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- (71) Applicant: **THE GUITAMMER COMPANY** [US/US];
6117 Maxtown Road, Westerville, OH 43082 (US).
- (72) Inventor: **LUDEM, Mark, A.**; 6117 Maxtown Road,
Westerville, OH 43082 (US).
- (74) Agent: **DUFF, Douglas, J.**; Ice Miller LLP, 250 West
Street, Suite 700, Columbus, OH 43215-7509 (US).

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- (54) Title: HAPTIC-TACTILE, MOTION OR MOVEMENT SIGNAL CONVERSION SYSTEM AND ASSEMBLY

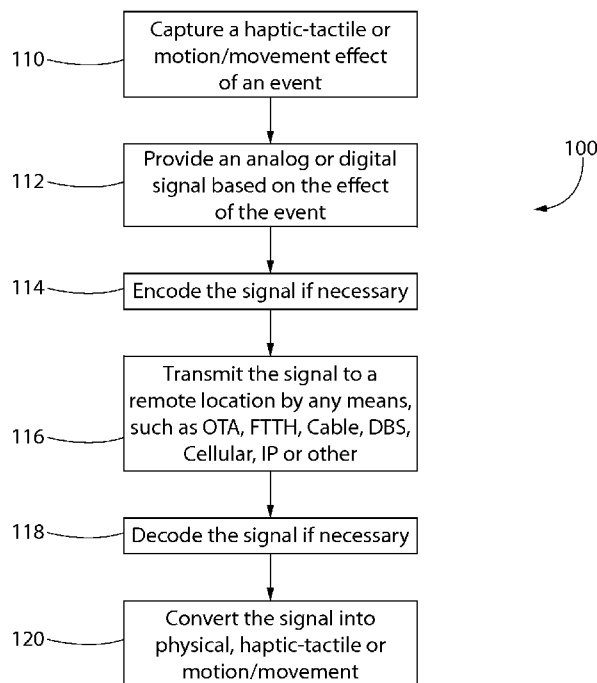


FIG. 1

- (57) Abstract: A haptic-tactile, motion or movement signal conversion system and assembly are disclosed. The conversion system includes a capturing member configured to capture one or more effects of an event, a processor in communication with the capturing member and configured to provide a signal based on the one or more effects for transmission to a remote location, a receiver positioned at the remote location and configured to receive the signal, a signal conversion device in communication with the receiver and configured to convert the signal into a physical movement, and a transmission member positioned adjacent to the signal conversion device and configured to transmit the physical movement from the signal conversion device to a signal conversion device user.



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HAPTIC-TACTILE, MOTION OR MOVEMENT SIGNAL CONVERSION SYSTEM AND ASSEMBLY

[001] This application claims the benefit of U.S. Patent Application Serial No. 61/932,991 filed on January 29, 2014, which is incorporated herein by reference in its entirety.

BACKGROUND

[002] There are many entertainment and educational events that are of interest to viewers who are not in attendance at the events or, if in attendance at the event, desire an experience that effects more than their visual or auditory senses. Some of the more popular activities of public interest include sporting contests, such as football games and automobile racing, and technological events, such as the launching of a space vehicle. Video broadcast allows reproduction of moving visible images in synchronism or along with the audio that was also generated by events. Stimuli that have been omitted from remote video reproductions of events include the haptic-tactile, motion or movement stimuli that can be perceived by the humans.

[003] Therefore, there exists a need for a realistic remote reproduction of an event for the enhancement of a remote user's experience by reproducing, at a remote location, a representation of haptic-tactile, motion or movements or vibrations generated by an event and applying them to the remote user so that he or she can perceive them.

SUMMARY

[004] In accordance with aspects of the present disclosure, a haptic-tactile, motion or movement signal conversion system is provided. The system includes a capturing member configured to capture one or more effects of an event, a processor in communication with the capturing member and configured to provide a signal based on the one or more effects for transmission to a remote location, a receiver positioned at the remote location and configured to receive the signal, a signal conversion device in communication with the receiver and configured to convert the signal into a physical movement, and a transmission member positioned adjacent to the signal conversion device and configured to transmit the physical movement from the signal conversion device to a signal conversion device user.

[005] In accordance with further aspects of the present disclosure, a haptic-tactile, motion or movement signal conversion assembly is provided. The assembly includes an outer casing, an actuator disposed in the outer casing and configured to receive a signal and produce a physical movement based on one or more effects of an event, a transmission member contact surface positioned at an outer surface of the outer casing and configured to transmit the physical haptic-tactile, motion or movement to a transmission member positioned adjacent to the transmission member contact surface, and a movement connector disposed between the actuator and the transmission member contact surface and configured to transmit the physical haptic-tactile, motion or movement from the actuator to the transmission member contact surface.

BRIEF DESCRIPTION OF THE FIGURES

[006] The embodiments described herein and other features, advantages, and disclosures contained herein, and the manner of attaining them, will be better understood from the following description in conjunction with the accompanying drawing figures, in which like reference numerals identify like elements, and wherein:

[007] Figure 1 illustrates a haptic-tactile, motion or movement signal broadcasting method in accordance with aspects of the present disclosure;

[008] Figure 2 illustrates a haptic-tactile, motion or movement signal broadcasting method in accordance with aspects of the present disclosure;

[009] Figure 3 illustrates a haptic-tactile, motion or movement signal source selection method in accordance with aspects of the present disclosure;

[010] Figure 4 is a perspective view of a haptic-tactile, motion or movement signal conversion assembly in accordance with aspects of the present disclosure;

[011] Figure 5 is an exploded view of a haptic-tactile, motion or movement signal conversion assembly in accordance with aspects of the present disclosure;

[012] Figure 6 is a cross-sectional view of a haptic-tactile, motion or movement signal conversion assembly in accordance with aspects of the present disclosure;

[013] Figure 7 is a perspective view of a haptic-tactile, motion or movement signal conversion assembly in accordance with aspects of the present disclosure;

[014] Figure 8 illustrates a haptic-tactile, motion or movement signal conversion system in accordance with aspects of the present disclosure; and

[015] Figure 9 illustrates transmission members in a haptic-tactile, motion or movement signal conversion system in accordance with aspects of the present disclosure.

DETAILED DESCRIPTION

[016] In the following detailed description of embodiments of the present disclosure, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration, and not by way of limitation, such specific embodiments. It is to be understood that other embodiments may be utilized and that changes may be made without departing from the spirit and scope of the present disclosure.

[017] Referring now to FIG. 1, a haptic-tactile, motion or movement signal broadcasting method 100 is disclosed. The method 100 includes capturing, at step 110, a haptic-tactile, motion or movement effect of an event. The event may include movements or other characteristics with animate or inanimate objects. As non-limiting examples, events described in the present disclosure include sporting events, racing events, or any other public or private event featuring effects that may be captured. The method 100 further includes providing, at step 112, a signal, signals, or other data based on the effect of the event. The term “signal” as described herein refers to any data captured, processed, transmitted, received, or converted, including analog or digital signals, data, and information of any number, size, or type. Additionally, the signal, as described herein, may also include video or audio data captured, processed, transmitted, received, and/or converted from the remote location to the user. In one or more embodiments of the present disclosure, a video and/or audio signal is transmitted and received with the haptic-tactile signal. In one or more embodiments, the haptic-tactile, motion or movement signal is distinct from any audio or video signal, while in one or more embodiments, the haptic-tactile, motion or movement signal is transmitted along with or mixed with an audio and/or video signal.

