

Exhibit B-12: Invalidity Based on Wearable Spatial Conferencing Space with Virtual i-O iglasses! (“Billinghurst System”)

U.S. Patent No. 9,674,628

Claims 9, 12, and 16 (the “Asserted Claims”) of the ’628 Patent are anticipated under 35 U.S.C. § 102 and/or obvious under 35 U.S.C. § 103 in view of the Wearable Spatial Conferencing Space with virtual i-O iglasses! (“Billinghurst System”), as embodied in the Billinghurst System itself and other prior art references that describe them.¹ To the extent Plaintiff argues that the Billinghurst System does not disclose any limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of the Billinghurst System alone or in combination with applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants’ invalidity contentions for at least the reasons stated in the cover pleading for Defendants’ invalidity contentions and/or in the accompanying claim charts.

The contentions provided below address the Asserted Claims that Plaintiff identified in its infringement contentions. Defendants reserve the right to supplement or modify these contentions in accordance with and to address orders of the Court (e.g., any claim construction order(s)), Local Rules, other applicable rules, and/or in response to any supplementation, amendment, or modification of Plaintiff’s infringement contentions.

The following disclosures are for prior art purposes only. The following chart may include positions in the alternative and does not constitute any concession by Defendants for purposes of infringement. Defendants’ contentions herein are not, and should in no way be seen as, admissions or adoptions regarding any particular claim scope or construction or alleged infringement, either literally or under the doctrine of equivalents. Defendants do not agree with Plaintiff’s application of the claims, or that the claims satisfy other statutory requirements, e.g., under 35 U.S.C. § 112. Furthermore, to the extent any Asserted Claim is subject to 35 U.S.C. § 112(6), Defendants’ invalidity contentions are in no way an admission that the ’628 Patent specification sufficiently discloses or describes corresponding structure for performing the claimed function. Defendants’ contentions also are based, at least in part, on Plaintiff’s Infringement Contentions to date and Plaintiff’s overly broad interpretation and application of the Asserted Claims..

The citations to portions of any reference in this chart are exemplary only and are not exhaustive of the disclosures of the limitations in the art. Furthermore, citations to any figure, table, chart, component, or embodiment are meant to encompass the language describing the respective figure, table, chart, component, or embodiment and vice versa. Defendants will rely on the entirety of the

¹ On information and belief, functionalities of the Billinghurst system are described by A Wearable Spatial Conferencing Space (“Billinghurst 1998”).

references cited in this chart to show that the Asserted Claims are invalid, as will Defendants’ experts. Defendants also reserve the right to rely on additional citations or sources of evidence that may be or may become applicable during discovery as this case progresses, e.g., through third-party discovery.

Claim	Billinghurst System’s Exemplary Disclosures
CLAIM 9	
9[pre]. A method executed by one or more electronic devices in an electronic system that improves an experience of a calling party and a called party talking to each other during a telephone call, the method comprising:	To the extent that the preamble is limiting, the Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “[a] method executed by one or more electronic devices in an electronic system that improves an experience of a calling party and a called party talking to each other during a telephone call, the method comprising” through the various disclosures in the reference. For example: In face-to-face conversation, speech, gesture, body language and other non-verbal cues combine to show attention and interest. Simple versions of these cues can be replicated in desktop video conferencing. For example, the Passepartout [15] enhanced desktop conferencing tool includes visual representation of a conference table alongside shared documents and a text chat facility. The conference table includes icons of those people within the conference and simple cues, such as microphone on/off, which allow a participant’s activity or interest to be inferred. However the absence of spatial cues in most video conferencing systems means that users often find it difficult to know when people are paying attention to them, to hold side conversations, and to establish eye contact [16]. Billinghurst (1998) at 3. Virtual reality can provide an alternative medium that allows groups of people to share the same communications space. British Telecom has demonstrated virtual conferencing in which many users can be represented as life like virtual avatars of themselves within virtual rooms [20]. Users can freely move through the space setting their own viewpoints and spatial relationships. In collaborative virtual environments (CVEs) spatial visual and audio cues can combine in natural ways to aid communication [21]. The well known “cocktail-party” effect shows that people can easily monitor several spatialized audio

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	streams at once, selectively focusing on those of interest [22], [23]. Even a simple virtual avatar representation and spatial audio model enables users to discriminate between multiple speakers [24]. Spatialized interactions are particularly valuable for governing interactions between large groups of people; enabling crowds of people to inhabit the same virtual environment and interact in a way impossible in traditional video or audio conferencing [25]. Billinghurst (1998) at 3-4. Just as in face-to-face collaboration, users could turn to face the collaborators they wanted to talk to while still being aware of the other conversations taking place. The user could also move about the space enabling them to choose their own viewpoint and the spatial relationships between the collaborators. In this way the space could support dozens of simultaneous users, similar to current collaborative virtual environments. Since the displays are see-through or see-around the user could also see the real world at the same time, enabling the remote collaborators to help them with real world tasks. These remote users may also be using wearable computers and head mounted displays or could be interacting through a desktop workstation. The wearable conferencing space would also allow the faces of remote users to appear life-size, a crucial factor for establishing equal relationships in remote collaboration [30]. Billinghurst (1998) at 5. Users at the desktop machine wear headmounted microphones to talk into the conferencing space and listen through stereo headphones. Just as with the wearable interface, desktop users are aware of the spatial relationships between participants. When a participant turns and talks to someone else, the desktop user sees their avatar turn and face the person they're talking to. Billinghurst (1998) at 6. Users are able to easily discriminate between three simultaneous speakers when their audio streams are spatialized, but not when non-spatialized audio is used. It is expected

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	that this effect will become even more noticeable as the number of simultaneous participants is increased. Participants preferred seeing a visual representation of their collaborators as opposed to just hearing their speech. Even though it was relatively poor quality the visual representation enabled them to see who is connected and the spatial relationship of the speakers. This allowed them to use some of the non-verbal cues commonly used in face-to-face communication such as gaze modulation and body motion. The radar display was useful for finding collaborators that were far away and barely visible. Users found that they could continue doing real world tasks while talking to collaborators in the conferencing space and it was possible to move the conferencing space with the trackball so that collaborators weren't blocking critical portions of the users field of view. The interface is easy and intuitive to use, although using the head tracking on the wearable was easier than the mouse only desktop interface. Billinghurst (1998) at 7. We have presented a prototype wearable communication space that uses spatial visual and audio cues to enhance communication between remote groups of people. Our interface shows what is possible when computing and communications facilities are coupled together on a wearable platform. Preliminary results have found that users prefer using both the audio and visual cues together and that spatialized audio makes it easy for users to discriminate between speakers. Billinghurst (1998) at 8.

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	Physical Sample of Virtual iglasses! The wearable computer we use is a custom built 586 PC 104 based computer with 20mb of RAM running Windows 95. Figure 3.0 shows a user wearing the display and computer. A hand held Logitech wireless radio trackball with three buttons is used as the primary input device. The display is a pair of Virtual i-O iglasses! converted into a monoscopic display by the removal of the left eyepiece. The Virtual i-O head mounted display can either be used in see-through or occluded mode, has a resolution of 262 by 230 pixels and a 26-degree field of view. The iglasses! also have a sourceless two-axis inclinometer and a magnetometer used as a three degree of

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	freedom orientation tracker. A BreezeCom wireless LAN is used to give 2mb/s Internet access up to 500 feet from a base station. The wearable also has a soundBlaster compatible sound board with headmounted microphone. The desktop PCs are standard Pentium class machines with Internet connectivity and sound capability. Billinghurst (1998) at 5-6. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Haddick 248</i> at [00636] ("An image of the wearer l 512AA may then be displayed on the display area l 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images l 514AA of other participants on the videoconference call."), [00637] ("In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference."), [00662] ("The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like."), [00730] ("The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input

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	could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data

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	communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
9[a]. processing, during the telephone call and with a processor, a voice of the calling party with head related transfer functions (HRTFs) so the voice of the calling party localizes to the called party as binaural	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “processing, during the telephone call and with a processor, a voice of the calling party with head related transfer functions (HRTFs) so the voice of the calling party localizes to the called party as binaural sound at a sound localization point (SLP) that is one meter to two meters away from the called party” through the various disclosures in the reference. For example: Similarly when a user speaks, their speech is digitized and broadcast to the audio multicast group. When received by the other clients the senders IP address identifies the

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sound at a sound localization point (SLP) that is one meter to two meters away from the called party;	avatar that the audio belongs to and its position and orientation. The audio is then spatialized in real time. Billinghurst (1998) at 7. We have presented a prototype wearable communication space that uses spatial visual and audio cues to enhance communication between remote groups of people. Our interface shows what is possible when computing and communications facilities are coupled together on a wearable platform. Preliminary results have found that users prefer using both the audio and visual cues together and that spatialized audio makes it easy for users to discriminate between speakers. Billinghurst (1998) at 8.

