

Petition for *Inter Partes* Review of
U.S. Patent No. 9,727,217 B2

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC.,
Petitioner

v.

IMMERSION CORPORATION,
Patent Owner

Case IPR2023-00946
U.S. Patent No. 9,727,217 B2
Issue Date: August 8, 2017

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,727,217 B2**

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List of Exhibits

Exhibit No.	Description of Document
1001	U.S. Patent No. 9,727,217 B2 to David M. Birnbaum, Danny A. Grant, and Robert W. Heubel (filed June 2, 2014, issued August 8, 2017) (“ ’217 ” or “ ’217 patent ”)
1002	Declaration of Jeremy Cooperstock, Ph.D. (“ Cooperstock ”)
1003	U.S. Patent Application Publication No. 2009/0066725 A1 to Atsushi Nogami and Naoki Nishimura (filed Sep. 9, 2008, published March 12, 2009) (“ Nogami ”)
1004	U.S. Patent Application Publication No. 2007/0088943 A1 to Robert Phelps et al. (filed October 18, 2005, published April 19, 2007) (“ Phelps ”)
1005	U.S. Patent Application Publication No. 2008/0285854 A1 to Daisuke Kotake et al. (filed August 8, 2007, published November 20, 2008) (“ Kotake ”)
1006	U.S. Patent No. 7,084,884 to Donald Nelson et al. (filed July 24, 2001, issued August 1, 2006) (“ Nelson ”)
1007	Excerpts from <i>Microsoft Computer Dictionary</i> (5th ed. 2002)
1008	Excerpts from <i>Newton’s Telecom Dictionary</i> (24th ed. 2008)
1009	Excerpts from <i>Dictionary of Computer and Internet Terms</i> (6th ed. 1998)
1010	Excerpts from <i>Oxford Dictionary of English</i> (2d ed. revised 2005)
1011	Joint Claim Construction Statement filed in <i>Immersion Corp. v. Meta Platforms, Inc.</i> , No. 6:22-cv-00541-ADA (filed January 21, 2023)
1012	Prosecution history of the ’217 patent

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List of Exhibits

Exhibit No.	Description of Document
1013	Affidavit of Service, ECF No. 6, dated June, 2, 2002, filed in <i>Immersion Corp. v. Meta Platforms, Inc.</i> , No. 6:22-cv-00541-ADA (W.D. Tex.)

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I. MANDATORY NOTICES UNDER §42.8(A)(1)

A. Real Party-In-Interest Under §42.8(b)(1)

Meta Platforms, Inc. is the real party-in-interest to this IPR petition.

B. Related Matters Under §42.8(b)(2)

The '217 patent is the subject of the following pending litigation involving
Petitioner: *Immersion Corp. v. Meta Platforms, Inc.*, No. 6:22-cv-00541-ADA
(W.D. Tex.). Petitioner was served with the Complaint in that action on May 27,
2022. (EX1013, p.001.)

C. Lead and Back-Up Counsel under §42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

This Petition is being served by Federal Express to the attorneys of record for the '217 patent, 34300 - Immersion / Kilpatrick Townsend and Stockton, Mailstop: IP Docketing – 22, 1100 Peachtree Street, Suite 2800, Atlanta, GA 30309. This Petition is also being served on litigation counsel identified in the Certificate of Service. Petitioner consents to electronic service at the addresses provided above for lead and back-up counsel.

E. Power of Attorney

Filed concurrently per 37 C.F.R. § 42.10(b).

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II. FEE PAYMENT

Petitioner requests review of ten claims, with a \$41,500 payment.

III. REQUIREMENTS UNDER §§ 42.104 AND 42.108 AND CONSIDERATIONS UNDER §§ 314(A) AND 325(D)

A. Standing

Petitioner certifies that the '217 patent is available for IPR and that Petitioner is not barred or otherwise estopped.

B. Identification of Challenge

Petitioner requests institution of IPR based on the following grounds:

Ground	Claims	Basis under §103
1	1-4, 8, 10-11, 17-19	Nogami in view of Phelps
2	11, 19	Nogami in view of Phelps and Kotake

Submitted herewith is a Declaration of Jeremy Cooperstock, Ph.D. (EX1002) (“Cooperstock”), a qualified technical expert. (Cooperstock, ¶¶1-7, Ex. A.)

C. §§314(a) and 325(d)

Petitioner respectfully submits that no basis exists under either §314(a) or §325(d) for discretionary denial of this Petition. Petitioner reserves its right to respond to any discretionary denial arguments later presented by Patent Owner.

§ 314(a): Petitioner has not previously filed an IPR petition against the '217 patent, and is unaware of any other prior IPR petition filed against the '217 patent

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by any party. In the pending litigation, the district court has continued the claim construction hearing several times, and as of the filing of this Petition, no claim construction or other substantive rulings have issued. A trial date has been set for February 20, 2024, but Petitioner has filed a motion to transfer the case to the Northern District of California (which remains pending). In the event of IPR institution, moreover, Petitioner intends to file a motion to stay the litigation pending the outcome of the IPR. In order to address any concerns regarding duplication of efforts, Petitioner hereby provides a *Sotera* stipulation that, in the event of IPR institution, Petitioner will not pursue in the district court any grounds of invalidity against the challenged claims that were raised or reasonably could have been raised in IPR.

§ 325(d): None of the prior art cited in the grounds identified in **Part III.B** above was previously presented during prosecution of the '217 patent.

IV. OVERVIEW OF THE '217 PATENT

A. Level of Ordinary Skill in the Art

A person of ordinary skill in the art would have possessed a bachelor's degree in electrical engineering or computer science (or an equivalent degree), and two years of practical or industry experience in the field of human computer interaction, including implementation of computer-based systems and software for providing haptic feedback effects to a user and determining the position and/or orientation of

a device used by a user (such as a device worn on the human body). (Cooperstock, ¶¶12-13.) A person could also have qualified as an ordinarily skilled artisan with more formal education and less practical or industry experience, or vice versa. (*Id.*)

B. Specification Overview

The '217 patent states that it “relates to haptically enhanced interactivity with interactive content being conveyed to a user by a content output appliance, wherein the content output appliance is under control of one or more processors that control the output of the interactive content based on one or more position parameters of a peripheral being manipulated by the user.” ('217, 1:17-23.)

The “Background” of the '217 patent acknowledges the existence of systems in the prior art in which “[u]sers may interact with virtual objects within a virtual environment in a number of manners,” in which users can also “manipulate a physical object in the real world in order to interact with a virtual object.” ('217, 1:27-30.) The '217 patent states that such interactions “may involve augmented reality technology” and that “visual and/or audio feedback may provide a sense of interaction with virtual objects to users.” ('217, 1:40-42.)

The patent goes on to describe “a system configured to present interactive content to a user that is manipulating a peripheral.” ('217, 1:46-48.) The disclosed system may include a “haptics module” that may be “configured to determine haptic

feedback to be provided to the user,” where the haptic feedback may be determined based on an “identification of the peripheral” and “one or more position parameters” that are “related to the position of the peripheral.” (’217, 1:48-64.) The ’217 patent explains that “[h]aptics may include tactile and/or kinesthetic (force) feedback technology that takes advantage of a user’s sense of touch by applying forces, vibrations, motions, and/or other touch feedback to the user.” (’217, 2:67-3:3.)

V. CLAIM CONSTRUCTION

No claim construction rulings have issued in the pending litigation. Claim constructions have been proposed by Petitioner and/or Patent Owner for the term “**real space**.” (EX1011, p.002.) Petitioner nevertheless does not believe any term of the ’217 patent requires express construction at this time because, as shown below, the claims are obvious under the constructions proposed by both parties in the pending litigation, or any other reasonable construction. Petitioner reserves its right to respond to any new claim construction arguments Patent Owner may make.

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE.

A. Overview of the Grounds of Unpatentability

The challenged claims attempt to lay claim to well-known interactive content techniques for providing haptic feedback to a user based on the position and identification of a peripheral in space. The challenged claims are disclosed and rendered obvious by **Nogami** (EX1003). As discussed in detail below, Nogami

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describes a system remarkably similar to the one later described in the '217 patent, in which a user wearing a head-mounted display can interact with virtual objects in a virtual space, and receive haptic feedback based on the position of the head-mounted display and the virtual objects with which the user is interacting.

Petitioner has cited additional references largely for ancillary features. **Phelps** (EX1004) is cited in **Ground 1** for limitations in the independent claims relating to establishing a “**communications pathway**,” which are obvious based on well-known techniques disclosed in Phelps about software used by conventional personal computers (PCs) to communicate with peripheral devices. **Kotake** (EX1005) is cited in **Ground 2** solely for dependent claims 11 and 19.

All of the prior art references cited in **Ground 1** and **Ground 2** qualify as prior art to the '217 patent under at least 35 U.S.C. § 102(b) (pre-AIA) because they were published more than one year before the earliest application filing date for the '217 patent. Nogami is an analogous reference in the same field as the '217 patent and would have been reasonably pertinent to a number of problems facing the '217 patent inventors. (Cooperstock, ¶39.) Nogami's teachings involve known image processing and computer graphics techniques that could have been implemented using conventional programming techniques, with at least a reasonable expectation of success. (*Id.*) Nogami also describes several numbered “exemplary

embodiments” with respect to its system. (Nogami, *e.g.*, ¶¶0046, 0202, 0214, 0233, 0240, 0252, 0262, 0268, 0275, 0278, 0284.) Nogami’s separately-numbered “embodiments” merely describe additional features that could have been incorporated into Nogami’s system rather than separate systems. (Cooperstock, ¶40.) Nogami states that each of his embodiments “can be used in combination with each other where appropriate.” (Nogami, ¶0283.) It would have been obvious to include and/or combine the features described in Nogami’s variously numbered embodiments. (Cooperstock, ¶40.) *See also Boston Scientific Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009) (“Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness.”).

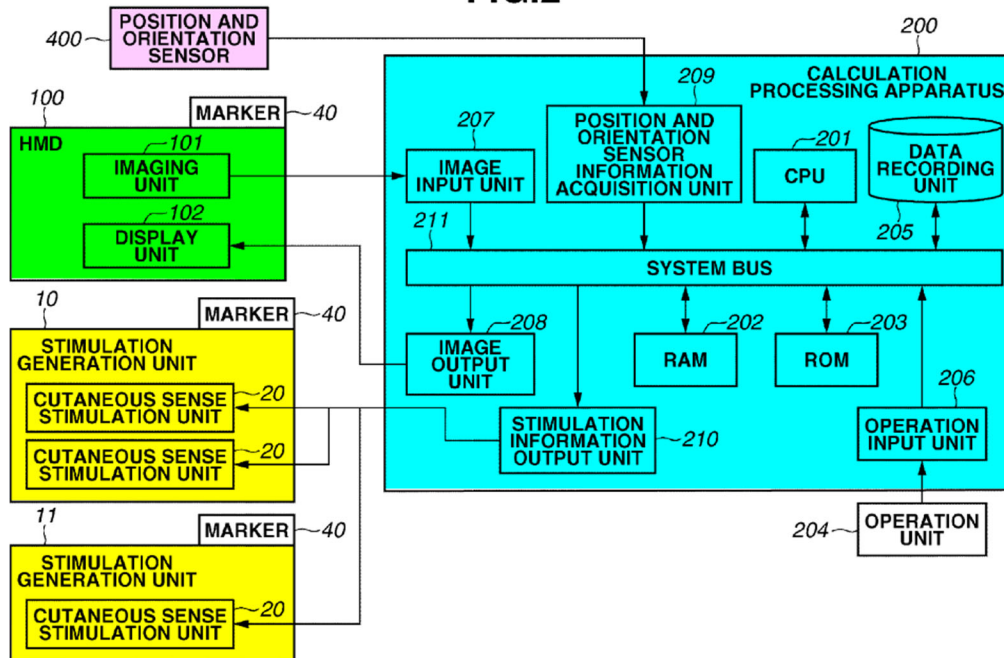
B. Ground 1: Claims 1-4, 8, 10-11, and 17-19 Are Obvious Over Nogami in view of Phelps.

1. Independent Claim 1

The preamble simply recites, “[a] **system comprising....**”

Nogami discloses a “**system**” that comprises various components shown in Figures 1 and 2 (reproduced below). Figure 2 of Nogami provides a block diagram of the system and these components (and respective subcomponents):

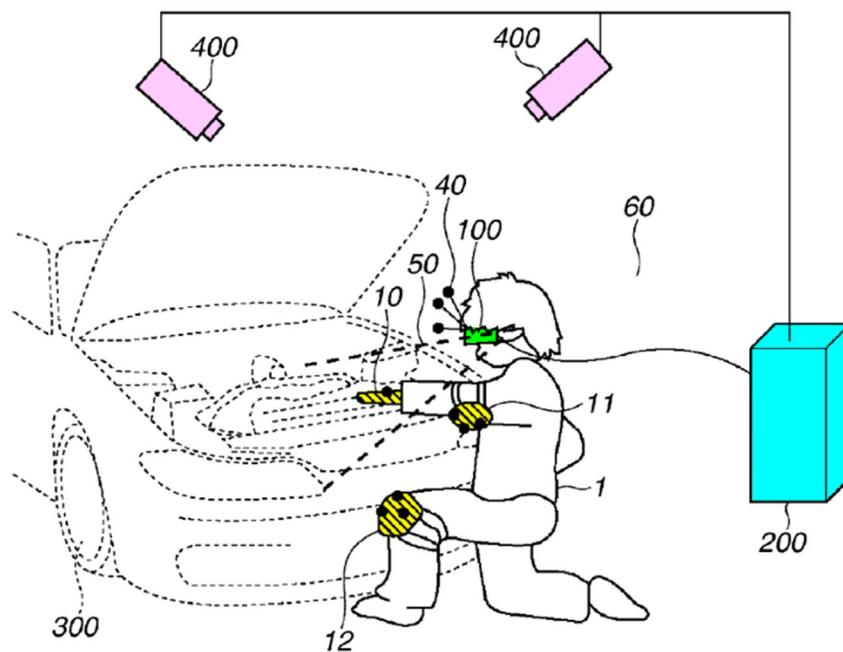
FIG.2



(Nogami, Fig. 2 (highlighting added).) Figure 2 above shows **stimulation generation units 10 and 11** mounted on the body of the user and **head-mounted display (HMD) 100** mounted on the user's head. (Nogami, ¶0049.) Figure 2 also shows **position and orientation sensor 400**, and **calculation processing apparatus 200**.