[018] The method 100 of one embodiment further includes encoding, at step 114, the signal. Encoding of the signal is not necessary in one or more embodiments of the present disclosure. The method 100 further includes transmitting, at step 116, the signal to a remote location. In one embodiment, a receiver receives the signal. The signal may be transmitted via wired or wireless transmission means, including over-the-air broadcast or through satellite, fiber optic, cable, internet protocol, or cellular transmission infrastructure. The receiver may include any device capable of receiving a signal, including such non-limiting examples as a television, PC, tablet, or cellular or satellite telephone. The method 100 of one embodiment further includes decoding, at step 118, the signal. The method 100 further includes converting, at step 120, the signal into physical movement. The physical movement one or more embodiments includes any one or more haptic-tactile, motion or movement, sound, and/or visual effects based on the captured effects of the event. As one non-limiting example, sound and visual effects based on the event may be transmitted to the remote location with motion or movement, vibratory, or other haptic-tactile effects based on the event or a separate event or effects source. The haptic-tactile, motion or movement effects of an embodiment are generally similar to the effects captured at the originating event in terms of, for example, movement or vibratory frequency, amplitude, range, direction, and/or duration.

[019] Referring now to FIG. 2, a haptic-tactile, motion or movement signal broadcasting method 200 is disclosed. The method 200 includes providing, at step 210, a transmission member positioned between a signal conversion device and a user. The method 200 further includes capturing, at step 212, an effect of an event. The method 200 further includes providing, at step 214, a signal based on the effect of the event. The signal may be analog or digital. The method 200 of an embodiment further includes encoding the signal at step 216. The

method 200 may not include encoding of the signal. The method 200 further includes transmitting, at step 218, the signal to a remote location. The transmission of the signal may be by any means such as over-the-air, FTTH, cable, DBS, cellular, IP, etc. The method 200 further includes decoding the signal at step 220. The method 200 further includes transmitting, at step 222, the signal to the signal conversion device. The method 200 further includes converting, at step 224, the signal into physical haptic-tactile, motion or movement of the signal conversion device. The method 200 further includes sending, at step 226, the physical haptic-tactile, motion or movement through the transmission member such that the user receives a haptic-tactile, motion or movement effect based on the effect of the event.

[020] Referring now to FIG. 3, a haptic-tactile, motion or movement signal source selection method 300 is disclosed. The method 300 includes capturing, at step 310, a first effect of an event with a first capturing member. The method 300 further includes providing, at step 312, a first signal based on the first effect. The method 300 further includes capturing, at step 314, a second effect of the event with a second capturing member. The method 300 further includes providing, at step 316, a second signal based on the second effect. Any signals may be digital or analog. The signals may or may not be encoded. If encoded, the signals will be decoded at the user location. The method 300 further includes receiving, at step 318, a user selection signal based on a user selection of at least one of the first capturing member and the second capturing member. The method 300 further includes transmitting, at step 320, at least one of the first signal and the second signal to a signal conversion device at a user location. The method 300 further includes converting, at step 322, the at least one of the first signal and the second signal into physical haptic-tactile, motion or movement at the signal conversion device.

[021] The signal source selection method 300 allows a party distributing, owning, and/or licensing the rights or a business handling broadcasting, transporting, and/or transmitting haptic-tactile, motion or movement signals to allow the selection for use and to monetize the signals separately, i.e. originating or captured from one unique animate or inanimate physical object or combination of such signals. Selection for use and payment for one or more haptic-tactile, motion or movement signals may be made by any conversion device user, not limited to users of haptic-tactile, motion or movement signal conversion devices, assemblies, or systems disclosed herein, for an individual event or program or through selection by the user of signal source or sources, such as selection of individual capturing members associated with animate or inanimate objects. The method 300 of one embodiment allows payment to be sent by the user and received by a second party based on a particular duration of time or through an ongoing subscription agreement.

[022] Referring now to FIG. 4, a haptic-tactile signal conversion assembly 400 is disclosed. The embodiment of the conversion assembly 400 shown in FIG. 4 is configured for positioning under or in a separate physical object, including such non-limiting examples as furniture, floors, seating areas, or standing platforms, such that a conversion assembly user or users receives haptic-tactile, motion or movement effects based on the effects of an event that occurs at a remote location. The conversion assembly 400 of an embodiment includes an outer casing 410. An actuator 412 is disposed in the outer casing 410 and receives a signal. The actuator 412 of one or more embodiments includes a vibration transducer as described in U.S. Patent 5,973,422, which is herein incorporated by reference in its entirety. The actuator 412 of one or more embodiments also includes a vibration transducer as described in U.S. Patent Application No. 13/653,035, which is herein incorporated by reference in its entirety. The actuator 412 of one

embodiment includes a magnetically suspended piston that moves or vibrates in response to one or more amplified signals, as described in further detail below. The actuator 412 produces a physical movement or vibration that replicates or is based on one or more effects of an event captured and sent as one or more signals. A transmission member contact surface 414 is positioned at an outer surface of the outer casing 410. The transmission member contact surface 414 transmits the physical movement to a transmission member 416, shown in FIG. 6, positioned adjacent to the transmission member contact surface 414. The physical movement of one embodiment includes multiple axis movement. As non-limiting examples, the actuator 412 may move in one or more of the x, y, and z axes, as well as rotation about those axes, or multiple actuators 412 may move independently in the x, y, and z axes, as well as rotation about those axes. In one or more embodiments, the actuator 412 produces haptic-tactile, motion or movement effects from a low frequency audio signal or signals from source content, such non-limiting examples including music, movies, video games, and content programming from prerecorded, post-produced, or live events regardless of the delivery method of the content media, either hard copy or streaming.

[023] The conversion assembly 400 includes a movement connector 418 disposed between the actuator 412 and the transmission member contact surface 414. The movement connector 418 of the embodiment shown in FIG. 5 is a platform configured to at least partially support the transmission member 416 or a signal conversion assembly user positioned above the movement connector 418. The movement connector 418 transmits the physical movement from the actuator 412 to the transmission member contact surface 414.

[024] Referring now to FIGS. 5 and 6, an exploded view of the haptic-tactile signal conversion assembly 400 and a cross-sectional view of the haptic-tactile signal conversion assembly 400 are

shown. In an embodiment, the assembly 400 includes a receiver to receive one or more signals, as described in further detail below. The receiver of one embodiment is incorporated in the outer casing 410. The receiver of an embodiment is positioned outside of the outer casing 410 and in communication with the assembly 400. As described in the present disclosure, the receiver may receive wireless or wired signals and may communicate with the assembly 400 through wireless or wired transmission. The actuator 412 of an embodiment is a vibration transducer configured to receive a haptic-tactile, motion or movement signal and produce a corresponding haptic-tactile, motion or movement based on the effects of the event. In one or more embodiments, the actuator 412 produces single or multiple axis movement through moving mass, magnetic members, or other type of actuation mechanism. The actuator 412 of an embodiment includes a permanent magnet 420 and two electromagnet coils 421 disposed between upper and lower pieces 424, 426. The actuator 412 of one embodiment includes a stator member 422 which has a cylindrical, central chamber 430. The chamber 430 of the stator member 422 extends along a central axis in opposite directions from a magnetic center 424 of the stator member 422.

[025] The pair of spaced coils 421 are mounted in the stator member 422 and are wound or connected in a direction to generate axial magnetic fields from those electrical signals in opposite axial directions.

[026] Two opposite ends 428 and 420 of a reciprocating piston member 426 extend radially outwardly from the central axis. In an embodiment, the reciprocating piston member 426 is formed from a circular, axially polarized, permanent magnet 432 sandwiched between and bonded to a pair of ferromagnetic cylinders, such as steel cylinders mounted on axially opposite ends of the permanent magnet 432. In this way, a complete magnetic circuit loop is created.