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	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. With this display configuration a wearable conferencing space could be created that allows remote collaborators appear as virtual avatars distributed about the user (figure 2.0). The avatars could be live video streams and as they speak their audio streams spatialized in real time so that they appear to emit from the corresponding avatar.

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	Just as in face-to-face collaboration, users could turn to face the collaborators they wanted to talk to while still being aware of the other conversations taking place. The user could also move about the space enabling them to choose their own viewpoint and the spatial relationships between the collaborators. In this way the space could support dozens of simultaneous users, similar to current collaborative virtual environments. Since the displays are see-through or see-around the user could also see the real world at the same time, enabling the remote collaborators to help them with real world tasks. These remote users may also be using wearable computers and head mounted displays or could be interacting through a desktop workstation. The wearable conferencing space would also allow the faces of remote users to appear life-size, a crucial factor for establishing equal relationships in remote collaboration [30]. Billinghurst (1998) at 5. Each user determines the position and orientation of their own avatar in space, which changes as they move or look about environment. Billinghurst (1998) at 6. One of the most important aspects of creating a collaborative communication interface is the visual and audio presentation of information. Most current wearable computers use see-through or see-around monoscopic head mounted displays with stereo headphones. Billinghurst (1998) at 4. The wearable interface also supports 3D spatialized Internet telephony. When users connect to the conferencing space their audio is broadcast to all the other users in the space. This is spatialized according to the distance and direction between speaker and listener. As users face or move closer to different speakers the speaker volume changes due to the sound spatialisation. Since the speakers are constrained to remain in the same plane as the listener the audio spatialisation is considerably simplified. Audio culling is also used so that only the audio streams from the speakers closest to the listener are broadcast and spatialized. This significantly reduces the CPU load. The conferencing

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	space uses custom developed telephony libraries that incorporate the Microsoft Direct Sound libraries. Billinghurst (1998) at 6. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.1, 4, 6, 8, 9, and 10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Schroder</i> at 1:5-6 ("The invention relates to the binaural reproduction of aural events using headphones."), 4:10-17 ("In addition to the method for avoiding in-head localization, rotational movements of the head are therefore evaluated and the signals for the left and right ears are altered such that a stable virtual position for sound sources in space becomes established."), 7:12-16 ("The inertia sensor, e.g. an acceleration pickup or a gyroscope system, shows, depending on complexity, changes of direction about one or more axes. The changes of direction or the changed absolute direction is/are supplied to the control circuit for controlling the variable HRTF filters."), 3:5-16 ("Figures 5 and 6 schematically show the situation described above. In Figure 5, headphones 8, 9 supply the left and right ears of the listener 1 with signals which contain not only the signals L, R which are respectively intended for the left and right ears but also portions of the signals L(HRTF), R(HRTF) which are respectively intended for the other ear. These additional signals L(HRTF), R(HRTF) are produced by applying an HRTF to the respective original signal L, R. The listener perceives the sound event as coming from outside the head, illustrated in the figure by arrow 6."), 12:20-24 ("The control circuit containing variable HRTF filters adjusts the audio signals for the left and right ears of the listener 1 such that the aural event is perceived as coming unchanged from the direction 6. The unchanged position of the trunk of the listener 1 in comparison with Figure 9 indicates that the rotation of the head is taking place for limited time or quickly."), 5:25-36 ("Normally, the head points in one preferred direction when listening to aural events, normally forwards in the direction of the front of the trunk. A change in the position of the listener which is for a limited time or is relatively frequent is when the listener turns his head, for example. The signals for the left and right ears are adjusted, on the basis of the position of the listener or of his head, using

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	variable filters for the HRT function such that the direction from which the aural event appears to come remains stable in space, that is to say has a constant spatial direction.”), 13:3-11 (“A high-pass filter (not shown in Figure 11) in the control circuit (likewise not shown) results in the direction from which the aural event appears to come initially remaining still at the position 6' . Depending on the cut-off frequency of the high-pass filter, the variable HRTF filters are then adjusted such that the aural event is perceived as coming from the direction 6 again.”), 14:16-21 (“The signal representing the change of position is routed to the variable HRTF filters in the control circuit (not shown in the figure) . The control circuit adjusts the audio signals for the left and right ears such that the aural event is perceived as coming from the direction 6.”), Figs. 5, 6, 7, 8; Zhou at 1047 (“In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the

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	modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal

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	communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”), 2:25-29 (“Another method, often used with headphones, requires complex individual filters or synthesized sound reflections. This method performs filtering of a monaural source with a pair of filters defined by a pair of head related transfer functions (HRTFs) for a particular location.”), 2:38-53 (“A head tracking system also mounted on the frame where speakers are mounted determines the location and orientation of the listener’s head and provides the measurements to a computer system for audio signal processing in conjunction with a head related transfer function (HRTF) filter to produce spatialized audio. The HRTF filter maintains virtual location of the audio signals, thus

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	allowing the listener to change locations and head orientation without degradation of the audio signal. The system of the present invention produces virtual sound sources that are externally perceived and positioned at any desired orientation in azimuth and elevation from the listener.”), 2:54-3:2 (“In its broader aspects, the present invention provides an apparatus for producing spatialized audio, the apparatus comprising at least one pair of speakers positioned near a user’s temple for generating spatialized audio signals, whereby the speakers are positioned coaxially with a user’s ear regardless of the user’s head movement; a tracking system for tracking the user’s head orientation and location; a head related transfer function (HRTF) filter for maintaining virtual location of the audio signals thereby allowing the user to change location and head orientation without degradation of the virtual location of audio signals; and a processor for receiving signals from the tracking system and causing the filter to generate spatialized audio, wherein the speakers are positioned to generate frontal positioning cues to augment spatial filtering for virtual frontal sources without degrading spatial filtering for other virtual positions.”), 3:60-4:4 (“The head tracking system 104 measures the location and orientation of a user's head and provides the measured information to the computer system 102 which processes the audio signals using a head related transfer function (HRTF) filter 106 thus producing spatialized audio. The spatialized audio signals are amplified in an amplifier 108 and fed to speakers 110. The amplified signals are binaural in nature (i.e., left channel signals are supplied to the left ear and right channel signals are supplied to the right ear. The amplifier 108 generates sound that is loud enough to be heard in the nearest ear but generally too soft to be heard in the opposite ear.”).), 4:21-26 (“FIG. 2 shows another embodiment of the present invention as in FIG. 1. Here, the processor 102 also performs the HRTF filtering functions. The audio source is generated and operates under the control of the computer system. The rest of the operation of FIG. 2 is similar to the operation as explained with respect to FIG. 1.”), Figs. 1-4.
9[b]. displaying, during the telephone call and to the called party with a wearable electronic device worn on a head of the called party, an image that represents the calling party that	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “displaying, during the telephone call and to the called party with a wearable electronic device worn on a head of the called party, an image that represents the calling party that is seen by the called party as being at the SLP that is one meter to two meters away from the called party” through the various disclosures in the reference. For example:

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is seen by the called party as being at the SLP that is one meter to two meters away from the called party;	Wearable computers are the most recent generation of portable machines. Worn on the body, they provide constant access to computing and communications resources. In general, a wearable computer may be defined as a computer that is subsumed into the personal space of the user, controlled by the wearer and has both operational and interactional constancy, i.e. is always on and always accessible [1]. Wearables are typically composed of a belt or back pack PC, see-through or see around head mounted display (HMD), wireless communications hardware and an input device such as touchpad or chording keyboard. This configuration has been demonstrated in a number of real world applications including aircraft maintenance [2], navigational assistance [3] and vehicle mechanics [4]. In such applications wearables have dramatically improved user performance, halving task time in the case of vehicle inspection [4]. Billinghurst (1998) at 2. Virtual reality can provide an alternative medium that allows groups of people to share the same communications space. British Telecom has demonstrated virtual conferencing in which many users can be represented as life like virtual avatars of themselves within virtual rooms [20]. Users can freely move through the space setting their own viewpoints and spatial relationships. In collaborative virtual environments (CVEs) spatial visual and audio cues can combine in natural ways to aid communication [21]. The well known "cocktail-party" effect shows that people can easily monitor several spatialized audio streams at once, selectively focusing on those of interest [22], [23]. Even a simple virtual avatar representation and spatial audio model enables users to discriminate between multiple speakers [24]. Spatialized interactions are particularly valuable for governing interactions between large groups of people; enabling crowds of people to inhabit the same virtual environment and interact in a way impossible in traditional video or audio conferencing [25]. Billinghurst (1998) at 3-4. In our work we have chosen to begin with the simplest form of body-stabilized display; one which uses one degree of orientation to give the user the impression they are surrounded by a virtual cylinder of visual and auditory information.