Figure 1 of Nogami shows an exemplary embodiment of the system including these components in use by a user:

FIG.1



(Nogami, Fig. 1 (highlighting added); *see also id.*, ¶¶0046-0059 (describing components of Figure 1).) Figure 1 shows stimulation generation units 10, 11, and 12 worn on the user's hand, elbow and knee, respectively, and HMD 100 worn on the user's head. (Nogami, ¶¶0049, 0051.)

Figure 1 also depicts position and orientation sensor 400, in this case in the form of a camera physically apart from HMD 100. (*See, e.g.*, Nogami, ¶0074.) In this example, sensor 400 acquires position and orientation information for HMD 100 by identifying a physical marker 40 attached to HMD 100. (*Id.*) Nogami discloses an alternative embodiment in which the position and orientation sensor takes the

form of a magnetic sensor included as part of **HMD 100**. (Nogami, ¶0077.)

Finally, Figures 1 and 2 show **calculation processing apparatus 200**. As shown in Figure 2 above, it includes a number of components including CPU **201**, RAM **202** and ROM **203**, data recording unit **205**, among others. (Nogami, ¶¶83-86.) “The calculation processing apparatus **200** includes a general-purpose personal computer (PC), for example.” (Nogami, ¶0082.) As explained below, Nogami’s system, which includes the components described above, discloses and renders obvious each claim limitation.

- (a) **“a manipulatable input device movable through real space in at least three degrees of freedom, the manipulatable input device incorporating a haptic output device;” (Limitation 1[a])**

Nogami discloses **“a manipulatable input device”** in the form of stimulation generation unit **10**, which is a “glove-like” unit “mounted on the hand of the user,” as illustrated in Figures 1 and 3:

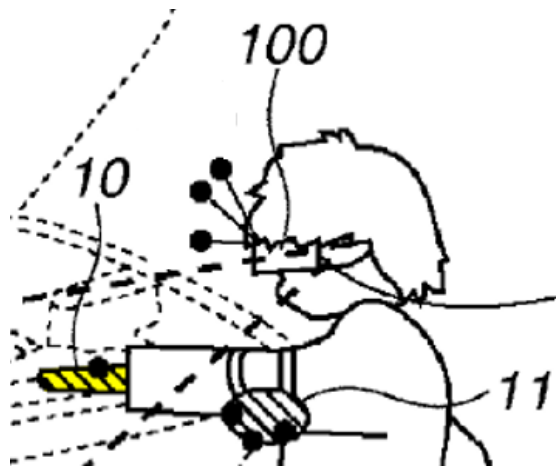
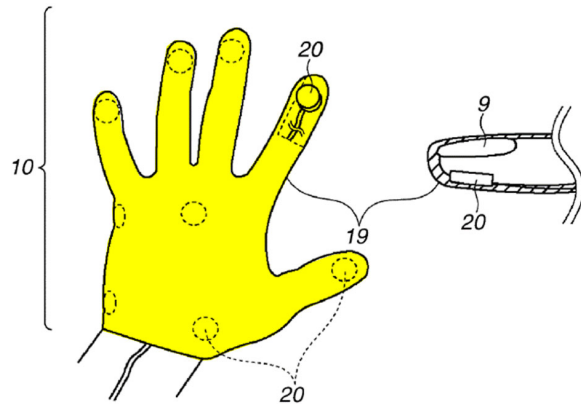


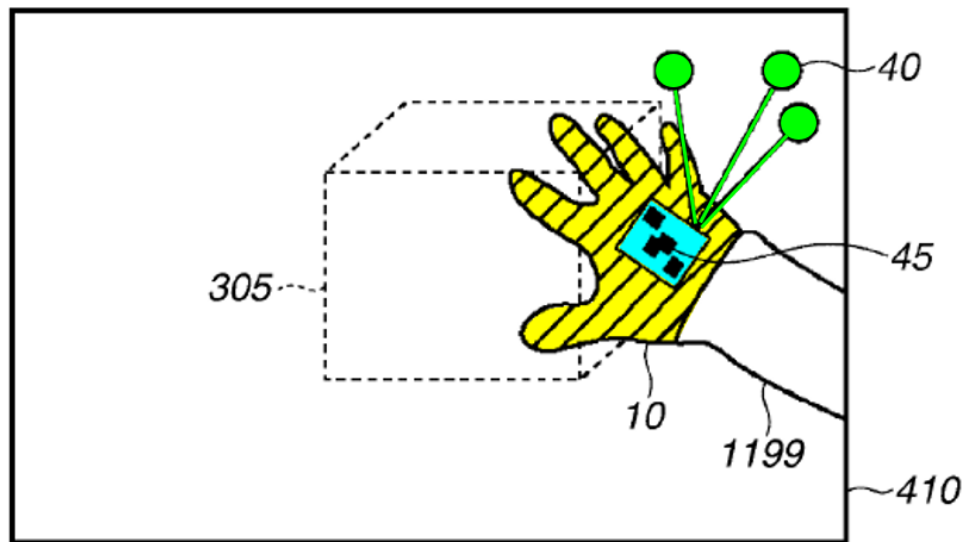
FIG.3



(Nogami, Fig. 1 (excerpt), Fig. 3 (highlighting added to both); *see also id.*, Fig. 2, ¶¶0049, 0051-0052, 0060-0061.)

Stimulation generation unit **10** in Nogami qualifies as an “**input device**.” This is because it enables input of information in at least two categories in response to user action: (1) device position and orientation information (based on location and movement of the user’s hand), as well as (2) device identification information (based on information on the stimulation generation unit worn by the user). (Cooperstock, ¶64.) First, with respect to device position and orientation information, Figure 11 depicts stimulation generation unit **10** that includes **marker 40** and **bar code 45**:

FIG.11



(Nogami, Fig. 11 (highlighting added); *see also id.*, ¶¶0204-0213 (describing Figure 11).) **Marker 40** is used to provide position and orientation information to the system based on the location and position of stimulation generation unit **10**. (Cooperstock, ¶64.) More specifically, **marker 40** is “made of a retroreflective material” that can be detected by an infrared camera of position and orientation sensors **400**. (Nogami, ¶0074.) In another embodiment, position and orientation information is provided by a magnetic receiver included in the stimulation generation unit itself. (Nogami, ¶¶0077-0078.) Under either embodiment, position and orientation information is input to the calculation processing apparatus **200** based on the movement, position, and orientation of stimulation generation unit **10** worn by the user. (Nogami, ¶¶0082 (“In the present exemplary embodiment, the

position and orientation information about... the stimulation generation units **10**, **11**, and **12** acquired by the position and orientation sensor **400** are sent to the calculation processing apparatus **200**.”), 0108 (describing Step **S4002** of Figure 4).) For this reason, stimulation generation unit **10** qualifies as an “**input device**,” as claimed.

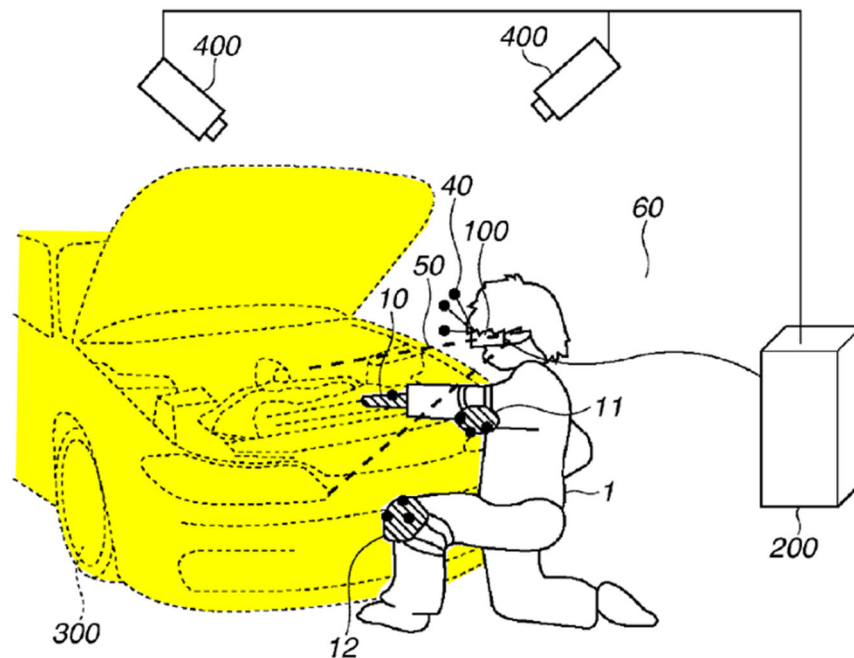
Although not necessary to qualify as a claimed “**input device**,” stimulation generation unit **10** also facilitates input of identification information. As noted above, stimulation generation unit **10** also includes **bar code 45**, which is a “two-dimensional bar code **45** [that] indicates ID information (e.g., an ID) unique to the stimulation generation unit **10**.” (Nogami, ¶0206.) Depending on the position and orientation of stimulation generation unit **10** in response to user input, bar code **45** may be captured by imaging unit **101** of the user’s HMD **100**, enabling the system to determine whether stimulation generation unit **10** is within the user’s visual field. (Nogami, ¶0208; *see also id.*, ¶¶0209-0210, 0052-0054 (describing real space image captured by imaging unit **101** of HMD **100**)).) This provides a second way in which stimulation generation unit **10** qualifies as an “**input device**,” as claimed.

Stimulation generation unit **10** is also a “**manipulatable input device**” because, for example, the user can move or manipulate it, resulting in inputs into the system. For example, as discussed above, the position and orientation information and bar code **45** information received by the system depend on how the user has

moved or manipulated stimulation generation unit **10**. (Nogami, ¶¶0073-0082 (describing acquiring position and orientation information of stimulation generation units), 0080 (“[I]t is useful to acquire the position and orientation information about the stimulation generation units **10**, **11**, and **12** using a publicly known motion capture method.”).) This manipulation of stimulation generation unit **10**, as explained in detail below, includes “**mov[ing] through real space in at least three degrees of freedom.**” (Cooperstock, ¶¶66, 69-71.)

The manipulability of stimulation generation unit **10** is further demonstrated by Nogami’s disclosures of how the user can interact with virtual objects by making virtual contact with them. For example, Figure 1 illustrates a user interacting with a virtual object **300** highlighted in yellow below:

FIG.1



(Nogami, Fig. 1 (highlighting added).) User **1** as shown in Figure 1 is wearing stimulation generation unit **10** on their hand, and is making virtual contact with virtual object **300**. (Nogami, ¶0102 (“Referring to FIG. 1, in the attention range **50**, a virtual contact occurs between the region (hand) of the user, on which the stimulation generation unit **10** is mounted, and the virtual object **300**.”).) In this example, “virtual object **300** is a virtually expressed imitation image of an automobile in an actual size.” (Nogami, ¶0050.) This further confirms that stimulation generation unit **10** is a “**manipulatable**” user input device because the user can move and manipulate it to cause virtual contact with a background virtual

object to occur. (*See also* Nogami, Fig. 6, ¶¶0140, 0148 (describing another example in which virtual contact is made with background virtual object); Cooperstock, ¶67.)

Nogami's stimulation generation unit **10** is also consistent with the ordinary understanding of the term "**input device**" as well as the '217 patent's description of "**manipulatable input device.**" The term "**input device**" in computer science generally refers to a peripheral device that allows the user to provide input to a computer system, such as a keyboard, mouse, joystick, stylus, among others. (Cooperstock, ¶68 (citing *Microsoft Computer Dictionary* (5th ed. 2002) (EX1007), p.0016).) Glove-like input devices were also well-known before the '217 patent. (Cooperstock, ¶64 n.1.) Turning back to stimulation generation unit **10**, it allows input of information relating to position and orientation, as well as device identification, to the computer system as discussed. (Cooperstock, ¶68.) Similarly, the written description of the '217 patent describes a manipulatable input device as a peripheral that "can be manipulated by a user to interact with interactive content. Such manipulation of the peripheral **102** may include translating, rotating, deforming, and/or otherwise moving the peripheral **102.**" ('217, 3:20-25; *see also id.*, 2:57-59.) This description tracks the functionality of stimulation generation unit **10** in Nogami, which can be manipulated by a user (for example, to interact with various virtual objects by making virtual contact).

