

EIGHT KHZ, LLC
v.
META PLATFORMS, INC.; META PLATFORMS TECHNOLOGIES, LLC

Case No. 6:22-cv-00575-ADA

Asserted U.S. Patent No. 10,798,509
“Switching Binaural Sound”

Plaintiff’s Infringement Contentions
Exhibit 15

March 3, 2023

This claim chart is based on publicly available literature regarding Defendants' products. Plaintiff will be seeking Defendants' internal documentation, including technical documentation such as schematics and datasheets, in discovery and therefore Plaintiff reserves the right to amend or further supplement this claim chart.

The term "Accused Products" herein refers to all products manufactured, used, tested, imported, or sold by or on behalf of Defendants practicing the Asserted Claims of the '509 Patent, and all processes employed by Defendants that practice the Asserted Claims of the '509 Patent, consisting of at least Defendants' products that support Oculus, including by way of example and without limitation the Oculus Quest product lines. On information and belief, such Accused Products include without limitation the following: Oculus Quest, Oculus Quest 2, and Oculus Quest Pro (Cambria). To the extent Defendants have substituted the name "Meta" or "Reality Labs" for "Oculus" in any of the above products, such products are also included in the Accused Products.

This claim chart specifically addresses infringement of Claims 9, 10 and 17 ("Asserted Claims") of the '509 Patent by Defendants' Oculus Quest product. Defendants' Oculus Quest product is representative of Defendants' infringement of the Asserted Claim. While this chart specifically addresses the functionality of the Oculus Quest, these infringement contentions are illustrative rather than exhaustive and they are representative of, and apply to, all Accused Products based on the fact that all the Accused Products infringe in the same general way.

A non-transitory computer readable storage medium storing instructions that one or more electronic devices execute as a method, the method comprising:

- The Accused Products include non-transitory computer readable medium storing instructions that one or more electronic devices execute as a method.
- By way of example, the Quest provides all-in-one virtual reality (VR) through its headset and hand-held controllers.
- The headset includes memory that stores instructions that one or more electronic devices execute as the claimed method.



Source: <https://www.meta.com/blog/quest/why-im-excited-for-vr-in-2019/>



Source: <https://www.youtube.com/watch?v=ryvsAjCaKKk&t=80s> at 1:20

¹By charting the preamble, we do not concede that the preamble is a limitation and reserve the right to contend that the preamble is not a limitation of the claim.

A non-transitory computer readable storage medium storing instructions that one or more electronic devices execute as a method, the method comprising:

- By way of example, the Quest Pro has a control board with either 64GB or 128GB of internal flash storage for storing, among other things, instructions for one or more electronic devices to execute as a method.
- Further by way of example, the Quest has a processor (the Qualcomm Snapdragon 835) that executes the instructions stored in memory to perform the claimed method.



Source: <https://medium.com/badvr/oculus-quest-headset-disassembly-2f404b004a3c>

With an OLED display panel, a 72Hz refresh rate, and 2880x1600 total resolution (1440x1600 per eye), seeing is believing. Quest comes in a 64GB model for \$399 USD and a 128GB model for \$499 USD, both of which run on a [Qualcomm](#) Snapdragon 835 chipset.

Source: <https://www.meta.com/blog/quest/its-game-time-oculus-quest-and-rift-s-now-available/>

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Claim: 9 – Element (A)

dividing, with a portable electronic device (PED) held in a hand of a user, an area around the user into a zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user;

- The Accused Products divide, with a portable electronic device (PED) that takes the form of a hand-held controller, an area around the user into a zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user.



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:22 and 0:25

Claim 9, Element (A) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

dividing, with a portable electronic device (PED) held in a hand of a user, an area around the user into a zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user;

- The zone represents the area for all game play, and will include sound localization points for presentation of binaural sound to the user.
- The Accused Products provide localization of sounds a 3D audio spatialization.