Claim	Billinghurst System's Exemplary Disclosures
	Billinghurst (1998) at 4. When using a head mounted display to navigate a cylindrical body-stabilized space, only the portion of the information space in its field of view can be seen. There are two ways the rest of the space can be viewed; by rotating the information space about the user's head, or tracking the user's head orientation as they look around the space. The first requires no additional hardware and can be done by mapping mouse, switch or voice input to direction and angle of rotation, while the second requires only a simple one degree of freedom tracker. The minimal hardware requirements make cylindrical spatial information displays particularly attractive. The cylindrical display is also very natural to use since most head and body motion is about the vertical axis, making it very difficult for the user to become disoriented. Billinghurst (1998) at 4-5. With this display configuration a wearable conferencing space could be created that allows remote collaborators appear as virtual avatars distributed about the user (figure 2.0). The avatars could be live video streams and as they speak their audio streams spatialized in real time so that they appear to emit from the corresponding avatar. Just as in face-to-face collaboration, users could turn to face the collaborators they wanted to talk to while still being aware of the other conversations taking place. The user could also move about the space enabling them to choose their own viewpoint and the spatial relationships between the collaborators. In this way the space could support dozens of simultaneous users, similar to current collaborative virtual environments. Since the displays are see-through or see-around the user could also see the real world at the same time, enabling the remote collaborators to help them with real world tasks. These remote users may also be using wearable computers and head mounted displays or could be interacting through a desktop workstation. The wearable conferencing space would also allow the faces of remote users to appear life-size, a crucial factor for establishing equal relationships in remote collaboration [30]. Billinghurst (1998) at 5.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 2.0 A Spatial Conferencing Space. Billinghurst (1998) at Fig. 2.0. The wearable computer we use is a custom built 586 PC 104 based computer with 20mb of RAM running Windows 95. Figure 3.0 shows a user wearing the display and computer. A hand held Logitech wireless radio trackball with three buttons is used as the primary input device. The display is a pair of Virtual i-O iglasses! converted into a monoscopic display by the removal of the left eyepiece.

Claim	Billinghurst System's Exemplary Disclosures
	The Virtual i-O head mounted display can either be used in see-through or occluded mode, has a resolution of 262 by 230 pixels and a 26-degree field of view. The iglasses! also have a sourceless two-axis inclinometer and a magnetometer used as a three degree of freedom orientation tracker. A BreezeCom wireless LAN is used to give 2mb/s Internet access up to 500 feet from a base station. The wearable also has a soundBlaster compatible sound board with headmounted microphone. The desktop PCs are standard Pentium class machines with Internet connectivity and sound capability. Billinghurst (1998) at 5-6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 3.0 The Wearable Hardware. Billinghurst (1998) at Fig. 3.0. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to

Claim	Billinghurst System's Exemplary Disclosures
	change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. The wearable interface also supports 3D spatialized Internet telephony. When users connect to the conferencing space their audio is broadcast to all the other users in the space. This is spatialized according to the distance and direction between speaker and listener. As users face or move closer to different speakers the speaker volume changes due to the sound spatialisation. Since the speakers are constrained to remain in the same plane as the listener the audio spatialisation is considerably simplified. Audio culling is also used so that only the audio streams from the speakers closest to the listener are broadcast and spatialized. This significantly reduces the CPU load. The conferencing space uses custom developed telephony libraries that incorporate the Microsoft Direct Sound libraries. Billinghurst (1998) at 6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. Users at the desktop machine wear headmounted microphones to talk into the conferencing space and listen through stereo headphones. Just as with the wearable interface, desktop users are aware of the spatial relationships between participants. When a participant turns and talks to someone else, the desktop user sees their avatar turn and face the person they're talking to.

Claim	Billinghurst System's Exemplary Disclosures
	Billinghurst (1998) at 6. We have presented a prototype wearable communication space that uses spatial visual and audio cues to enhance communication between remote groups of people. Our interface shows what is possible when computing and communications facilities are coupled together on a wearable platform. Preliminary results have found that users prefer using both the audio and visual cues together and that spatialized audio makes it easy for users to discriminate between speakers. Billinghurst (1998) at 8. When connected to a personal computer, Virtual iglasses bring a real life feel to gaming. This is accomplished using stereoscopic 3D displays and a head tracking device that lets users look up, down, around, and even behind themselves. Virtual IO - I-Glasses (1995) at 0:19.²

² <https://youtu.be/E2sfA0BGw1g?t=19>.

Claim	Billinghurst System's Exemplary Disclosures
	 Virtual IO – i-glasses (1995).³

³ <https://www.youtube.com/watch?v=E2sfA0BGw1g>.

Claim	Billinghurst System's Exemplary Disclosures
	 Physical Sample of Virtual iglasses! To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.9 and 10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Zhou</i> at 1047 ("In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical

Claim	Billinghurst System's Exemplary Disclosures
	space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a

Claim	Billinghurst System's Exemplary Disclosures
	headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may

Claim	Billinghurst System's Exemplary Disclosures
	be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
9[c]. tracking, during the telephone call and with the wearable electronic device, head movements of the called party with respect to the image that represents the calling party and that is seen by the called party as being at the SLP; and	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “tracking, during the telephone call and with the wearable electronic device, head movements of the called party with respect to the image that represents the calling party and that is seen by the called party as being at the SLP.” For example: When using a head mounted display to navigate a cylindrical body-stabilized space, only the portion of the information space in its field of view can be seen. There are two ways the rest of the space can be viewed; by rotating the information space about the user’s head, or tracking the user’s head orientation as they look around the space. The first requires no additional hardware and can be done by mapping mouse, switch or voice input to direction and angle of rotation, while the second requires only a simple one degree of freedom tracker. The minimal hardware requirements make cylindrical spatial information displays particularly attractive. The cylindrical display is also very natural to use since most head and body motion is about the vertical axis, making it very difficult for the user to become disoriented. Billinghurst (1998) at 4-5.

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	Just as in face-to-face collaboration, users could turn to face the collaborators they wanted to talk to while still being aware of the other conversations taking place. The user could also move about the space enabling them to choose their own viewpoint and the spatial relationships between the collaborators. In this way the space could support dozens of simultaneous users, similar to current collaborative virtual environments. Since the displays are see-through or see-around the user could also see the real world at the same time, enabling the remote collaborators to help them with real world tasks. These remote users may also be using wearable computers and head mounted displays or could be interacting through a desktop workstation. The wearable conferencing space would also allow the faces of remote users to appear life-size, a crucial factor for establishing equal relationships in remote collaboration [30]. Billinghurst (1998) at 5.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 2.0 A Spatial Conferencing Space. Billinghurst (1998) at Fig. 2.0. Each user determines the position and orientation of their own avatar in space, which changes as they move or look about environment. Billinghurst (1998) at 6. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the

Claim	Billinghurst System's Exemplary Disclosures
	direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. Billinghurst (1998) at 6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. When connected to a personal computer, Virtual iglasses bring a real life feel to gaming. This is accomplished using stereoscopic 3D displays and a head tracking device that lets users look up, down, around, and even behind themselves.

Claim	Billinghurst System's Exemplary Disclosures
	Virtual IO - I-Glasses (1995) at 0:19.⁴ To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Section IV.J.10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Haddick 248</i> at [00636] ("An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call."), [00637] ("In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference."), [00662] ("The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like."), [00730] ("The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video

⁴ <https://youtu.be/E2sfA0BGw1g?t=19>.

