THE HONORABLE _____

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON

IMMERSION CORPORATION,

Plaintiff,

v.

VALVE CORPORATION

Defendant.

Case No. _____

COMPLAINT FOR PATENT INFRINGEMENT

JURY TRIAL DEMANDED

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Seattle, WA 9810 , Tel: 206-880-1802

Valve Exhibit 1013
Valve v. Immersion

Plaintiff Immersion Corporation ("Immersion") files this Complaint against Defendant Valve Corporation ("Valve").

NATURE OF THE ACTION

1. This is an action for the infringement of seven United States Patents: U.S. Patent Nos. 7,336,260 ("the '260 patent"); 8,749,507 ("the '507 patent"); 9,430,042 ("the '042 patent"); 9,116,546 ("the '546 patent"); 10,627,907 ("the '907 patent"); 10,665,067 ("the '067 patent"); and 11,175,738 ("the '738 patent") (collectively, "the Patents-in-Suit").

2. Defendant Valve has been making, using, selling, offering for sale, and/or importing handheld as well as augmented reality and virtual reality ("AR/VR") video game systems such as the Steam Deck and Valve Index. These video game systems integrate multiple game engines[1] including, for example and without limitation, Unity, Unreal Engine, and Source 2, and related software[2] including, for example and without limitation, SteamVR and Steam Input, as well as game titles available for sale by Valve through its Steam platform, including for example and without limitation, *Half-Life: Alyx*,[3] *MoonDust: Knuckles Tech Demo*,[4] *Counter-Strike: Global Offensive*,[5] *STAR WARS Jedi: Survivor*,[6] *War Thunder*,[7] *Apex Legends*,[8] *Call of Duty®: Black Ops III*,[9] *Call of Duty®: Modern Warfare® II*,[10] *Warframe*,[11] *Marvel's Guardians of the Galaxy*,[12]

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[1] *See* https://valvesoftware.github.io/steamvr_unity_plugin/ ("Valve maintains a Unity plugin to smoothly interface SteamVR with Unity") (last accessed May 10, 2023); https://docs.unrealengine.com ("The Online Subsystem Steam API enables you to ship Unreal Engine 4 (UE4) applications to Valve's Steam platform.") (last accessed May 10, 2023); https://developer.valvesoftware.com (Source2 is a 3D video game engine in development by Valve as a successor to Source.") (last accessed May 10, 2023).

[2] *See, e.g.,* https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://store.steampowered.com/app/250820/steamVR/ (last accessed May 10, 2023).

[3] *See* https://store.steampowered.com/app/546560/HalfLife_Alyx/ (last accessed May 10, 2023).

[4] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/(last accessed May 10, 2023).

[5] *See* https://store.steampowered.com/app/730/CounterStrike_Global_Offensive/ (last accessed May 10, 2023).

[6] *See* https://store.steampowered.com/app/1774580/STAR_WARS_Jedi_Survivor/ (last accessed May 10, 2023).

[7] *See* https://store.steampowered.com/app/236390/War_Thunder/ (last accessed May 10, 2023).

[8] *See* https://store.steampowered.com/app/1172470/Apex_Legends/ (last accessed May 10, 2023).

[9] *See* https://store.steampowered.com/agecheck/app/311210/ (last accessed May 10, 2023).

[10] *See* https://store.steampowered.com/agecheck/app/1938090/ (last accessed May 10, 2023).

[11] *See* https://store.steampowered.com/agecheck/app/230410/ (last accessed May 10, 2023).

[12] *See* https://store.steampowered.com/app/1088850/Marvels_Guardians_of_the_Galaxy/ (last accessed May 10, 2023).

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Grand Theft Auto V,[13] and any other game titles sold on the Steam platform that incorporate haptic capabilities. The Steam Deck and the corresponding software (including Steam), and game titles (collectively, "the Accused Handheld Instrumentalities"), as well as the Valve Index and the corresponding software (including SteamVR), and game titles (collectively "Accused VR Instrumentalities") infringe the Patents-in-Suit in violation of 35 U.S.C. § 271.

3. Immersion seeks appropriate damages, injunctive relief, prejudgment and post-judgment interest, and ongoing royalties for Valve's infringement of the Patents-in-Suit.

THE PARTIES

4. Founded in 1993, Immersion is widely known as the pioneering and leading innovator of haptic technology. "Haptics" refers to the science of touch. Haptics in consumer electronic devices provide tactile sensations to the users of electronic devices. Immersion creates software for implementing advanced haptic effects in video game systems and controllers and other handheld computers. Immersion also owns and licenses a broad portfolio of pioneering patents related to the use of haptics technology. Immersion's software is found in products that are sold and used worldwide. Immersion's patented technology is used even more widely, subject to patent licenses between Immersion and many of the world's most recognizable companies. Immersion's hard work and ingenuity in the field of haptics has resulted in extensive intellectual property protection for Immersion's innovations. This protection includes more than 1,000 world-wide granted and pending patents, including the Patents-in-Suit. During its nearly 30-year history, Immersion redefined how haptics are implemented in consumer technology. The recent proliferation of haptics-enabled consumer electronics demonstrates the importance of Immersion's innovations. Immersion continues to invest in research and development today.

5. Immersion is a Delaware corporation with its principal place of business located at 2999 N. E. 191st Street, Suite 610, Aventura, Florida 33180. Immersion owns the Patents-in-Suit.

[13] *See* https://store.steampowered.com/agecheck/app/271590/ (last accessed May 10, 2023).

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6. Valve Corporation is a corporation organized and existing under the laws of Washington with its principal place of business at 10400 NE 4th St., Suite 1400, Bellevue, Washington 98004. Valve also has a registered agent at CorpServe, Inc., 1001 4th Ave, Ste. 4400, Seattle, WA 98154-1192.

JURISDICTION AND VENUE

7. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

8. This Court has original subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has personal jurisdiction over Valve because, inter alia, Valve's corporate headquarters are located in Bellevue, Washington, and Valve has a continuous presence in, and systematic contact with, this District.

10. Valve has committed and continues to commit acts of infringement of the Patents-in-Suit in violation of the United States Patent Laws, and has used the Accused Handheld Instrumentalities and Accused VR Instrumentalities within this District. Valve's infringement has caused substantial injury to Immersion, including within this District.

11. Venue is proper in this District. Valve resides in this District within the meaning of 28 U.S.C. § 1400(b). Valve has committed acts of infringement within this District and has regular and established places of business here.

THE PATENTS-IN-SUIT

12. The '260 patent is titled "Method and Apparatus for Providing Tactile Sensations" and was issued by the United States Patent Office to inventors Kenneth M. Martin, Steven P. Vassallo, Alex S. Goldenberg, Alexander Jasso, and Kollin Tierling on February 26, 2008. The earliest application related to the '260 patent was filed on November 1, 2001. A true and correct copy of the '260 patent is attached as Exhibit A.

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13. Immersion is the owner of all right, title, and interest in and to the ’260 patent with the full and exclusive right to bring suit to enforce the ’260 patent.

14. The ’260 patent is valid and enforceable under the United States Patent Laws.

15. The ’507 patent is titled “Systems and Methods for Adaptive Interpretation of Input from a Touch-sensitive Input Device” and was issued by the United States Patent Office to inventors Henry DaCosta, Christophe Ramstein, and Danny Grant on June 10, 2014. The earliest application related to the ’507 patent was filed on November 26, 2003. A true and correct copy of the ’507 patent is attached as Exhibit B.

16. Immersion is the owner of all right, title, and interest in and to the ’507 patent with the full and exclusive right to bring suit to enforce the ’507 patent.

17. The ’507 patent is valid and enforceable under the United States Patent Laws.

18. The ’042 patent is titled “Virtual Detents Through Vibrotactile Feedback” and was issued by the United States Patent Office to inventor Michael D. Levin on August 30, 2016. The earliest application related to the ’402 patent was filed on December 27, 2006. A true and correct copy of the ’042 patent is attached as Exhibit C.

19. Immersion is the owner of all right, title, and interest in and to the ’042 patent with the full and exclusive right to bring suit to enforce the ’042 patent.

20. The ’042 patent is valid and enforceable under the United States Patent Laws.

21. The ’546 patent is titled “System for Haptically Representing Sensor Input” and was issued by the United States Patent Office to inventors David Birnbaum, Christopher J. Ullrich, Danny Grant, Ali Modarres, and Juan Manuel Cruz-Hernandez on August 25, 2015. The earliest application related to the ’546 patent was filed on August 29, 2012. A true and correct copy of the ’546 patent is attached as Exhibit D.

22. Immersion is the owner of all right, title, and interest in and to the ’546 patent with the full and exclusive right to bring suit to enforce the ’546 patent.

23. The ’546 patent is valid and enforceable under the United States Patent Laws.

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24. The ’907 patent is titled “Position Control of a User Input Element Associated with a Haptic Output Device” and was issued by the United States Patent Office to inventors Srivatsav Venkatesan, Kaniyalal Shah, Douglas George Billington, Aaron Kapelus, Stephen Rank, and Daniel Parker on April 21, 2020. The earliest application related to the ’907 patent was filed on December 23, 2014. A true and correct copy of the ’907 patent is attached as Exhibit E.

25. Immersion is the owner of all right, title, and interest in and to the ’907 patent with the full and exclusive right to bring suit to enforce the ’907 patent.

26. The ’907 patent is valid and enforceable under the United States Patent Laws.

27. The ’067 patent is titled “Systems and Methods for Integrating Haptics Overlay in Augmented Reality” and was issued by the United States Patent Office to inventors Satoshi Araki, Christopher J. Ullrich, Liwen Wu, Juan Manuel Cruz-Hernandez, Danny A. Grant, Sanya Attari, and Colin Swindells on May 26, 2020. The earliest application related to the ’067 patent was filed on June 15, 2018. A true and correct copy of the ’067 patent is attached as Exhibit F.

28. Immersion is the owner of all right, title, and interest in and to the ’067 patent with the full and exclusive right to bring suit to enforce the ’ 067 patent.

29. The ’067 patent is valid and enforceable under the United States Patent Laws.

30. The ’738 patent is titled “Systems and Methods for Proximity-based Haptic Feedback” and was issued by the United States Patent Office to inventors Vahid Khoshkava and Abdelwahab Hamam on November 16, 2021. The earliest application related to the ’738 patent was filed on December 13, 2016. A true and correct copy of the ’738 patent is attached as Exhibit G.

31. Immersion is the owner of all right, title, and interest in and to the ’738 patent with the full and exclusive right to bring suit to enforce the ’738 patent.

32. The ’738 patent is valid and enforceable under the United States Patent Laws.

33. The Patents-in-Suit generally teach novel systems and methods for generating haptic signals used to generate haptic feedback in, among other things, video game systems and

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controllers. The claimed systems and methods combine specific hardware and software components in unconventional ways. In contrast, conventional systems provided rudimentary mechanisms for applying static effects that merely informed users that basic events occurred. Through novel innovations, the Patents-in-Suit expand haptic stimulation to provide users feedback based on a range of interactions with video game systems and controllers. The combinations of features are uniquely technological, and each claim improves on known systems and methods for providing haptic feedback.

34. For example, the ’260 patent, in general describes advances in providing haptic feedback in a variety of electronic devices such as gamepads and portable gaming devices, that, among other things, detect pressures and provide tactile sensations. The ’260 patent teaches, among other things, systems in which the electronic device detects different levels of pressure on the device and provide tactile sensations in response. Further details of the invention are described in the specification and the claims.

35. The ’507 patent, in general, describes advances in providing haptic feedback in processor-equipped devices that receive contact data from interactions with a touch-pad. The ’507 patent teaches, among other things, systems and methods in which the device determines a pressure and a change in pressure based on contact data. The device outputs a haptic effect if the pressure is greater than a pressure threshold, the change in pressure is greater than a change in pressure threshold, and an interval has elapsed. Further details of the invention are described in the specification and the claims.

36. The ’042 patent, in general, describes advances in providing haptic feedback in, among other things, portable video players and portable game systems, operated through, for example, a touch-pad. The ’042 patent teaches, among other things, providing virtual detents to simulate mechanical feedback through vibrotactile feedback delivered to an input device such as, for example, a touch-pad. Further details of the invention are described in the specification and the claims.

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37. The ’546 patent, in general, describes advances in providing haptic feedback in, among other things, game consoles. The ’546 patent teaches, among other things, generating haptic effects based on received inputs, including extra-sensory information. Further details of the invention are described in the specification and the claims.

38. The ’907 patent, in general, describes advances in providing haptic feedback in, among other things, video games systems and video game controllers. The ’907 patent teaches, among other things, defining position and range information for a user input element associated with a haptic output device—including a primary range of positions, a secondary range of positions, and a boundary range of positions—and rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of position. Further details of the invention are described in the specification and the claims.

39. The ’067 patent, in general, describes advances in providing haptic feedback in, among other things, AR/VR systems. The ’607 patent teaches, among other things, transmitting a visual effect through a display on a proxy object comprising one or more haptic output devices, and transmitting a haptic effect to one or more haptic output devices based in part on sensor data. Further details of the invention are described in the specification and the claims.

40. Lastly, the ’738 patent, in general, describes advances in providing haptic feedback in, among other things, video game controllers. The ’738 patent teaches, among other things, generating haptic feedback based at least in part on a first signal received from a proxy sensor capable of detecting a non-contact interaction with a touch-sensitive device and a second signal received from a touch-sensitive device upon detecting a touch. Further details of the invention are described in the specification and the claims.

HAPTIC TECHNOLOGY

41. Haptic feedback provides touch or tactile sensations to users of electronic devices and may include tactile sensations produced by an actuator, such as a motor, a linear resonant actuator, or a piezoelectric actuator. Because of the importance of the sense of touch to the way

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people perceive their surroundings and the things with which they interact, haptics can greatly enhance the usability and functionality of consumer electronic devices. For example, when haptic technology is implemented in video game systems and controllers, users can experience vibrating forces that mimic real-life forces as they navigate through virtual controls or interact with virtual objects, including with virtual hands, with natural actions such pressing or squeezing. The Accused Handheld Instrumentalities and Accused VR Instrumentalities include haptic feedback technology. The presence of haptics in the Accused Handheld Instrumentalities and Accused VR Instrumentalities provides enhanced user interaction through haptic cues, which give users a richer and more immersive user experience.

42. In electronic devices, haptic effects are typically managed and controlled by embedded software, and integrated into device user interfaces and applications via embedded control software application programming interfaces ("APIs"). Applications running on an electronic device call these APIs to implement haptic effects. These APIs in turn cause specific haptic effect commands to be sent to an actuator in the electronic device, resulting in the associated haptic effect. More sophisticated applications may provide a variety of tactile sensations. For example, user actions may trigger different haptic effects and thus communicate different types of information. This information may be conveyed, for example, by varying the type, duration, intensity, or frequency of the tactile sensations. This enables the creation of different haptic effects so that users can easily distinguish different actions in a virtual environment.

43. Valve is capitalizing on Immersion's innovation and success by selling and otherwise monetizing video game systems, controllers, games, and applications that infringe Immersion's patents, including the Patents-in-Suit. Valve is using Immersion's patented inventions without license or authority from Immersion. Immersion has brought this action to remedy Valve's infringement.