Stimulation generation unit **10** (“**manipulatable input device**”) is also “**movable through real space in at least three degrees of freedom.**” The concept of “degrees of freedom” is not expressly described in the ’217 patent but was well known to skilled artisans as referring to any of the directions in which independent motion can occur. (Cooperstock, ¶69.) For example, independent motion in the x- and y-planes would be an example of motion in two degrees of freedom. Additional independent motion in the z-plane – *i.e.*, motion in a 3-dimensional space – provides an example of motion in three degrees of freedom. (*Id.*)

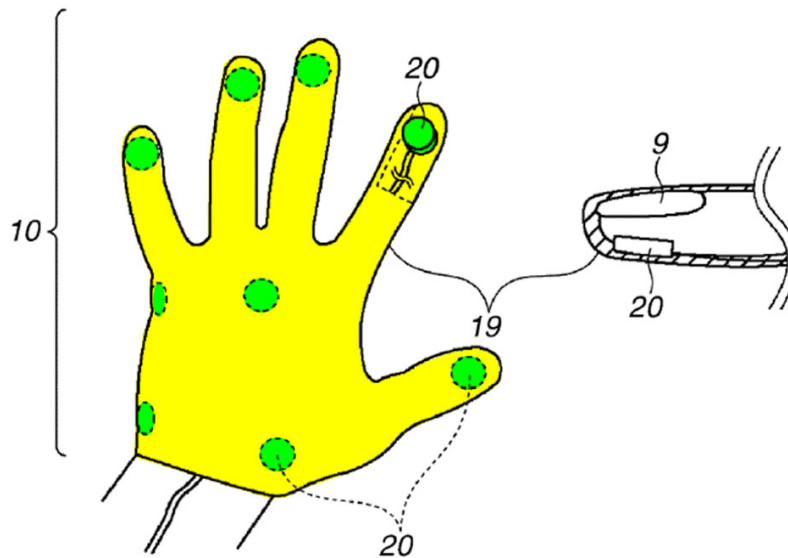
Stimulation generation unit **10** is movable by the user through real space in at least three degrees of freedom. (Cooperstock, ¶70.) This is because stimulation generation unit **10**, which is mounted on the user’s hand, can move vertically, horizontally, and forward/backward in space based on movement of the user’s hand, as illustrated in Figures 1, 6 and 11 of Nogami, for example. (Nogami, Figs. 1, 6 & 11.) Nogami itself confirms that the position of a stimulation generation unit can be tracked in three degrees of freedom, *i.e.*, along the x, y, and z axes. (Nogami, ¶0078 (sensor system can use a “sensor coordinate system” that has an origin point denoting the position of a transmitter and “an x-axis, a y-axis, and a z-axis orthogonal to one another at the origin point”).) Nogami also repeatedly refers to a user interacting in a “space” or “volume,” which an ordinarily skilled artisan would

have understood as referring to three-dimensional space. (Cooperstock, ¶70 (citing Nogami, *e.g.*, ¶¶0004, 0005, 0045, 0049, 0113, 0144, 0149).)

As explained in **Part V**, the parties in the pending litigation have proposed competing constructions of “**real space**,” but Nogami easily satisfies either construction. Petitioner has asserted that “**real space**” means “*a three-dimensional area in the real world*,” while Patent Owner contends that it should be given is “plain and ordinary meaning,” and alternatively, “*the three-dimensional real world user surroundings*.” (EX1011, p.002.) Nogami satisfies both constructions because, as explained, stimulation generation unit **10** is movable in three degrees of freedom within real and three-dimensional user surroundings. (Cooperstock, ¶71.)

Finally, stimulation generation unit **10** (“**manipulatable input device**”) also “**incorporat[es] a haptic output device**,” because it includes one or more **cutaneous sense stimulation units 20**. This is shown in Figure 3:

FIG.3



(Nogami, Fig. 3 (highlighting added); *see also id.*, ¶¶0061-0062 (describing cutaneous sense stimulation units).)

The one or more **cutaneous sense stimulation units 20** incorporated within stimulation generation unit **10** (and any associated electronics within a stimulation generation unit enabling its operation) thus discloses a “**haptic output device.**” (Cooperstock, ¶72.) This is because cutaneous sense stimulation units **20** express tactile sense information to the user. (Nogami, ¶¶0013 (“A device that expresses tactile sense information is generally called a ‘haptic device’ or a ‘haptic display’. Such a ‘haptic device’ or a ‘haptic display’ includes a force feedback providing apparatus that expresses a reaction from a virtual object and a cutaneous sense providing apparatus (tactile display) that provides a stimulation to a cutaneous sense

of a user.”), 0061-0071 (describing stimulation generation unit and cutaneous sense stimulation via vibration and other techniques).)¹

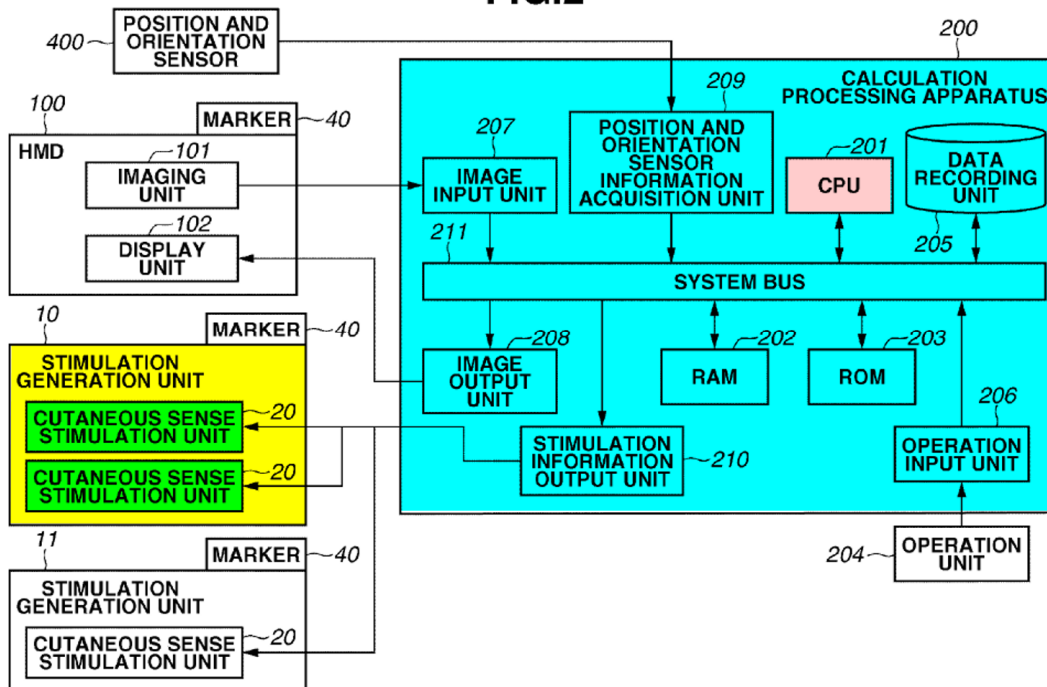
This is consistent with the description of “haptics” in the ’217 patent and how that term was commonly understood. (Cooperstock, ¶72 (citing ’217, 2:67-3:3).) Moreover, the exemplary cutaneous sense stimulation units described in Nogami, including “vibration motor,” “voice-coil type device,” and other “actuators,” are consistent with examples of “**haptic output devices**” described in the ’217 patent. (Nogami, ¶¶0067-0069; ’217, 4:50-57 (“electronic sound transducer,” “actuator”), 7:60-8:1 (“electric motor with an unbalanced mass on its driveshaft”); Cooperstock, ¶72.)

(b) “a processor in communication with the haptic output device;” (Limitation 1[b])

Nogami discloses “a processor,” *i.e.*, central processing unit (CPU) 201 within calculation processing apparatus 200, as shown in Figure 2:

¹ Except as otherwise noted, all underlining and other emphasis added to quotations was added by Petitioner.

FIG.2



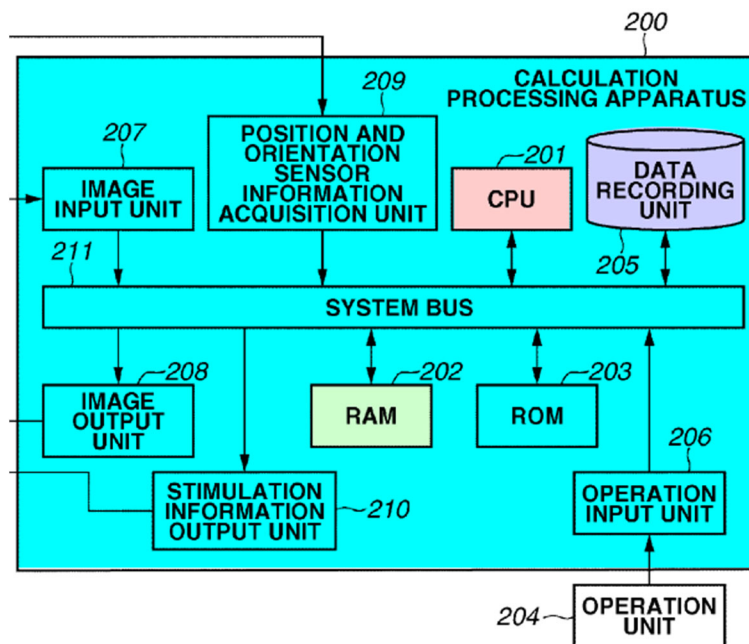
(Nogami, Fig. 2 (highlighting added); *see also id.*, ¶¶0083.)

CPU 201 is also “in communication with the haptic output device,” *i.e.*, the one or more cutaneous sense stimulation unit 20 within stimulation generation unit 10. As shown above in Figure 2, CPU 201 communicates with each cutaneous sense stimulation unit 20 via system bus 211 and stimulation information output unit 210. (*E.g.*, Nogami, ¶¶0095 (“The stimulation information output unit 210 functions as an interface for connecting the cutaneous sense stimulation unit 20 to the calculation processing apparatus 200. The operation setting information generated by the calculation processing apparatus 200 is output to a specified cutaneous sense stimulation unit 20 via the stimulation information output unit 210.”), 0096 (“The

above-described components of the calculation processing apparatus 200 are connected to a system bus 211.”), 0123 (“In step S4007, the CPU 201 outputs, via the stimulation information output unit 210, the operation setting information generated in step S4006 to the stimulation generation unit (in the present exemplary embodiment, the cutaneous sense stimulation unit 20)....”).)

- (c) “a memory on which instructions executable by the processor are stored for causing the processor to:”
(Limitation 1[c])

The claimed “memory” is also contained within calculation processing apparatus 200 of Nogami, shown in Figure 2:



(Nogami, Fig. 2 (excerpt; highlighting added); *see also id.*, ¶¶0088-0090.) The “memory” in Nogami can correspond to either data recording unit 205 and random

access memory (RAM) **202**, or both. (Cooperstock, ¶¶75-76.) Data recording unit **205** is “a mass storage device, such as a hard disk drive (HDD).” (Nogami, ¶0088.)

A skilled artisan would have understood and found it obvious that data recording unit **205** and/or RAM **202** is a memory on which “instructions executable by the processor [*i.e.*, CPU **201**] are stored for causing the processor to” perform various operations, including the functions recited in the claim. For example, data recording unit **205** stores “an operating system (OS) and a program and data” used by the CPU **201**. (Nogami, ¶0088.) That program “includes a program for executing each processing according to a flow of processing to be executed by the CPU **201**.” (Nogami, ¶0089.) Data recording unit **205** also “stores publicly known information and information that a person skilled in the art can easily arrive at using in performing the following processing.” (Nogami, ¶0090.) “The program and the data stored in the data recording unit **205** are loaded therefrom to the RAM **202** under the control of the CPU **201**.” (Nogami, ¶0090.) “The CPU **201** uses the program and data loaded on the RAM **202** to perform each [sic] processing.” (Nogami, ¶0091; *see also id.*, ¶0083 (“[E]ach of the following processing operations performed by the calculation processing apparatus **200** is performed with the CPU **201** as the main unit of performing the processing.”).) Nogami therefore discloses and renders obvious a memory storing “instructions executable by the processor,” *i.e.*

software instructions executed by CPU 201 that cause it to perform and carry out each claimed function described below. (Cooperstock, ¶¶77-78, 80, 82, 84, 87, 90, 99-100, 106.)

- (d) **“receive one or more sensor signals indicating a position of the manipulatable input device in the at least three degrees of freedom and an identification of the manipulatable input device;” (Limitation 1[d])**

Limitation 1[d] requires receipt of **“one or more sensor signals”** indicating:

- (1) **“a position of the manipulatable input device in the at least three degrees of freedom”** and (2) **“an identification of the manipulatable input device.”**

Petitioner will separately address these below.

- (1) **“... a position of the manipulatable input device in the at least three degrees of freedom”**

CPU 201 (**“processor”**) of Nogami **“receives one or more sensor signals indicating the position of the manipulatable input device,”** *i.e.*, stimulation generation unit 10, **“in the at least three degrees of freedom.”** As discussed below, the sensor signals take the form of signals received by CPU 201 from position and orientation information sensor 400 in Nogami.