Claim	Billinghurst System's Exemplary Disclosures
	conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send

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	an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
9[d]. changing, during the telephone call and in response to the head movements of the called party, the HRTFs processing the voice of the calling party so the voice of the calling party continues to localize to the SLP that is seen by the called party as being the	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “changing, during the telephone call and in response to the head movements of the called party, the HRTFs processing the voice of the calling party so the voice of the calling party continues to localize to the SLP that is seen by the called party as being the image that represents the calling party that is one meter to two meters away from the called party while the head of the called party moves with respect to the image that represents the calling party” through the various disclosures in the reference. For example:

Claim	Billinghurst System's Exemplary Disclosures
image that represents the calling party that is one meter to two meters away from the called party while the head of the called party moves with respect to the image that represents the calling party.	Each user determines the position and orientation of their own avatar in space, which changes as they move or look about environment. Billinghurst (1998) at 6. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. The wearable interface also supports 3D spatialized Internet telephony. When users connect to the conferencing space their audio is broadcast to all the other users in the space. This is spatialized according to the distance and direction between speaker and listener. As users face or move closer to different speakers the speaker volume changes due to the sound spatialisation. Since the speakers are constrained to remain in the same plane as the listener the audio spatialisation is considerably simplified. Audio culling is also used so that only the audio streams from the speakers closest to the listener are broadcast and spatialized. This significantly reduces the CPU load. The conferencing space uses custom developed telephony libraries that incorporate the Microsoft Direct Sound libraries. Billinghurst (1998) at 6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. Similarly when a user speaks, their speech is digitized and broadcast to the audio multicast group. When received by the other clients the senders IP address identifies the avatar that the audio belongs to and its position and orientation. The audio is then spatialized in real time.

Claim	Billinghurst System's Exemplary Disclosures
	Billinghurst (1998) at 7. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.1, 4, 6, 8, 9, and 10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Schroder</i> at 1:5-6 ("The invention relates to the binaural reproduction of aural events using headphones."), 4:10-17 ("In addition to the method for avoiding in-head localization, rotational movements of the head are therefore evaluated and the signals for the left and right ears are altered such that a stable virtual position for sound sources in space becomes established."), 7:12-16 ("The inertia sensor, e.g. an acceleration pickup or a gyroscope system, shows, depending on complexity, changes of direction about one or more axes. The changes of direction or the changed absolute direction is/are supplied to the control circuit for controlling the variable HRTF filters."), 3:5-16 ("Figures 5 and 6 schematically show the situation described above. In Figure 5, headphones 8, 9 supply the left and right ears of the listener 1 with signals which contain not only the signals L, R which are respectively intended for the left and right ears but also portions of the signals L(HRTF), R(HRTF) which are respectively intended for the other ear. These additional signals L(HRTF), R(HRTF) are produced by applying an HRTF to the respective original signal L, R. The listener perceives the sound event as coming from outside the head, illustrated in the figure by arrow 6."), 12:20-24 ("The control circuit containing variable HRTF filters adjusts the audio signals for the left and right ears of the listener 1 such that the aural event is perceived as coming unchanged from the direction 6. The unchanged position of the trunk of the listener 1 in comparison with Figure 9 indicates that the rotation of the head is taking place for limited time or quickly."), 5:25-36 ("Normally, the head points in one preferred direction when listening to aural events, normally forwards in the direction of the front of the trunk. A change in the position of the listener which is for a limited time or is relatively frequent is when the listener turns his head, for example. The signals for the left and right ears are adjusted, on the basis of the position of the listener or of his head, using variable filters for the HRT function such that the direction from which the aural event appears to come remains stable in space, that is to say has a constant spatial direction."), 13:3-11 ("A high-

Claim	Billinghurst System's Exemplary Disclosures
	pass filter (not shown in Figure 11) in the control circuit (likewise not shown) results in the direction from which the aural event appears to come initially remaining still at the position 6' . Depending on the cut-off frequency of the high-pass filter, the variable HRTF filters are then adjusted such that the aural event is perceived as coming from the direction 6 again.”), 14:16-21 (“The signal representing the change of position is routed to the variable HRTF filters in the control circuit (not shown in the figure) . The control circuit adjusts the audio signals for the left and right ears such that the aural event is perceived as coming from the direction 6.”), Figs. 5, 6, 7, 8; Zhou at 1047 (“In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the

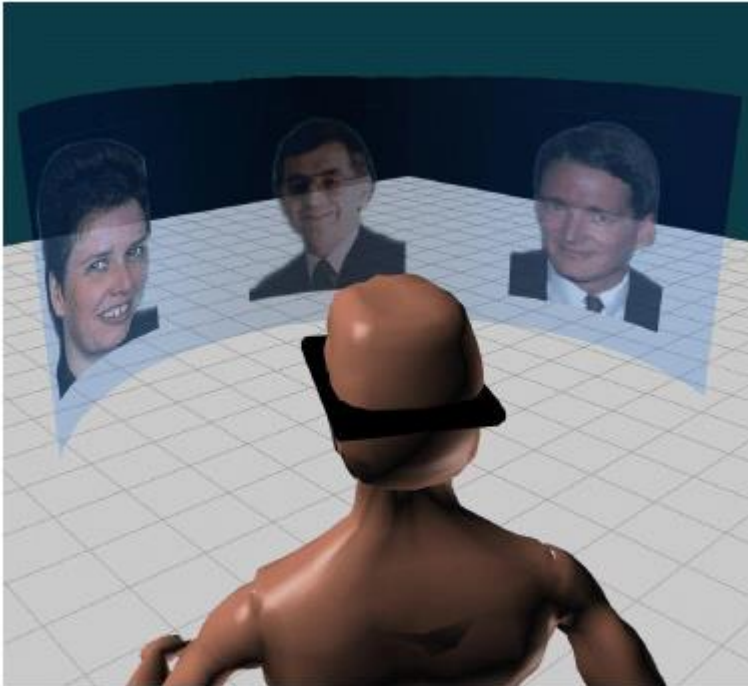
Claim	Billinghurst System's Exemplary Disclosures
	video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA)

Claim	Billinghurst System's Exemplary Disclosures
	that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”), 2:25-29 (“Another method, often used with headphones, requires complex individual filters or synthesized sound reflections. This method performs filtering of a monaural source with a pair of filters defined by a pair of head related transfer functions (HRTFs) for a particular location.”), 2:38-53 (“A head tracking system also mounted on the frame where speakers are mounted determines the location and orientation of the listener’s head and provides the measurements to a computer system for audio signal processing in conjunction with a head related transfer function (HRTF) filter to produce spatialized audio. The HRTF filter maintains virtual location of the audio signals, thus allowing the listener to change locations and head orientation without degradation of the audio signal. The system of the present invention produces virtual sound sources that are externally

Claim	Billinghurst System's Exemplary Disclosures
	perceived and positioned at any desired orientation in azimuth and elevation from the listener.”), 2:54-3:2 (“In its broader aspects, the present invention provides an apparatus for producing spatialized audio, the apparatus comprising at least one pair of speakers positioned near a user’s temple for generating spatialized audio signals, whereby the speakers are positioned coaxially with a user’s ear regardless of the user’s head movement; a tracking system for tracking the user’s head orientation and location; a head related transfer function (HRTF) filter for maintaining virtual location of the audio signals thereby allowing the user to change location and head orientation without degradation of the virtual location of audio signals; and a processor for receiving signals from the tracking system and causing the filter to generate spatialized audio, wherein the speakers are positioned to generate frontal positioning cues to augment spatial filtering for virtual frontal sources without degrading spatial filtering for other virtual positions.”), 3:60-4:4 (“The head tracking system 104 measures the location and orientation of a user's head and provides the measured information to the computer system 102 which processes the audio signals using a head related transfer function (HRTF) filter 106 thus producing spatialized audio. The spatialized audio signals are amplified in an amplifier 108 and fed to speakers 110. The amplified signals are binaural in nature (i.e., left channel signals are supplied to the left ear and right channel signals are supplied to the right ear. The amplifier 108 generates sound that is loud enough to be heard in the nearest ear but generally too soft to be heard in the opposite ear.”).), 4:21-26 (“FIG. 2 shows another embodiment of the present invention as in FIG. 1. Here, the processor 102 also performs the HRTF filtering functions. The audio source is generated and operates under the control of the computer system. The rest of the operation of FIG. 2 is similar to the operation as explained with respect to FIG. 1.”), Figs. 1-4.
CLAIM 12	
12[pre][a]. The method of claim 9 further comprising: displaying, during the telephone call and to the called	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “[t]he method of claim 9 further comprising: displaying, during the telephone call and to the called party with the wearable electronic device worn on the head of the called party, the