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THE ACCUSED INSTRUMENTALITIES

44. The Valve Index is an AR/VR system developed by Valve to provide users with an "immersive"[14] and "high fidelity"[15] AR/VR experience. The system consists of several key components, including a headset, controllers, and base stations. One of the standout features of the Valve Index is its precise and responsive controllers.[16] The controllers are designed to track the movements of each individual finger, enabling more natural and intuitive interactions within AR/VR[17] while the base stations ensure precise tracking of the user's movements in physical space. This position tracking and the haptic feedback incorporated into the controllers greatly enhance the sense of immersion and enables users to manipulate virtual objects with a high degree of accuracy.[18]

45. The Steam Deck is Valve's handheld gaming system featuring a built-in controller layout, including thumbsticks, buttons, touch-pads, and triggers. One of the key features of the Steam Deck is its haptic feedback technology which enhances the tactile feedback and immersion during gameplay.[19] The Steam Deck utilizes advanced haptic feedback technology to provide more realistic and engaging gameplay experiences.[20] The haptics system is integrated into the device's controllers, offering players a mix of high sensitivity haptic feedback and trackball emulation, which allows a thumb to carefully nudge a mouse pointer or rapidly spin the viewport in a first-person shooter.[21] For example, the touch-pads provide a carefully engineered combination of

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[14] *See* https://www.livescience.com/valve-index-review (last accessed May 10, 2023).
[15] *See* https://store.steampowered.com/sub/354231/ (last accessed May 10, 2023).
[16] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).
[17] *See* https://docs.vrchat.com/docs/valve-index#:~:text=Finger%20Posing,your%20thumb%20is%20%22down%22 (last accessed May 10, 2023).
[18] *See*, *e.g.*, https://www.valvesoftware.com/en/index/controllers; https://partner.steamgames.com/vrlicensing (last accessed May 10, 2023).
[19] *See* https://gamerant.com/steam-deck-how-to-customize-haptics/#:~:text=The%20Steam%20Deck%20trackpads%20provide,the%20right%20and%20left%20triggers (last accessed May 10, 2023).
[20] *See* https://arstechnica.com/gaming/2022/02/steam-deck-the-comprehensive-ars-technica-review/3/ (last accessed May 10, 2023).
[21] *See* https://arstechnica.com/gaming/2022/02/steam-deck-the-comprehensive-ars-technica-review/3/ (last accessed May 10, 2023).

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haptic feedback and glide-friendly plastic, where every unit of movement triggers a rumble against the user's thumb.[22]

46. Both the Valve Index and Steam Deck take advantage of the extensive library of games available on Valve's Steam platform.[23] It serves as a central hub for gamers to purchase, download, and manage their library of digital games.[24] The platform offers a vast catalog of games including games that incorporate haptic effects. These games are designed to take advantage of the haptic feedback on the Valve Index and Steam Deck to deliver a more immersive gameplay experience.

VALVE'S CONTROL OVER THE ACCUSED INSTRUMENTALITIES

47. To facilitate the development and deployment of games and applications for the Accused Handheld Instrumentalities and Accused VR Instrumentalities, Valve exercises control over how games and applications are designed for and sold through the Accused Handheld Instrumentalities and Accused VR Instrumentalities, and exercises ongoing control over the operation of the Accused Handheld Instrumentalities and Accused VR Instrumentalities after each is sold.

48. Valve exercises control over how games and applications are designed for and sold through the Accused Handheld Instrumentalities and Accused VR Instrumentalities, for example and without limitation, in at least the following ways: (a) setting design requirements;[25] (b) actively curating the Steam platform by reviewing games and applications to ensure that there are no technical issues and that the content is designed and developed to meet user expectations;[26]

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[22] *See* https://arstechnica.com/gaming/2022/02/steam-deck-the-comprehensive-ars-technica-review/3/ (last accessed May 10, 2023).

[23] *See* https://store.steampowered.com/libraryupdate (last accessed May 10, 2023).

[24] *See* https://www.pcmag.com/news/steam-experiments-with-a-new-way-to-browse-its-huge-library-of-games (last accessed May 10, 2023).

[25] *See* https://www.steamdeck.com/en/verified (last accessed May 10, 2023).

[26] *See* https://www.youtube.com/watch?v=_OAqvtlgfGA (last accessed May 10, 2023).; https://partner.steamgames.com/doc/steamdeck/compat ("Valve will review your game on Steam Deck, checking it against a specific set of criteria.") (last accessed May 10, 2023).

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(c) providing developer resources such as design guides,[27] marketing resources,[28] developer kits,[29] and documentation for user input and other features;[30] (d) implementing and funding a royalty payment program;[31] and (e) providing examples of how developers can add haptics to games and applications that run on the Accused Handheld Instrumentalities and Accused VR Instrumentalities.[32]

49. Valve exercises ongoing control over the operation of the Accused Handheld Instrumentalities and Accused VR Instrumentalities after each is sold, for example and without limitation, in at least the following ways: (a) requiring users of the Accused Handheld Instrumentalities and Accused VR Instrumentalities to log into a Steam account controlled by Valve to access the user's Steam library of games;[33] (b) defining and identifying the haptic APIs for with the Accused Handheld Instrumentalities and Accused VR Instrumentalities;[34] (c) specifying minimum system requirements for a PC to use the Accused Handheld Instrumentalities and Accused VR Instrumentalities ("Steam Host PC")[35] and providing test applications for assessing VR readiness;[36] and (d) taking control over the Steam Host PC while running games on SteamVR.

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[27] *See* https://partner.steamgames.com/doc/steamdeck (last accessed May 10, 2023).
[28] *See* https://partner.steamgames.com/doc/marketing/tools (last accessed May 10, 2023).
[29] *See* https://partner.steamgames.com/doc/steamdeck/devkits (last accessed May 10, 2023).
[30] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/SteamVR-Input.html (last accessed May 10, 2023) ; https://github.com/ValveSoftware/openvr/wiki/SteamVR-Skeletal-Input (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steamvr/input (last accessed May 10, 2023).
[31] *See* https://www.theverge.com/2018/11/30/18120577/valve-steam-game-marketplace-revenue-split-new-rules-competition (last accessed May 10, 2023).
[32] *See*, *e.g.*, https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023).
[33] *See*, *e.g.*, https://store.steampowered.com/steamdeck ("Once you've logged into Steam Deck, your entire Steam Library shows up, just like any other PC.") (last accessed May 10, 2023); https://store.steampowered.com/libraryupdate (last accessed May 10, 2023).
[34] *See*, *e.g.*. https://github.com/ValveSoftware/openvr/wiki/IVRSystem::TriggerHapticPulse (last accessed May 10, 2023); https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[35] *See*, *e.g.*, https://store.steampowered.com/app/250820/SteamVR/ (last accessed May 10, 2023); https://help.steampowered.com/en/faqs/view/105E-66E3-962A-1577 (last accessed May 10, 2023).
[36] *See* https://store.steampowered.com/app/323910/SteamVR_Performance_Test/ (last accessed May 10, 2023).

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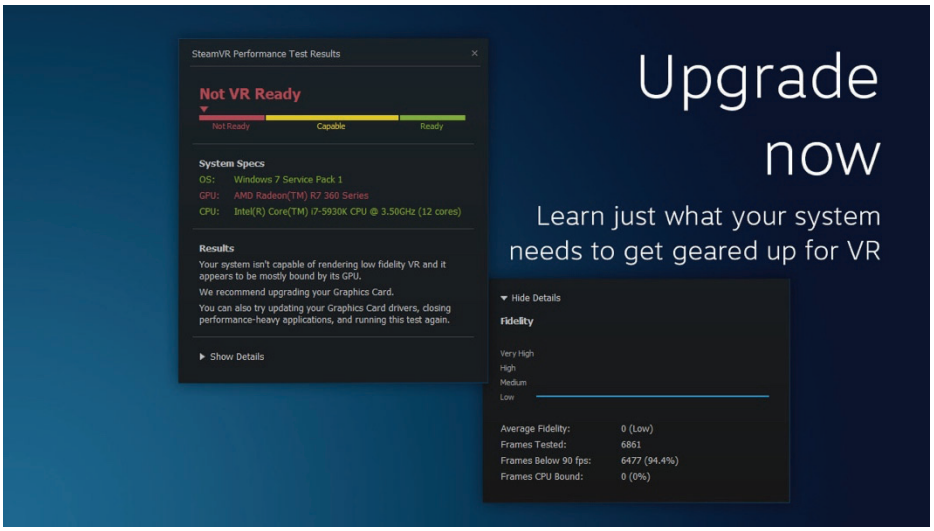
50. For example, Valve provides a *SteamVR Performance Test* application that determines whether the Steam Host PC is "VR Ready."[37] For machines that are not "VR Ready" the tool can help determine whether capabilities are bound by Graphics Card, CPU, or both:[38]



51. Further, running games in SteamVR takes control over the Steam Host PC. For example, wearing the headset physically precludes users from using the Steam Host PC for anything other than the Accused VR Instrumentalities. Further, running games in SteamVR runs in full screen mode on the Steam Host PC, preventing users from running anything other than the Accused VR Instrumentalities. For example, the figure below is a screenshot taken from a Steam Host PC while testing this functionality. This figure highlights the SteamVR application with a green box and shows the *Moondust*[39] game running in full screen mode on the Steam Host PC:

[37] *See* https://store.steampowered.com/app/323910/SteamVR_Performance_Test/ (last accessed May 10, 2023).
[38] *See* https://store.steampowered.com/app/323910/SteamVR_Performance_Test/ (last accessed May 10, 2023).
[39] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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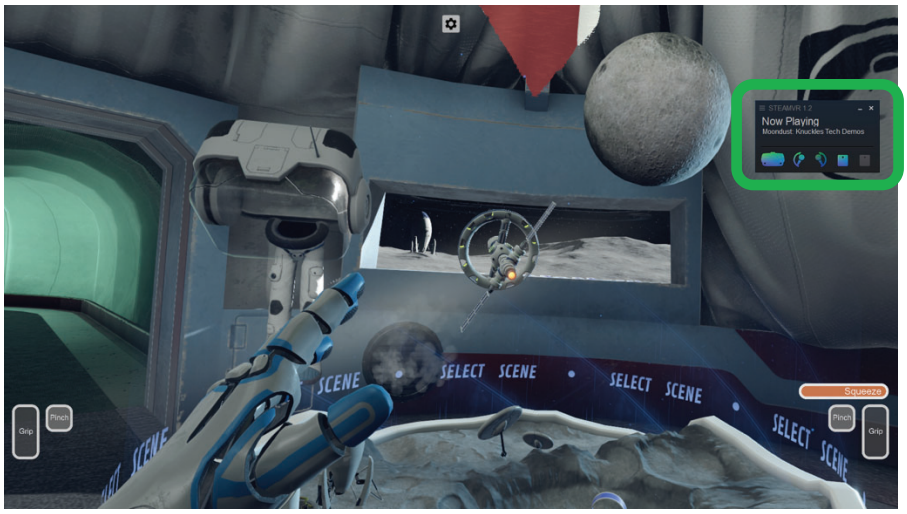

52. In addition to generating revenue from the sale of each Steam Deck or Valve Index, Valve generates or plans to generate revenue in various ways from the Accused Handheld Instrumentalities and Accused VR Instrumentalities after each Steam Deck and/or Valve Index unit is sold, including for example and without limitation, by realizing a financial benefit from games and applications sold on the Steam platform,[40] and collecting a percentage of sales of virtual assets sold through the Accused Handheld Instrumentalities and Accused VR Instrumentalities.[41]

FIRST CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '260 PATENT)

53. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

54. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1, of the '260 patent in violation of 35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused VR Instrumentalities.

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[40] *See* https://www.protocol.com/bulletins/valve-defends-30-percent-commission (last accessed May 10, 2023); https://www.theverge.com/21445923/platform-fees-apps-games-business-marketplace-apple-google (last accessed May 10, 2023).

[41] *See* https://partner.steamgames.com/doc/features/microtransactions (last accessed May 10, 2023); https://steamcommunity.com/discussions/forum/7/4329623982991246741/ (last accessed May 10, 2023).

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55. Claim 1 of the ’260 patent provides:

> 1. A computer-readable medium having instructions, the instructions including instructions that cause a processor to:
>
> [1A] detect a first pressure on a first input device;
>
> [1B] provide a first tactile sensation to the first input device, the first tactile sensation based at least in part on the first pressure;
>
> [1C] detect a second pressure on the first input device, the second pressure greater than the first pressure; and
>
> [1D] provide a second tactile sensation to the first input device, the second tactile sensation based at least in part on the second pressure;
>
> [1E] detect a third pressure on the first input device, the third pressure greater than the second pressure; and
>
> [1F] provide a third tactile sensation to the first input device.

56. Based on publicly available information, Valve’s Accused VR Instrumentalities meet all elements of at least claim 1 of the ’260 patent.

57. Regarding the preamble of claim 1, to the extent the preamble is determined to be limiting, the Accused VR Instrumentalities provide the features described in the preamble, which recites “[a] computer-readable medium having instructions, the instructions including instructions that cause a processor to” perform the claimed steps. For example, Valve specifies certain minimum system specifications, including processor requirements:[42]

Minimum

- OS: Windows 10, SteamOS, Linux
- Processor: Dual Core with Hyper-Threading
- Memory: 8 GB RAM
- Graphics: Nvidia GeForce GTX 970 / AMD RX 480
- Network: Broadband Internet connection
- Additional Notes: Available DisplayPort (Version1.2) and USB (2.0+) Port required

[42] *See* https://help.steampowered.com/en/faqs/view/105E-66E3-962A-1577 (last accessed May 10, 2023).

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58. Further, Valve's SteamVR supports multiple engines, including the Unity Engine,[43] the Unreal Engine,[44] and the proprietary Source 2 Engine, through multiple SDKs such as OpenVR[45] and OpenXR[46] to implement applications and games.

59. As one example, OpenVR is divided into two layers: application and driver. Valve documentation notes that, "One real-world example of an application is a game engine like Unity."[47] Further, "OpenVR for application talks to SteamVR. SteamVR then talks to OpenVR driver."[48]

60. As another example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[49] This API includes member functions, such as, `TriggerHapticPulse`, that "[t]riggers a (low-level) haptic pulse on supported controllers."[50]

61. Accordingly, the Accused VR Instrumentalities meet the preamble of claim 1.

62. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

63. Limitation 1A requires causing the processor to "detect a first pressure on a first input device." The Accused VR Instrumentalities perform this step. Users operate the Valve Index with two controllers, each of which is an example of an input device. For example in *Moondust*,[51] which demonstrates the technical capabilities of the Valve Index controllers (also known as Knuckles), users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage

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[43] *See* https://valvesoftware.github.io/steamvr_unity_plugin/ (last accessed May 10, 2023); https://github.com/ValveSoftware/unity-xr-plugin (last accessed May 10, 2023).
[44] *See* https://github.com/ValveSoftware/steamvr_unreal_plugin (last accessed May 10, 2023).
[45] *See* https://help.steampowered.com/en/faqs/view/46C3-050A-2E52-12D6 (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[46] *See* https://github.com/ValveSoftware/OpenXR-Canonical-Pose-Tool (last accessed May 10, 2023); https://github.com/ValveSoftware/openxr_engine_plugins (last accessed May 10, 2023).
[47] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[48] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[49] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[50] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).
[51] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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of the high-fidelity force sensors on Knuckles."[52] The "source code and assets" for *Moondust* are publicly available.[53] This project uses Unity and "the new SteamVR Input System."[54] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets a value for the user's grip squeeze:[55]

```
42          float squeeze = actionSqueeze.GetAxis(hand);
```

64. Further, the figure below is a screenshot taken from a Valve Index while testing this functionality. As shown below, while recording this interaction, a "Squeeze" bar shows how much pressure the user applies while squeezing the controller:

65. Accordingly, the Accused VR Instrumentalities perform Limitation 1A of claim 1.

66. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

67. Limitation 1B requires causing the processor to "provide a first tactile sensation to the first input device, the first tactile sensation based at least in part on the first pressure." The Accused VR Instrumentalities perform this step. For example, the "source code and assets" for

[52] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[53] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[54] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[55] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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Moondust are publicly available.[56] This project uses Unity and "the new SteamVR Input System."[57] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets a value for the user's grip squeeze, which is an example of the first pressure:[58]

```
float squeeze = actionSqueeze.GetAxis(hand);
```