[027] The conversion assembly 400 of one or more embodiments includes an internal or external power source (not shown). The power source may include alternating or direct current electricity, disposable or rechargeable batteries, and an amplifier or transformer.

[028] Referring now to FIG. 7, one embodiment of the haptic-tactile, motion or movement signal conversion assembly 400 is shown. When the actuator 412 receives a signal, the actuator 412 produces the physical haptic-tactile, motion or movement based on the effects of the event captured. The transmission member contact surface 414 transmits the physical haptic-tactile, motion or movement to the transmission member 416 positioned adjacent to the transmission member contact surface 414. In the embodiment shown in FIG. 7, the transmission member 416 is a piece of furniture, such as a couch or chair supporting a conversion assembly user 434, positioned above the movement connector 418 on the transmission member contact surface 414. The movement connector 418 transmits the physical haptic-tactile, motion or movement from the actuator 412 of the conversion assembly 400 to the transmission member contact surface 414, the transmission member 416, and the user 434.

[029] Referring now to FIG. 8, a haptic-tactile, motion or movement signal conversion system 500 is illustrated. The system 500 includes a capturing member 510 configured to capture one or more effects 512 of an event 514. The capturing member 510 of an embodiment is a sensor configured to capture physical movement. The capturing member 510 of one embodiment is configured to capture multiple axis and rotation about those axes haptic-tactile, motion or movement. The capturing member 510 may include an accelerometer, an impact sensor, or other type of sensor or transducer. The capturing member 510 is in communication with a processor 516 or encoding system that is configured to provide an analog or digital signal 518 based on the effects 512 for transmission by any means such as wired or wireless transmission means,

including over-the-air broadcast or through satellite, fiber optic, cable, internet protocol, or cellular transmission infrastructure to a remote location 520. A receiver 522, including a receiver system that may include processing and decoding, is positioned at the remote location 520 and is configured to receive the signal 518. The system 500 further includes a signal conversion device 524 in wired or wireless communication with the receiver 522. The signal conversion device 524 converts the signal into a physical haptic-tactile, motion or movement 526 and may include any embodiment of the signal conversion assembly 400 described with reference to FIGS. 4-7 of the present disclosure. A transmission member 528 is positioned adjacent to the signal conversion device 524 to transmit, whether by wired or wireless means, the physical haptic-tactile, motion or movement 526 from the signal conversion device 524 to a signal conversion device user 530. The transmission member 528 of an embodiment abuts or otherwise physically touches the signal conversion device 524 such that the signal conversion device user 530 receives a haptic-tactile, motion or movement effect based on the effects 512 of the event 514. In one embodiment, such as when the transmission member 528 is furniture, the signal conversion device 524 and/or the transmission member 528 at least partially physically supports the signal conversion device user 530.

[030] In an embodiment, the processor 516 encodes the signal 518 for transmission to the remote location 520. The receiver 522 of an embodiment decodes the signal 518 received from the processor 516. The receiver 522 may receive the signal 518 via wired or wireless transmission. An amplifier 532 is provided in an embodiment to communicate with the signal conversion device 524 and enhance the signal 518 received by the receiver 522.

[031] Referring now to FIG. 9, various transmission members 610-620 for use with one or more haptic-tactile, motion or movement signal conversion systems 500 are illustrated. When

the signal conversion device 524 of any embodiment of the present disclosure receives a signal 518, an actuator (not shown) produces a physical haptic-tactile, motion or movement based on captured event effects to ultimately transmit to one or more of the transmission members 610-620. Transmission members 610-620 of the present disclosure include, as non-limiting examples, a couch transmission member 610, a chair transmission member 612, a seat post transmission member 614, a head gear transmission member 616, a virtual reality or augmented reality transmission member 618, and a wearable transmission member 620. Each of the transmission members 610-620 includes a movement connector (not shown) that transmits physical movement, such as a haptic-tactile, motion or movement, from the actuator (not shown) to a transmission member contact surface (not shown) and, ultimately to the transmission member 610-620 and thereby the remote end user.

[032] While particular embodiments of the present disclosure have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the present disclosure. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this disclosure.

CLAIMS

I claim:

1. A haptic-tactile, motion or movement signal conversion system comprising:
a capturing member configured to capture one or more effects of an event;
a processor in communication with the capturing member and configured to provide a signal based on the one or more effects for transmission to a remote location;
a receiver positioned at the remote location and configured to receive the signal;
a signal conversion device in communication with the receiver and configured to convert the signal into a physical movement; and
a transmission member positioned adjacent to the signal conversion device and configured to transmit the physical movement from the signal conversion device to a signal conversion device user.
2. The conversion system of claim 1, wherein the processor is further configured to encode the signal for transmission to the remote location.
3. The conversion system of claim 2, wherein the receiver is further configured to decode the signal received from the processor.
4. The conversion system of claim 1, further comprising an amplifier in communication with the signal conversion device and configured to enhance the signal received by the receiver.
5. The conversion system of claim 1, wherein the capturing member is a sensor configured to capture physical movement.
6. The conversion system of claim 5, wherein the sensor is further configured to capture multiple axis movement and rotation about the axes.

7. The conversion system of claim 6, wherein the signal conversion device is configured to convert the signal into multiple axis movement and rotation about the axes.

8. The conversion system of claim 1, wherein the receiver is configured to receive the signal via wireless transmission.

9. The conversion system of claim 1, wherein the transmission member abuts the signal conversion device such that the signal conversion device user receives a haptic-tactile, motion or movement effect based on the one or more effects of the event.

10. The conversion system of claim 1, wherein one or more of the signal conversion device and the transmission member at least partially physically supports the signal conversion device user.

11. A haptic-tactile, motion or movement signal conversion assembly comprising:
an outer casing;
an actuator disposed in the outer casing and configured to receive a signal and produce a physical movement based on one or more effects of an event;
a transmission member contact surface positioned at an outer surface of the outer casing and configured to transmit the physical haptic-tactile, motion or movement to a transmission member positioned adjacent to the transmission member contact surface; and
a movement connector disposed between the actuator and the transmission member contact surface and configured to transmit the physical haptic-tactile, motion or movement from the actuator to the transmission member contact surface.

12. The conversion assembly of claim 11, wherein the actuator is a vibration transducer configured to receive a signal and produce a haptic-tactile vibrational, motion or movement based on the one or more effects of the event.

13. The conversion assembly of claim 11, wherein the actuator comprises:
- a stator member having a central chamber extending along a central axis between opposite ends, and a cylindrical ferromagnetic reciprocating member axially, movably mounted in the chamber, the stator member including a coil connectable to an electrical signal and the reciprocating member including an axially polarized permanent magnet for forming a magnetic spring providing an axially centering force upon the reciprocating member, wherein the reciprocating member has a mass m and the magnetic spring has a spring constant k and wherein a ratio k/m is substantially equal to a square of a radian frequency in an operating frequency range of the vibrator.
14. The conversion assembly of claim 13, further comprising a tubular liner of non-ferromagnetic material extending axially through the chamber and forming a bearing.
15. The conversion assembly of claim 14, wherein the bearing extends axially outwardly beyond pole piece portions.
16. The conversion assembly of claim 15, wherein the permanent magnet is circular and is sandwiched between a pair of ferromagnetic cylinders mounted to axially opposite ends of the permanent magnet.
17. The conversion assembly of claim 11, wherein the movement connector comprises a platform configured to at least partially support the transmission member.
18. The conversion assembly of claim 17, wherein the platform is configured to at least partially support a signal conversion assembly user.
19. The conversion assembly of claim 11, wherein the physical movement comprises multiple axis movement.