As discussed for limitation 1[a], stimulation generation unit 10 includes one or more markers 40 that are tracked by position and orientation sensor 400 to acquire position and orientation information, as Nogami explains:

[O]ne or more marker(s) 40 are provided to each of the stimulation

generation units **10**, **11**, and **12** and the HMD **100**. A position and orientation sensor **400** acquires position and orientation information indicating the position and orientation of the marker **40**. The position and orientation information about the marker **40** acquired by the position and orientation sensor **400** and a real space image obtained via the HMD **100** are input to a calculation processing apparatus (information-processing apparatus) **200**.

(Nogami, ¶0052; *see also id.*, ¶0073.)

And in another embodiment, as discussed above, position and orientation information is provided by a magnetic receiver included in the stimulation generation unit. (Nogami, ¶¶0077-0078.) As discussed above for limitation 1[a], under either embodiment, this position and orientation information indicates a position “**in the at least three degrees of freedom**” in the real space within which the stimulation generation unit **10** operates – including vertically, horizontally, and forward/backward in space. (Cooperstock, ¶¶67, 69-71, 81.)

Nogami discloses that CPU **201** receives this position and orientation information, explaining that “CPU **201** acquires ... position and orientation information about the stimulation generation units **10**, **11**, and **12** sent from the position and orientation sensor **400** via the position and orientation sensor information acquisition unit **209** and stores the acquired information on the RAM **202**.” (Nogami, ¶0108.) An ordinarily skilled artisan would have understood and

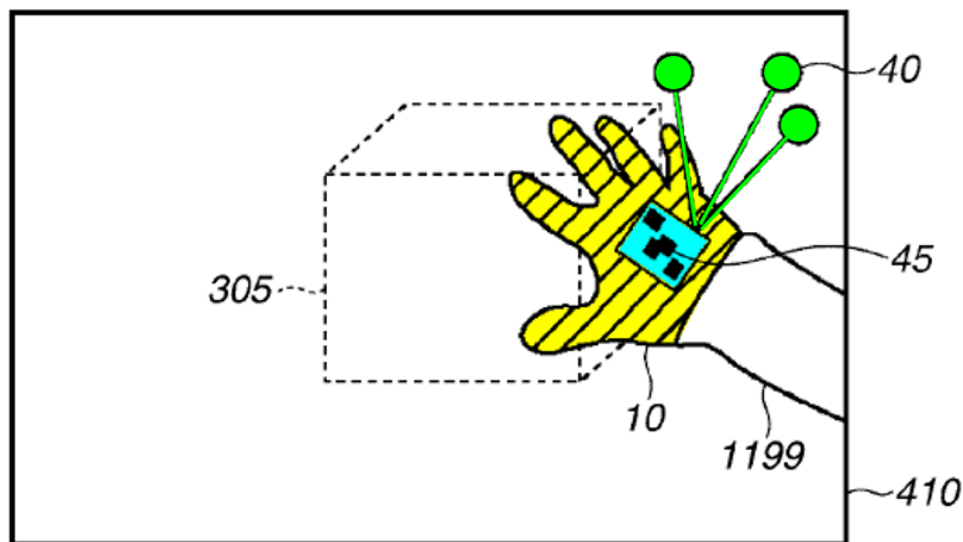
found it obvious that the sensor information in Nogami, under both embodiments of the position and orientation sensor, would have been received by CPU **201** in the form of one or more sensor “**signals.**” (Cooperstock, ¶¶82-83.)

(2) “... and an identification of the manipulatable input device”

Nogami’s CPU **201** (“processor”) also “receives one or more sensor signals... indicating an identification of the manipulatable input device,” *i.e.*, an identification of stimulation generation unit **10**. The sensor signals here take the form of signals received by CPU **201** from imaging unit **101** of HMD **100**, the signals indicating **bar code 45** which identifies stimulation generation unit **10**.

This is illustrated in Figure 11:

FIG.11



(Nogami, Fig. 11 (highlighting added).) Nogami explains that “[t]he two-dimensional bar code **45** indicates ID information (e.g., an ID) unique to the stimulation generation unit **10**.” (Nogami, ¶0206; *see also id.*, ¶¶0204-0213 (describing Figure 11).) As noted previously, imaging unit **101** of HMD **100** can capture a real space image **410** that includes **bar code 45**:

In the present exemplary embodiment, when the stimulation generation unit **10** is included in the real space image **410** (located within the real space image **410**), the CPU **201** determines that the stimulation generation unit **10** is located within the attention range. More specifically, if the two-dimensional bar code **45** is detected in the real space image **410** and the two-dimensional bar code **45** is successfully recognized, then the CPU **201** determines that a stimulation generation unit **10** indicated by the two-dimensional bar code **45** and identified by the recognition is located within the attention range.

(Nogami, ¶0208; *see also id.*, ¶¶0209-0210, 0052-0054 (describing real space image captured by imaging unit **101** of HMD **100**).) CPU **201** also processes the real space image **410** to recognize **bar code 45**. (Nogami, ¶0208.)

A real space image that includes **bar code 45** is therefore an image “**indicating an identification of**” stimulation generation unit **10** (“**the manipulatable input device**”) because it includes information indicating the unique identity of stimulation generation unit **10**. (Nogami, ¶0206 (“The two-dimensional bar code **45** indicates

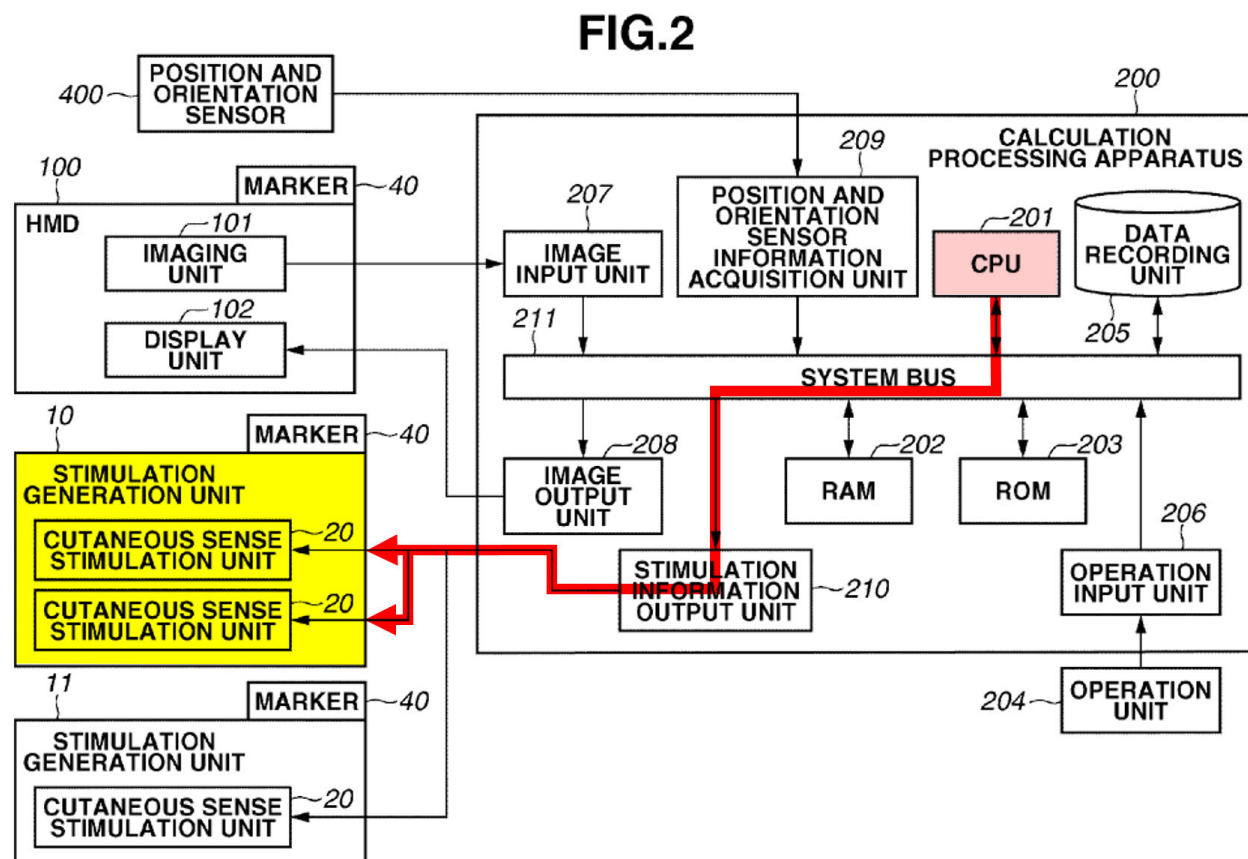
ID information (e.g., an ID) unique to the stimulation generation unit 10.”).)

A skilled artisan would have regarded imaging unit **101** as a “**sensor.**” Imaging unit **101** “captures a moving image of the real space” (Nogami, ¶0054), like an ordinary digital camera. (Cooperstock, ¶85.) Imaging unit **101** thus comprises a “**sensor**” because it detects light in order to record image data to send to CPU **201**. (Cooperstock, ¶85.) The ’217 patent expressly identifies imaging devices as examples of a sensor. (’217, 5:1-4, 5:12-13.) A skilled artisan would also have understood and found it obvious that the real space image would have been received by CPU **201** as one or more sensor “**signals.**” (Cooperstock, ¶86.)

(e) “**establish a communication pathway between the manipulatable input device and the processor;**”
(Limitation 1[e])

An ordinarily skilled artisan would have understood and found it obvious that Nogami’s CPU **201** executes instructions to “**establish a communication pathway between the manipulatable input device,**” *i.e.*, stimulation generation unit **10**, “**and the processor,**” *i.e.*, CPU **201**. (Cooperstock, ¶87.) As demonstrated below, limitation 1[e] describes a routine and conventional step in any computer-based system that can allow a peripheral to communicate with the CPU. CPU **201** in Nogami “**establish[es] a communication pathway**” by configuring the system to direct information from CPU **201** to stimulation generation unit **10**. (*Id.*)

Figure 2 of below illustrates a communication link (indicated in **red**) between CPU 201 and stimulation generation unit 10:



(Nogami, Fig. 2 (highlighting added); Cooperstock, ¶88.)

Figure 2 shows a communication link (in **red**) between CPU 201 and stimulation generation unit 10 that includes system bus 211 between CPU 201 and stimulation information output unit 210, which in turn communicates with stimulation generation unit 10. (Nogami, *e.g.*, ¶¶0095 (“The stimulation information output unit 210 functions as an interface for connecting the cutaneous sense

stimulation unit **20** [of stimulation generation unit **10**] to the calculation processing apparatus **200**.”), 0096 (“The above-described components of the calculation processing apparatus **200** are connected to a system bus **211**.”).)

It would have been obvious that software executed by CPU **201** “**establish[es] a communication pathway**” between **stimulation generation unit 10** and **CPU 201**. (Cooperstock, ¶90.) For example, as explained in more detail below, **CPU 201** is capable of transmitting operation setting information to **stimulation generation unit 10**. (Nogami, ¶0123.) It would have been obvious that such functionality would have required that a communication pathway have been established at least between **stimulation generation unit 10** by **CPU 201**, otherwise they could not communicate in the manner described in Nogami. (Cooperstock, ¶90.)

Petitioner notes that limitation 1[f], addressed below, recites the ability to “**determine a feedback parameter**,” but states that this occurs “**after establishing the communication pathway**” recited in this limitation 1[e]. This sequence does not present a non-obvious difference from the prior art.

Nogami discloses the ability to initialize calculation processing apparatus **200** as part of its initial setup (Step **S4001** in Figure 4), before the other steps in Nogami are performed. (Nogami, ¶0107 (Step **S4001**); Fig. 4.) It would have been obvious that the claimed establishment of a communication pathway would have occurred

before, or as part of, initialization step S4001 in Nogami. (Cooperstock, ¶¶91-96.)

For example, Nogami explains that calculation processing apparatus 200 can include “a general-purpose personal computer (PC), for example.” (Nogami, ¶0082.) **Phelps** describes the well-known and standard process performed by conventional personal computers (PCs), known as a power-on self-test (POST), in which the various hardware components in the system are checked when the PC is turned on. (Phelps, ¶0002.) This process would have been familiar not only to skilled artisans, but laypersons who had ever turned on a PC and observed the familiar POST process. (Cooperstock, ¶92.) Phelps explains that, as part of this process, software known as the basic input output system (BIOS) is loaded:

Part of performing the POST involves loading the basic input and output system (BIOS) code into memory. A computer system requires BIOS to control the basic hardware operations, such as interactions with disk drives, hard drives, the keyboard, and other peripheral devices. After performing the POST, the computer typically loads an operating system (OS).

(Phelps, ¶0002.) The BIOS, in turn, is software or instructions “used by a processor of a computer to identify, initialize, allocate and manage other system hardware.”

(Phelps, ¶0003; *see also Microsoft Computer Dictionary* (5th ed. 2002) (EX1007), p.005 (“**BIOS** *n.* Acronym for **b**asic **i**nput/**o**utput system. On PC-compatible computers, the set of essential software routines that tests hardware at startup, starts

the operating system, and supports the transfer of data among hardware devices, including the date and time.”) (bold and italics in original).) “By providing a set of low-level routines the BIOS enables the OS to interface with different hardware devices while in operation, thus facilitating the operation of various software applications.” (Phelps, ¶0003.)