68. Later in the `Update()` method, the script triggers a tactile sensation, for example a haptic pulse, based on this `squeeze` value:[59]

```
if (squeeze > 0.3f)
    interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

69. Accordingly, the Accused VR Instrumentalities perform Limitation 1B of claim 1.

70. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

71. Limitation 1C requires causing the processor to "detect a second pressure on the first input device, the second pressure greater than the first pressure." The Accused VR Instrumentalities perform this step. For example in *Moondust*, users can "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[60] The figure below is a screenshot taken from a Valve Index while testing this functionality, and shows an example of a second pressure greater than the first pressure. As shown below, while recording this interaction, a "Squeeze" bar shows a greater pressure than illustrated under Limitation 1A that users can apply while squeezing the controller before crushing the rock:

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[56] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[57] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[58] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[59] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs. (last accessed May 10, 2023).
[60] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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72. Accordingly, the Accused VR Instrumentalities perform Limitation 1C of claim 1.

73. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

74. Limitation 1D requires causing the processor to "provide a second tactile sensation to the first input device, the second tactile sensation based at least in part on the second pressure." The Valve Index provides a tactile sensation in response to, for example, the functionality shown under Limitation 1C. (*See* Limitation 1B for a more detailed explanation of how the Accused VR Instrumentalities provide a second tactile sensation based at least in part on the second pressure.)

75. Accordingly, the Accused VR Instrumentalities perform Limitation 1D of claim 1.

76. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

77. Limitation 1E requires causing the processor to "detect a third pressure on the first input device, the third pressure greater than the second pressure." The Accused VR Instrumentalities perform this step. For example in *Moondust*, users can "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[61] The figure below is a screenshot taken from a Valve Index while testing this functionality, and shows an example of a third pressure greater than the second pressure. As shown

[61] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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below, while recording this interaction, a "Squeeze" bar shows a greater pressure than illustrated under Limitations 1A and 1C that users can apply while squeezing the controller before crushing the rock:

78. Accordingly, the Accused VR Instrumentalities perform Limitation 1E of claim 1.

79. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

80. Limitation 1F requires causing the processor to "provide a third tactile sensation to the first input device." The Valve Index provides a tactile sensation in response to, for example, the functionality shown under Limitation 1E. (*See* Limitation 1B for a more detailed explanation of how the Accused VR Instrumentalities provide a third tactile sensation.)

81. Accordingly, the Accused VR Instrumentalities perform Limitation 1F of claim 1.

82. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

83. Thus, Valve directly infringes at least claim 1 of the '260 patent. For example, the Accused VR Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

84. On information and belief, Valve has taken active steps to induce infringement of at least claim 1 of the '260 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps

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include, but are not limited to, providing its users with instructions on the use of the above-described features.[62]

85. By way of at least this Complaint, Valve knows of the ’260 patent and performs acts that it knows, or should know, induce the direct infringement of claim 1 of the ’260 patent by users of the Accused VR Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 1 of the ’260 patent under 35 U.S.C. § 271(b).

SECOND CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE ’507 PATENT)

86. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

87. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1 of the ’507 patent in violation of 35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused Handheld Instrumentalities and Accused VR Instrumentalities.

88. Claim 1 of the ’507 patent provides:

> [Preamble] A method comprising:
>
> [1A] receiving contact data from an input device;
>
> [1B] determining an interaction with a displayed object on a screen based on the contact data;
>
> [1C] responsive to determining the interaction, determining a gesture based on the contact data comprising:
>
> > determining a pressure and a change in pressure based on the contact data, and

[62] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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determining a press if:

the pressure is greater than a pressure threshold,

the change in pressure is greater than a change in pressure threshold, and

a first interval has elapsed; and

[1D] responsive to determining the gesture, outputting a haptic effect.

89. Based on publicly available information, Valve's Accused Handheld Instrumentalities and Accused VR Instrumentalities meet all elements of at least claim 1 of the '507 patent.

90. Regarding the preamble of claim 1, to the extent the preamble is determined to be limiting, the Accused Handheld Instrumentalities and Accused VR Instrumentalities perform the claimed method. For example, Valve's SteamVR supports multiple engines, including the Unity Engine, the Unreal Engine, and the proprietary Source 2 Engine, through multiple SDKs such as OpenVR and OpenXR to implement applications and games.

91. As one example, OpenVR is divided into two layers: application and driver. Valve documentation notes that, "One real-world example of an application is a game engine like Unity." [63] Further, "OpenVR for application talks to SteamVR. SteamVR then talks to OpenVR driver."[64]

92. As another example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[65] This API includes member functions, such as, `TriggerHapticPulse`, that "[t]riggers a (low-level) haptic pulse on supported controllers."[66]

93. Accordingly, the Accused Handheld Instrumentalities and Accused VR Instrumentalities meet the preamble of claim 1.

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[63] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[64] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[65] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[66] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).

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94. Valve makes and sells the Accused Handheld Instrumentalities and Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

95. Limitation 1A requires "receiving contact data from an input device." The Accused Handheld Instrumentalities and Accused VR Instrumentalities perform this step. Users operate the Valve Index with two controllers, each of which is an example of an input device that receives contact data. For example in *Moondust*,[67] which demonstrates the technical capabilities of the Valve Index controllers (also known as Knuckles), users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[68] The "source code and assets" for *Moondust* are publicly available.[69] This project uses Unity and "the new SteamVR Input System."[70] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets a value for the user's grip squeeze:[71]

```
42          float squeeze = actionSqueeze.GetAxis(hand);
```

[67] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[68] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/. (last accessed May 10, 2023).
[69] *See* https://github.com/ValveSoftware/Moondust. (last accessed May 10, 2023).
[70] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[71] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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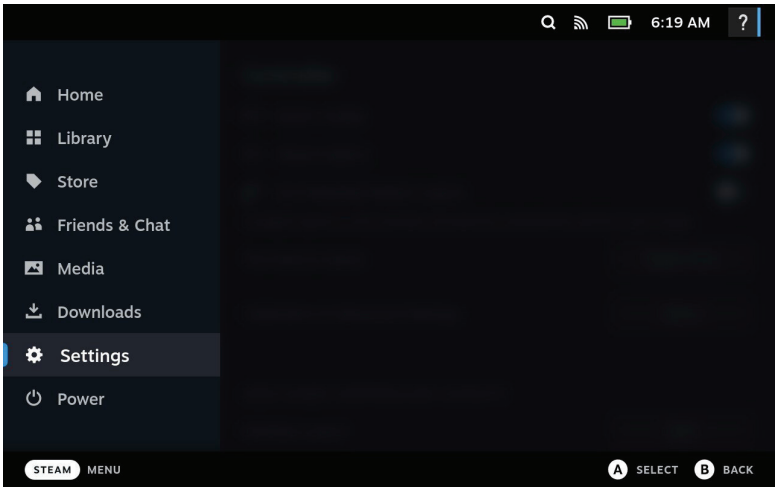
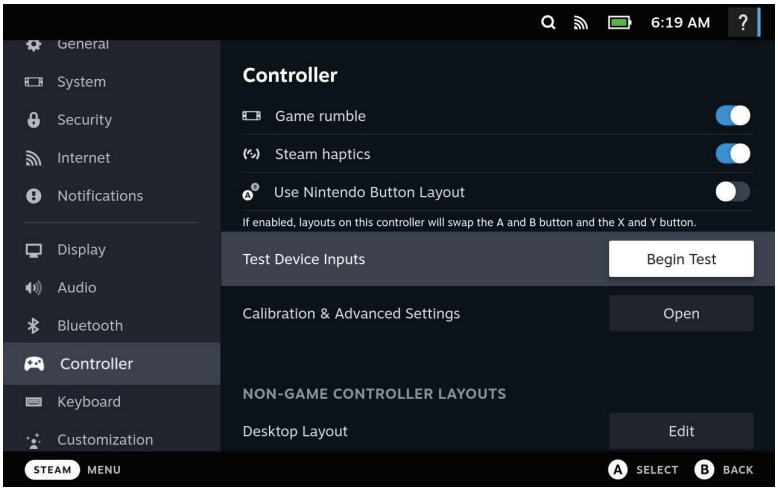
96. As another example in the Accused Handheld Instrumentalities, pressing the Steam Deck's "Steam" button allows for configuring settings:



97. This menu allows users to "Test Device Inputs":



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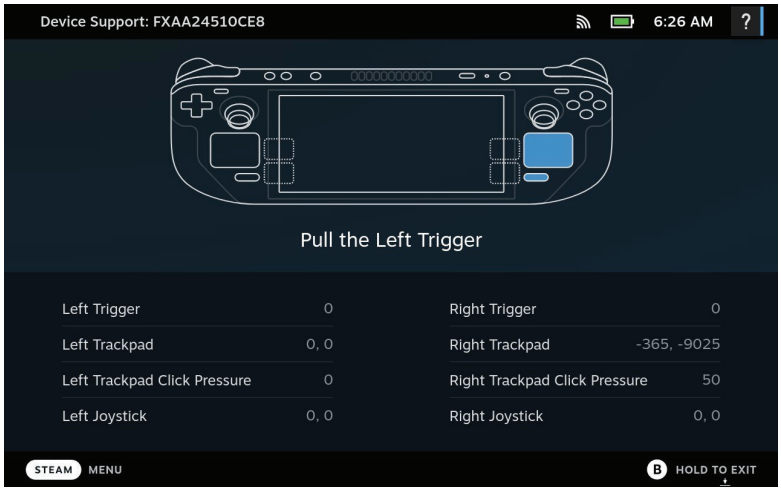
98. The resulting interface shows various examples of input devices that receive contact data, and shows the "Right Trackpad Click Pressure":



99. Accordingly, the Accused Handheld Instrumentalities and Accused VR Instrumentalities perform Limitation 1A of claim 1.

100. Valve makes and sells the Accused Handheld Instrumentalities and Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

101. Limitation 1B requires "determining an interaction with a displayed object on a screen based on the contact data." The Accused Handheld Instrumentalities and Accused VR Instrumentalities perform this step. For example, in *Moondust,*[72] users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[73] The figure below is a screenshot taken from a Valve Index while testing this functionality. It shows an example of an interaction with a displayed object based on contact data. In addition, as shown below, while recording this interaction, a "Squeeze" bar shows how much pressure the user applies while squeezing the controller:

[72] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[73] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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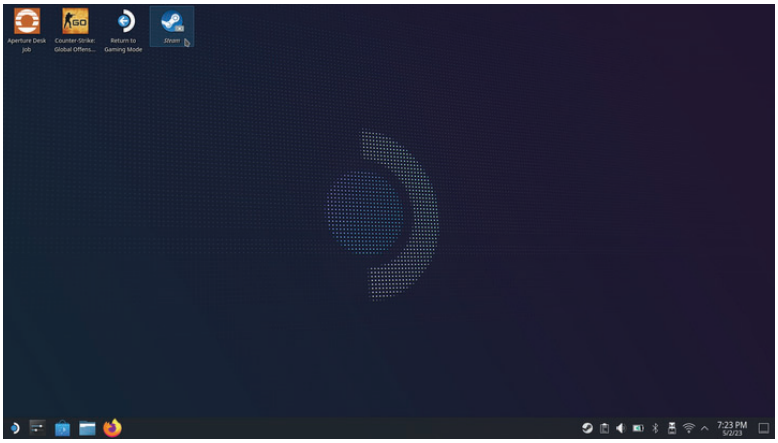
102. As another example, while in Desktop Mode on a Steam Deck, users can move the mouse cursor with the right trackpad, thus showing an example of an interaction with a displayed object based on contact data. Hovering over an icon causes that icon to highlight with an outlined box:



103. Accordingly, the Accused Handheld Instrumentalities and Accused VR Instrumentalities perform Limitation 1B of claim 1.

104. Valve makes and sells the Accused Handheld Instrumentalities and Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

105. Limitation 1C requires "responsive to determining the interaction, determining a gesture based on the contact data comprising: determining a pressure and a change in pressure based on the contact data, and determining a press if: the pressure is greater than a pressure

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threshold, the change in pressure is greater than a change in pressure threshold, and a first interval has elapsed." The Accused Handheld Instrumentalities and Accused VR Instrumentalities perform this step. For example, in *Moondust*,[74] users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[75] The figures below are screenshots taken from a Valve Index while testing this functionality. As shown below, while recording this interaction, a "Squeeze" bar shows how much pressure the user applies while squeezing the controller:

106. The Accused Handheld Instrumentalities and Accused VR Instrumentalities further perform the step of, "determining a press if: the pressure is greater than a pressure threshold, the change in pressure is greater than a change in pressure threshold, and a first interval has elapsed." For example, in *Moondust*,[76] users can continue squeezing the rock as long as the pressure stays below a threshold level, as depicted above. After this interval of time has elapsed, once the pressure passes a threshold the user successfully crushes the rock, which is visually depicted below, along with the highlighting of the "Crush" icon. This functionality indicates that Accused VR

[74] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[75] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[76] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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Instrumentalities determine a press if the pressure is greater than a pressure threshold, the change in pressure is greater than a change in pressure threshold, and a first interval has elapsed.

107. Further, the "source code and assets" for *Moondust* are publicly available.[77] *Moondust* uses Unity and "the new SteamVR Input System."[78] Inside of the script `MoonRock.cs`, the `Update()` method checks to see if the user has crushed the rock. Otherwise, the code further checks to see if the user's squeeze exceeds the threshold value of `0.3f`:[79]

```
48          bool crush = actionCrush.GetStateDown(hand);
49
50          if (crush)
51          {
52              Instantiate(BrokenPrefab, transform.position, Quaternion.identity);
53              Destroy(gameObject);
54          }
55          else
56          {
57              float stress = Mathf.Pow(squeeze, 2);
58
59              if (squeeze > 0.3f)
60                  interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

[77] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[78] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[79] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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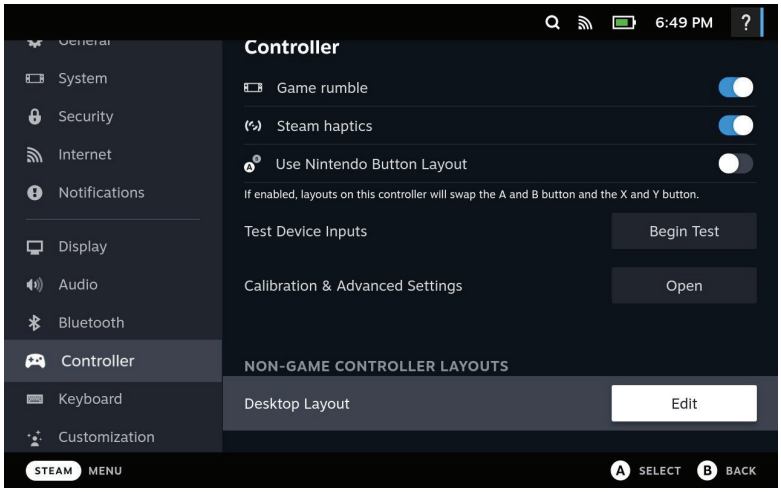
108. Further, the Knuckles bindings file, "bindings_knuckles.json," includes values for the crush threshold, which is passed to the "Crush" action shown above:[80]

```
518            {
519                "inputs" : {
520                    "click" : {
521                        "output" : "/actions/rock/in/Crush"
522                    }
523                },
524                "mode" : "button",
525                "parameters" : {
526                    "click_activate_threshold" : "0.65",
527                    "click_deactivate_threshold" : "0.6",
528                    "force_input" : "force"
529                },
530                "path" : "/user/hand/right/input/grip"
531            },
```

109. As another example in the Accused Handheld Instrumentalities, pressing the Steam Deck's "Steam" button allows for configuring and viewing the default settings, such as for viewing or editing the default controller layout while in Desktop Mode:



[80] *See* https://github.com/ValveSoftware/Moondust/blob/master/bindings_knuckles.json (last accessed May 10, 2023).