20. The conversion assembly of claim 11, wherein the actuator is further configured to receive a signal and produce single or multi-axis motion or movement based on the one or more effects of the event.

21. The conversion assembly of claim 11, wherein the actuator is further configured to receive a signal and produce rotation around one or more axes based on the one or more effects of the event.

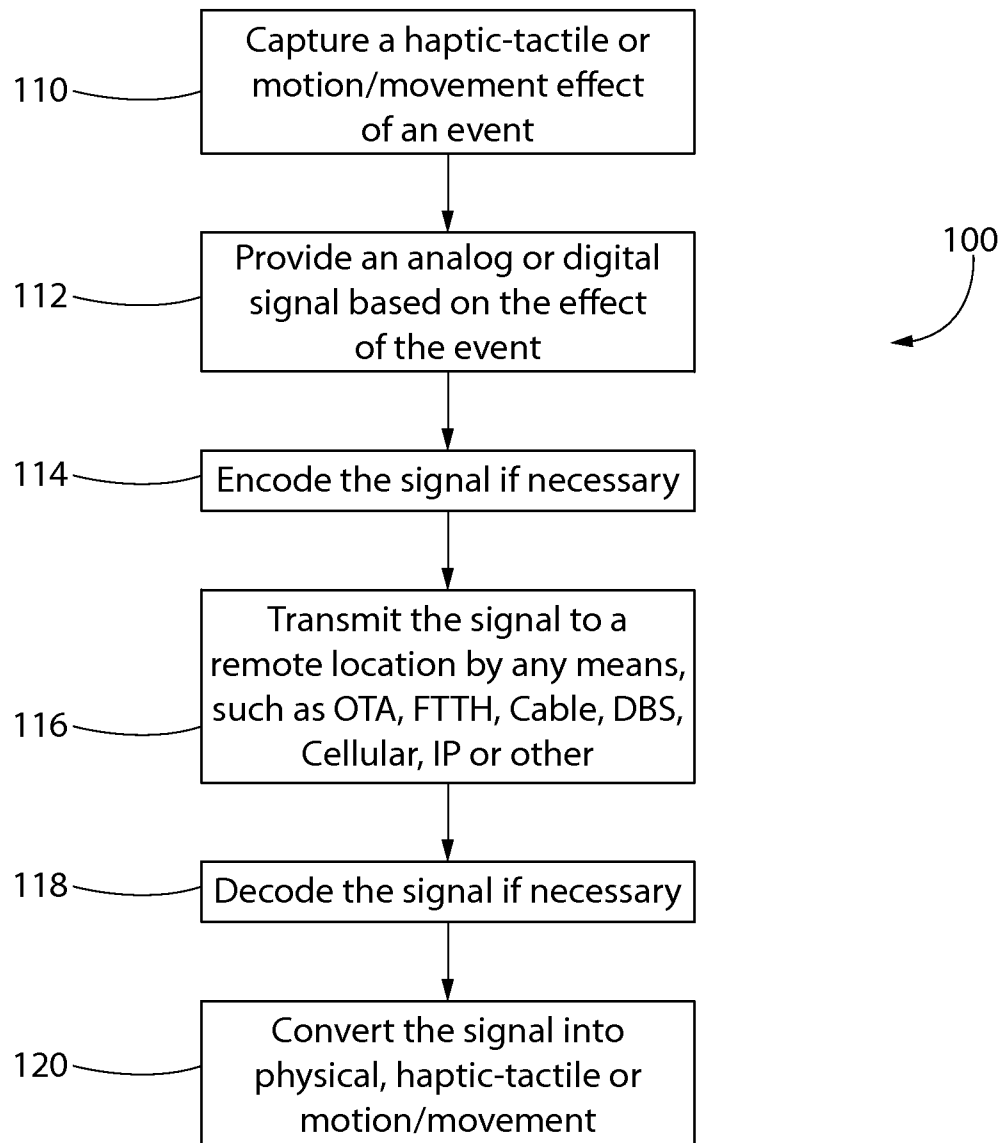


FIG. 1

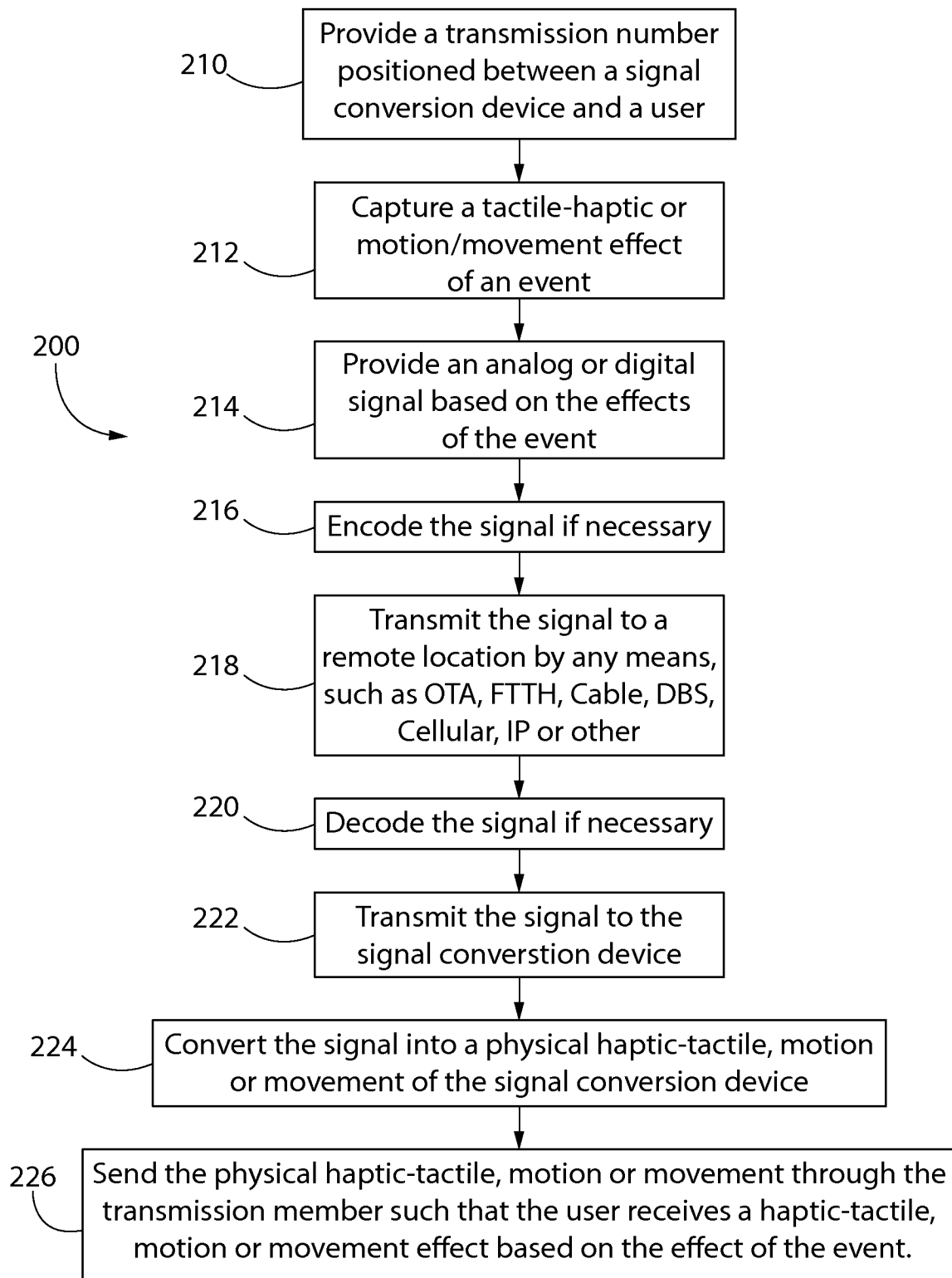


FIG. 2

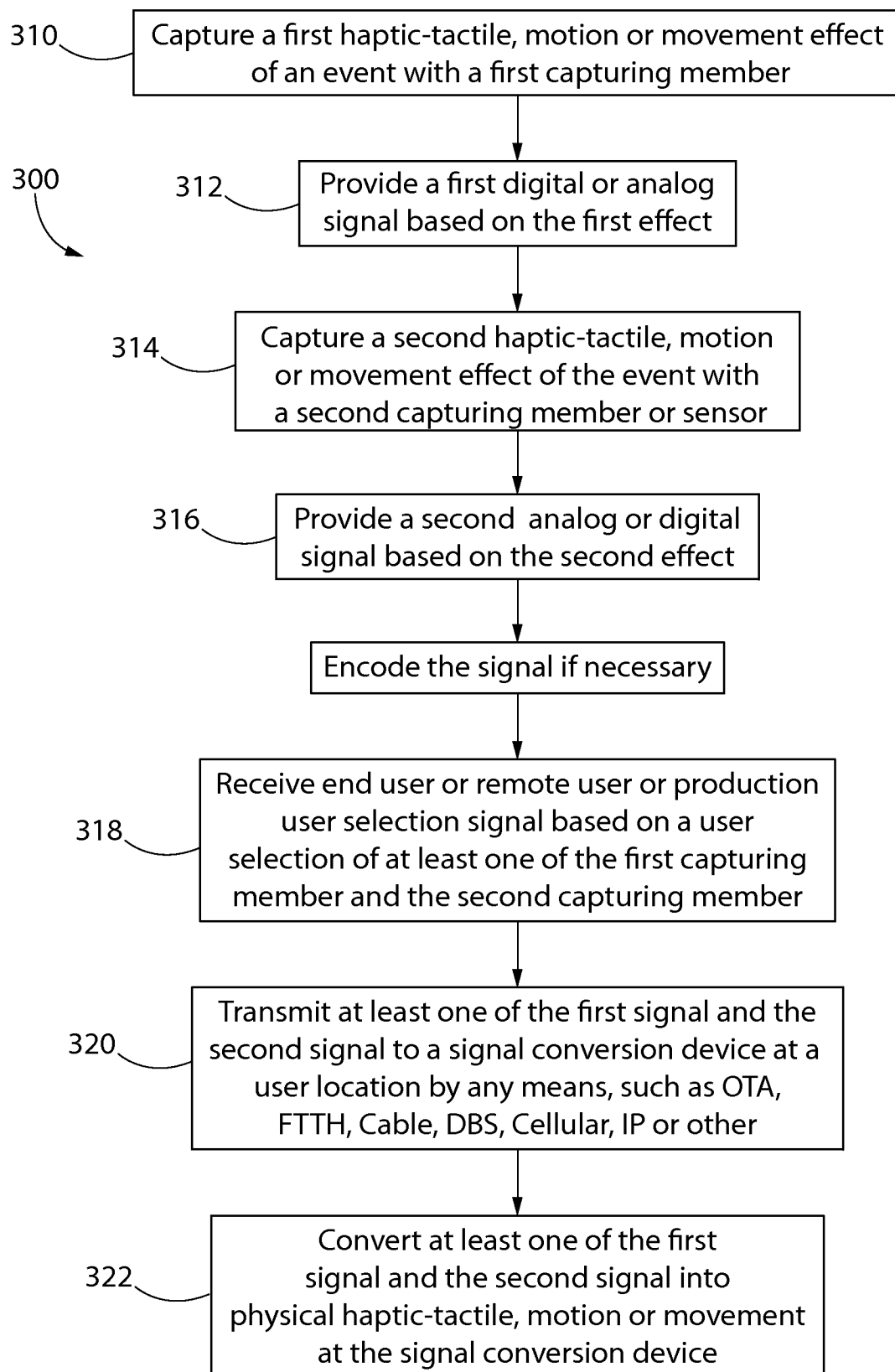


FIG. 3

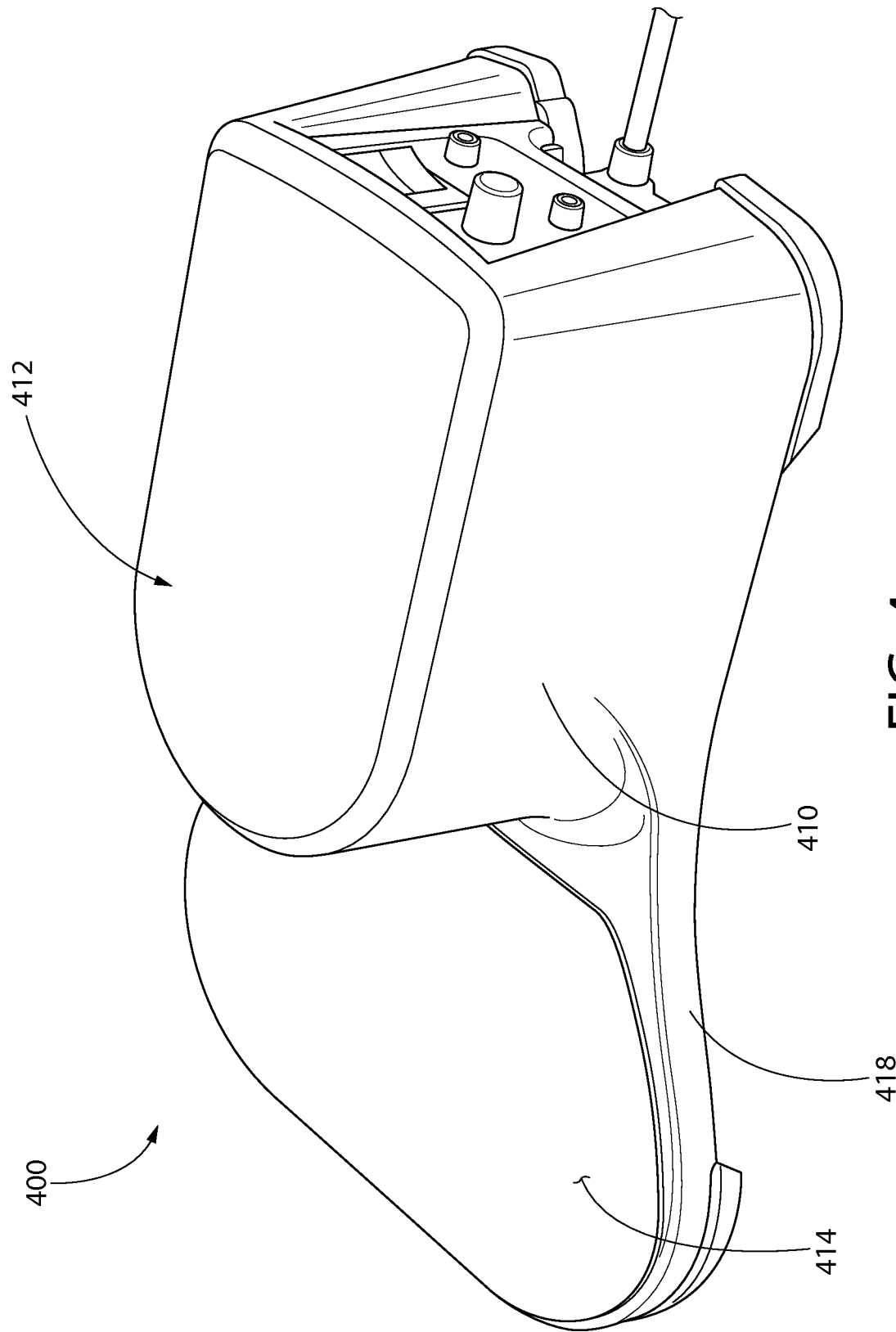


FIG. 4

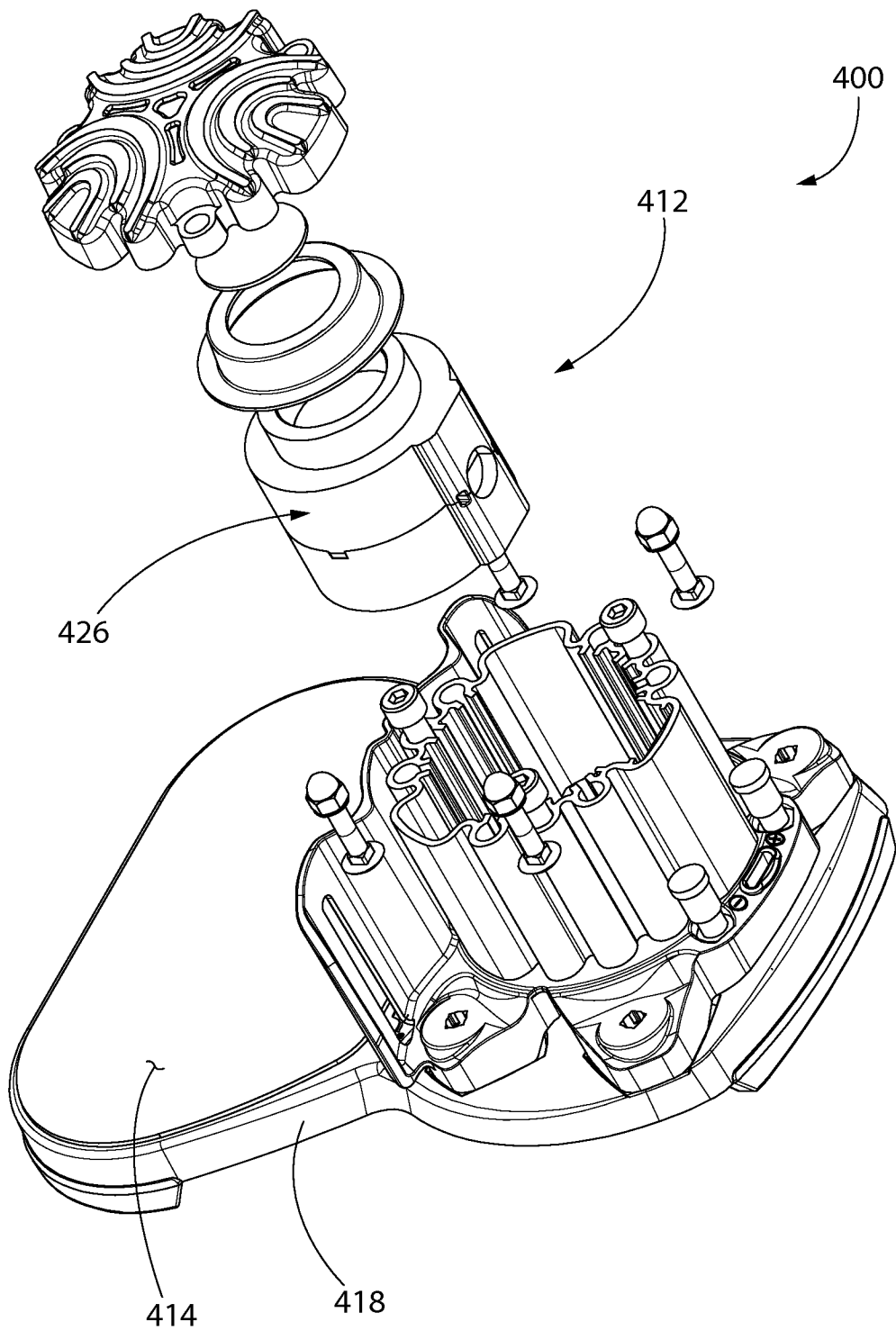


FIG. 5

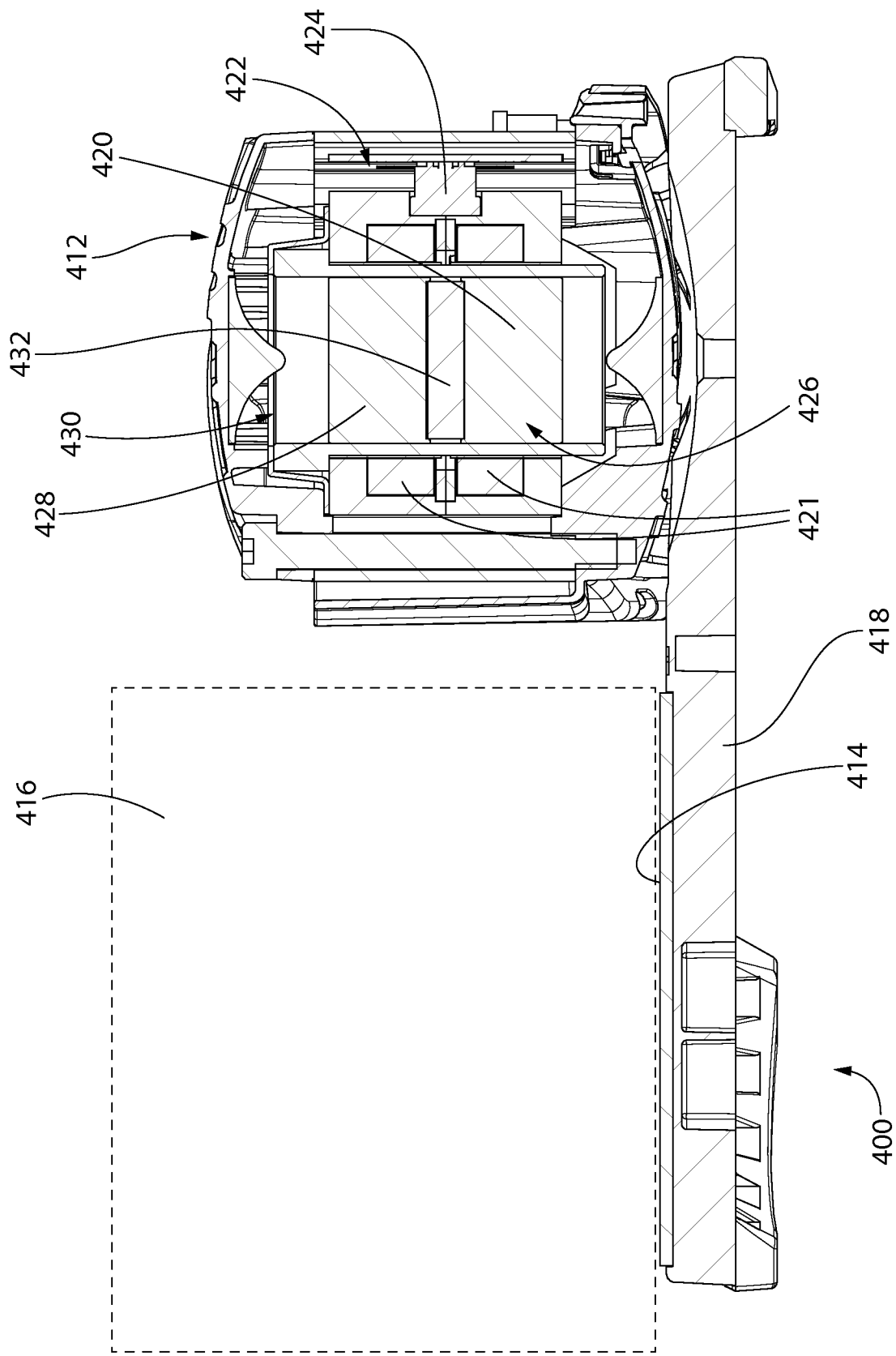


FIG. 6

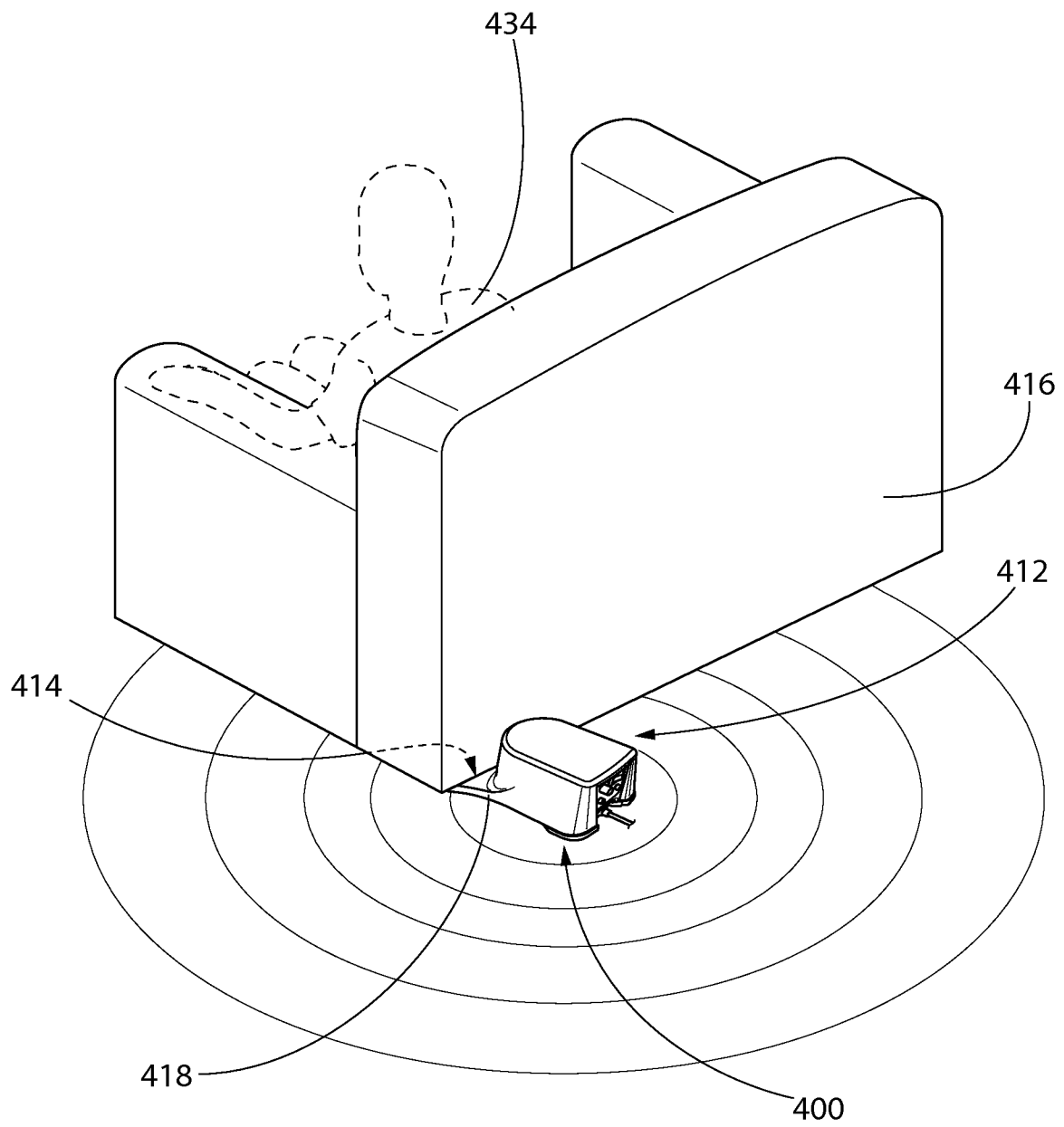


FIG. 7

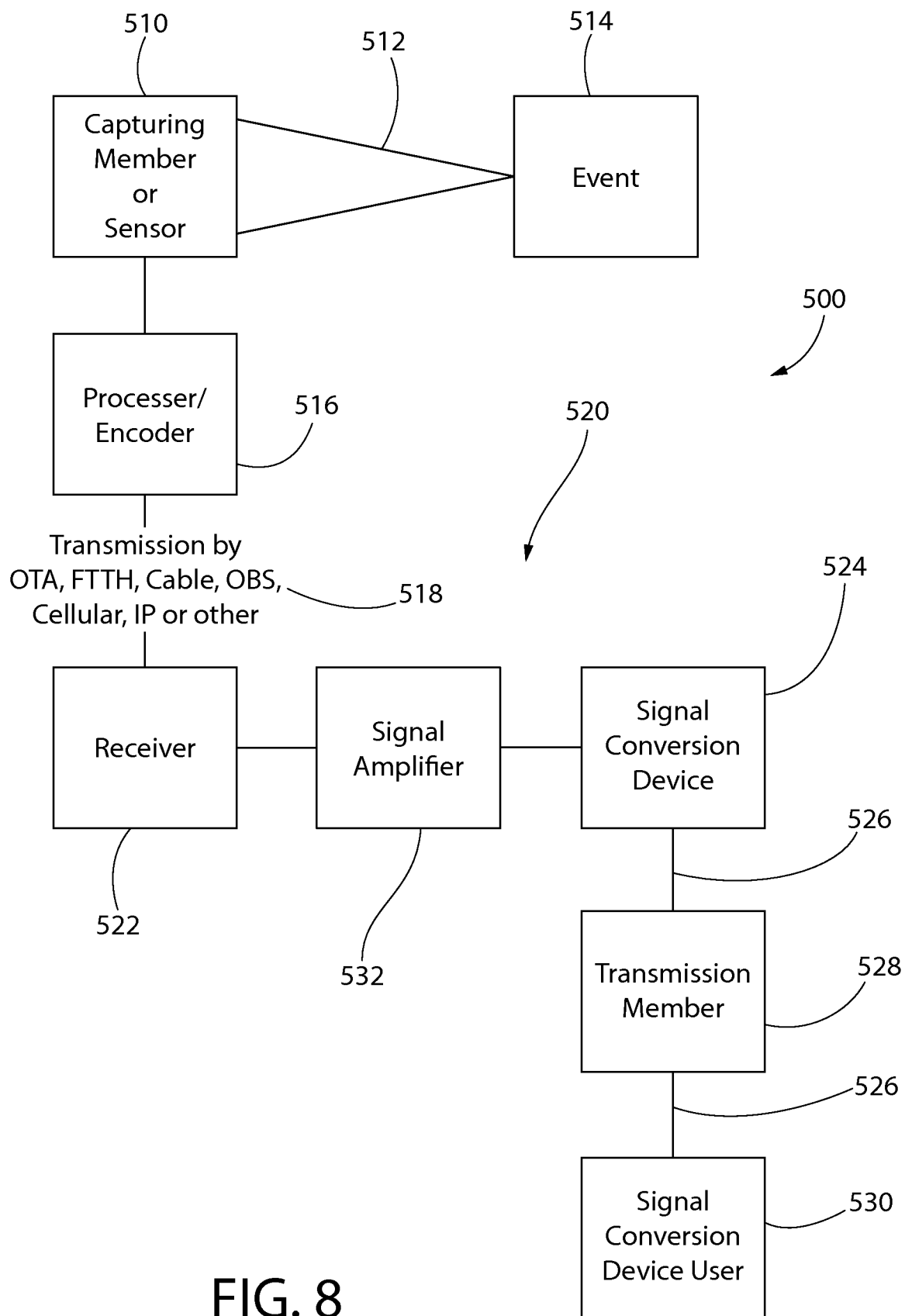


FIG. 8

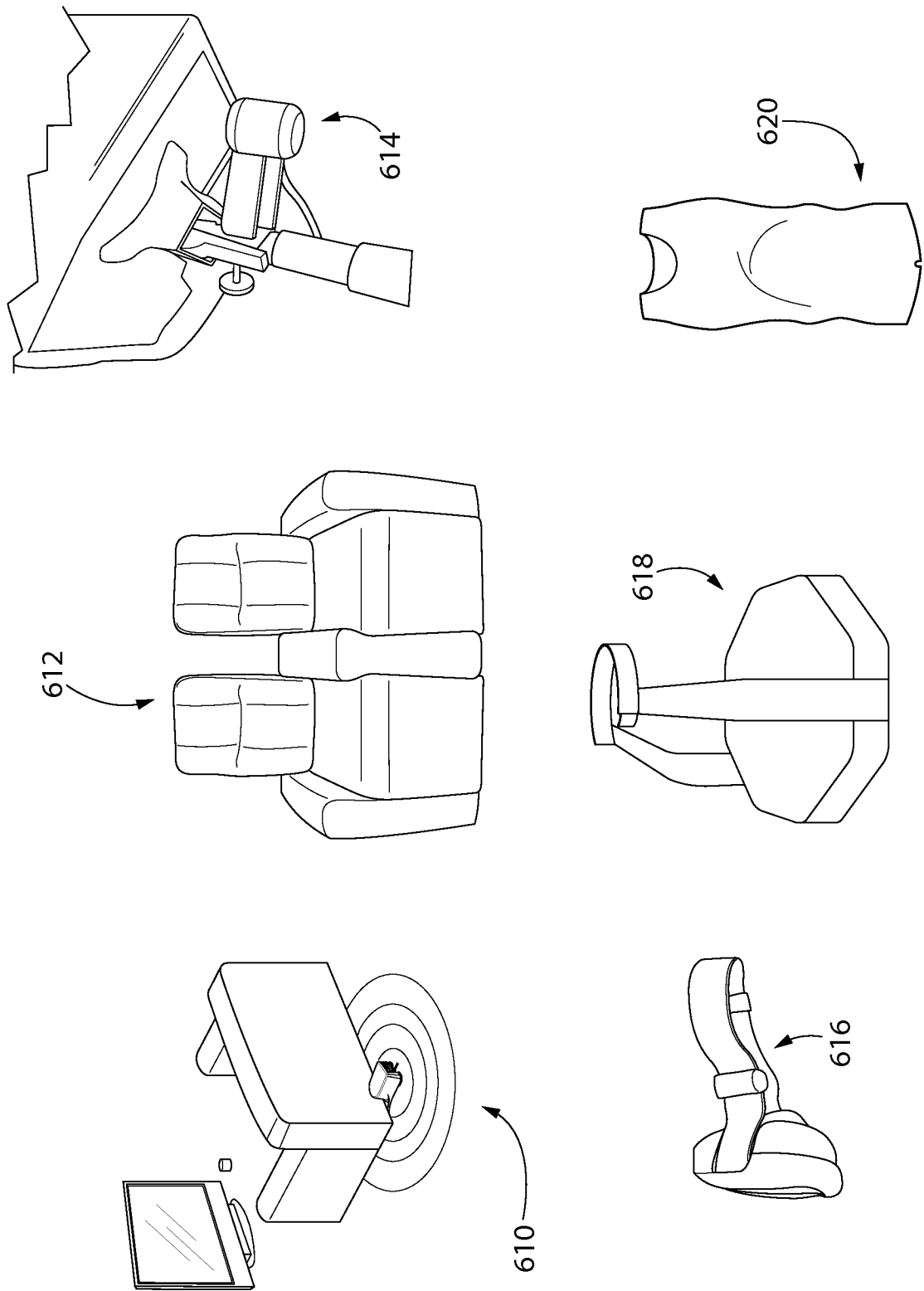


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/13558