The disclosures from Phelps cited above come from its Background section, and Phelps goes on to describe more advanced ways of organizing BIOS code for greater modularity. (Phelps, ¶¶0007-0008.) These additional details are not pertinent here because Petitioner has only relied on Phelps for basic POST and BIOS loading techniques for PCs that would have fallen within the general knowledge of a skilled artisan. (Cooperstock, ¶92.)

Rationale and Motivation to Combine (Nogami with Phelps): It would have been obvious to combine Nogami with Phelps, predictably resulting in the system of Nogami in which its CPU **201**, before or as part of its initialization Step **S4001** (Fig. 4), would have established a communication pathway between stimulation generation unit **10** (“**the manipulatable input device**”) and CPU **201** (“**the processor**”). (Cooperstock, ¶94.) Limitation 1[e] does not specify any particular operation that must be performed in order to establish the claimed communication pathway. Under the proposed combination, this would have occurred when CPU

201 performs the power-on self-test (POST) and loads the BIOS program code into memory, as disclosed in Phelps. (Cooperstock, ¶94.) This would, in turn, have enabled CPU **201** in Nogami to communicate with the various hardware components and peripheral devices connected to calculation processing apparatus **200** – including system bus **211**, stimulation information unit **210**, stimulation generation unit **10**, among others. (Phelps, ¶¶0003 (“[T]he BIOS is a collection of instructions... used by a processor of a computer to identify, initialize, allocate and manage other system hardware.”), 0002 (“A computer system requires BIOS to control the basic hardware operations, such as interactions with... peripheral devices.”).) Under the proposed combination, in other words, performing the power-on self-test and loading the BIOS code into memory would have established a communication pathway between at least stimulation generation unit **10** and CPU **201**. (Cooperstock, ¶95; Phelps, ¶¶0003 (“By providing a set of low-level routines the BIOS enables the OS to interface with different hardware devices while in operation, thus facilitating the operation of various software applications.”).)

As noted, limitation 1[f] below recites the step of determining a haptic feedback parameter, which must take place “**after establishing the communication pathway**” of this limitation 1[e]. This is clearly disclosed by and obvious over the proposed combination. As explained above, Phelps confirms that the PC loads the

BIOS into memory before the computer loads even the operating system (OS), which would typically have preceded loading and execution of application software. (Phelps, ¶¶0002-0003; Cooperstock, ¶95.) It would therefore have been obvious that, under the proposed combination, the BIOS code would have been loaded by CPU **201** of Nogami – thus establishing the communication pathway between at least stimulation generation unit **10** and CPU **201** – before any of the software described in Nogami that performs the function of limitation 1[f] of determining a haptic parameter (as described below) could have been executed. (*Id.*)

Nogami and Phelps are analogous references. With respect to Nogami, it is an analogous reference in the same field as the '217 patent of providing interactive content, including a virtual space that includes interactive content with which the user can interact, and in response to which, haptic stimulation can be provided. (Cooperstock, ¶¶39, 96.) Nogami would also have been reasonably pertinent to a number of problems facing the '217 patent inventors. (*Id.*) Phelps is also an analogous reference that would have been reasonably pertinent to problems facing the '217 patent inventors, including understanding how communication pathways are established between a processor and peripheral devices, including basic software used by the PCs to perform this function. (Cooperstock, ¶96; *see also* '217, 3:63-4:4 (“By way of non-limiting example, the digital device **106** may include one or

more of a desktop computer....”).) Moreover, the disclosures from Phelps relied upon above would also have fallen within basic knowledge of an ordinarily skilled artisan, who would have understood the central role of a computer’s BIOS code in establishing communication pathways between the processor and any connected peripheral devices – including stimulation generation unit **10** in Nogami. (Cooperstock, ¶96.)

An ordinarily skilled artisan would have been motivated to combine Nogami and Phelps to better understand the basic operation of the computer on which Nogami would have been implemented. Nogami explains that “[t]he calculation processing apparatus **200** includes a general-purpose personal computer (PC), for example.” (Nogami, ¶0082.) An ordinarily skilled artisan would have been motivated to consult Phelps to better understand the role of the BIOS in facilitating the ability of a conventional PC, such as calculation processing apparatus **200** in Nogami, to communicate with other hardware components and peripheral devices. In fact, loading of the BIOS by a conventional PC would have been such basic knowledge that an ordinarily skilled artisan would have already understood, even if they did not have access to Phelps. (Cooperstock, ¶97.)

A skilled artisan would also have had a reasonable expectation of success, as the loading of the BIOS into memory is a basic function that would have been

already built-into the conventional PC used to implement Nogami. (Cooperstock, ¶97.) A skilled artisan would also have had at least a reasonable expectation of success in carrying out Nogami’s teachings, as they involve known image processing and computer graphics techniques, that could have been implemented using conventional programming techniques. (Cooperstock, ¶39.)

- (f) “after establishing the communication pathway, determine a feedback parameter based at least in part on the position of the manipulatable input device in the at least three degrees of freedom and the identification of the manipulatable input device; and” (Limitation 1[f])

Nogami discloses that CPU 201 “determine[s] a feedback parameter,” through the process by which CPU 201 generates the information used to generate haptic stimulation. Nogami refers to this information as “operation setting information,” which can specify the intensity of haptic stimulation provided to the user. (Nogami, *e.g.*, ¶¶0120 (“In step S4006, the CPU 201 generates operation setting information for controlling an operation of the stimulation generation unit corresponding to the region virtual object contacting the background virtual object.”), 0122 (“[T]he intensity of the stimulation indicated in each operation setting information mutually differs.”), 0123 (“After receiving the operation setting information, the stimulation generation unit operates to generate a stimulation of the intensity indicated by the operation setting information.”); Cooperstock ¶¶100-101.)

The operation setting information in Nogami for haptic feedback intensity qualifies as a **“feedback parameter”** as claimed. The ’217 patent itself expressly identifies haptic feedback intensity as an exemplary feedback parameter. (’217, 8:16-22; Cooperstock, ¶101.)

Limitation 1[f] goes on to recite that the feedback parameter is determined **“based at least in part on”**: (1) **“the position of the manipulatable input device in the at least three degrees of freedom,”** and (2) **“the identification of the manipulatable input device.”** These are separately addressed below.

- (1) **“... a feedback parameter based at least in part on the position of the manipulatable input device in the at least three degrees of freedom”**

Turning first to **position**, Nogami explains that the position of the stimulation generation unit is used (along with orientation) to determine whether the unit is making virtual contact with a background virtual object. For example, Nogami describes a determination unit **“configured to determine whether the virtual object and the stimulation generation unit contact each other based on position and orientation information about the virtual object and the positional information about the stimulation generation unit.”** (Nogami, ¶0027; *see also id.*, ¶¶0109 (“CPU 201 sets the region virtual object corresponding to each stimulation generation unit **according to the position** and orientation of each of the stimulation generation units

10, 11, and 12”), 0117, claim 1 (describing “determination unit”).)

This determination of whether the stimulation generation unit is making virtual contact with a background virtual object is then used to generate the operation setting information. (Nogami, ¶0027 (“generate operation setting information for controlling an operation of the stimulation generation unit according to a result of determination by the determination unit and to output the generated operation setting information to the stimulation generation unit”); *see also id.*, ¶¶0120-0121 (operation setting information generated based on virtual contact), claim 1 (describing “output unit”).) This operation setting information in Nogami, as explained for limitation 1 [g] below, will be used to provide haptic stimulation.

As noted, the position of stimulation generation unit (“**manipulatable input device**”) in real space determines whether virtual contact is being made with a background virtual object. If so, operation setting information will be generated to provide haptic stimulation. (Nogami, ¶¶0120-0123.) Accordingly, the operation setting information (“**feedback parameter**”) is “**based at least in part**” on “**the position of the manipulatable input device in the at least three degrees of freedom,**” as claimed. (Cooperstock, ¶104.)

(2) “... and the identification of the manipulatable input device”

The operation setting information in Nogami can also be influenced by (and

thus be based on) the **identification** of the stimulation generation unit with which virtual contact is made. This can occur in at least two independent ways.

First, Nogami explains that CPU **201** generates operation setting information of different intensities based on whether or not the stimulation generation unit is within the view area of the user's HMD. (*E.g.*, Nogami, ¶0120.) Nogami explains that, in some embodiments, the view area of the HMD is called the “attention range.” (Nogami, ¶¶0101 (“The attention range **50** is a range in which the user **1** can perceive a virtual object with the visual sense and a part thereof.”), 0164 (“[I]t is useful to set the attention range around the central visual field.”).)

Nogami further explains that the haptic feedback intensity can vary based on whether or not the stimulation generation unit (as represented by its corresponding region virtual object) is making virtual contact with a virtual object within the user's attention range. If so, the haptic feedback intensity is lower, because the virtual object is already within the view area of the HMD (attention range of the user). Conversely, if the stimulation generation unit makes making contact outside of the user's attention range, the haptic feedback intensity is higher. (Nogami, ¶0179.)

As Nogami explains:

In step **S4006**, the CPU **201** generates operation setting information for controlling an operation of the stimulation generation unit corresponding to the region virtual object contacting the background

virtual object. The operation setting information can differ according to whether the region virtual object contacting the background virtual object is located within the attention range.

Suppose, for example, that both the region virtual object disposed according to the position and orientation of the stimulation generation unit **10** and the region virtual object disposed according to the position and orientation of the stimulation generation unit **11** contact the background virtual object.

If the region virtual object disposed according to the position and orientation of the stimulation generation unit **10** is located within the attention range and the region virtual object disposed according to the position and orientation of the stimulation generation unit **11** is not located within the attention range, the operation setting information generated for the stimulation generation unit **10** differs from that generated for the stimulation generation unit **11**. That is, the intensity of the stimulation indicated in each operation setting information mutually differs.

(Nogami, ¶¶0120-0122; *see also id.*, ¶0027, claim 1.)

Nogami also discloses that determining the operation setting information described above is based at least in part on “**the identification of the manipulatable input device.**” This is because CPU **201** uses bar code **45** on the stimulation generation unit to determine whether stimulation generation unit is located within the user’s attention range. As explained above for limitation 1[d], the key purpose

of bar code **45** is to allow the system to uniquely identify the stimulation generation unit. (Nogami, *e.g.*, ¶¶0206 (“The two-dimensional bar code **45** indicates ID information (e.g. an ID) unique to the stimulation generation unit **10**.”).) As also discussed earlier, bar code **45** can be captured by HMD **100**’s imaging unit in a real space image. If bar code **45** is recognized in the real space image, then CPU **201** determines that the stimulation generation unit is located within the attention range, and generates corresponding operation setting information (including intensity):

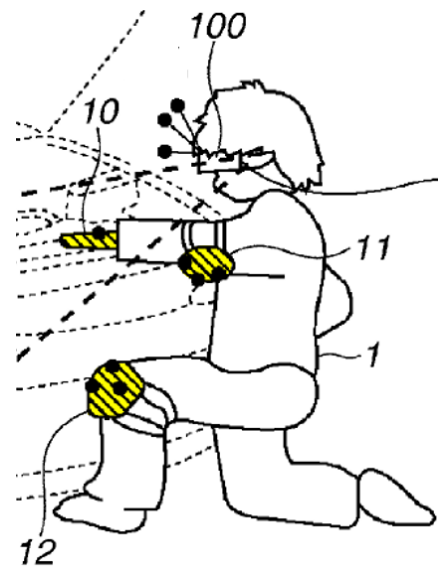
In the present exemplary embodiment, when the stimulation generation unit **10** is included in the real space image **410** (located within the real space image **410**), the CPU **201** determines that the stimulation generation unit **10** is located within the attention range. More specifically, if the two-dimensional bar code **45** is detected in the real space image **410** and the two-dimensional bar code **45** is successfully recognized, then the CPU **201** determines that a stimulation generation unit **10** indicated by the two-dimensional bar code **45** and identified by the recognition is located within the attention range.

In the example illustrated in FIG. **11**, when the two-dimensional bar code **45** is detected and recognized, the CPU **201** can determine that the two-dimensional bar code **45** indicating the stimulation generation unit **10** is located within the real space image **410**. Thus, the CPU **201** sets the operation setting information for the contact within the attention range to the stimulation generation unit **10**.

(Nogami, ¶¶0208-0209; *see also id.*, ¶0202, claim 3.)

Nogami therefore discloses determining operation setting information for haptic feedback intensity (“**feedback parameter**”) “**based at least in part on... the identification of the manipulatable input device.**” This is because the operation setting information may indicate a lower or higher intensity, respectively, based on whether or not stimulation generation unit **10** (based on its bar code identifier) was identified inside the user’s attention range, as discussed. (Nogami, *e.g.*, ¶0179; Cooperstock, ¶107.)