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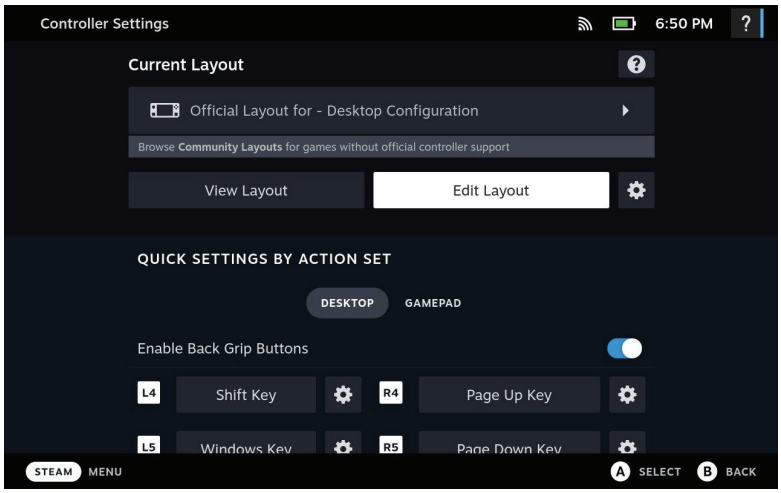
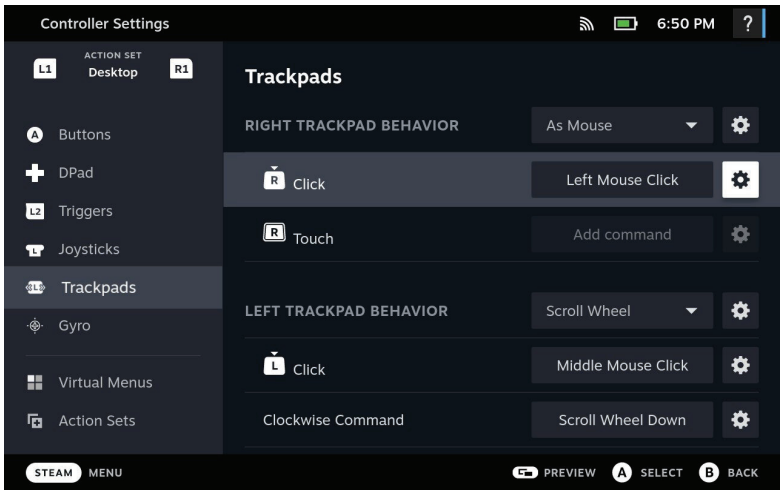


110. By default, the "Official Layout" provided by Valve defines the right trackpad behavior as "As Mouse." Users can then further view the configuration of the "Left Mouse Click":



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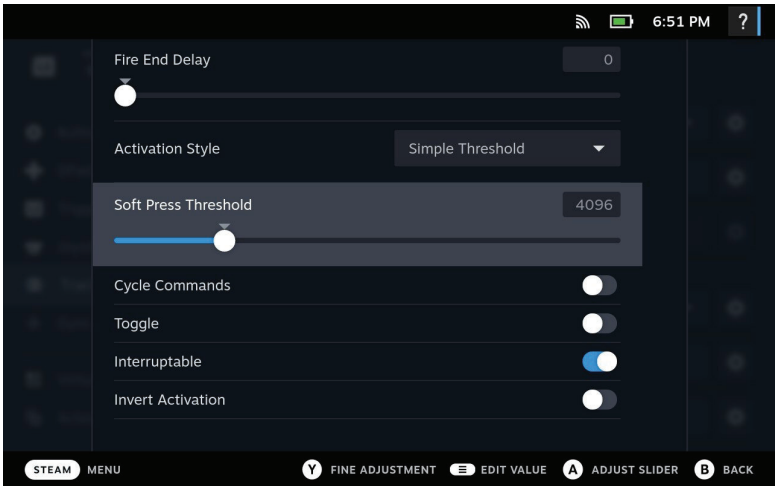
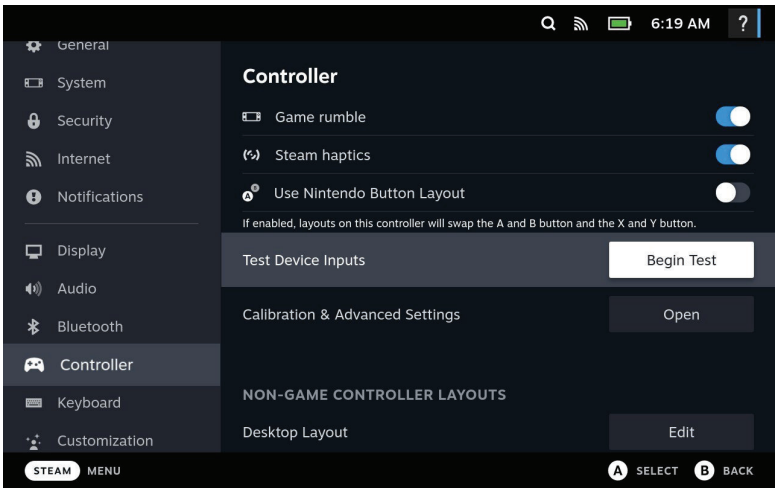
111. The default settings for the Left Mouse Click confirm that the Activation Style of "Simple Threshold" with a "Soft Press Threshold":



112. This menu serves as just one example of the "Left Mouse Click" behavior. As a more general example, the effect of this setting can be viewed through the "Test Device Inputs" menu:



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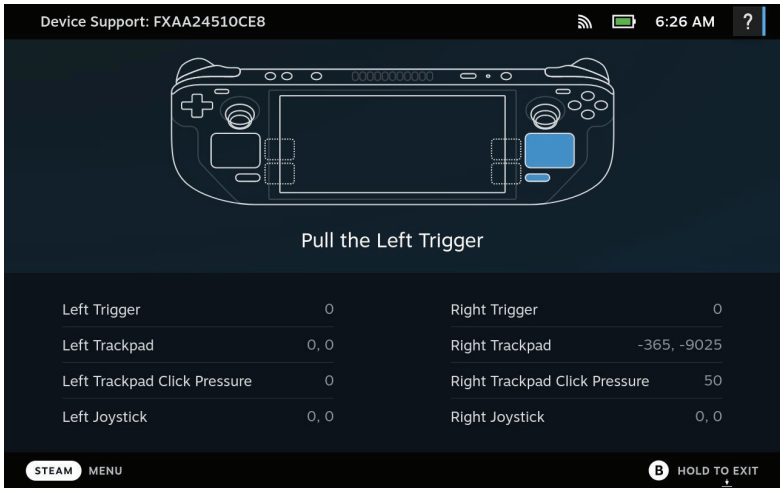
113. The resulting interface shows the "Right Trackpad" location and "Right Trackpad Click Pressure":



114. For example, users can press the right trackpad, and the "Right Trackpad Click Pressure" will indicate the pressure level. While the pressure is below a threshold, such as the "Soft Press Threshold," discussed above, the user will not experience haptics. After an interval of time has elapsed, once the pressure passes a threshold the user feels the haptics similar to a mouse click. Testing confirms this functionality, indicating that Accused Handheld Instrumentalities determine a press if the pressure is greater than a pressure threshold, the change in pressure is greater than a change in pressure threshold, and a first interval has elapsed.

115. Accordingly, the Accused Handheld Instrumentalities and Accused VR Instrumentalities perform Limitation 1C of claim 1.

116. Valve makes and sells the Accused Handheld Instrumentalities and Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

117. Limitation 1D requires "responsive to determining the gesture, outputting a haptic effect." The Accused Handheld Instrumentalities and Accused VR Instrumentalities perform this step. As one example for the Accused VR Instrumentalities, the "source code and assets" for

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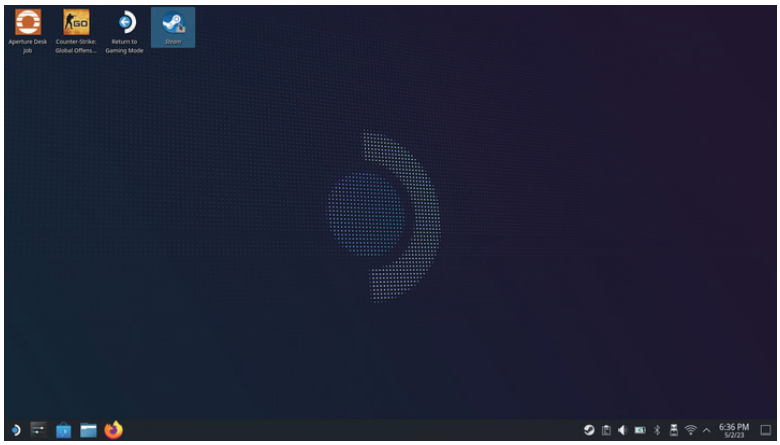
Moondust are publicly available.[81] This project uses Unity and the "new SteamVR Input System."[82] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets a value for the user's grip squeeze:[83]

```
float squeeze = actionSqueeze.GetAxis(hand);
```