Claim	Billinghurst System's Exemplary Disclosures
party with the wearable electronic device worn on the head of the called party, the image that represents the calling party as a virtual image of the calling party.	image that represents the calling party as a virtual image of the calling party.” See claim 9. For example: Wearable computers are the most recent generation of portable machines. Worn on the body, they provide constant access to computing and communications resources. In general, a wearable computer may be defined as a computer that is subsumed into the personal space of the user, controlled by the wearer and has both operational and interactional constancy, i.e. is always on and always accessible [1]. Wearables are typically composed of a belt or back pack PC, see-through or see around head mounted display (HMD), wireless communications hardware and an input device such as touchpad or chording keyboard. This configuration has been demonstrated in a number of real world applications including aircraft maintenance [2], navigational assistance [3] and vehicle mechanics [4]. In such applications wearables have dramatically improved user performance, halving task time in the case of vehicle inspection [4]. Billinghurst (1998) at 2. Virtual reality can provide an alternative medium that allows groups of people to share the same communications space. British Telecom has demonstrated virtual conferencing in which many users can be represented as life like virtual avatars of themselves within virtual rooms [20]. Users can freely move through the space setting their own viewpoints and spatial relationships. In collaborative virtual environments (CVEs) spatial visual and audio cues can combine in natural ways to aid communication [21]. The well known “cocktail-party” effect shows that people can easily monitor several spatialized audio streams at once, selectively focusing on those of interest [22], [23]. Even a simple virtual avatar representation and spatial audio model enables users to discriminate between multiple speakers [24]. Spatialized interactions are particularly valuable for governing interactions between large groups of people; enabling crowds of people to inhabit the same virtual environment and interact in a way impossible in traditional video or audio conferencing [25]. Billinghurst (1998) at 3-4.

Claim	Billinghurst System's Exemplary Disclosures
	In our work we have chosen to begin with the simplest form of body-stabilized display; one which uses one degree of orientation to give the user the impression they are surrounded by a virtual cylinder of visual and auditory information. Billinghurst (1998) at 4. When using a head mounted display to navigate a cylindrical body-stabilized space, only the portion of the information space in its field of view can be seen. There are two ways the rest of the space can be viewed; by rotating the information space about the user's head, or tracking the user's head orientation as they look around the space. The first requires no additional hardware and can be done by mapping mouse, switch or voice input to direction and angle of rotation, while the second requires only a simple one degree of freedom tracker. The minimal hardware requirements make cylindrical spatial information displays particularly attractive. The cylindrical display is also very natural to use since most head and body motion is about the vertical axis, making it very difficult for the user to become disoriented. Billinghurst (1998) at 4-5. With this display configuration a wearable conferencing space could be created that allows remote collaborators appear as virtual avatars distributed about the user (figure 2.0). The avatars could be live video streams and as they speak their audio streams spatialized in real time so that they appear to emit from the corresponding avatar. Just as in face-to-face collaboration, users could turn to face the collaborators they wanted to talk to while still being aware of the other conversations taking place. The user could also move about the space enabling them to choose their own viewpoint and the spatial relationships between the collaborators. In this way the space could support dozens of simultaneous users, similar to current collaborative virtual environments. Since the displays are see-through or see-around the user could also see the real world at the same time, enabling the remote collaborators to help them with real world tasks. These remote users may also be using wearable computers and head mounted displays or could be interacting through a desktop workstation. The wearable conferencing space would also

Claim	Billinghurst System's Exemplary Disclosures
	allow the faces of remote users to appear life-size, a crucial factor for establishing equal relationships in remote collaboration [30]. Billinghurst (1998) at 5.  Figure 2.0 A Spatial Conferencing Space. Billinghurst (1998) at Fig. 2.0. The wearable computer we use is a custom built 586 PC 104 based computer with 20mb of RAM running Windows 95. Figure 3.0 shows a user wearing the display and computer.

Claim	Billinghurst System's Exemplary Disclosures
	A hand held Logitech wireless radio trackball with three buttons is used as the primary input device. The display is a pair of Virtual i-O iglasses! converted into a monoscopic display by the removal of the left eyepiece. The Virtual i-O head mounted display can either be used in see-through or occluded mode, has a resolution of 262 by 230 pixels and a 26-degree field of view. The iglasses! also have a sourceless two-axis inclinometer and a magnetometer used as a three degree of freedom orientation tracker. A BreezeCom wireless LAN is used to give 2mb/s Internet access up to 500 feet from a base station. The wearable also has a soundBlaster compatible sound board with headmounted microphone. The desktop PCs are standard Pentium class machines with Internet connectivity and sound capability. Billinghurst (1998) at 5-6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 3.0 The Wearable Hardware. Billinghurst (1998) at Fig. 3.0. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to

Claim	Billinghurst System's Exemplary Disclosures
	change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. The wearable interface also supports 3D spatialized Internet telephony. When users connect to the conferencing space their audio is broadcast to all the other users in the space. This is spatialized according to the distance and direction between speaker and listener. As users face or move closer to different speakers the speaker volume changes due to the sound spatialisation. Since the speakers are constrained to remain in the same plane as the listener the audio spatialisation is considerably simplified. Audio culling is also used so that only the audio streams from the speakers closest to the listener are broadcast and spatialized. This significantly reduces the CPU load. The conferencing space uses custom developed telephony libraries that incorporate the Microsoft Direct Sound libraries. Billinghurst (1998) at 6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. Users at the desktop machine wear headmounted microphones to talk into the conferencing space and listen through stereo headphones. Just as with the wearable interface, desktop users are aware of the spatial relationships between participants. When a participant turns and talks to someone else, the desktop user sees their avatar turn and face the person they're talking to.

Claim	Billinghurst System's Exemplary Disclosures
	Billinghurst (1998) at 6. We have presented a prototype wearable communication space that uses spatial visual and audio cues to enhance communication between remote groups of people. Our interface shows what is possible when computing and communications facilities are coupled together on a wearable platform. Preliminary results have found that users prefer using both the audio and visual cues together and that spatialized audio makes it easy for users to discriminate between speakers. Billinghurst (1998) at 8. When connected to a personal computer, Virtual iglasses bring a real life feel to gaming. This is accomplished using stereoscopic 3D displays and a head tracking device that lets users look up, down, around, and even behind themselves. Virtual IO - I-Glasses (1995) at 0:19.⁵

⁵ <https://youtu.be/E2sfA0BGw1g?t=19>.

Claim	Billinghurst System's Exemplary Disclosures
	 Virtual IO – i-glasses (1995).⁶

⁶ <https://www.youtube.com/watch?v=E2sfA0BGw1g>.

Claim	Billinghurst System's Exemplary Disclosures
	Physical Sample of Virtual iglasses! To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Section IV.J.10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Haddick 248</i> at [00636] ("An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the

Claim	Billinghurst System's Exemplary Disclosures
	videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others through the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing

Claim	Billinghurst System's Exemplary Disclosures
	aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown)."); Boustead at 7:14-20 ("The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc."); Bedingfield at 3:25-32 ("An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field."); Nystrom at 5:27-34 ("User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . ."), 5:38-39 ("Via user device 204, a user may place a telephone call, text message another user, send an email, etc."); Ballas 439 at 1:42-58 ("Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments"); Craner at 4:18-21 ("Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system."), 4:58-64 ("The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications."), 17:12-17 ("In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting

Claim	Billinghurst System's Exemplary Disclosures
	device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
CLAIM 16	
16[pre]. A non-transitory computer readable storage medium storing instructions that one or more electronic devices in an electronic system execute as a method during a telephone call between a calling party and a called party, the method comprising:	To the extent the preamble is limiting, the Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “[a] non-transitory computer readable storage medium storing instructions that one or more electronic devices in an electronic system execute as a method during a telephone call between a calling party and a called party, the method comprising” through the various disclosures in the reference. For example: The wearable computer we use is a custom built 586 PC 104 based computer with 20mb of RAM running Windows 95. Figure 3.0 shows a user wearing the display and computer. A hand held Logitech wireless radio trackball with three buttons is used as the primary input device. The display is a pair of Virtual i-O iglasses! converted into a monoscopic display by the removal of the left eyepiece. The Virtual i-O head mounted display can either be used in see-through or occluded mode, has a resolution of 262 by 230 pixels and a 26-degree field of view. The iglasses! also have a sourceless two-axis inclinometer and a magnetometer used as a three degree of freedom orientation tracker. A BreezeCom wireless LAN is used to give 2mb/s Internet access up to 500 feet from a base station. The wearable also has a soundBlaster compatible sound board with headmounted microphone. The desktop PCs are standard Pentium class machines with Internet connectivity and sound capability.