Nogami discloses a second independent way in which the haptic feedback intensity is based at least in part on “**the identification of the manipulatable input device,**” as claimed. In particular, Nogami discloses that stimulation generation units can be worn on various regions of a user’s body, such as the user’s hand, elbow, and knee. (Nogami, ¶0051, Fig. 1 (excerpted at right; highlighting added).) But Nogami identifies an issue when multiple stimulation generation units are worn by a user: the intensity of haptic feedback felt by different regions of the user’s body may be different. (Nogami, ¶¶0279-0280.)



intensity (referred to in Nogami as a “reference intensity”) can be applied based on the location of the stimulation generation unit on the body. (Nogami, ¶¶0280-0281.) Nogami explains that “in the case of mounting a cutaneous sense stimulation unit on different regions of the body of a user, it is useful if each region is previously caused to contact the virtual object and a value at which the user feels the intensity of the stimulation as the same is set as a reference intensity for each region.” (Nogami, ¶0280.) In other words, a different “reference intensity” can be provided for each region on the body where a stimulation generation unit is worn. (Nogami, ¶¶0280-0281.) This “reference intensity” is then used as one of the parameters to determine haptic feedback intensity. (Nogami, ¶0281.)

Nogami does not provide implementation details about how a “reference intensity” value for a region is associated with the stimulation generation unit worn by the user at that region. But an ordinarily skilled artisan would have found this omission immaterial because this detail would have been regarded as a trivial implementation detail. (Cooperstock, ¶111.) It would have been obvious that the stimulation generation unit would have used an identifier associated with the unit in order to identify the appropriate “reference intensity” for the contacted body region. This would have predictably resulted in “**determine[ing] a feedback parameter [haptic feedback intensity] based at least in part on... the identification of the**

manipulatable input device [stimulation generation unit].” (*Id.*)

As fully explained for limitation 1[d] and above, Nogami discloses bar code **45** on the stimulation generation unit that indicates the unique identifier associated with the unit. Although Nogami does not specifically disclose using bar code **45** to assign the appropriate “reference intensity” to the stimulation generation unit, it would have been obvious to use bar code **45** to identify the stimulation generation unit and then use that identification to assign the appropriate reference intensity. (Cooperstock, ¶112.) The key purpose of bar code **45**, as noted, is to allow the system to uniquely identify the stimulation generation unit. (Nogami, *e.g.*, ¶0206.) It would also have been obvious to provide a different bar code for each stimulation generation unit in order to allow CPU **201** to uniquely identify and differentiate the stimulation generation unit making virtual contact, to select the appropriate reference intensity. (Cooperstock, ¶112.) If Nogami did not use an identifier such as bar code **45**, in fact, the system would have been unable to distinguish one stimulation generation unit from another (regardless of region), thus defeating the purpose of Nogami’s region-specific “reference intensity” values. (*Id.*)

* * *

To summarize the discussion of limitation 1[f], therefore, Nogami discloses determining “**a feedback parameter** [*i.e.*, operation setting information indicating

haptic feedback intensity] **based at least in part on the position of the manipulatable input device** [*i.e.*, the position of stimulation generation unit **10** in real space],” as well as “**the identification of the manipulatable input device** [*i.e.*, the identification of stimulation generation unit **10** based on bar code **45**].” This is because, as explained, haptic feedback of an intensity will be triggered if – based on the position of stimulation generation unit **10** – it makes virtual contact with a background virtual object. And the intensity of that haptic feedback may be further varied based on the identification of stimulation generation unit **10**, in two independent ways: (1) by decreasing the intensity if stimulation generation unit **10** is identified as being within the user’s attention or (2) by utilizing a “reference intensity” for the haptic feedback based on the identification of stimulation generation unit **10** which corresponds to the region of the user’s body where the unit is worn. The resulting operation setting information for the haptic feedback intensity (“**a feedback parameter**”) is therefore “**based at least in part**” on **both** the **position** and **identification** of stimulation generation unit **10**. (Cooperstock, ¶113.)

Finally, as fully explained for limitation 1[e] above, it would have been obvious that determining the feedback parameter on Nogami would have taken place “**after establishing the communication pathway**,” as claimed. Moreover, the step of establishing a communication pathway between CPU **201** and stimulation

generation unit **10** need only be performed once. (Cooperstock, ¶114.) Even if one could read Nogami as initially establishing the claimed communication pathway the only after the first time the feedback parameter was determined and haptic feedback was provided, any second or other subsequent determination of the claimed feedback parameter would have occurred *after* that communication pathway had already been established, thus satisfying the sequence in the claim. (*Id.*)

(g) **“transmit a haptic signal to the haptic output device, the haptic signal configured to cause the haptic output device to output a haptic effect according to the feedback parameter.” (Limitation 1[g])**

Petitioner largely addressed the requirements of limitation 1[g] in the analysis of limitation 1[f] above. As explained, Nogami discloses that CPU **201**, after generating the operation setting information (“**feedback parameter**”), transmits a signal containing the operation setting information (“**haptic signal**”) to the cutaneous sense stimulation unit(s) **20** (“**haptic output device**”) of the stimulation generation unit corresponding to the region virtual object that is contacting a background virtual object. (Nogami, ¶¶0123 (“In step S4007, the CPU 201 outputs, via the stimulation information output unit 210, the operation setting information generated in step S4006 to the stimulation generation unit (in the present exemplary embodiment, the cutaneous sense stimulation unit 20) corresponding to the region virtual object contacting the background virtual object.”), 0177-0178 (CPU **201**

outputs operating setting information to appropriate stimulation generation unit), Fig. 3 (illustrating cutaneous sense stimulation unit **20**.) It would have been obvious that the operation setting information transmitted by CPU **201** would have taken the form of a haptic “**signal**,” as claimed. (Cooperstock, ¶116.)

Nogami further discloses that the one or more cutaneous sense stimulation units **20** (“**haptic output device**”) “**output[s] a haptic effect according to the feedback parameter.**” This is because the haptic effect delivered to the user via the one or more cutaneous sense stimulation units will reflect the intensity specified by the feedback parameter. (*E.g.*, Nogami, ¶¶0123 (“After receiving the operation setting information, the stimulation generation unit operates to generate a stimulation of the intensity indicated by the operation setting information.”), 0154.)

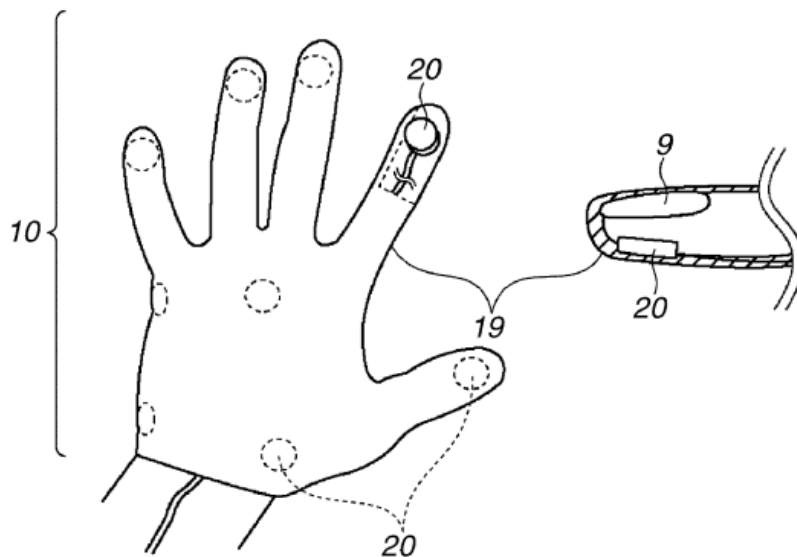
2. **Claim 2: “The system of claim 1, wherein the manipulatable input device comprises an accessory.”**
3. **Claim 3: “The system of claim 2, wherein the manipulatable input device further comprises a base device.”**
4. **Claim 4: “The system of claim 3, wherein the base device comprises the haptic output device.”**
5. **Claim 8: “The system of claim 2, wherein the accessory comprises a wearable accessory or clothing.”**

Because these four claims are closely-related, Petitioner will discuss them together. With respect to claim 2, an “**accessory**” is typically understood as something that can be added to something else to make it more useful, versatile or

attractive. (Cooperstock, ¶118.) The written description of the '217 patent describes an “**accessory**” as “a physical object and/or a physical device configured to be associated with the base device,” where the association can even include “permanently attaching” the accessory to the base device. ('217, 8:45-54.)

Turning first to claim 2, the stimulation generation unit **10** (“**the manipulatable input device**”) in Nogami comprises an “**accessory**” in the form of glove-like main body unit **19**, shown in Figure 3 below:

FIG.3



(Nogami, Fig. 3; *see also id.*, ¶0061 (describing “glove-like shaped main body unit **19**”).) Nogami’s glove-like unit **19** qualifies as “**accessory**” because it makes the cutaneous sense generation units **20** more useful and versatile by providing a simple

and easy way to place them close to the user's body. (Cooperstock, ¶120.)

Moving to claim 3, the “**base device**” corresponds to the one or more cutaneous sense stimulation units **20**, along with marker **40** and/or magnetic receiver, and bar code **45**, all of which are also part of the stimulation generation unit. (Cooperstock, ¶122; (Nogami, ¶0061 (“[I]t is useful if the main body unit **19** has such a configuration that the cutaneous sense stimulation unit **20** closely contacts the human body **9** of the user **1**...”), Fig. 11 (showing bar code **45** and marker **40** configured on glove-like unit **19**), ¶¶0077-0078 (explaining that a magnetic receiver can be included in stimulation generation unit instead of a marker).) This is consistent with the examples of a “**base device**” in the '217 patent, which may “complement the use of the accessory” and may “include one or more of an actuator **208**, a wireless transmitter/receiver **210**, an actuator control **212**, one or more identifying features **214**, and/or other components” but that this list of exemplary components “is not intended to be limiting.” ('217, 7:45-51, 9:20-24.)

Moving to claim 4, “**the base device comprises the haptic output device,**” because the base device includes the one or more cutaneous sense stimulation units **20** (“**haptic output device**”) as discussed. And finally for claim 8, “**the accessory comprises a wearable accessory or clothing,**” because glove-like unit **19** is a wearable accessory or clothing worn on the user's hand.

6. Claim 10: “The system of claim 1, wherein the haptic effect is further based on interactive content.”

As explained for limitations 1[f] and 1[g], Nogami discloses that haptic effects are provided in response to a user making virtual contact with virtual objects. (*E.g.*, Nogami, Fig. 4, ¶¶0108-0123 (describing user’s interaction with virtual objects resulting in haptic feedback).) The ’217 patent describes “**interactive content**” as including, among other things, “a virtual object” that may be output visually and/or haptically to be perceived by a user. (’217, 2:60-64, 4:41-42.)

Nogami’s virtual objects are “**interactive content.**” Nogami explains that “the user **1** can experience a virtual space including a virtual object **300** with both a visual sense and a tactile sense.” (Nogami, ¶0049.) The user can visually interact with a background virtual object (“**interactive content**”) by changing their position relative to the object, thereby changing how the object is displayed to the user. (Nogami, *e.g.*, ¶¶0005 (“In the case of using an HMD in such a conventional system, a user can feel a greater sense of immersion into a virtual space because the virtual space is displayed according to a viewpoint of the user and a direction of a line of sight (visual axis) of the user.”), 0027 (“...generate an image in a virtual space including a virtual object based on position and orientation information about a viewpoint of a user...”), Fig. 6 & 0140-0147 (describing how virtual objects including background virtual objects are generated for display based on current

position and orientation information as well as shape and size of the object).) A user can also interact with the background virtual object by touch, *e.g.*, by experiencing haptic feedback based on the system calculating that a stimulation generation unit, via its corresponding region virtual object, has made contact with the background virtual object. (Nogami, *e.g.*, ¶0097 (“[T]he calculation processing apparatus **200** detects whether the stimulation generation unit **10**, **11**, or **12** contacts a virtual object.”); *see also id.*, ¶¶0098-0103, Fig. 4 (*e.g.*, steps **S4004** – **S4007**), 0117-0123 (describing steps **S4004** – **S4007**).) This can in turn result in a haptic stimulation being generated. (Nogami, ¶¶0122-0123, Fig. 4 (Step **S4006**, **4007**).) Nogami therefore discloses that “**the haptic effect is further based on interactive content**,” as claimed, because haptic effect is delivered based on the user making virtual contact with a virtual object (“**interactive content**”).

7. **Claim 11: “The system of claim 1, further comprising: a position sensor configured to detect the position of the manipulatable input device in the at least three degrees of freedom and transmit a first sensor signal; and an identification sensor configured to identify the manipulatable input device and transmit a second sensor signal.”**

The analysis for limitation 1[d] above largely addressed the first part of claim 11 relating to the claimed “**position sensor**.” As discussed, Nogami discloses that the position and orientation of a stimulation generation unit can be acquired in

various ways, including using position and orientation sensor **400**, and alternatively, using a magnetic receiver mounted on a stimulation generation unit. (*E.g.*, Nogami, ¶¶0073, 0077-0078.) Each of these ways discloses a “**position sensor**” that detects a physical property (*e.g.*, light or electromagnetic radiation) in order to determine position information to send to CPU **201**. (Cooperstock, ¶128.)

And as explained above for limitation 1[d], the position and orientation sensor in Nogami “**detects the position of the manipulatable input device** [stimulation generation unit **10**] **in the at least three degrees of freedom**” and “**transmit[s] a first sensor signal** [position and orientation information conveyed from the position sensor to CPU **201**].” (Nogami, Figs. 1, 6 & 11, ¶¶0004, 0005, 0045, 0049, 0078, 0108 0113, 0144, 0149.) For example, Nogami explains in reference to Figure 4 that “[i]n step **S4002**, the CPU **201** acquires position and orientation information about... the stimulation generation units **10**, **11**, and **12** sent from the position and orientation sensor **400** via the position and orientation sensor information acquisition unit **209** and stores the acquired information on the RAM **202**.” (Nogami, ¶0108.)