118. Later in the `Update()` method, the script triggers a haptic pulse based on this `squeeze` value:[84]

```
if (squeeze > 0.3f)
    interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

119. As another example in the Accused Handheld Instrumentalities, pressing the selected icon discussed in Limitation 1C with the right trackpad results in a left mouse click that outputs a haptic effect, as shown in the settings also discussed in Limitation 1C. Testing on the Steam Deck confirms this functionality:



120. This functionality serves as just one example of the "Left Mouse Click" behavior. As a more general example, testing confirms similar functionality in the "Test Device Inputs" menu, as discussed in Limitation 1C.

---

[81] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[82] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[83] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[84] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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121. Accordingly, the Accused Handheld Instrumentalities and Accused VR Instrumentalities perform Limitation 1D of claim 1.

122. Valve makes and sells the Accused Handheld Instrumentalities and Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

123. Thus, Valve directly infringes at least claim 1 of the '507 patent. For example, the Accused VR Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

124. On information and belief, Valve has taken active steps to induce infringement of at least claim 1 of the '507 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[85]

125. By way of at least this Complaint, Valve knows of the '507 patent and performs acts that it knows, or should know, induce the direct infringement of claim 1 of the '507 patent by users of the Accused Handheld Instrumentalities and Accused VR Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 1 of the '507 patent under 35 U.S.C. § 271(b).

THIRD CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '042 PATENT)

126. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

[85] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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127. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1, of the '042 patent in violation of 35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused Handheld Instrumentalities.

128. Claim 1 of the '042 patent provides:

> [Preamble] A method comprising:
>
> [1A] receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;
>
> [1B] receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and
>
> [1C] generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

129. Based on publicly available information, Valve's Accused Handheld Instrumentalities meet all elements of at least claim 1 of the '042 patent.

130. Regarding the preamble of claim 1, to the extent the preamble is determined to be limiting, the Accused Handheld Instrumentalities perform the claimed steps. For example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[86] This API includes member functions that trigger a low-level haptic pulse on supported controllers.[87]

131. Accordingly, the Accused Handheld Instrumentalities meet the preamble of claim 1.

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[86] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[87] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).

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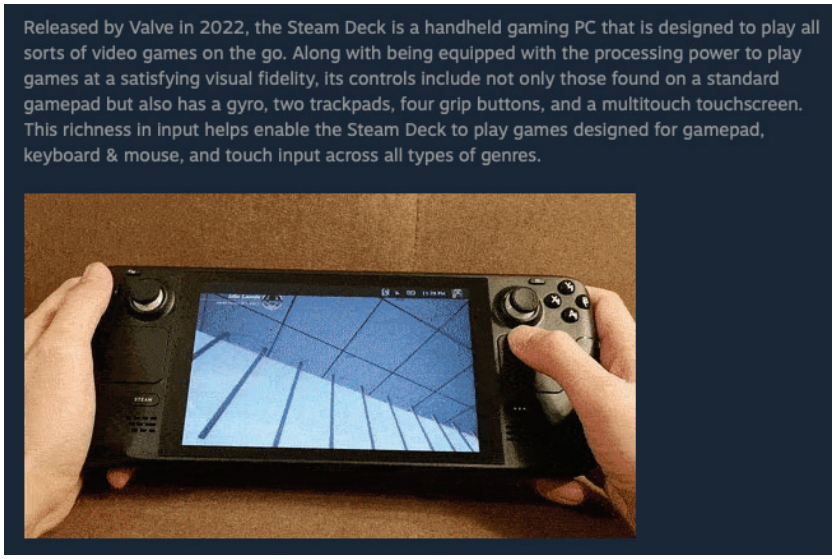
132. Limitation 1A requires "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad." The Accused Handheld Instrumentalities perform this step. For example, the Steam Deck includes multiple exemplary systems, including the various modes, games, and menu navigations that can be controlled with a touch-pad. As just one example, the Steam Deck can be run in two modes: Gaming Mode and Desktop Mode.[88] When turned on, the Steam Deck runs in Gaming Mode, a state dedicated to gaming, where users can play the games they have purchased. In Desktop Mode, users can use the Deck as a PC, such as by browsing the internet and playing games on Steam.[89]

133. Further, the Steam Deck includes multiple touch-pads, including the right and left trackpads:[90]



[88] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[89] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[90] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).

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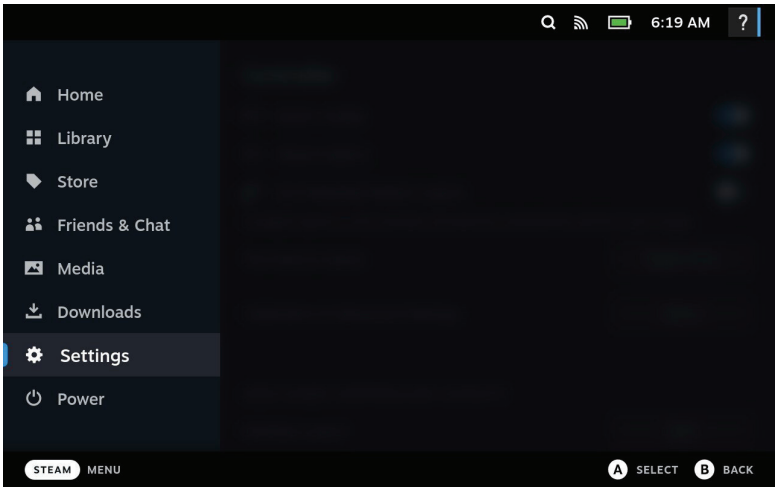
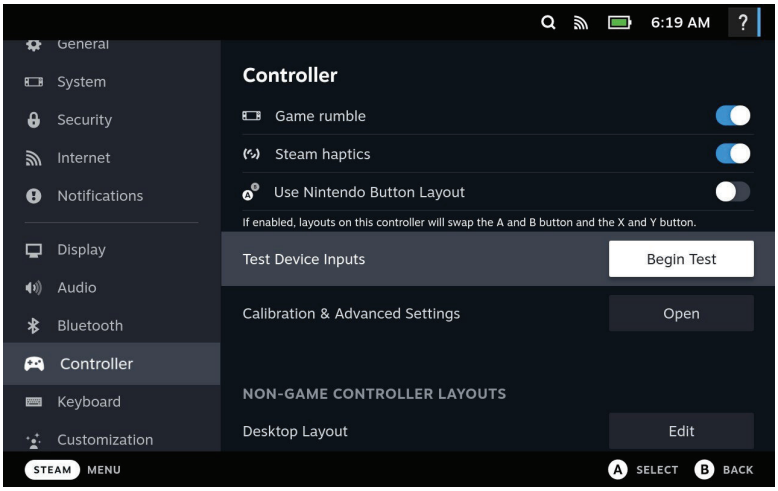
134. Further, pressing the Steam button brings up a list of menu items for navigating to other parts of Steam:[91]



135. For example, this menu allows users to "Test Device Inputs":



[91] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).

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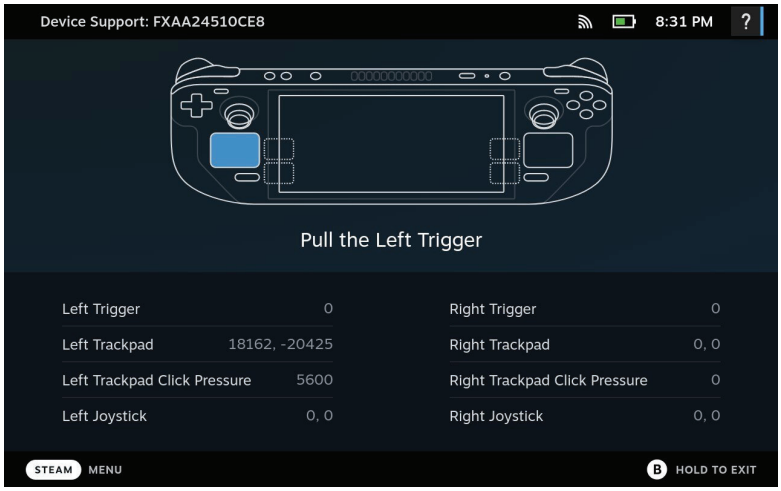
136. The resulting interface shows the "Left Trackpad" location and "Left Trackpad Click Pressure," where the trackpads are examples of touch-pads:



137. This functionality indicates that the Accused Handheld Instrumentalities receive an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad.

138. Accordingly, the Accused Handheld Instrumentalities perform Limitation 1A of claim 1.

139. Valve makes and sells the Accused Handheld Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

140. Limitation 1B requires "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent." The Accused Handheld Instrumentalities perform this step. For example, on the Steam Deck, how the trackpad acts in-game "depends significantly on the Behavior that has been assigned."[92] The chart below shows "the list of the Behaviors that are available for each control," including the Trackpads.[93] Each of these behaviors will have default configurations as set through the controller layout for a given game:[94]

[92] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[93] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[94] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).

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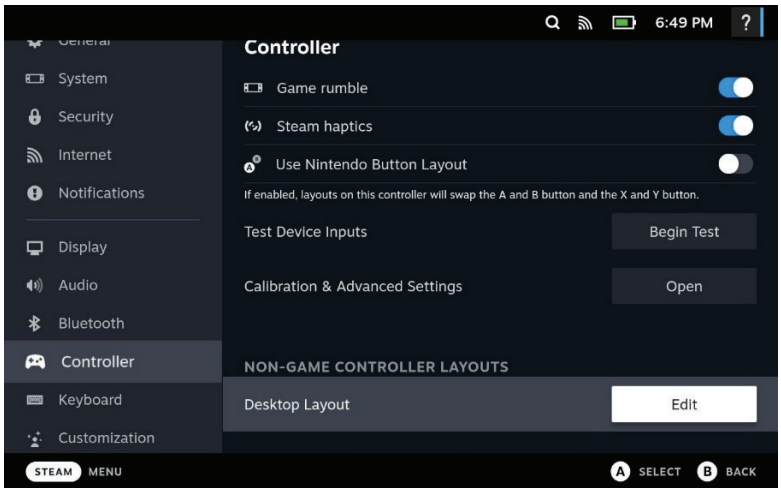
Behaviors - Introduction

How the D-Pad, Button Pad, Analog Sticks, Trackpads, and Gyro act in-game depend significantly on the Behavior that has been assigned. For example, you can set [Right Trackpad] to use As Mouse, where sliding your thumb across the [Trackpad] moves the mouse cursor, or you can set it to Radial Menu, where moving your thumb on the [Trackpad] brings up a menu of user-defined options.

Here is the list of the Behaviors that are available for each control:

Behaviors	D-Pad	Button Pad	Analog Sticks	Trackpads	Gyro
Directional Pad	✔	✔	✔	✔	✔
Button Pad	✔	✔		✔	✔
As Mouse				✔	✔
As Joystick				✔	✔
Joystick	✔	✔	✔	✔	✔
Joystick Mouse			✔		
Flick Stick			✔	✔	
Scroll Wheel			✔	✔	
Radial Menu	✔	✔	✔	✔	
Touch Menu			✔	✔	✔
Hotbar Menu	✔		✔	✔	
Mouse Region			✔	✔	✔
Single Button				✔	
Directional Swipe				✔	✔

141. Further, the "Steam" button menu allows for configuring the controller layout settings while in Desktop mode:



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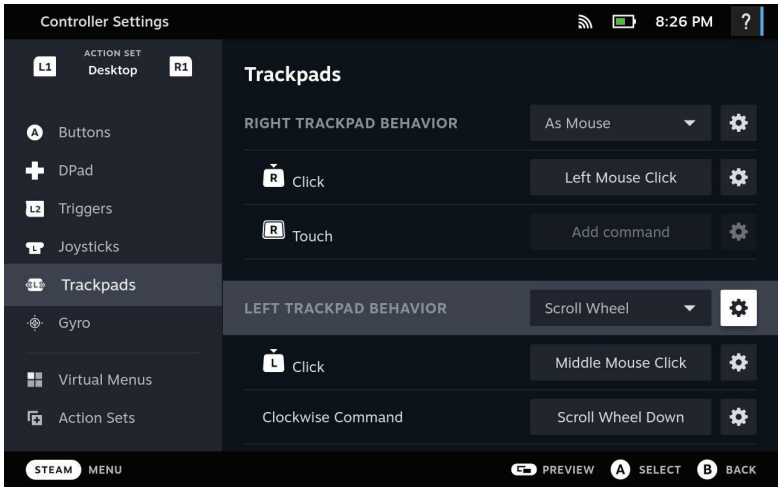
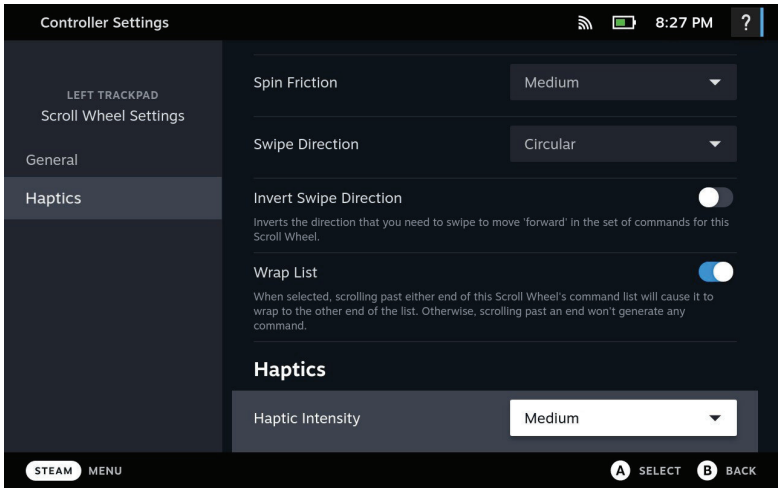
142. The default layout assigns the "Scroll Wheel" Behavior to the left trackpad, which is an example of a detent profile:



143. Users can further view the default haptic intensity for this behavior:



144. This functionality indicates that the Accused Handheld Instrumentalities receive a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent.

145. Accordingly, the Accused Handheld Instrumentalities perform Limitation 1B of claim 1.

146. Valve makes and sells the Accused Handheld Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

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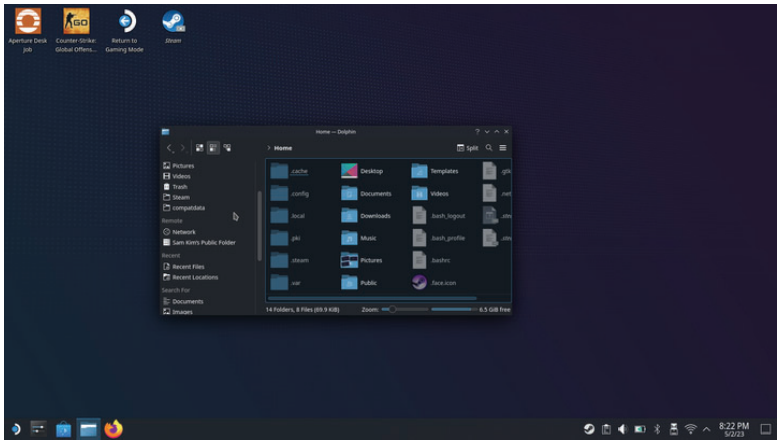
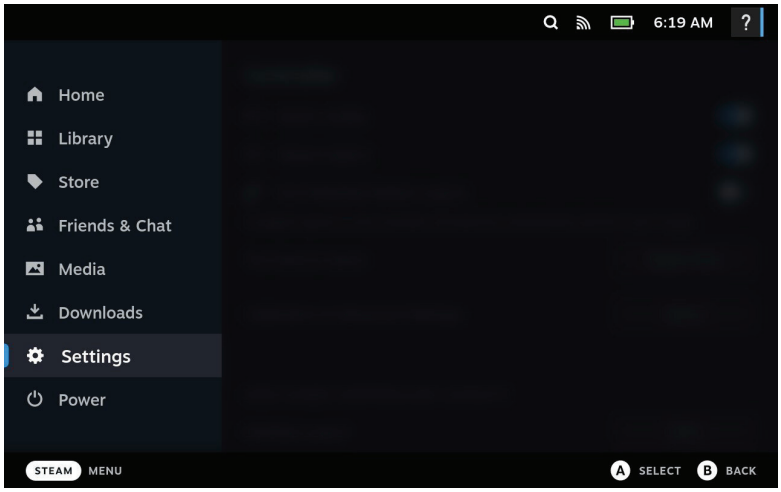
147. Limitation 1C requires "generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent." The Accused Handheld Instrumentalities perform this step. For example, in Desktop Mode on the Steam Deck, using the left track pad acts as a scroll wheel. Testing this functionality confirms the vibrotactile effects for the "Scroll Wheel" Behavior, which is an example of a virtual detent:



148. Further, pressing the left trackpad while viewing the user interface that results from pressing "Steam" menu button results in haptics similar to the "Directional Pad" behavior. That is, touching the top, bottom, left, and right edges of the right trackpad results in navigation and haptic effects, which is also an example of a virtual detent. Testing this functionality on the Steam Deck confirms these results.



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149. Accordingly, the Accused Handheld Instrumentalities perform Limitation 1C of claim 1.

150. Valve makes and sells the Accused Handheld Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

151. Thus, Valve directly infringes at least claim 1 of the '042 patent. For example, the Accused Handheld Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

152. On information and belief, Valve has taken active steps to induce infringement of at least claim 1 of the '042 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[95]

153. By way of at least this Complaint, Valve knows of the '042 patent and performs acts that it knows, or should know, induce the direct infringement of claim 1 of the '042 patent by users of the Accused Handheld Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 1 of the '042 patent under 35 U.S.C. § 271(b).

FOURTH CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '546 PATENT)

154. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

155. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 5 of the '546 patent in violation of

[95] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused VR Instrumentalities.

156. Claim 5 of the '546 patent provides:

> [Preamble]. A computer-implemented method for generating a haptic effect, the computer-implemented method comprising:
>
> [5A] receiving input from a sensor, wherein the input comprises extra-sensory information, wherein the input further comprises one or more interaction parameters, and wherein each interaction parameter comprises a value;
>
> [5B] mapping the received input to a haptic signal; and
>
> [5C] sending the haptic signal to an actuator to generate the haptic effect;
>
> [5D] the mapping the received input to the haptic signal further comprising modulating the haptic signal when new input is received, wherein the new received input comprises an update of at least one value of at least one interaction parameter of the received input; and
>
> [5E] the sending the haptic signal to the actuator to generate the haptic effect further comprising sending the modulated haptic signal to the actuator to modulate the generated haptic effect.

157. Based on publicly available information, Valve's Accused VR Instrumentalities meet all elements of at least claim 5 of the '546 patent.

158. Regarding the preamble of claim 5, to the extent the preamble is determined to be limiting, the Accused VR Instrumentalities provide the features described in the preamble, which recites "computer-implemented method for generating a haptic effect" comprising the claimed steps. For example, SteamVR Tracking is a "hardware/software solution" developed "in-house at Valve" that "lets devices know in realtime where they are, within a room":[96]

[96] *See* https://partner.steamgames.com/vrlicensing (last accessed May 10, 2023).

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SteamVR™ Tracking

Whether you're building a VR golf club or an indoor quad-copter, 3D tracking is the heart of your product. Developed in-house at Valve, SteamVR Tracking is a hardware/software solution that lets your devices know in real time where they are, within a room. Valve is now making SteamVR Tracking fully available to other companies, without licensing fees.

159. SteamVR Tracking has three main components, including a "host," meaning a PC, that "[i]ntegrates 3D positional information from multiple devices" and includes the SteamVR API:[97]

HOST

- Integrates 3D positional information from multiple devices. For now, this means a PC.
- SteamVR API for accurate timing, synchronization, and prediction
- Compatibility with Steam and access to the full SteamVR catalog

160. The SteamVR API includes methods that "[t]rigger a single haptic pulse on a controller."[98] Further, Valve's SteamVR supports multiple engines, including the Unity Engine,[99] the Unreal Engine,[100] and the proprietary Source 2 Engine, through multiple SDKs such as OpenVR[101] and OpenXR[102] to implement applications and games.

161. As one example, OpenVR is divided into two layers: application and driver. Valve documentation notes that, "One real-world example of an application is a game engine like Unity."[103] Further, "OpenVR for application talks to SteamVR. SteamVR then talks to OpenVR driver."[104]

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[97] *See* https://partner.steamgames.com/vrlicensing (last accessed May 10, 2023).
[98] *See* https://github.com/ValveSoftware/openvr/wiki/IVRSystem::TriggerHapticPulse (last accessed May 10, 2023).
[99] *See* https://valvesoftware.github.io/steamvr_unity_plugin/; https://github.com/ValveSoftware/unity-xr-plugin (last accessed May 10, 2023).
[100] *See* https://github.com/ValveSoftware/steamvr_unreal_plugin (last accessed May 10, 2023).
[101] *See* https://help.steampowered.com/en/faqs/view/46C3-050A-2E52-12D6 (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[102] *See* https://github.com/ValveSoftware/OpenXR-Canonical-Pose-Tool (last accessed May 10, 2023); https://github.com/ValveSoftware/openxr_engine_plugins (last accessed May 10, 2023).
[103] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[104] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).

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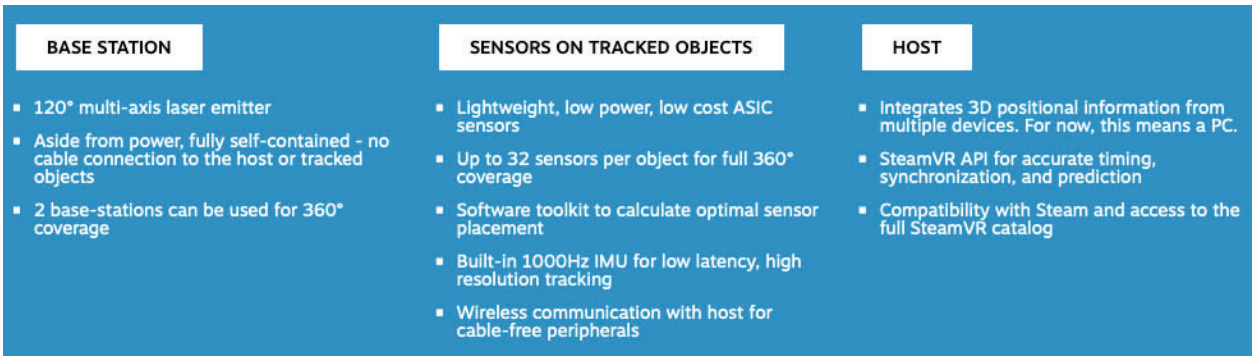
162. As another example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[105] This API includes member functions, such as, `TriggerHapticPulse`, that "[t]riggers a (low-level) haptic pulse on supported controllers."[106]

163. Accordingly, the Accused VR Instrumentalities meet the preamble of claim 5.

164. Limitation 5A requires "receiving input from a sensor, wherein the input comprises extra-sensory information, wherein the input further comprises one or more interaction parameters, and wherein each interaction parameter comprises a value." The Accused VR Instrumentalities perform this step. For example, SteamVR tracking has three main components, including a base station, sensors on tracked objects, and a host:[107]



165. Further, the Accused VR Instrumentalities perform the step of "receiving input from a sensor, wherein the input comprises extra-sensory information." For example, the SteamVR Tracking Base stations sweep the room with "sync pulses and laser lines" to "find the location of

[105] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[106] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).
[107] *See* https://partner.steamgames.com/vrlicensing (last accessed May 10, 2023).

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each sensor within a fraction of a millimeter," which are examples of a sensor receiving input that comprises extra-sensory information:

> **How It Works**
>
> The SteamVR Tracking Basestations sweep the room with multiple sync pulses and laser lines, reaching out to about 5 meters. By keeping careful track of the timings between pulses and sweeps, the SteamVR Tracking system uses simple trigonometry to find the location of each sensor to within a fraction of a millimeter. By combining multiple sensors, 2 basestations, as well as adding a high speed IMU (inertial measurement unit), SteamVR also calculates the tracked object's orientation, velocity, and angular velocity, all at an update rate of 1000Hz.

166. Moreover, the SteamVR API includes methods that provide this controller pose information, which is just one example that demonstrates how the Accused VR Instrumentalities receives input from a sensor. One such example method includes `GetControllerState:`[108]

> **IVRSystem::GetControllerState**
>
> Matthew Hoffman edited this page on Aug 10, 2016 · 3 revisions
>
> `bool GetControllerState( vr::TrackedDeviceIndex_t unControllerDeviceIndex, vr::VRControllerState_t *pControllerState )`
> `bool GetControllerStateWithPose( TrackingUniverseOrigin eOrigin, vr::TrackedDeviceIndex_t unControllerDeviceIndex, vr::VRControllerState_t *pControllerState, TrackedDevicePose_t *pTrackedDevicePose )`
>
> Fills the supplied struct with the current state of the controller.
>
> - `vr::TrackedDeviceIndex_t unControllerDeviceIndex` - The tracked device index of the controller to get the state of.
> - `vr::VRControllerState_t *pControllerState` - A struct to fill with the controller state.
> - `TrackingUniverseOrigin eOrigin` - The tracking coordinate system to return the pose in.
> - `TrackedDevicePose_t *pTrackedDevicePose` - A pose struct to fill with the pose of the controller when the last button event occurred.

167. As just one additional example, in *Moondust*,[109] which demonstrates the technical capabilities of the Valve Index controllers (also known as Knuckles), users "[c]rush moon rocks

[108] *See* https://github.com/ValveSoftware/openvr/wiki/IVRSystem::GetControllerState (last accessed May 10, 2023).
[109] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[110] The "source code and assets" for *Moondust* are publicly available.[111] This project uses Unity and "the new SteamVR Input System."[112] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets a value for the user's grip squeeze, which indicates that the Accused VR Instrumentalities receive input further comprised of one or more interaction parameters, wherein each interaction parameter comprises a value:[113]