Claim	Billinghurst System's Exemplary Disclosures
	Billinghurst (1998) at 5-6.  Figure 3.0 The Wearable Hardware. Billinghurst (1998) at Fig. 3.0. Users at the desktop machine wear headmounted microphones to talk into the conferencing space and listen through stereo headphones. Just as with the wearable interface, desktop users are aware of the spatial relationships between participants. When

Claim	Billinghurst System's Exemplary Disclosures
	a participant turns and talks to someone else, the desktop user sees their avatar turn and face the person they're talking to. Billinghurst (1998) at 6. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Section IV.J.10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Haddick 248</i> at [00636] ("An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call."), [00637] ("In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference."), [00662] ("The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like."), [00730] ("The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the

Claim	Billinghurst System's Exemplary Disclosures
	like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”),

Claim	Billinghurst System's Exemplary Disclosures
	5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
16[a]. displaying, during the telephone call and to the called party with a wearable electronic device worn on a head of the called party, an image of the calling party that appears to the called party as being at least	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “displaying, during the telephone call and to the called party with a wearable electronic device worn on a head of the called party, an image of the calling party that appears to the called party as being at least one meter away from a head of the called party” through the various disclosures in the reference. For example: Wearable computers are the most recent generation of portable machines. Worn on the body, they provide constant access to computing and communications resources. In general, a wearable computer may be defined as a computer that is subsumed into the

Claim	Billinghurst System's Exemplary Disclosures
one meter away from a head of the called party;	personal space of the user, controlled by the wearer and has both operational and interactional constancy, i.e. is always on and always accessible [1]. Wearables are typically composed of a belt or back pack PC, see-through or see around head mounted display (HMD), wireless communications hardware and an input device such as touchpad or chording keyboard. This configuration has been demonstrated in a number of real world applications including aircraft maintenance [2], navigational assistance [3] and vehicle mechanics [4]. In such applications wearables have dramatically improved user performance, halving task time in the case of vehicle inspection [4]. Billinghurst (1998) at 1. Virtual reality can provide an alternative medium that allows groups of people to share the same communications space. British Telecom has demonstrated virtual conferencing in which many users can be represented as life like virtual avatars of themselves within virtual rooms [20]. Users can freely move through the space setting their own viewpoints and spatial relationships. In collaborative virtual environments (CVEs) spatial visual and audio cues can combine in natural ways to aid communication [21]. The well known "cocktail-party" effect shows that people can easily monitor several spatialized audio streams at once, selectively focusing on those of interest [22], [23]. Even a simple virtual avatar representation and spatial audio model enables users to discriminate between multiple speakers [24]. Spatialized interactions are particularly valuable for governing interactions between large groups of people; enabling crowds of people to inhabit the same virtual environment and interact in a way impossible in traditional video or audio conferencing [25]. Billinghurst (1998) at 2-3. The wearable computer we use is a custom built 586 PC 104 based computer with 20mb of RAM running Windows 95. Figure 3.0 shows a user wearing the display and computer. A hand held Logitech wireless radio trackball with three buttons is used as the primary input device. The display is a pair of Virtual i-O iglasses! converted into a monoscopic display by the removal of the left eyepiece.

Claim	Billinghurst System's Exemplary Disclosures
	The Virtual i-O head mounted display can either be used in see-through or occluded mode, has a resolution of 262 by 230 pixels and a 26-degree field of view. The iglasses! also have a sourceless two-axis inclinometer and a magnetometer used as a three degree of freedom orientation tracker. A BreezeCom wireless LAN is used to give 2mb/s Internet access up to 500 feet from a base station. The wearable also has a soundBlaster compatible sound board with headmounted microphone. The desktop PCs are standard Pentium class machines with Internet connectivity and sound capability. Billinghurst (1998) at 5-6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 3.0 The Wearable Hardware. Billinghurst (1998) at Fig. 3.0. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to

Claim	Billinghurst System's Exemplary Disclosures
	change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. Billinghurst (1998) at 6. The image shows a first-person perspective of a virtual conferencing space. In the center-left, a large screen displays a male avatar with glasses. To the right, a smaller screen displays a female avatar. The background is a simple virtual room with shelves and a doorway. In the bottom right corner, there is a circular navigation overlay with a green border, a red 'X' through it, and several yellow dots indicating movement paths or targets. Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0.

Claim	Billinghurst System's Exemplary Disclosures
	Physical Sample of Virtual iglasses! To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.9 and 10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. See, e.g., Zhou at 1047 ("In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical

Claim	Billinghurst System's Exemplary Disclosures
	space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a

Claim	Billinghurst System's Exemplary Disclosures
	headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may

Claim	Billinghurst System's Exemplary Disclosures
	be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
16[b]. processing, during the telephone call, a voice of the calling party with head related transfer functions (HRTFs) so the voice of the calling party localizes to the called party as binaural sound at the image of the calling party that appears at least one meter away from the head of the called party;	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “processing, during the telephone call, a voice of the calling party with head related transfer functions (HRTFs) so the voice of the calling party localizes to the called party as binaural sound at the image of the calling party that appears at least one meter away from the head of the called party” through the various disclosures in the reference. For example: Similarly when a user speaks, their speech is digitized and broadcast to the audio multicast group. When received by the other clients the senders IP address identifies the avatar that the audio belongs to and its position and orientation. The audio is then spatialized in real time. Billinghurst (1998) at 7. We have presented a prototype wearable communication space that uses spatial visual and audio cues to enhance communication between remote groups of people. Our interface shows what is possible when computing and communications facilities are coupled together on a wearable platform. Preliminary results have found that users prefer using

Claim	Billinghurst System's Exemplary Disclosures
	both the audio and visual cues together and that spatialized audio makes it easy for users to discriminate between speakers. Billinghurst (1998) at 8. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. Billinghurst (1998) at 6.

Claim	Billinghurst System's Exemplary Disclosures
	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under

Claim	Billinghurst System's Exemplary Disclosures
	Sections IV.J.1, 4, 6, 8, 9, and 10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Schroder</i> at 1:5-6 ("The invention relates to the binaural reproduction of aural events using headphones."), 4:10-17 ("In addition to the method for avoiding in-head localization, rotational movements of the head are therefore evaluated and the signals for the left and right ears are altered such that a stable virtual position for sound sources in space becomes established."), 7:12-16 ("The inertia sensor, e.g. an acceleration pickup or a gyroscope system, shows, depending on complexity, changes of direction about one or more axes. The changes of direction or the changed absolute direction is/are supplied to the control circuit for controlling the variable HRTF filters."), 3:5-16 ("Figures 5 and 6 schematically show the situation described above. In Figure 5, headphones 8, 9 supply the left and right ears of the listener 1 with signals which contain not only the signals L, R which are respectively intended for the left and right ears but also portions of the signals L(HRTF), R(HRTF) which are respectively intended for the other ear. These additional signals L(HRTF), R(HRTF) are produced by applying an HRTF to the respective original signal L, R. The listener perceives the sound event as coming from outside the head, illustrated in the figure by arrow 6."), 12:20-24 ("The control circuit containing variable HRTF filters adjusts the audio signals for the left and right ears of the listener 1 such that the aural event is perceived as coming unchanged from the direction 6. The unchanged position of the trunk of the listener 1 in comparison with Figure 9 indicates that the rotation of the head is taking place for limited time or quickly."), 5:25-36 ("Normally, the head points in one preferred direction when listening to aural events, normally forwards in the direction of the front of the trunk. A change in the position of the listener which is for a limited time or is relatively frequent is when the listener turns his head, for example. The signals for the left and right ears are adjusted, on the basis of the position of the listener or of his head, using variable filters for the HRT function such that the direction from which the aural event appears to come remains stable in space, that is to say has a constant spatial direction."), 13:3-11 ("A high-pass filter (not shown in Figure 11) in the control circuit (likewise not shown) results in the direction from which the aural event appears to come initially remaining still at the position 6' . Depending on the cut-off frequency of the high-pass filter, the variable HRTF filters are then adjusted such that the aural event is perceived as coming from the direction 6 again."), 14:16-21 ("The signal representing the change of position is routed to the variable HRTF filters in the control circuit (not shown in the figure) . The control circuit adjusts the audio signals for the left