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G08B 6/00 (2015.01)

CPC - G08B 6/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) Classification(s): G08B 6/00; G06F 3/00, 3/01, 3/023 (2015.01)

CPC Classification(s): G08B 6/00; G06F 3/01, 3/016, 3/023, 3/0338; H04N 21/422

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC); ProQuest; IEEE/IEEEExplore; Google/Google Scholar; capturing, detecting, transmission, haptic, touch, tactile, sensor, sensation, converter, remote, motion, physical, movement, vibrations, perception, viewer, user, event, effects, signal, location

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0133910 A1 (ALARCON, R) June 9, 2011; paragraphs [0014], [0016], [0017], [0044], [0052], [0053], [0059], [0060], [0063], [0096], [0128].	1, 2, 4-9, 11, 12, 17, 19-21
Y		3, 10, 13-16, 18
Y	US 2013/0227410 A1 (SRIDHARA, V et al.) August 29, 2013; paragraphs [0028], [0098].	3, 10
Y	US 5973422 A (CLAMME, M) October 26, 1999; claims 1-4.	13-16
Y	US 2010/0312154 A1 (BECKER, C et al.) December 9, 2010; paragraphs [0015], [0026].	18
A	US 7911328 B2 (LUDEN, M et al.) March 22, 2011; entire document.	1-21

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

2 June 2015 (02.06.2015)

Date of mailing of the international search report

25 JUN 2015

Name and mailing address of the ISA/

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer

Shane Thomas

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/13558

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: Claims 1-10; Group II: Claims 11-21

---Please See Supplemental Page---

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/13558

-Continued from Box No. III - Observations where unity of invention is lacking-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-10 are directed toward a signal conversion system comprising a remote location.