```
42          float squeeze = actionSqueeze.GetAxis(hand);
```

168. Accordingly, the Accused VR Instrumentalities perform Limitation 5A of claim 5.

169. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

170. Limitation 5B requires "mapping the received input to a haptic signal." The Accused VR Instrumentalities perform this step. For example, "the source code and assets" for *Moondust* are publicly available.[114] This project uses Unity and "the new SteamVR Input System."[115] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that inputs the user's "squeeze" value as a parameter to `TriggerHapticPulse` through a linear interpolation,[116] which is just one example for how the Accused VR Instrumentalities map the received input to a haptic signal:[117]

```
59              if (squeeze > 0.3f)
60                  interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

[110] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[111] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[112] *See, e.g.,* https://github.com/ValveSoftware/Moondust; https://youtu.be/qo-9CmcKWlY?t=55 (last accessed May 10, 2023).
[113] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[114] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[115] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[116] *See* https://docs.unity3d.com/ScriptReference/Mathf.Lerp.html (last accessed May 10, 2023).
[117] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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171. Accordingly, the Accused VR Instrumentalities perform Limitation 5B of claim 5.

172. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

173. Limitation 5C requires "sending the haptic signal to an actuator to generate the haptic effect." The Accused VR Instrumentalities perform this step. For example in *Moondust*,[118] users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[119] As shown below, while recording this interaction, a "Squeeze" bar shows how much pressure the user applies while squeezing the controller. Testing confirms that this functionality generates haptics effects.

174. Further, the Valve Index Controllers include an HD LRA for Haptics actuator:[120]

Tech specs

Inputs	Ergonomics	Connections	Haptics
A Button, B Button, System Button, Trigger, Thumbstick, Track Button with Force Sensor, Grip Force Sensor, Finger Tracking, IMU	Adjustable strap with pivot, antimicrobial tech fabric	USB-C, 2.4GHz Wireless	HD LRA

[118] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[119] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[120] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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175. Accordingly, the Accused VR Instrumentalities perform Limitation 5C of claim 5.

176. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

177. Limitation 5D requires "the mapping the received input to the haptic signal further comprising modulating the haptic signal when new input is received, wherein the new received input comprises an update of at least one value of at least one interaction parameter of the received input." The Accused VR Instrumentalities perform this step. For example in *Moondust*,[121] users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[122] As shown below, while recording this interaction, a "Squeeze" bar shows how much pressure the user applies while squeezing the controller:

178. Further, the Accused VR Instrumentalities perform the step of "modulating the haptic signal when new input is received." For example, the harder the user squeezes, the more haptic effects occur. Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that updates the value for the user's grip squeeze:[123]

```
42          float squeeze = actionSqueeze.GetAxis(hand);
```

[121] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[122] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[123] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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179. This updated value is passed as a parameter to `TriggerHapticPulse,` which is just one example that demonstrates how the Accused VR Instrumentalities modulate the haptic signal when new input is received:[124]

```
59            if (squeeze > 0.3f)
60                interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

180. Accordingly, the Accused VR Instrumentalities perform Limitation 5D of claim 5.

181. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

182. Limitation 5E requires "the sending the haptic signal to the actuator to generate the haptic effect further comprising sending the modulated haptic signal to the actuator to modulate the generated haptic effect." The Accused VR Instrumentalities perform this step. For example, the Valve Index Controllers include an HD LRA for Haptics actuator:[125]

Tech specs

Inputs	Ergonomics	Connections	Haptics
A Button, B Button, System Button, Trigger, Thumbstick, Track Button with Force Sensor, Grip Force Sensor, Finger Tracking, IMU	Adjustable strap with pivot, antimicrobial tech fabric	USB-C, 2.4GHz Wireless	HD LRA

183. As just one additional example, in *Moondust*, the harder the user squeezes, the more haptic effects occur. Testing confirms this functionality, which is just one example that the Accused VR Instrumentalities send the modulated haptic signal to the actuator to modulate the generated haptic effect. Further, Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that inputs the user's "squeeze" value as a parameter to

[124] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[125] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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`TriggerHapticPulse`.[126] As discussed in Limitation 5D, these calls would include updated values as the user varies their squeeze pressure:

```
59            if (squeeze > 0.3f)
60                interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

184. This functionality indicates that the Accused VR Instrumentalities send a modulated haptic signal to the actuator to modulate the generated haptic effect.

185. Accordingly, the Accused VR Instrumentalities perform Limitation 5E of claim 5.

186. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

187. Thus, Valve directly infringes at least claim 5 of the '546 patent. For example, the Accused VR Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

188. On information and belief, Valve has taken active steps to induce infringement of at least claim 5 of the '546 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[127]

189. By way of at least this Complaint, Valve knows of the '546 patent and performs acts that it knows, or should know, induce the direct infringement of claim 5 of the '546 patent by

[126] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

[127] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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users of the Accused VR Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 5 of the '546 patent under 35 U.S.C. § 271(b).

FIFTH CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '907 PATENT)

190. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

191. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1, of the '907 patent in violation of 35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused Handheld Instrumentalities.

192. Claim 1 of the '907 patent provides:

> [Preamble] A method for controlling a user input element associated with a haptic output device, the method comprising:
>
> [1A] defining position and range information for the user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and
>
> [1B] rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

193. Based on publicly available information, Valve's Accused Handheld Instrumentalities meet all elements of at least claim 1 of the '907 patent.

194. Regarding the preamble of claim 1, to the extent the preamble is determined to be limiting, the Accused Handheld Instrumentalities provide the features described in the preamble, which recites a "method for controlling a user input element associated with a haptic output device." For example, the Steam Deck includes analog triggers:[128]

[128] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).

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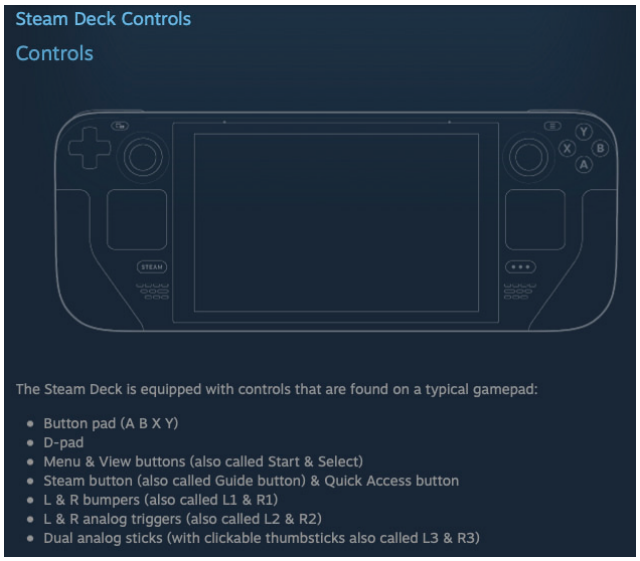
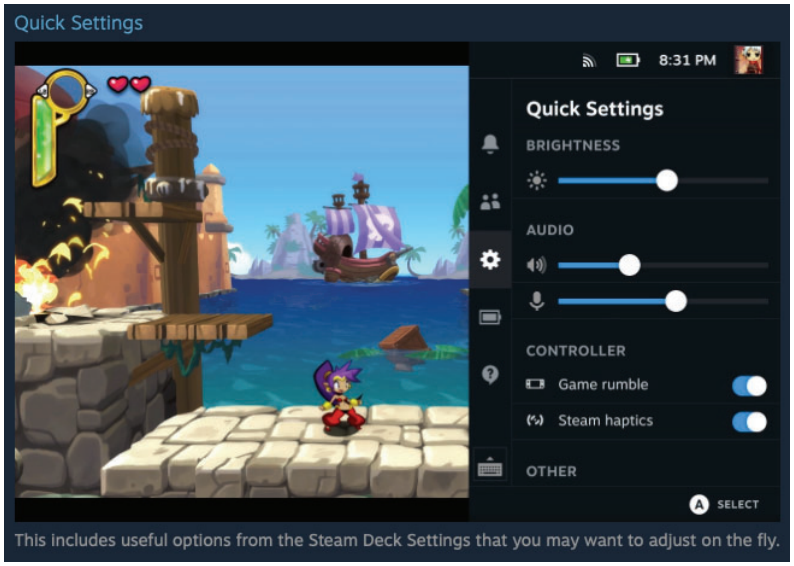


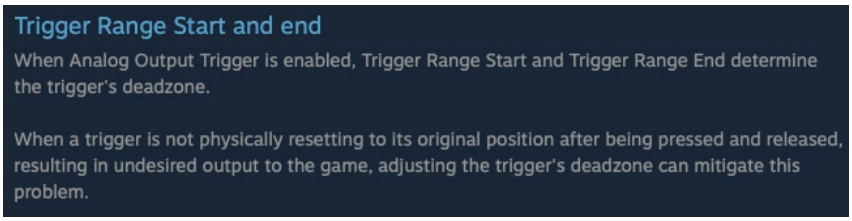
195. Further, the Accused Handheld Instrumentalities comprise a haptic output device at least because, for example, Steam Input refers to the collection of software, hardware, and configuration utilities that Steam uses to interface with games,[129] and the Steam Deck offers "Game rumble" and "Steam haptics": [130]



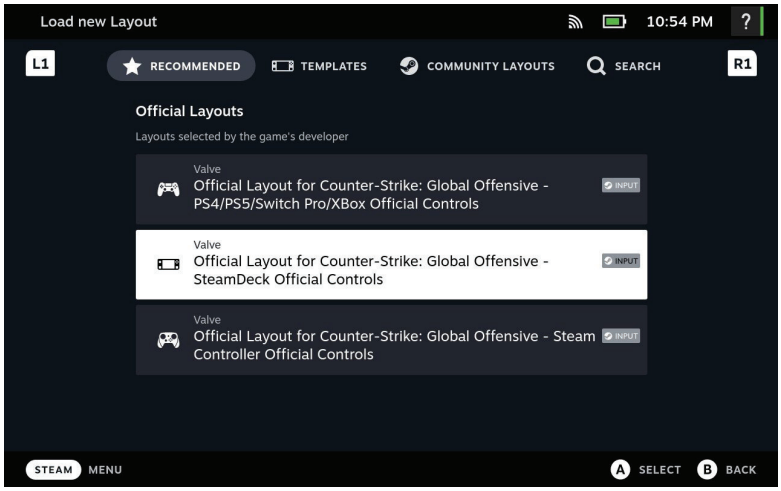
196. Accordingly, the Accused Handheld Instrumentalities meet the preamble of claim 1.

[129] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[130] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).

197. Limitation 1A requires "defining position and range information for the user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions." The Accused Handheld Instrumentalities perform this step. For example, the Steam Deck offers the ability to view or edit the analog trigger's range start and end, which are examples of a primary range of positions and a secondary range of positions, as further described below:[131]



198. Further, the figures below are screenshots taken from a Steam Deck while testing this functionality in *Counter-Strike: Global Offensive*[132] ("*CSGO*") with the "SteamDeck Official Controls":



199. *CSGO*'s SteamDeck Official Controls bind the "Soft Pull" for the right trigger to the action "Fire":

[131] *See* https://steamcommunity.com/sharedfiles/filedetails/?id=2804823261 (last accessed May 10, 2023).
[132] *See* https://store.steampowered.com/app/730/CounterStrike_Global_Offensive/ (last accessed May 10, 2023).