3D Audio Spatialization

An essential element of VR audio is spatialization: the ability to play a sound as if it is positioned at a specific point in three-dimensional space. Spatial audio is essential to deliver an immersive experience because it provides powerful cues that make the user feel they are actually in the 3D environment.

The Audio Localization page discussed how humans localize audio sources in three dimensions, we will now explore methods to synthesize those localization cues, to produce spatial audio.

The two key components to spatialization are direction and distance, in this guide we'll cover both of these topics, and the technologies which enable them.

Directional Spatialization with Head-Related Transfer Functions (HRTFs)

The sounds we experience are directly impacted by the shape and geometry of our body (especially our ear), as well as direction of the incoming sound. These two elements: our body + the direction of the audio source, form the basis of HRTFs which are filters we use to localize sound.

Applying HRTFs

Given an HRTF set, if we know the direction we want a sound to appear to come from, we can select an appropriate HRTF and apply it to the sound. This is usually done either in the form of a time-domain convolution or a frequency domain convolution using FFT. If you don't know what these are, don't worry - those details are only relevant if you are implementing the HRTF system yourself. Our discussion glosses over a lot of the implementation details (e.g., how we store an HRTF, how we use it when processing a sound). For our purposes, what matters is the high-level concept: we are simply filtering an audio signal to make it sound like it's coming from a specific direction.

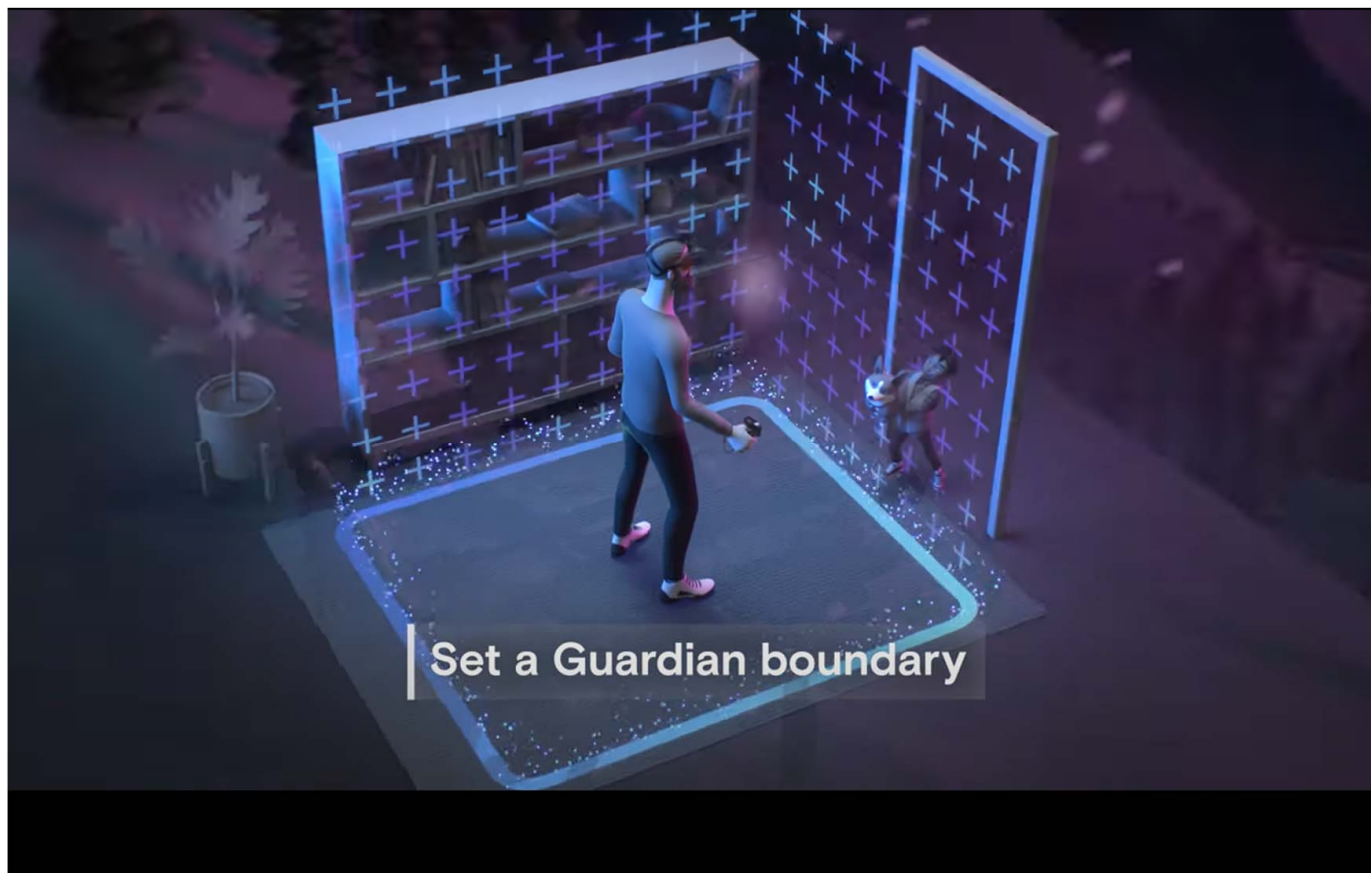
Since HRTFs take the listener's head geometry into account, it is important to use headphones when performing spatialization. Without headphones, you are effectively applying two HRTFs: the simulated one, and the actual HRTF caused by the geometry of your body.