Now turning to the remaining aspects of claim 11, Nogami also discloses and renders obvious “**an identification sensor configured to identify the manipulatable input device and transmit a second sensor signal.**” As explained for limitation 1[d], CPU **201** receives a real space image from imaging unit **101** of

HMD **100** that includes bar code **45**. (Nogami, Fig. 11, ¶¶0205-0209.) “The two-dimensional bar code **45** indicates ID information (e.g., an ID) unique to the stimulation generation unit **10**.” (Nogami, ¶0206.) Identification of stimulation generation unit **10** (“**manipulatable input device**”) therefore occurs, as explained previously, when bar code **45** is detected in the real space image. (Nogami, ¶¶0208-0209.) As also explained for claim 1, the functions performed in Nogami may be performed by software executed by CPU **201**. (Nogami, *e.g.*, ¶¶0083, 0284.)

Accordingly, for purposes of claim 11, the “**identification sensor**” in Nogami corresponds to the combination of imaging unit **101** of HMD **100** (which captures a real space image) and CPU **201** along with software that when executed detects bar code **45** to identify stimulation generation unit **10** in the image. (Cooperstock, ¶129.) Nogami explains that the detection of bar code **45** can occur by either “perform[ing] the image processing for the entire real space image **410**,” or performing image processing “for a predetermined area only by masking an area not to be image-processed.” (Nogami, ¶0210.)

A skilled artisan would have understood that this collection of components can qualify as an “**identification sensor**.” (Cooperstock, ¶129.) In fact, inclusion of CPU **201** and software executed by CPU **201** as part of the claimed “**identification sensor**” is consistent with exemplary embodiments in the ’217

patent. For example, Figure 4 of the '217 patent shows a flowchart of method **400** for carrying out the alleged invention, with step **406** corresponding to the function performed by the identification sensor. ('217, Fig. 4, Step **406** (“Identify Peripheral Manipulated by User from Among Plurality of Possible Peripherals.”).) The '217 patent makes clear that the method **400** can be implemented, for example, using a processor executing software. ('217, 11:51-64.) Accordingly, a processor executing software can play a role in performing the functions of the claimed “**identification sensor**,” consistent with the operation of Nogami discussed above.

The identification sensor in claim 11 also has to “**transmit a second sensor signal**.” Nogami explains that CPU **201** “determines that the stimulation generation unit **10** is located within the attention range,” which occurs “if the two-dimensional bar code **45** is detected in the real space image **410** and the two-dimensional bar code **45** is successfully recognized....” (Nogami, ¶0208.) The “**second sensor signal**” in Nogami thus corresponds to a signal sent by CPU **201** and the software identified above, which indicates that bar code **45** corresponding to stimulation generation unit **10** was successfully detected in the real space image. (Nogami, ¶¶0208-0209.) Nogami does not specify internal details about how this software communicates with other portions of the software executed by CPU **201**, but it would have been obvious that the bar code detection software would have caused at least a “**second sensor**

signal” to be transmitted to other portions of the software to notify them that bar code **45** for stimulation generation unit **10** was successfully recognized. (Cooperstock, ¶131; Nogami, ¶0208.) For example, CPU **201** in Nogami takes specific action in direct response to bar code **45** having been recognized, including setting operation setting information for stimulation generation unit **10**. (Nogami, ¶¶0208-0209.)

It would have been obvious that, in order for CPU **201** to take specific action in direct response to bar code **45** having been detected, that the software that detected bar code **45** would have caused some type of signal to be sent indicating that bar code **45** was in fact recognized. (Cooperstock, ¶131.) Claim 11 does not place any restrictions on the format or composition of the “**second sensor signal**,” and a skilled artisan would have understood that the second sensor signal could have been implemented in any number of ways including by providing a variable or value provided to other portions of the software, *e.g.*, as a return value provided from a procedure, a parameter passed into a procedure, or through any number of well-known communication or sharing techniques. (Cooperstock, ¶131.)

Nothing in the '217 patent requires that the “**second sensor signal**” be transmitted externally to another device. In the exemplary embodiment in the '217 patent, in fact, identification sensor **116** transmits the second sensor signal to

processor **112** and/or other software modules within the same device **106**. ('217, Fig. 1 (showing components of digital device **106** including peripheral identification sensor **116** and processor **122**), 5:21-24.)

8. Independent Claim 17

Independent claim 17 is a method claim that recites limitations substantially similar to system claim 1. The proposed combination renders obvious a method that includes each of the steps of claim 17, as shown below.

- (a) “receiving, by a processor, one or more sensor signals indicating a position of a manipulatable input device in at least three degrees of freedom and an identification of the manipulatable input device, wherein the manipulatable input device incorporates a haptic output device;” (Limitation 17[a])**

Limitation 17[a] is largely a combination of limitations 1[a]-1[d], addressed above. As explained, Nogami discloses and renders obvious receiving, by **CPU 201** (“**by a processor**”), one or more sensor signals indicating a position of a manipulatable input device (stimulation generation unit **10**) in at least three degrees of freedom and an identification of that device (as indicated by bar code **45** on unit **10**), wherein the unit **10** incorporates a haptic output device (cutaneous sense stimulation unit **20**). (Nogami, *e.g.*, Figs. 1-3, 6 & 11, ¶¶0049-0054, 0060-0062, 0073-0083, 0108, 0140-0149, 0204-0213; Cooperstock, ¶136.)

- (b) **“establishing, by the processor, a communication pathway between the manipulatable input device and the processor;” (Limitation 17[b])**
- (c) **“after establishing the communication pathway, determining by the processor a feedback parameter based at least in part on the position of a manipulatable input device in the at least three degrees of freedom and the identification of the manipulatable input device;” (Limitation 17[c])**
- (d) **“transmitting, by the processor, a haptic signal to the haptic output device, the haptic signal configured to cause the haptic output device to output a haptic effect according to the feedback parameter.” (Limitation 17[d])**

Limitations 17[b]-[d] are substantially similar to limitations 1[e]-[g], respectively, addressed above. As explained above, the proposed combination discloses and renders obvious these steps. (Cooperstock, ¶¶137-139.)

9. Claim 18

Claim 18 recites **“[t]he method of claim 17, further comprising”** the following two steps which are addressed below.

- (a) **“identifying the manipulatable input device from a plurality of manipulatable input devices based on the one or more sensor signals; and” (Limitation 18[a])**

As explained above for limitation 1[d], Nogami discloses and renders obvious **“identifying the manipulatable input device”** (stimulation generation unit 10) based on the **“sensor signal”** embodying a real space image with bar code 45

identification information conveyed to CPU **201**. (Nogami, *e.g.*, Fig. 11, ¶¶0204-0213, 0052-0054; *see also id.* ¶0206 (bar code **45** “indicates ID information (*e.g.*, an ID) unique to the stimulation generation unit **10**”).)

Nogami further discloses “**a plurality of manipulatable input devices.**” As discussed for claim 1 above, Nogami discloses that a user can wear a plurality of stimulation generation units on their body, such as on their hand, elbow, and knee – stimulation generation units **10**, **11**, and **12**, respectively. (Nogami, Fig. 1, ¶¶0051, 0058, 0063.) Each of these stimulation generation units is a “**manipulatable input device**” because, as explained for limitation 1[a], each one enables position and orientation input to be provided to the system based on the position and movement of the user’s hand. (Nogami, *e.g.*, Figs. 1, 3, 5, 6, 11, ¶¶0049-0054, 0060-0061, 0073-0083, 0140-0154, 0204-0213.) In any case, because a user could have been wearing multiple stimulation generation units, using bar code information **45** to specifically identify stimulation generation unit **10** would have predictably resulted in “**identifying the manipulatable input device** [stimulation generation unit **10**] **from a plurality of manipulatable input devices** [stimulation generation units **10**, **11** and **12**] **based on the one or more sensor signals.**” (Cooperstock, ¶142.)

Petitioner notes that Nogami provides an exemplary illustration of bar code **45** mounted specifically on stimulation generation unit **10**, which as shown in Figure

11 is worn on the user's right hand. (Nogami, Fig. 11, ¶¶206-210.) Although not necessary to satisfy limitation 18[a], it would also have been obvious that each of the other stimulation generation units in Nogami would also have had its own unique bar code. (Cooperstock, ¶142.) A skilled artisan would have understood and found it obvious that, because a user may be wearing multiple stimulation generation units, using bar code information to specifically identify stimulation generation unit **10** would have predictably resulted in **“identifying the manipulatable input device [stimulation generation unit 10] from a plurality of manipulatable input devices [stimulation generation units 10, 11 and 12] based on the one or more sensor signals.”** (Cooperstock, ¶144.)

**(b) “adjusting interactive content output to a user via a content output appliance based at least in part on the identification of the manipulatable input device.”
(Limitation 18[b])**

As explained below, Nogami discloses and renders obvious limitation 18[b] in two separate ways: **(1)** adjusting haptic feedback output by stimulation generation unit **10** based on whether the unit is identified as being within the user's attention range; and **(2)** adjusting virtual object imagery output to the user's HMD **100** based on whether the unit is identified as being within the user's attention range.

Petitioner notes that the '217 patent describes a **“content output appliance”** as a device that can output interactive content “visually, audibly and/or haptically”

to a user. ('217, 4:40-51.) And as explained for claim 10 above, the '217 patent describes “**interactive content**” as including, among other things, content such as a virtual object that can be visually and/or haptically perceived by a user. ('217, 2:60-64, 4:41-42.) Thus, the '217 patent makes clear that “**interactive content output to a user**” includes both visual and haptic output related to interaction with a virtual object. (Cooperstock, ¶146.)

Turning to the first way in which Nogami discloses and renders obvious this limitation, the “**content output appliance**” corresponds to one or more cutaneous sense stimulation units **20**, which may be included as part of a stimulation generation unit. (Nogami, ¶¶0061, 0062.) Cutaneous sense stimulation units **20** can output a stimulation that is “transmitted to the human body **1** with an intensity high enough for the user **1** to recognize the vibration.” (Nogami, ¶0061.) The “**interactive content**” thus takes the form of haptic stimulation provided to the user.

As explained for claim 1, a user experiences haptic feedback when the system determines that a stimulation generation unit has made contact with a background virtual object. (Nogami, *e.g.*, ¶0097; *see also id.*, ¶¶0049 (“the user **1** can experience a virtual space including a virtual object **300** with both a visual sense and a tactile sense”), 0098-0103, Fig. 4 (*e.g.*, steps **S4004 – S4007**), 0117-0123 (describing steps **S4004 – S4007**).) Nogami further discloses that the haptic feedback, based on

virtual contact being made with a background virtual object (“**interactive content output to a user**”), is “**adjust[ed]...based at least in part on the identification of the manipulatable input device.**” This is because, as explained for limitation 1[f], the haptic feedback is adjusted based on whether identifying bar code **45** is recognized as being within the user’s attention range. (Nogami, ¶¶0101, 0120-0122, 0164, 0179, 0202-0210.) For example, as explained, the intensity of the haptic feedback provided to the user (“**interactive content output to a user**”) is adjusted to be either high or low based on, respectively, whether the stimulation generation unit is outside or inside the user’s attention range. (Nogami, *e.g.*, ¶0179.) Because that adjustment depends on whether bar code **45** was detected in the real space image, the adjustment is “**based at least in part on the identification**” of stimulation generation unit **10**. (Cooperstock, ¶¶105-107, 151.)

Petitioner notes that, under this first mapping, stimulation generation unit **10** includes both the “**manipulatable input device**” and a “**content output appliance.**” But nothing in the claim language or written description of the ’217 patent precludes a particular device from satisfying both limitations. Petitioner has also relied upon different aspects of stimulation generation unit **10** to perform the functions of these claim limitations. The functions of the “**content output appliance**” are carried out by the one or more cutaneous sense stimulation units **20**, whereas the functions of

the “**manipulatable input device**” are provided by marker **40** or magnetic receiver, and bar code **45**, which enable the system to determine the position, orientation, and identity of stimulation generation unit **10**. (Cooperstock, ¶¶149, 64-65.) Similarly, neither claim 18 nor the ’217 written description suggests that a device that provides haptic feedback – such as Nogami’s cutaneous sense stimulation unit(s) **20** – cannot qualify as both a “**haptic output device**” (recited in claim 17 from which claim 18 depends) and a “**content output appliance.**” (Cooperstock, ¶150.) In fact, as noted above, the ’217 patent expressly states that a content output appliance can be a device that provides haptic output. (’217, 4:40-51.)