Group II: Claims 11-21 are directed toward a signal conversion assembly comprising an actuator disposed in an outer casing.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include a receiver positioned at a remote location configured to receive a signal; a signal conversion device in communication with the receiver and configured to convert the signal; and transmitting a physical movement from the signal conversion device to a signal conversion device user, which are not present in Group II.

The special technical features of Group II include an actuator disposed in an outer casing; a transmission member contact surface positioned at an outer surface of the outer casing; and a movement connector disposed between the actuator and the transmission member contact surface, which are not present in Group I.

The common technical feature shared by Groups I-II is a haptic-tactile, motion or movement signal conversion system comprising: capturing one or more effects of an event; producing a physical movement based on the one or more effects of an event; and a transmission member. However, this common feature is previously disclosed by US 2011/0133910 A1 (ALARCON). Alarcon discloses a haptic-tactile, motion or movement signal conversion system (system for generating sensations in response to haptic data; Abstract) comprising: capturing one or more effects of an event (sensation output device outputs a particular sensation in conjunction with the presentation of a corresponding media event; paragraph [0052]); producing a physical movement based on the one or more effects of an event (actuators generate physical stimuli; paragraph [0053]); and a transmission member (sensation output device includes an interface surface (transmission member); paragraph [0068]).

Since the common technical features are previously disclosed by the Alarcon reference, these common features are not special and so Groups I-II lack unity.