Claim	Billinghurst System's Exemplary Disclosures
	and right ears such that the aural event is perceived as coming from the direction 6.”), Figs. 5, 6, 7, 8; Zhou at 1047 (“In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen

Claim	Billinghurst System's Exemplary Disclosures
	at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant's system. To further enhance the listener's experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice

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	information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”), 2:25-29 (“Another method, often used with headphones, requires complex individual filters or synthesized sound reflections. This method performs filtering of a monaural source with a pair of filters defined by a pair of head related transfer functions (HRTFs) for a particular location.”), 2:38-53 (“A head tracking system also mounted on the frame where speakers are mounted determines the location and orientation of the listener’s head and provides the measurements to a computer system for audio signal processing in conjunction with a head related transfer function (HRTF) filter to produce spatialized audio. The HRTF filter maintains virtual location of the audio signals, thus allowing the listener to change locations and head orientation without degradation of the audio signal. The system of the present invention produces virtual sound sources that are externally perceived and positioned at any desired orientation in azimuth and elevation from the listener.”), 2:54-3:2 (“In its broader aspects, the present invention provides an apparatus for producing spatialized audio, the apparatus comprising at least one pair of speakers positioned near a user’s temple for generating spatialized audio signals, whereby the speakers are positioned coaxially with a user’s ear regardless of the user’s head movement; a tracking system for tracking the user’s head orientation and location; a head related transfer function (HRTF) filter for maintaining

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	virtual location of the audio signals thereby allowing the user to change location and head orientation without degradation of the virtual location of audio signals; and a processor for receiving signals from the tracking system and causing the filter to generate spatialized audio, wherein the speakers are positioned to generate frontal positioning cues to augment spatial filtering for virtual frontal sources without degrading spatial filtering for other virtual positions.”), 3:60-4:4 (“The head tracking system 104 measures the location and orientation of a user's head and provides the measured information to the computer system 102 which processes the audio signals using a head related transfer function (HRTF) filter 106 thus producing spatialized audio. The spatialized audio signals are amplified in an amplifier 108 and fed to speakers 110. The amplified signals are binaural in nature (i.e., left channel signals are supplied to the left ear and right channel signals are supplied to the right ear. The amplifier 108 generates sound that is loud enough to be heard in the nearest ear but generally too soft to be heard in the opposite ear.”).), 4:21-26 (“FIG. 2 shows another embodiment of the present invention as in FIG. 1. Here, the processor 102 also performs the HRTF filtering functions. The audio source is generated and operates under the control of the computer system. The rest of the operation of FIG. 2 is similar to the operation as explained with respect to FIG. 1.”), Figs. 1-4.
16[c]. tracking, during the telephone call, head movements of the called party; and	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “tracking, during the telephone call, head movements of the called party” through the various disclosures in the reference. For example: When using a head mounted display to navigate a cylindrical body-stabilized space, only the portion of the information space in its field of view can be seen. There are two ways the rest of the space can be viewed; by rotating the information space about the user's head, or tracking the user's head orientation as they look around the space. The first requires no additional hardware and can be done by mapping mouse, switch or voice input to direction and angle of rotation, while the second requires only a simple one degree of freedom tracker. The minimal hardware requirements make cylindrical spatial information displays particularly attractive. The cylindrical display is also very natural to use since

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	most head and body motion is about the vertical axis, making it very difficult for the user to become disoriented. Billinghurst (1998) at 4-5. Each user determines the position and orientation of their own avatar in space, which changes as they move or look about environment. Billinghurst (1998) at 6. The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group. Billinghurst (1998) at 6.

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	Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under

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	Section IV.J.10 for at least the reasons stated in Defendants' Invalidity Contentions cover pleading. <i>See, e.g., Haddick 248</i> at [00636] ("An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call."), [00637] ("In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people 78patialed in the videoconference."), [00662] ("The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like."), [00730] ("The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference."), [00731] ("In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like."), Figs. 7, 15AA; Jarvinen at 26:30-37 ("For purposes of illustration and not of limitation, consider an example in which a user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50)

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	with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant’s system. To further enhance the listener’s experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Ballas 439 at 1:42-58 (“Possible applications of spatial audio processing techniques include: . . . teleconferencing and telepresence applications; virtual and augmented reality environments”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the associated voice projecting device 23 may

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	be as simple as a telephone or stereo phone or, alternatively, may be as complex as a teleconferencing system with video, audio, and data communications.”), 17:12-17 (“In voice/video teleconferencing applications, spatialization provided by at least two-dimensional spatialization equipment processing at both the voice capture device 300 and the voice-projecting device 400 allows for the relative locations of the different talkers to be accurately reflected (both in voice and in video) to the listener.”); Gardner at 3:16-18 (“More generally, the present invention relates to audio teleconferencing systems that recreate a sound-field effect of participants in a shared acoustical space.”), 11:59-63 (“The server 900 can receive calls from telephones if it is equipped with one or more line interface devices (LIDs), which connect the server to the public switched telephone network (PSTN) 922. FIG.9B shows how a telephone client 920 can connect to the server 900.”), 13:55-58 (“As shown in FIG. 9C, the spatializing server 900 can receive calls from telephones if it is equipped with one or more LIDS 925 which connect the server 900 to the PSTN 922.”).
16[d]. changing, during the telephone call and in response to the head movements of the called party, the HRTFs processing the voice of the calling party so the voice of the calling party continues to localize to the image of the calling party that appears at least one meter away from the head of the called party as the head of the called party moves and changes head orientations.	The Billinghurst System discloses and/or renders obvious, alone or in combination with other prior art, “changing, during the telephone call and in response to the head movements of the called party, the HRTFs processing the voice of the calling party so the voice of the calling party continues to localize to the image of the calling party that appears at least one meter away from the head of the called party as the head of the called party moves and changes head orientations” through the various disclosures in the reference. For example: The wearable user has their head tracked so they can simply turn to face the speakers they are interested in. Users can also navigate through the space; by rolling the trackball forwards or backwards their viewpoint is moved forwards or backwards along the direction they are looking. Since the virtual images are superimposed on the real world, when the user rolls the trackball it appears to them as though they are moving the virtual space around them, rather than navigating through the space. Users are constrained to change viewpoint on the horizontal plane, just as in face-to-face conversations. The two different navigation methods (trackball motion, head tracking), match the different types of motion used in face to face communication; walking to join a join a group for conversation, and body orientation changes within a conversational group.

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	The wearable interface 81patialts 3D spatialized Internet telephony. When users connect to the conferencing space their audio is broadcast to all the other users in the space. This is spatialized according to the distance and direction between speaker and listener. As users face or move closer to different speakers the speaker volume changes due to the sound 81patialization. Since the speakers are constrained to remain in the same plane as the listener the audio 81patialization is considerably simplified. Audio culling is also used so that only the audio streams from the speakers closest to the listener are broadcast and spatialized. This significantly reduces the CPU load. The conferencing space uses custom developed telephony libraries that incorporate the Microsoft Direct Sound libraries. Billinghurst (1998) at 6.

