghan's digitizer 11 may also function as a display, which produces a "visually sensible output." Ex-1013 ¶20.

i. Claim 10 – An electronic input device according to claim 1 and wherein said sensor array is operative to provide an output indication of each of position, orientation, shape and size of an electromagnetic radiation pattern on said input area produced by said input object.

Geaghan-Ishii teaches Claim 10, as discussed in Sections XIII.D.2.d (explaining how each of position, orientation, shape, and size is taught).