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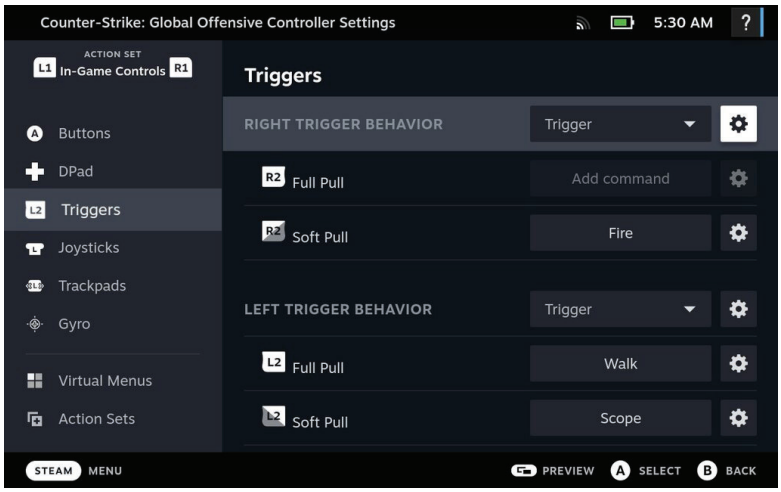
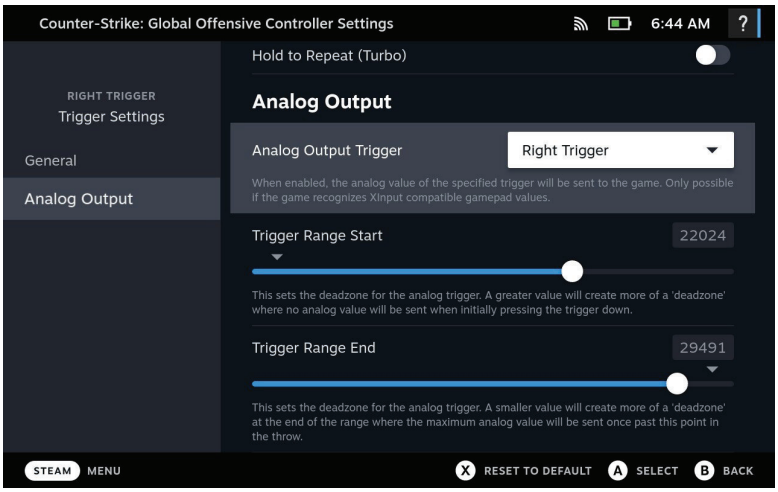


200. Additionally, viewing the settings for the "Right Trigger Behavior" allows for viewing the default "Trigger Range Start" and "Trigger Range End" for the Soft Pull. Testing confirms this functionality:



201. The help text beneath the Trigger Range Start explains that this sets the deadzone for the analog trigger, where no analog values will be sent when initially pressing the trigger down, which is just one example of a primary range of positions:

> This sets the deadzone for the analog trigger. A greater value will create more of a 'deadzone' where no analog value will be sent when initially pressing the trigger down.

202. Further, the help text beneath the Trigger Range Ends explains that this creates a deadzone at the end of the range, where the maximum analog values will be sent once past this point, which is just one example of a secondary range of positions:

This sets the deadzone for the analog trigger. A smaller value will create more of a 'deadzone' at the end of the range where the maximum analog value will be sent once past this point in the throw.

203. The above configurations result in a range of positions between the trigger range start and end that constitute analog values outside of the trigger's deadzone. This is just one example of a boundary range of positions that partially overlaps each of the primary range of positions and the secondary range of positions.

204. Accordingly, the Accused Handheld Instrumentalities perform Limitation 1A of claim 1.

205. Valve makes and sells the Accused Handheld Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

206. Limitation 1B requires "rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions." The Accused Handheld Instrumentalities perform this step. For example, testing in *CSGO* with the configuration described in Limitation 1A confirms that firing occurred late into the Soft Pull of the right trigger, i.e., upon entry of the user input element within the boundary range of positions. Firing also causes haptic effects to occur.

207. Accordingly, the Accused Handheld Instrumentalities perform Limitation 1B of claim 1.

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208. Valve makes and sells the Accused Handheld Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

209. Thus, Valve directly infringes at least claim 1 of the '907 patent. For example, the Accused Handheld Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

210. On information and belief, Valve has taken active steps to induce infringement of at least claim 1 of the '907 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[133]

211. By way of at least this Complaint, Valve knows of the '907 patent and performs acts that it knows, or should know, induce the direct infringement of claim 1 of the '907 patent by users of the Accused Handheld Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 1 of the '907 patent under 35 U.S.C. § 271(b).

SIXTH CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '067 PATENT)

212. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

213. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 11 of the '067 patent in violation of 35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District

[133] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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and in the United States certain products including, but not limited to those, relating to the Accused VR Instrumentalities.

214. Claim 11 of the '067 patent provides:

> [Preamble] A method comprising:
>
> [11A] determining a modified visual effect based in part on data received from a sensor;
>
> [11B] determining a haptic effect based in part on data received from the sensor;
>
> [11C] transmitting a display signal associated with the modified visual effect to a display, the modified visual effect being displayed on a surface of a proxy object via the display, the proxy object comprising one or more haptic output devices;
>
> [11D] transmitting a haptic signal associated with the haptic effect to the one or more haptic output devices; and
>
> [11E] outputting the haptic effect using the one or more haptic output devices.

215. Based on publicly available information, Valve's Accused VR Instrumentalities meet all elements of at least claim 11 of the '067 patent.

216. Regarding the preamble of claim 11, to the extent the preamble is determined to be limiting, the Accused VR Instrumentalities perform the claimed method. For example, Valve's SteamVR supports multiple engines, including the Unity Engine, the Unreal Engine, and the proprietary Source 2 Engine, through multiple SDKs such as OpenVR and OpenXR to implement applications and games.

217. As one example, OpenVR is divided into two layers: application and driver. Valve documentation notes that, "One real-world example of an application is a game engine like Unity." [134] Further, "OpenVR for application talks to SteamVR. SteamVR then talks to OpenVR driver."[135]

---

[134] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[135] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).

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218. As another example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[136] This API includes member functions, such as, `TriggerHapticPulse`, that "[t]riggers a (low-level) haptic pulse on supported controllers."[137]

219. Accordingly, the Accused VR Instrumentalities meet the preamble of claim 11.

220. Limitation 11A requires "determining a modified visual effect based in part on data received from a sensor." The Accused VR Instrumentalities perform this step. For example, the Skeletal Input system allows drivers for each type of controller to provide applications with an animated skeleton of the user's hand to the best level of fidelity that its sensors are able to detect. Skeletal data can be bound to input actions, just like other input:[138]

> **Overview**
>
> The Skeletal Input system allows drivers for each type of controller to provide applications with an animated skeleton of the user's hand to the best level of fidelity that its sensors are able to detect. Developers can then reduce their need to create custom hand animations for each controller they plan to support, and can instead use the animation provided by the current driver in conjunction with their own game-specific animations. Skeletal data can be bound to input actions, just like other input. The animation can be requested to be as accurate as possible (which will often mean that the range of motion of the

221. Additionally, Valve further provides two ranges of motion with different visual effects, `WithController` and `WithoutController`:

[136] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[137] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).
[138] *See* https://github.com/ValveSoftware/openvr/wiki/SteamVR-Skeletal-Input (last accessed May 10, 2023).

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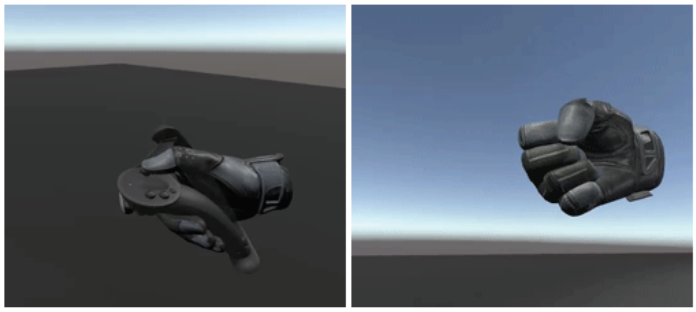
Range Of Motion

We have two ranges of motion that you can get bone data for. If you're looking for accurate-to-real-world data you can use the `WithController` range of motion. This means we try and estimate where your fingers are in the real world as best as the controller will allow. `WithoutController` gives you a full range from a flat hand with fingers spread out to a balled fist.



222. Further, the Valve Index controllers provide the "Partial" level of fidelity that measures finger curl:[139]

Skeletal Tracking Level

Different controllers have different abilities to track the individual joints of your fingers. Here we provide an overview value that should give you a general idea what level of fidelity your current controller has.

- **Estimated:** Body part location can't be directly determined by the device. Any skeletal pose provided by the device is estimated based on the active buttons, triggers, joysticks, or other input sensors. Examples include the Vive Controller and gamepads.
- **Partial:** Body part location can be measured directly but with fewer degrees of freedom than the actual body part.Certain body part positions may be unmeasured by the device and estimated from other input data.Examples include Knuckles or gloves that only measure finger curl
- **Full:** Body part location can be measured directly throughout the entire range of motion of the body part.Examples include hi-end mocap systems, or gloves that measure the rotation of each finger segment.

223. Accordingly, the Accused VR Instrumentalities perform Limitation 11A of claim 11.

224. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

225. Limitation 11B requires "determining a haptic effect based in part on data received from the sensor." The Accused VR Instrumentalities perform this step. As just one example, in *Moondust*,[140] which demonstrates the technical capabilities of the Valve Index controllers (also

[139] *See* https://valvesoftware.github.io/steamvr_unity_plugin/articles/Skeleton-Input.html (last accessed May 10, 2023).
[140] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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known as Knuckles), users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[141] The "source code and assets" for *Moondust* are publicly available.[142] This project uses Unity and the "new SteamVR Input System."[143] On information and belief, inside of the script `MoonRock.cs`, the `Update()` method contains the following line that gets the value for the user's grip squeeze:[144]

```
float squeeze = actionSqueeze.GetAxis(hand);
```

226. Further, the `Update()` method contains the following subsequent line that inputs the user's "squeeze" value as a parameter to `TriggerHapticPulse`,[145] indicating that the Accused VR Instrumentalities determine a haptic effect based in part on data received from the grip sensor:

```
if (squeeze > 0.3f)
    interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

227. Accordingly, the Accused VR Instrumentalities perform Limitation 11B of claim 11.

228. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

229. Limitation 11C requires "transmitting a display signal associated with the modified visual effect to a display, the modified visual effect being displayed on a surface of a proxy object via the display, the proxy object comprising one or more haptic output devices." The Accused VR Instrumentalities perform this step. For example, the Valve Index Controllers include an HD LRA for Haptics:[146]

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[141] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).
[142] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[143] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[144] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[145] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).
[146] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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Tech specs

Inputs	Ergonomics	Connections	Haptics
A Button, B Button, System Button, Trigger, Thumbstick, Track Button with Force Sensor, Grip Force Sensor, Finger Tracking, IMU	Adjustable strap with pivot, antimicrobial tech fabric	USB-C, 2.4GHz Wireless	HD LRA

230. Further, in *Moondust*, users "[c]rush moon rocks to a fine powder with your powerful hands, taking advantage of the high-fidelity force sensors on Knuckles."[147] As shown below, *Moondust* displays virtual hands over the physical controllers. As discussed in Limitation 11A, these virtual hands are just one example of modified visual effects. These virtual hands are displayed on the surface of the user's controllers, which are examples of a proxy object comprising one or more haptic output devices:

231. Accordingly, the Accused VR Instrumentalities perform Limitation 11C of claim 11.

232. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

[147] *See* https://store.steampowered.com/app/887260/Moondust_Knuckles_Tech_Demos/ (last accessed May 10, 2023).

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233. Limitation 11D requires "transmitting a haptic signal associated with the haptic effect to the one or more haptic output devices." The Accused VR Instrumentalities perform this step. For example, the Valve Index Controllers include an HD LRA for Haptics:[148]

Tech specs

Inputs	Ergonomics	Connections	Haptics
A Button, B Button, System Button, Trigger, Thumbstick, Track Button with Force Sensor, Grip Force Sensor, Finger Tracking, IMU	Adjustable strap with pivot, antimicrobial tech fabric	USB-C, 2.4GHz Wireless	HD LRA

234. Further, the "source code and assets" for *Moondust* are publicly available.[149] This project uses Unity and "the new SteamVR Input System."[150] Inside of the script `MoonRock.cs`, the `Update()` method contains the following line that inputs the user's "squeeze" value as a parameter to `TriggerHapticPulse`:[151]