Source: <https://developer.oculus.com/resources/audio-intro-spatialization/>

Claim 9, Element (A) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

determining, with a wearable electronic device (WED) worn on a head of the user, when the user is located inside the zone;

- The Accused Products include a headset, which is a wearable electronic device (WED) worn on the head of a user.
- The Accused Products determine, with the WED, when the user is located inside the zone.



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:25

Claim 9, Element (B) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

determining, with the WED worn on the head of the user, when the user is leaving the zone; and

- The Accused Products determine, with the WED worn on the head of the user, when the user is leaving the zone.



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:32

Claim 9, Element (C) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

Claim: 9 – Element (D)

displaying, with the WED worn on the head of the user, a three dimensional (3D) virtual image of the zone in response to the WED determining that the user is leaving the zone.

- The WED includes a display.
- The WED displays a three dimensional (3D) virtual image of the zone in response to the WED determining that the user is leaving the zone.



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:32

Claim 9, Element (D) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

Claim: 10 – Element (A)

The non-transitory computer readable storage medium of claim 9 in which the method further comprises:

determining, with the WED, when the PED is pointed at one of the SLPs while the user is located in the zone; and

- The Accused Products determine, with the WED, when the PED is pointed at one of the SLPs while the user is located in the zone.
- The Accused Products designate, with the HPED held in the hand of the user, a sound localization point (SLP) where binaural sound originates to the user. By way of example only, a virtual image in an environment is shown to the right. This image is taken from a video depicting the user experience with the “Bogo” application.
- In this example, the game character may be moved by direction of the PED, and the SLP will also move to the corresponding location of the game character.



Source: <https://www.youtube.com/watch?v=sKDXksl7S6o> at 7:04 and 7:37

Claim 10, Element (A) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

Claim: 10 – Element (B)

playing the binaural sound that originates from the one of the SLPs in the zone in response to the WED determining that the PED is pointed at the one of the SLPs.

- The Accused Products play binaural sound that originates from the one of the SLPs in the zone in response to the WED determining that the PED is pointed at the one of the SLPs.
- Continuing with the example from above, the WED will play binaural sound that originates from the SLP corresponding to the game character targeted/moved by the PED.



Source: <https://www.youtube.com/watch?v=sKDXksl7S6o> at 7:04 and 7:37

Claim 10, Element (B) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

An electronic system comprising:

- The Accused Products include an electronic system.
- By way of example, the Quest provides all-in-one virtual reality (VR) through its headset and hand-held controllers. The headset and hand-held controllers are an electronic system.