Turning to the second independent way in which Nogami discloses and renders obvious limitation 18[b], Nogami’s HMD **100** comprises a “**content output appliance**” because it outputs content visually to a user. (Nogami, *e.g.*, ¶¶0045, 0057 (“a publicly known method can be used as the method for visually presenting a real object and a virtual object”), 0093 (“[A] combined image generated by the calculation processing apparatus **200** is output to the display unit **102** of the HMD **100** via the image output unit **208**.”).) In this second way, the “**interactive content**” includes a virtual work tool, such as a screwdriver or wrench, corresponding to a user’s stimulation generation unit that can be displayed to the user. (Nogami, ¶¶0270-0273; Cooperstock, ¶153.) A user can visually interact with the virtual work

tool by, for example, changing the relative positions of HMD **100** or the stimulation generation unit associated with the virtual work tool. (Nogami, *e.g.*, ¶¶0005, 0027, 0109, 0140-0147 (describing how virtual objects including region virtual objects are generated for display based on current position and orientation information).)

With respect to “**adjusting interactive content output to a user**” via HMD **100**, Nogami teaches that the virtual object imagery output to a user’s HMD **100** is based on whether or not virtual objects are within the user’s attention range. (Nogami, ¶¶0143-0144, 0101.) Nogami explains, for example, that the view volume corresponding to the user’s attention range, “indicates a range of the virtual space drawn on the display unit **102** of the HMD **100**.” (Nogami, ¶0144.) It would have been obvious that the collection of virtual objects displayed to a user would have depended on which virtual objects the system identified as being within the user’s attention range. As the user’s attention range changed, the system might identify different virtual objects as being within the attention range and adjust the user’s display accordingly. (Cooperstock, ¶154.)

Nogami further discloses and renders obvious that the virtual object imagery displayed to a user (“**interactive content output to a user**”) is “**adjust[ed]...based at least in part on the identification of the manipulatable input device.**” This is because, as explained for limitation 1[f], Nogami teaches using the bar code **45**

identification of stimulation generation unit **10** to determine whether the stimulation generation unit is within the user's attention range. (Nogami, ¶¶0202-0213.) It would have been obvious that, in order to display the virtual work tool associated with stimulation generation unit **10** when that unit is within the attention range (*e.g.*, by displaying a virtual screwdriver or wrench), the system would have relied at least in part on the identification of stimulation generation unit **10**, among other reasons, to distinguish it from other stimulation generation units. (Cooperstock, ¶155.)

For example, suppose the user is wearing two stimulation generation units: (1) stimulation generation unit **10** on the right hand, which is associated with a virtual screwdriver, and (2) a second stimulation generation unit on the left hand associated with a virtual wrench (or no tool at all). It would have been obvious that, by correctly displaying the virtual screwdriver when stimulation generation unit **10** worn on the right hand appears within the attention range, the system has adjusted the display at least in part on the identification of stimulation generation unit **10**. (Cooperstock, ¶156.) Accordingly, if stimulation generation unit **10** was associated with a virtual screwdriver and the bar code for stimulation generation unit **10** was recognized as being within the user's attention range, then the system would update the imagery displayed to the user to include an image of that tool based on having identified stimulation generation unit **10** as the unit that entered the attention range. (*Id.*)

10. Claim 19: “The system of claim 11, wherein the identification sensor is configured to identify the manipulatable input device based on a visual characteristic of the manipulatable input device.”

Claim 19 does not add anything not already addressed above. The “**identification sensor**” in Nogami is configured to “**identify the manipulatable input device [stimulation generation unit 10] based on a visual characteristic of the manipulatable input device [bar code 45 representing a unique identification of stimulation generation unit 10].**” (*E.g.*, Nogami, ¶¶0206, 0208, Fig. 11.) Bar code 45 is a “**visual characteristic**” because it is visibly attached to stimulation generation unit 10 and can be identified in the real space image captured by the identification sensor. (Nogami, ¶¶0208-210; Fig. 11 (showing visible bar code 45).)

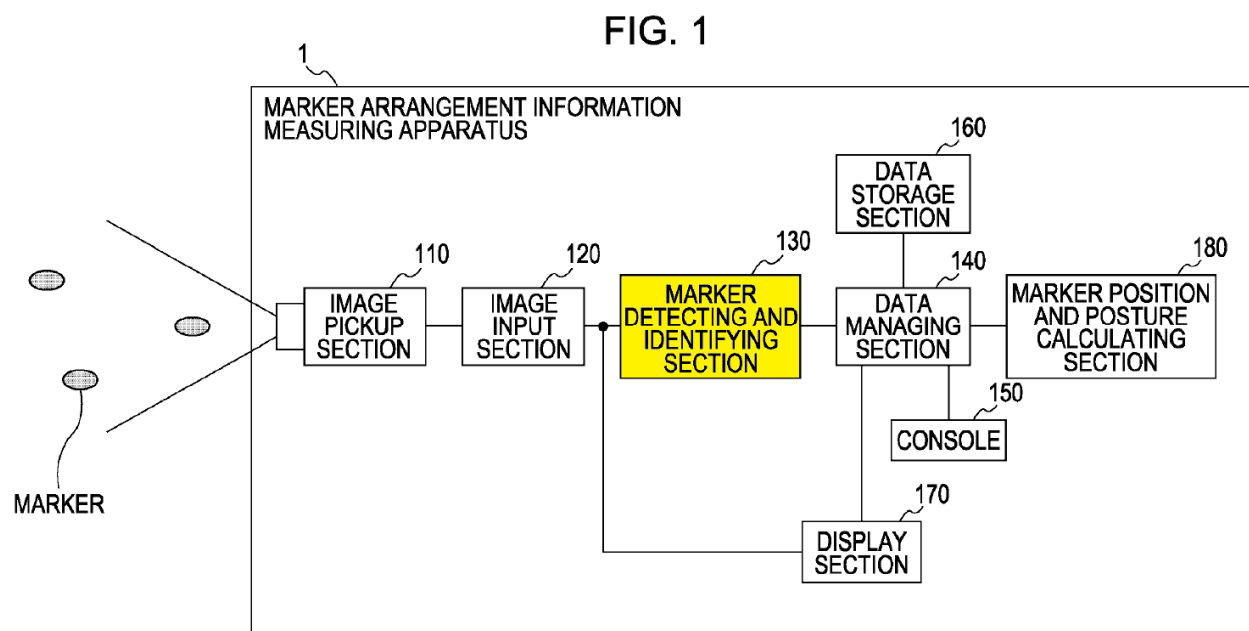
C. Ground 2: Claims 11 and 19 Are Obvious Over Nogami and Phelps in View of Kotake.

Ground 1 demonstrated how Nogami in view of Phelps renders obvious claims 11 and 19. **Ground 2** provides as an alternative basis for obviousness of the second part of dependent claim 11, which recites in pertinent part, “**an identification sensor configured to identify the manipulatable input device and transmit a second sensor signal.**” With respect to all other aspects of claim 11, as well as the limitations of claim 19, the analysis for **Ground 1** applies.

With respect to the claimed identification sensor, as explained above for **Ground 1**, Nogami discloses the ability to detect bar code 45 in a real space image

captured by imaging unit **101** of the user's HMD **100**, the bar code identifying the stimulation generation unit. (Nogami, *e.g.*, ¶¶0206-0209.) As explained, Nogami does not provide specific details about how CPU **201** is notified that bar code **45** has in fact been detected in the real space image. **Ground 2** thus also cites to **Kotake**, which provides more internal details about how this notification takes place.

Kotake discloses a technique for detecting “markers” appearing in an image of three-dimensional space captured by a camera, which are analogous to bar code **45** attached to stimulation generation unit **10** of Nogami. Figure 1 shows a block diagram of a marker arrangement information measuring apparatus **1**:



(Kotake, Fig. 1 (highlighting added).)

Figure 1 shows an image pickup section **110**, which is “constituted by a video camera and captures an image of a scene or an object on which markers [shown on

the left] are arranged.” (Kotake, ¶0046.) In one embodiment, the markers in the image can take the form of “square markers” that have an outer boundary region or frame and an inner region. (Kotake, ¶0047; *see also id.*, ¶0073 (explaining that other types of markers can be used).) “An image input section **120** takes the image captured by the image pickup section **110** into a computer.” (Kotake, ¶0046.)

The key section of Figure 1 is **marker detecting and identifying section 130** shown in highlighting. This section, as its label indicates, detects and identifies markers within the captured image, and outputs a marker detection result. (Kotake, ¶0046; *see also id.*, ¶¶0051-0052.) Marker detecting and identifying section **130**, more specifically, “detects the markers contained in the image and reads the identifier specific to each marker for identification of the marker.” (Kotake, ¶0055.) Marker detecting and identifying section **130** then “outputs, as detection data, image coordinates of four apexes of the marker to the data managing section 140.” (Kotake, ¶0055; *see also id.*, ¶0052 (“The marker detection results are each stored in a set of the image number, the marker identifier, and the image coordinates of four apexes of the square defining the inner region of the marker.”).) Data managing section **140**, in turn, can store the marker detection result and/or perform other operations. (Kotake, *e.g.*, ¶¶0052-0053.)

Kotake’s techniques can be implemented by program code (software)

executed using a CPU in a computer. (Kotake, ¶¶0199, 0203, 0200 (“In that case, the program code (software) serves= [sic] to implement the functions of the above-described exemplary embodiments.”).) Kotake also explains that, alternatively, the supplied program code can be provided and executed in a separate “function extension board” or “function extension unit.” (Kotake, ¶0203.)

Manner, Rationale, and Motivation to Combine (Ground 1 Prior Art with Kotake). As I explained for **Ground 1**, Nogami itself already discloses detection of bar code **45** in a real space image captured by imaging unit **101** of the user’s HMD **100**, but does not disclose details about how CPU **201** is notified that this has occurred. (Nogami, ¶¶0206-0209.) It would have been obvious to combine Nogami with Kotake, predictably resulting in the system of Nogami that included an identification sensor for analyzing the real space image from imaging unit **101** to detect and identify bar code **45**. That identification sensor would, in turn, have “transmit[ted] a second sensor signal,” by outputting a signal to CPU **201** identifying bar code **45**, similar to the “marker detection result” output by **marker detecting and identifying section 130** in Kotake.

Under the proposed combination, therefore, it would have been obvious to implement Nogami such that the bar code detection functionality was performed by components separate from CPU **201**, such as “a function extension board inserted in

the computer or in a function extension unit connected to the computer” as disclosed in Kotake (Kotake, ¶0203), which would have performed the bar code **45** detection and transmitted the bar code identification to CPU **201**. The “**identification sensor**” would thus have included, under the proposed combination, imaging unit **101** of HMD **100** which captures the real space image, along with a “function extension board” or “function extension unit” that would have performed the function of detecting bar code **45** in the image and outputting the identification to CPU **201**. The proposed combination therefore renders obvious an identification sensor configured “**to identify the manipulatable input device,**” *i.e.* stimulation generation unit **10**, and “**transmit a second sensor signal,**” *i.e.*, data identifying bar code **45** detected in the real space image, as required by claim 11. Although not required by claim 11, the second sensor signal could also optionally have included the location of bar code **45** in the real space image. (Cooperstock, ¶164.) Kotake is an analogous reference in the field of augmented reality systems, and would have been reasonably pertinent to problems facing the ’217 patent inventors. (Cooperstock, ¶165.)

An ordinarily skilled artisan would have been motivated to combine. As noted, Petitioner has cited Kotake primarily for the proposition that it would have been obvious to implement Nogami to include an “**identification sensor**” that is separate from CPU **201** and that outputs a second sensor signal identifying bar code

45 to CPU **201**. The motivation to implement Nogami in this manner would have been straightforward – to reduce the burden on CPU **201**. (Cooperstock, ¶166.) An ordinarily skilled artisan would have appreciated that identifying bar code **45** in a real space image would have been a potentially complex and time-consuming task for CPU **201**, which is also responsible for performing other functions. A skilled artisan would have been motivated to offload this function, for example, to “a function extension board inserted in the computer or in a function extension unit connected to the computer,” as described in Kotake. (Kotake, ¶0203.) It was well-known that graphics cards installed in conventional personal computers were frequently used in lieu of the CPU to perform image processing and other related tasks, including computer vision tasks. (Cooperstock, ¶166.) This would have relieved CPU **201** of the potentially complex and time-consuming task of analyzing the real space image to identify bar code **45**, freeing up CPU **201** to focus on other tasks. In fact, an ordinarily skilled artisan would have recognized Kotake’s description of using “a function extension board inserted in the computer,” as referring to well-known specialized circuit boards such as graphics cards, which often had processors specifically designed to perform image processing tasks more efficiently than the main CPU in the computer. (Cooperstock, ¶166.)

A skilled artisan would have had at least a reasonable expectation of success

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because the proposed combination would have involved nothing more than the use of conventional techniques. (Cooperstock, ¶168.) As noted, Petitioner has not relied upon Kotake for teachings about how to recognize bar code **45** in the real space image – those are already provided by Nogami. The proposed combination would thus have involved nothing more than having the functions already performed by CPU **201** in Nogami performed by other components of the system, which could have been implemented using well-known techniques. (Cooperstock, ¶168.)

VII. CONCLUSION

Petitioner respectfully requests institution of review on the challenged claims.

Dated: May 26, 2023

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 13,941 words, according to the word-processing system used to prepare this petition, excluding the parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

DATED: May 26, 2023

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 9,727,217 B2**, including all exhibits (**Nos. 1001-1013**) and related documents, are being served via Federal Express on the 26th day of May, 2023, the same day as the filing of the above-identified document in the United States Patent and Trademark Office/Patent Trial and Appeal Board, upon Patent Owner by serving the correspondence address of record with the USPTO as follows:

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