```
59            if (squeeze > 0.3f)
60                interactable.attachedToHand.TriggerHapticPulse((ushort)Mathf.Lerp(200, 1000, squeeze * 2));
```

235. Testing confirms this functionality. Accordingly, the Accused VR Instrumentalities perform Limitation 11D of claim 11.

236. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

237. Limitation 11E requires "outputting the haptic effect using the one or more haptic output devices." The Accused VR Instrumentalities perform this step. For example, testing on a Valve Index confirms haptic effects during the use case described in Limitation 11C.

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[148] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).
[149] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[150] *See* https://github.com/ValveSoftware/Moondust (last accessed May 10, 2023).
[151] *See* https://github.com/ValveSoftware/Moondust/blob/master/Assets/Scripts/MoonRock.cs (last accessed May 10, 2023).

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238. Accordingly, the Accused VR Instrumentalities perform Limitation 11E of claim 11.

239. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

240. Thus, Valve directly infringes at least claim 11 of the '067 patent. For example, the Accused VR Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

241. On information and belief, Valve has taken active steps to induce infringement of at least claim 11 of the '067 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[152]

242. By way of at least this Complaint, Valve knows of the '067 patent and performs acts that it knows, or should know, induce the direct infringement of claim 11 of the '067 patent by users of the Accused VR Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 11 of the '067 patent under 35 U.S.C. § 271(b).

SEVENTH CAUSE OF ACTION
(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 OF THE '738 PATENT)

243. Immersion re-alleges and incorporates by reference all of the foregoing paragraphs.

244. Valve has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 15 of the '738 patent in violation of

[152] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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35 U.S.C. § 271, et seq., directly and/or indirectly, by using and/or inducing the use in this District and in the United States certain products including, but not limited to those, relating to the Accused VR Instrumentalities.

245. Claim 15 of the '738 patent provides:

> [Preamble] A method comprising:
>
> [15A] detecting, by a proximity sensor, a non-contact interaction with a touch-sensitive device;
>
> [15B] detecting, by a touch sensor, a touch on the touch-sensitive device;
>
> [15C] transmitting a first sensor signal associated with the non-contact interaction to a processor;
>
> [15D] transmitting a second sensor signal associated with the touch to a processor;
>
> [15E] receiving, by the processor, the first and second sensor signals;
>
> [15F] generating, by the processor, a haptic output signal based at least in part on the first and second sensor signals;
>
> [15G] transmitting, by the processor, the haptic output signal to a haptic output device; and
>
> [15H] outputting, by the haptic output device, a haptic effect in response to the haptic output signal.

246. Based on publicly available information, Valve's Accused VR Instrumentalities meet all elements of at least claim 15 of the '738 patent.

247. Regarding the preamble of claim 15, to the extent the preamble is determined to be limiting, the Accused VR Instrumentalities perform the claimed method. For example, Valve's SteamVR supports multiple engines, including the Unity Engine,[153] the Unreal Engine,[154] and the

[153] *See* https://valvesoftware.github.io/steamvr_unity_plugin/; https://github.com/ValveSoftware/unity-xr-plugin (last accessed May 10, 2023).
[154] *See* https://github.com/ValveSoftware/steamvr_unreal_plugin (last accessed May 10, 2023).

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proprietary Source 2 Engine, through multiple SDKs such as OpenVR[155] and OpenXR[156] to implement applications and games.

248. As one example, OpenVR is divided into two layers: application and driver. Valve documentation notes that, "One real-world example of an application is a game engine like Unity."[157] Further, "OpenVR for application talks to SteamVR. SteamVR then talks to OpenVR driver."[158]

249. As another example, Valve provides the Steam Input API, which is a flexible action-based API that supports all major controller types.[159] This API includes member functions, such as, `TriggerHapticPulse`, that "[t]riggers a (low-level) haptic pulse on supported controllers."[160]

250. Accordingly, the Accused VR Instrumentalities meet the preamble of claim 15.

251. Limitation 15A requires "detecting, by a proximity sensor, a non-contact interaction with a touch-sensitive device." The Accused VR Instrumentalities perform this step. For example Valve Index Controllers, also known as Knuckles,[161] use sensors to track finger position:[162]

[155] *See* https://help.steampowered.com/en/faqs/view/46C3-050A-2E52-12D6 (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[156] *See* https://github.com/ValveSoftware/OpenXR-Canonical-Pose-Tool (last accessed May 10, 2023); https://github.com/ValveSoftware/openxr_engine_plugins (last accessed May 10, 2023).
[157] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[158] *See* https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023).
[159] *See* https://partner.steamgames.com/doc/api/isteaminput (last accessed May 10, 2023).
[160] *See* https://partner.steamgames.com/doc/api/isteaminput#functions (last accessed May 10, 2023).
[161] *See* https://www.ifixit.com/Device/Valve_Index_Controller (last accessed May 10, 2023).
[162] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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Sensor fusion

Each controller uses 87 sensors to track hand position, finger position, motion, and pressure to determine user intent. All of these signals, combined with fine-tuned software and algorithms, give us a better understanding of how a player is holding and using the controllers.

252. Further, Valve documentation notes that, "[t]o read controller input state, applications provide a list of the 'actions' that represent the operations a user can perform. SteamVR then binds those actions to actual inputs on a game/vr controller," or the specific input for the specific device the user is using:[163]

Input Overview

To read controller input state in OpenVR, an application provides a list of the "actions" that represent the operations a user can perform in the application. SteamVR then binds those actions to actual inputs on a game/vr controller, or more specifically input components provided for the input devices that the user is using. Application developers can provide default bindings for any controller types they like. Users are able to modify those bindings or create new bindings for new devices. Users can also select bindings that were shared by other users.

253. Additionally, the Skeletal Input system allows drivers for each type of controller to provide applications with an animated skeleton of the user's hand to the best level of fidelity that its sensors are able to detect. Skeletal data can be bound to input actions, just like other input:[164]

Overview

The Skeletal Input system allows drivers for each type of controller to provide applications with an animated skeleton of the user's hand to the best level of fidelity that its sensors are able to detect. Developers can then reduce their need to create custom hand animations for each controller they plan to support, and can instead use the animation provided by the current driver in conjunction with their own game-specific animations. Skeletal data can be bound to input actions, just like other input. The animation can be requested to be as accurate as possible (which will often mean that the range of motion of the

[163] *See* https://github.com/ValveSoftware/openvr/wiki/SteamVR-Input#input-overview (last accessed May 10, 2023).
[164] *See* https://github.com/ValveSoftware/openvr/wiki/SteamVR-Skeletal-Input (last accessed May 10, 2023).

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254. For example, the Valve Index controllers provide the "Partial" level of fidelity that measures finger curl:[165]

Skeletal Tracking Level

Different controllers have different abilities to track the individual joints of your fingers. Here we provide an overview value that should give you a general idea what level of fidelity your current controller has.

- **Estimated:** Body part location can't be directly determined by the device. Any skeletal pose provided by the device is estimated based on the active buttons, triggers, joysticks, or other input sensors. Examples include the Vive Controller and gamepads.
- **Partial:** Body part location can be measured directly but with fewer degrees of freedom than the actual body part.Certain body part positions may be unmeasured by the device and estimated from other input data.Examples include Knuckles or gloves that only measure finger curl
- **Full:** Body part location can be measured directly throughout the entire range of motion of the body part.Examples include hi-end mocap systems, or gloves that measure the rotation of each finger segment.

255. Further, SteamVR Skeleton Input provides an API to get per joint data for all of these different types of devices.[166] For example, this API can provide curl information for the index finger:[167]

Finger Curls

For some things it may be more useful to access a summary of how curled the finger is as opposed to the position and rotation for 4 joints on each finger. These values range from 0 to 1, with 1 being fully curled. You can access curl information at `skeletonAction.fingerCurls[]` as an array, or individually named at `skeletonAction.indexCurl`, `skeletonAction.middleCurl`, `skeletonAction.RingCurl`, `skeletonAction.pinkyCurl`, and `skeletonAction.thumbCurl`.

[165] *See* https://valvesoftware.github.io/steamvr_unity_plugin/articles/Skeleton-Input.html (last accessed May 10, 2023).
[166] *See* https://valvesoftware.github.io/steamvr_unity_plugin/articles/Skeleton-Input.html (last accessed May 10, 2023).
[167] *See* https://valvesoftware.github.io/steamvr_unity_plugin/articles/Skeleton-Input.html#finger-curls (last accessed May 10, 2023).

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256. Using the Skeletal Input API requires adding a "skeletal action" entry for each hand to the actions section of an application's action manifest file. Bindings then need to be added for these actions to each controller:[168]

Add an Action and Controller Binding

To use the Skeletal Input API, first add a "skeletal action" entry for each hand to the actions section of your application's action manifest file. Make sure that the 'type' is skeleton, and that it has an additional 'skeleton' field to define which skeleton the action should use. The choices for skeleton are either "/skeleton/hand/left" or "/skeleton/hand/right". For example:

```
{
"name": "/actions/demo/in/lefthand_anim",
"type": "skeleton",
"skeleton": "/skeleton/hand/left"
}
```

Next, you need to add a binding for this action to each controller. You can do this through the SteamVR binding UI (preferred).

257. The *Half-Life: Alyx* installation includes json files under "Half-Life Alix/games/hlvr/cfg" that confirm this configuration. For example, the action manifest file, "actions.json," includes the following skeletal action entries:

```
215        {
216            "name" : "/actions/default/in/HandSkeletonLeft",
217            "skeleton" : "/skeleton/hand/left",
218            "type" : "skeleton"
219        },
220        {
221            "name" : "/actions/default/in/HandSkeletonRight",
222            "skeleton" : "/skeleton/hand/right",
223            "type" : "skeleton"
224        },
```

258. The Knuckles bindings file, "bindings_knuckles.json," includes the bindings of these actions:

```
26         "skeleton" : [
27             {
28                 "output" : "/actions/default/in/handskeletonleft",
29                 "path" : "/user/hand/left/input/skeleton/left"
30             },
31             {
32                 "output" : "/actions/default/in/handskeletonright",
33                 "path" : "/user/hand/right/input/skeleton/right"
34             }
35         ],
```

[168] *See* https://github.com/ValveSoftware/openvr/wiki/SteamVR-Skeletal-Input (last accessed May 10, 2023).

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259. The bindings file includes additional bindings for the actions for each individual finger curl:

```
100            {
101               "inputs" : {
102                  "pull" : {
103                     "output" : "/actions/default/in/fingercurlindex"
104                  }
105               },
106               "mode" : "trigger",
107               "path" : "/user/hand/right/input/finger/index"
108            },
109            {
110               "inputs" : {
111                  "pull" : {
112                     "output" : "/actions/default/in/fingercurlmiddle"
113                  }
114               },
115               "mode" : "trigger",
116               "path" : "/user/hand/right/input/finger/middle"
117            },
118            {
119               "inputs" : {
120                  "pull" : {
121                     "output" : "/actions/default/in/fingercurlring"
122                  }
123               },
124               "mode" : "trigger",
125               "path" : "/user/hand/right/input/finger/ring"
126            },
```

260. Further, the figure below is a screenshot taken from a Valve Index while testing this functionality. As just one example, curling an index finger towards the Index Controller's trigger causes the virtual finger to also curl, indicating that the Accused VR Instrumentalities detect, by a proximity sensor, a non-contact interaction with a touch-sensitive device:

261. Accordingly, the Accused VR Instrumentalities perform Limitation 15A of claim 15.

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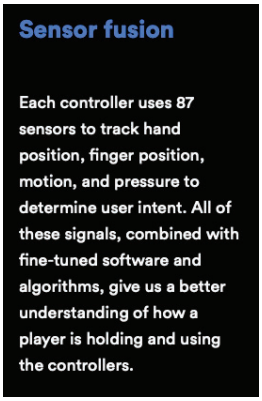
262. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

263. Limitation 15B requires "detecting, by a touch sensor, a touch on the touch-sensitive device." The Accused VR Instrumentalities perform this step. For example, Valve Index Controllers, also known as Knuckles,[169] use sensors to track pressure:[170]



264. Further, the figure below is a screenshot taken from a Valve Index while testing this functionality. As just one example, touching the Index Controller's trigger causes the virtual finger to partially ball into the virtual hand, indicating that the Accused VR Instrumentalities detect a touch on the touch-sensitive device:

[169] *See* https://www.ifixit.com/Device/Valve_Index_Controller (last accessed May 10, 2023).
[170] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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265. Note that the above hand pose differs from when a user pulls the trigger, which causes the finger to fully ball into the virtual hand, further indicating that the Accused VR Instrumentalities detect a touch on the touch-sensitive device, as distinct from a trigger pull:

266. Accordingly, the Accused VR Instrumentalities perform Limitation 15B of claim 15.

267. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

268. Limitation 15C requires "transmitting a first sensor signal associated with the non-contact interaction to a processor." Limitation 15D requires "transmitting a second sensor signal associated with the touch to a processor." Limitation 15E requires "receiving, by the processor, the first and second sensor signals." The Accused VR Instrumentalities perform these steps. For example, Valve specifies certain minimum system specifications, including processor requirements:[171]

Minimum

- OS: Windows 10, SteamOS, Linux
- Processor: Dual Core with Hyper-Threading
- Memory: 8 GB RAM
- Graphics: Nvidia GeForce GTX 970 / AMD RX 480
- Network: Broadband Internet connection
- Additional Notes: Available DisplayPort (Version1.2) and USB (2.0+) Port required

[171] *See* https://help.steampowered.com/en/faqs/view/105E-66E3-962A-1577 (last accessed May 10, 2023).

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269. Further, the APIs identified for Limitation 15A run on this processor, indicating that the Accused VR Instrumentalities transmit a first sensor signal associated with the non-contact interaction to a processor.

270. Further, the APIs identified for Limitation 15B run on this processor, indicating that the Accused VR Instrumentalities transmit a second sensor signal associated with the touch to a processor.

271. Testing confirms the functionality described in Limitations 15A and 15B, support for both functions indicate that the Accused VR Instrumentalities receive, by the processor, the first and second sensor signals.

272. Accordingly, the Accused VR Instrumentalities perform Limitations 15C, 15D, and 15E of claim 15.

273. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

274. Limitation 15F requires "generating, by the processor, a haptic output signal based at least in part on the first and second sensor signals." Limitation 15G requires "transmitting, by the processor, the haptic output signal to a haptic output device." Limitation 15H requires "outputting, by the haptic output device, a haptic effect in response to the haptic output signal." The Accused VR Instrumentalities perform these steps.

275. For example, the Valve Index Controllers include an HD LRA for Haptics:[172]

Tech specs

Inputs	Ergonomics	Connections	Haptics
A Button, B Button, System Button, Trigger, Thumbstick, Track Button with Force Sensor, Grip Force Sensor, Finger Tracking, IMU	Adjustable strap with pivot, antimicrobial tech fabric	USB-C, 2.4GHz Wireless	HD LRA

[172] *See* https://www.valvesoftware.com/en/index/controllers (last accessed May 10, 2023).

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276. Further, the "bindings_knuckles.json" configuration file includes bindings for haptics actions:

```
"bindings" : {
   "/actions/default" : {
      "haptics" : [
         {
            "output" : "/actions/default/in/hapticvibration",
            "path" : "/user/hand/left/output/haptic"
         },
         {
            "output" : "/actions/default/in/hapticvibration",
            "path" : "/user/hand/right/output/haptic"
         }
      ],
```

277. Further, the figures below are screenshots taken from a Valve Index while testing this functionality. As just one example, as mentioned in Limitation 15A, curling an index finger towards the trigger causes a virtual finger to curl, as shown in the left figure below, which are screenshots taken from a Valve Index while testing this functionality. If the resulting curl causes the virtual finger to touch a virtual object, haptic effects occur. Additionally, as mentioned in Limitation 15B, touching the trigger also causes the virtual finger to curl, as shown in the right figure below. If the resulting curl causes the virtual finger to touch a virtual object, haptic effects also occur:

278. Note that pulling the trigger results in the virtual hand grabbing the object, further indicating that the Accused VR Instrumentalities independently track proximity to, touching, and

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pulling the trigger. Based on this behavior and on information and belief, the haptic output signal is based at least in part on the first and second sensor signals:

279. Accordingly, the Accused VR Instrumentalities perform Limitations 15F, 15G, and 15H of claim 15.

280. Valve makes and sells the Accused VR Instrumentalities, with which Valve performs the claimed step under Valve's control for Valve's benefit.

281. Thus, Valve directly infringes at least claim 15 of the '738 patent. For example, the Accused VR Instrumentalities with which Valve performs all the of the claimed steps as described in the examples above are under Valve's control for Valve's benefit.

282. On information and belief, Valve has taken active steps to induce infringement of at least claim 15 of the '738 patent by its users, knowing that these steps will induce, encourage, and facilitate direct infringement by its users in violation of 35 U.S.C. § 271(b). Such active steps include, but are not limited to, providing its users with instructions on the use of the above-described features.[173]

[173] *See*, *e.g.*, https://valvesoftware.github.io/steamvr_unity_plugin/articles/Quickstart.html (last accessed May 10, 2023); https://valvesoftware.github.io/steamvr_unity_plugin/tutorials/SteamVR-Input.html (last accessed May 10, 2023); https://www.youtube.com/watch?v=qo-9CmcKWlY (last accessed May 10, 2023); https://developer.valvesoftware.com/wiki/Main_Page (last accessed May 10, 2023); https://partner.steamgames.com/doc/features/steam_controller (last accessed May 10, 2023); https://github.com/ValveSoftware/openvr/wiki/API-Documentation (last accessed May 10, 2023); https://store.steampowered.com/app/450390/The_Lab/?gclid=CjwKCAjwge2iBhBBEiwAfXDBR4vG9bCn_TXxjF0yACKmAIHjVNNQ_qb2Cbbz4wPeXmLpSAQ2tW03AxoCDzkQAvD_BwE (last accessed May 10, 2023); https://store.steampowered.com/app/868020/Aperture_Hand_Lab/ (last accessed May 10, 2023).

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283. By way of at least this Complaint, Valve knows of the ’738 patent and performs acts that it knows, or should know, induce the direct infringement of claim 15 of the ’738 patent by users of the Accused VR Instrumentalities. Valve is thus also indirectly liable for infringement of at least claim 15 of the ’738 patent under 35 U.S.C. § 271(b).

PRAYER FOR RELIEF

WHEREFORE, Immersion respectfully requests judgment against Valve as follows:

A. that this Court adjudge that Valve, to the extent not enjoined, infringes the ’260 patent; the ’507 patent; the ’042 patent; the ’546 patent; the ’907 patent; the ’067 patent; and the ’738 patent;

B. that the Court enter an injunction prohibiting Valve and its agents, officers, servants, employees, and all persons in active concert or participation with Valve from deploying, operating, maintaining, testing, and using the Accused Handheld Instrumentalities and Accused VR Instrumentalities, and from otherwise infringing any of the Patents-in-Suit;

C. that this Court ascertain and award Immersion damages under 35 U.S.C. § 284 sufficient to compensate for Valve’s infringement, including but not limited to infringement occurring before the filing of this lawsuit;

D. that this Court ascertain and award Immersion any post-judgment ongoing royalties under 35 U.S.C. § 284 as may be appropriate;

E. that this Court award Immersion any applicable prejudgment and post-judgment interest; and

F. that this Court award Immersion such other relief at law or in equity as the Court deems just and proper.

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JURY DEMAND

Immersion requests that all claims and causes of action raised in this Complaint against Valve be tried to a jury to the fullest extent possible.

DATED: May 15, 2023

Respectfully submitted,

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/s/ Stefan Szpajda

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