Source: <https://www.meta.com/blog/quest/why-im-excited-for-vr-in-2019/>



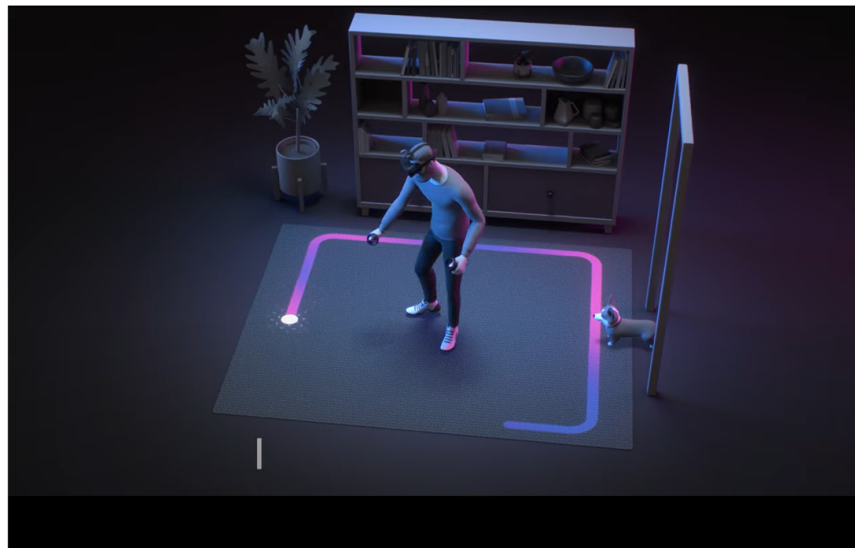
Source: <https://www.youtube.com/watch?v=ryvsAjCaKKk&t=80s> at 1:20

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Claim: 17 – Element (A)

a portable electronic device (PED) held in a hand of a user that divides an area around the user into a three-dimensional (3D) zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user; and

- The Accused Products include a portable electronic device (PED), that takes the form of a hand-held controller, which divides an area around the user into a 3D zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user.



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:22 and 0:25

Claim 17, Element (A) - The Accused Products literally infringe this claim element. Alternatively, the limitations of this claim element are present under the Doctrine of Equivalents because to the extent there are any differences between the Accused Product and this claim element, such differences are insubstantial. Further, equivalency may be shown by the fact that the Accused Product performs substantially the same function in substantially the same way to achieve substantially the same result as recited in this claim element.

a portable electronic device (PED) held in a hand of a user that divides an area around the user into a three-dimensional (3D) zone that includes sound localization points (SLPs) in empty space from where binaural sound originates to the user; and

- The zone represents the area for all game play, and will include sound localization points for presentation of binaural sound to the user.
- The Accused Products provide localization of sounds a 3D audio spatialization.

3D Audio Spatialization

An essential element of VR audio is spatialization: the ability to play a sound as if it is positioned at a specific point in three-dimensional space. Spatial audio is essential to deliver an immersive experience because it provides powerful cues that make the user feel they are actually in the 3D environment.

The Audio Localization page discussed how humans localize audio sources in three dimensions, we will now explore methods to synthesize those localization cues, to produce spatial audio.

The two key components to spatialization are direction and distance, in this guide we'll cover both of these topics, and the technologies which enable them.

Directional Spatialization with Head-Related Transfer Functions (HRTFs)

The sounds we experience are directly impacted by the shape and geometry of our body (especially our ear), as well as direction of the incoming sound. These two elements: our body + the direction of the audio source, form the basis of HRTFs which are filters we use to localize sound.

Applying HRTFs

Given an HRTF set, if we know the direction we want a sound to appear to come from, we can select an appropriate HRTF and apply it to the sound. This is usually done either in the form of a time-domain convolution or a frequency domain convolution using FFT. If you don't know what these are, don't worry - those details are only relevant if you are implementing the HRTF system yourself. Our discussion glosses over a lot of the implementation details (e.g., how we store an HRTF, how we use it when processing a sound). For our purposes, what matters is the high-level concept: we are simply filtering an audio signal to make it sound like it's coming from a specific direction.