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	 Figure 4.0 The User's View of the Wearable Conferencing Space Billinghurst (1998) at Fig. 4.0. To the extent Plaintiff argues that the Billinghurst System does not disclose this limitation, either expressly, implicitly, and/or by inherency, a person of ordinary skill in the art would have determined that the limitation would have been obvious in light of Billinghurst System alone or in combination with any applicant admitted prior art, the knowledge of one of ordinary skill in the art, or any one or more of the references identified in Defendants' Invalidity Contentions under Sections IV.J.1, 4, 6, 8, 9, and 10 for at least the reasons stated in Defendants' Invalidity

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	Contentions cover pleading. See, e.g., Schroder at 1:5-6 (“The invention relates to the binaural reproduction of aural events using headphones.”), 4:10-17 (“In addition to the method for avoiding in-head localization, rotational movements of the head are therefore evaluated and the signals for the left and right ears are altered such that a stable virtual position for sound sources in space becomes established.”), 7:12-16 (“The inertia sensor, e.g. an acceleration pickup or a gyroscope system, shows, depending on complexity, changes of direction about one or more axes. The changes of direction or the changed absolute direction is/are supplied to the control circuit for controlling the variable HRTF filters.”), 3:5-16 (“Figures 5 and 6 schematically show the situation described above. In Figure 5, headphones 8, 9 supply the left and right ears of the listener 1 with signals which contain not only the signals L, R which are respectively intended for the left and right ears but also portions of the signals L(HRTF), R(HRTF) which are respectively intended for the other ear. These additional signals L(HRTF), R(HRTF) are produced by applying an HRTF to the respective original signal L, R. The listener perceives the sound event as coming from outside the head, illustrated in the figure by arrow 6.”), 12:20-24 (“The control circuit containing variable HRTF filters adjusts the audio signals for the left and right ears of the listener 1 such that the aural event is perceived as coming unchanged from the direction 6. The unchanged position of the trunk of the listener 1 in comparison with Figure 9 indicates that the rotation of the head is taking place for limited time or quickly.”), 5:25-36 (“Normally, the head points in one preferred direction when listening to aural events, normally forwards in the direction of the front of the trunk. A change in the position of the listener which is for a limited time or is relatively frequent is when the listener turns his head, for example. The signals for the left and right ears are adjusted, on the basis of the position of the listener or of his head, using variable filters for the HRT function such that the direction from which the aural event appears to come remains stable in space, that is to say has a constant spatial direction.”), 13:3-11 (“A high-pass filter (not shown in Figure 11) in the control circuit (likewise not shown) results in the direction from which the aural event appears to come initially remaining still at the position 6’ . Depending on the cut-off frequency of the high-pass filter, the variable HRTF filters are then adjusted such that the aural event is perceived as coming from the direction 6 again.”), 14:16-21 (“The signal representing the change of position is routed to the variable HRTF filters in the control circuit (not shown in the figure) . The control circuit adjusts the audio signals for the left and right ears such that the aural event is perceived as coming from the direction 6.”), Figs. 5, 6,

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	7, 8; Zhou at 1047 (“In our first experiment, the sound sources are always placed around 1.5 m away in the front of the listener. However, in a more general and complex AR environment like the second experimental environment, the listener can walk freely in a physical space where virtual sound sources can be very close to the left and the right side of the head.”); Haddick 248 at [00636] (“An image of the wearer 1 512AA may then be displayed on the display area 1 518AA of the eyepiece and transmitted to others on the videoconference, such as along with the images 1 514AA of other participants on the videoconference call.”), [00637] (“In embodiments, the eyepiece may provide a system and method for providing an image of the wearer to videoconference participants through the use of an external mirror, where the wearer views themselves in the mirror and an image of themselves is captured through an integrated camera of the eyepiece. The captured image may be used directly, or the image may be flipped to correct for the image reversal of the mirror. In an example, the wearer may enter into a videoconference with a plurality of other people, where the wearer may be able to view live video images of the others though the eyepiece. By utilizing an ordinary mirror, and an integrated camera in the eyepiece, the user may be able to view themselves in the mirror, have the image captured by the integrated camera, and provide the other people with an image of themselves for purposes of the videoconference. This image may also be available to the wearer as a projected image to the eyepiece, such as in addition to the images of the other people involved in the videoconference.”), [00662] (“The indicator may be an icon, a picture, a color, symbol, a blinking object, and the like, and indicate an alert, an email arriving, an incoming phone call, a calendar event, an internal or external processing facility that requires attention from the user, and the like.”), [00730] (“The streamed video of the video conference could also be modified by the eyepiece, where the modification could be based on a sensor input. The sensor input could be a visual sensor input or an audio sensor input. The visual sensor input could be an image of another participant of the video conference, a visual presentation, or the like. The audio sensor input could be the voice of a particular participant of the video conference.”), [00731] (“In embodiments, the eyepiece may provide for an interface to accept wireless streaming media (e.g. video, audio, text messaging, phone call and calendar alerts) from an external facility, such as a smart phone, a tablet, a personal computer, an entertainment device, a portable music and video device, a home theater system, a home entertainment system, another eyepiece, and the like.”), Figs. 7, 15AA; Jarvinen at 26:30-37 (“For purposes of illustration and not of limitation, consider an example in which a

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	user is participating in a teleconference or listening to music. In this example, presume that Peter (e.g., a fictitious person) is participating in a spatial audio teleconference (or is listening to music) using a smartphone (e.g., apparatus 50) with a headset/headphones while Anna (e.g., another fictitious person) suddenly enters the room.”); Pedersen at 13:14-24 (“The upper part of FIG. 1 schematically illustrates a meeting in which one of the participants 100 uses a new hearing device system (not visible) comprising a binaural hearing aid (not visible) and his or her smartphone 110 controlling the binaural hearing aid and illustrated in the lower part of FIG. 1. The other meeting participants 102, 104, 106 wear spouse microphones (not visible) that transmit speech from the respective meeting participants to the binaural hearing aid of participant 100. Further, a participant in a remote location also participates in the meeting using a teleconference system (not shown).”); Boustead at 7:14-20 (“The conference server 110 may e.g. be an application server of an audio conference service provider within a telecommunication network. The terminals 120 may e.g. be computing devices, such as laptop computers, desktop computers, tablet computers, and/or smartphones; as well as telephones, such as mobile telephones, cordless telephones, desktop handsets, etc.”); Bedingfield at 3:25-32 (“An improved telephone or network-based communication system may more closely simulate an in-person conference setting. For example, a communication system may provide multi-channel sound to a listener by modifying a single channel signal provided by another participant’s system. To further enhance the listener’s experience, the communication system may assign each participant a virtual position within a virtual sound field.”); Nystrom at 5:27-34 (“User device 204 may include any of the following devices to which earphones may be attached (e.g., via a headphone jack): a personal computer; a tablet computer; a cellular or mobile telephone; a smart phone; a laptop computer; a personal communications system (PCS) terminal that may combine a cellular telephone with data processing, facsimile, and/or data communications capabilities; a personal digital assistant (PDA) that includes a telephone . . .”), 5:38-39 (“Via user device 204, a user may place a telephone call, text message another user, send an email, etc.”); Craner at 4:18-21 (“Voices are projected over the voice-projecting device in a manner that can be heard by a listener, whether the voice-projecting device includes a telephone, audio system, personal speaker system, or some other system.”), 4:58-64 (“The voice capture device 14 (or a plurality of voice capture devices) is configured to capture voices from one or more talkers, and transmit the voices as voice information over the network to the voice-projecting device 23. The voice capture device and the

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	orientation without degradation of the virtual location of audio signals; and a processor for receiving signals from the tracking system and causing the filter to generate spatialized audio, wherein the speakers are positioned to generate frontal positioning cues to augment spatial filtering for virtual frontal sources without degrading spatial filtering for other virtual positions.”), 3:60-4:4 (“The head tracking system 104 measures the location and orientation of a user's head and provides the measured information to the computer system 102 which processes the audio signals using a head related transfer function (HRTF) filter 106 thus producing spatialized audio. The spatialized audio signals are amplified in an amplifier 108 and fed to speakers 110. The amplified signals are binaural in nature (i.e., left channel signals are supplied to the left ear and right channel signals are supplied to the right ear. The amplifier 108 generates sound that is loud enough to be heard in the nearest ear but generally too soft to be heard in the opposite ear.”).), 4:21-26 (“FIG. 2 shows another embodiment of the present invention as in FIG. 1. Here, the processor 102 also performs the HRTF filtering functions. The audio source is generated and operates under the control of the computer system. The rest of the operation of FIG. 2 is similar to the operation as explained with respect to FIG. 1.”), Figs. 1-4.