Since HRTFs take the listener's head geometry into account, it is important to use headphones when performing spatialization. Without headphones, you are effectively applying two HRTFs: the simulated one, and the actual HRTF caused by the geometry of your body.

Source: <https://developer.oculus.com/resources/audio-intro-spatialization/>

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Claim: 17 – Element (B)

a wearable electronic device (WED) that is worn on a head of the user, wirelessly communicates with the PED, includes speakers that play the binaural sound to the user that emanates from the SLPs in empty space, includes one or more sensors that sense when the PED leaves the zone, and includes a display that displays a 3d virtual image of the zone in response to sending that the PED leaves the zone, wherein the display displays the 3D virtual image of the zone to warn the user that the user is leaving the zone.

- The Accused Products include a wearable electronic device (WED), in the form of a headset, worn on a head of the user.



Source: <https://www.youtube.com/watch?v=ryysAjCaKKk&t=80s> at 1:20



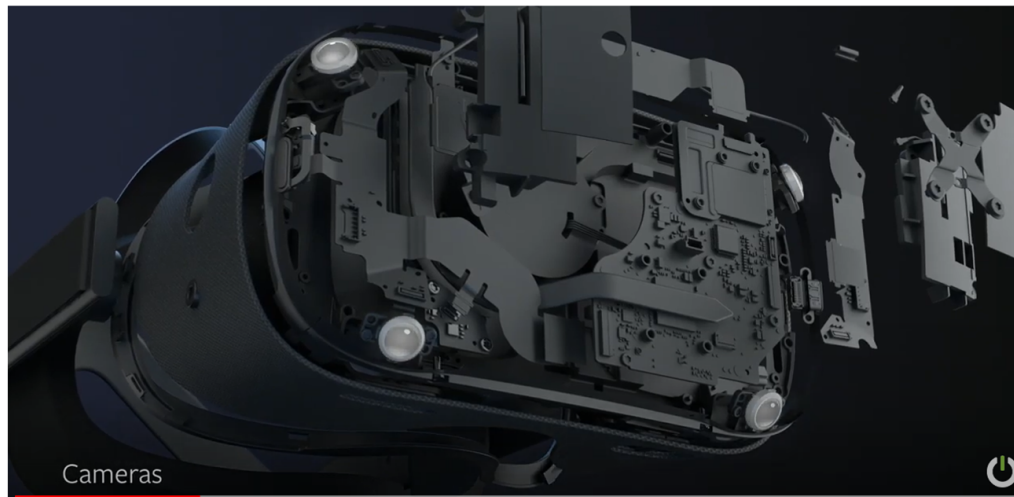
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Claim: 17 – Element (B)

a wearable electronic device (WED) that is worn on a head of the user, **wirelessly communicates with the PED**, includes speakers that play the binaural sound to the user that emanates from the SLPs in empty space, includes one or more sensors that sense when the PED leaves the zone, and includes a display that displays a 3D virtual image of the zone in response to sending that the PED leaves the zone, wherein the display displays the 3D virtual image of the zone to warn the user that the user is leaving the zone.

- The WED wirelessly communicates with the PED.
- In addition to sending/receiving signals, the WED wirelessly tracks the movement of the PED through its infrared cameras.



Source: <https://www.youtube.com/watch?v=AZ7ufYef-dM> at 0:07

We're excited to usher in the next era of VR gaming with the introduction of Oculus Quest, our first all-in-one VR gaming system. Oculus Quest will launch in Spring 2019 for \$399 USD. Offering six degrees of freedom and Touch controllers, Oculus Quest makes it easy to jump right into the action—with no PC, no wires, and no external sensors. We have over 50 titles lined up for launch, with even more in the works including some of your favorite Rift games like Robo Recall, The Climb, and Moss.

We also unveiled Oculus Insight, our breakthrough technology that powers inside-out tracking, Guardian, and Touch controller tracking. This innovative system uses four ultra wide-angle sensors and computer vision algorithms to track your exact position in real time without any external sensors. Insight gives you a greater sense of immersion, presence, and mobility, plus the ability to go beyond room-scale. And we've brought over Guardian to help keep you safer while in VR. It's easy to setup and experience whenever you want.

Source: <https://www.meta.com/blog/quest/introducing-oculus-quest-our-first-6dof-all-in-one-vr-system-launching-spring-2019/>

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Claim: 17 – Element (B)

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- The WED includes speakers that play the binaural sound to the user that emanates from the SLPs in empty space.

Quest has positional audio built directly into the headset for maximum convenience, while 3.5mm headphone jacks allow for enhanced audio or private listening. Customize your Quest

Source: <https://www.meta.com/blog/quest/its-game-time-oculus-quest-and-rift-s-now-available/>

3D Audio Spatialization

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Since HRTFs take the listener's head geometry into account, it is important to use headphones when performing spatialization. Without headphones, you are effectively applying two HRTFs: the simulated one, and the actual HRTF caused by the geometry of your body.

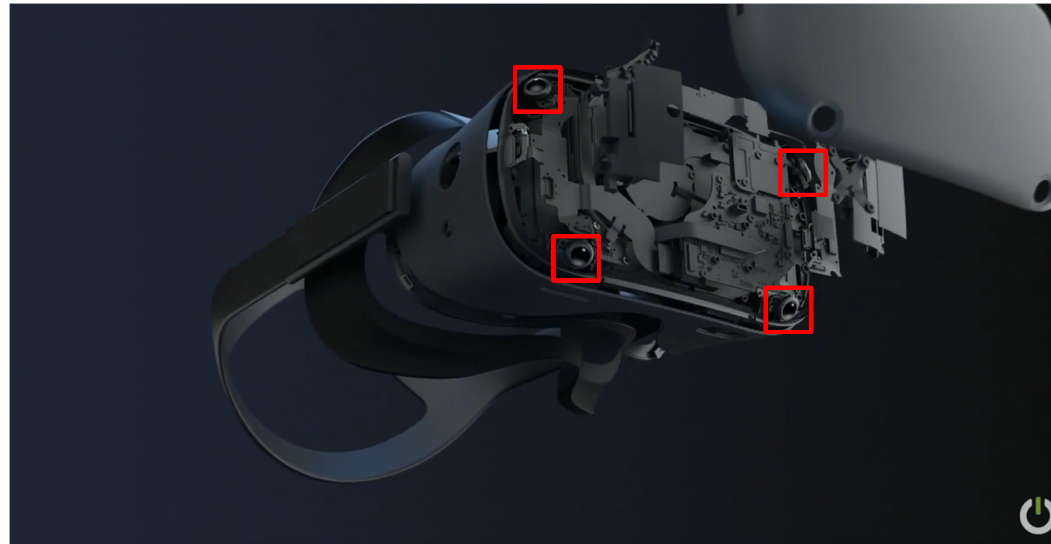
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Claim: 17 – Element (B)

a wearable electronic device (WED) that is worn on a head of the user, wirelessly communicates with the PED, includes speakers that play the binaural sound to the user that emanates from the SLPs in empty space, **includes one or more sensors that sense when the PED leaves the zone, and includes a display that displays a 3D virtual image of the zone in response to sending that the PED leaves the zone, wherein the display displays the 3D virtual image of the zone to warn the user that the user is leaving the zone.**

- As discussed above, the WED includes one or more sensors that sense when the PED leaves the zone, and includes a display that displays a 3D virtual image of the zone in response to sensing that the PED leaves the zone.
- The displaying of the zone as described above serves as a warning to the user that the user is leaving the zone.



Source: <https://www.youtube.com/watch?v=AZ7ufYef-dM> at 0:01



Source: <https://www.youtube.com/watch?v=7TFWckMXCWk&t=5s> at 0:25 and 0:32

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