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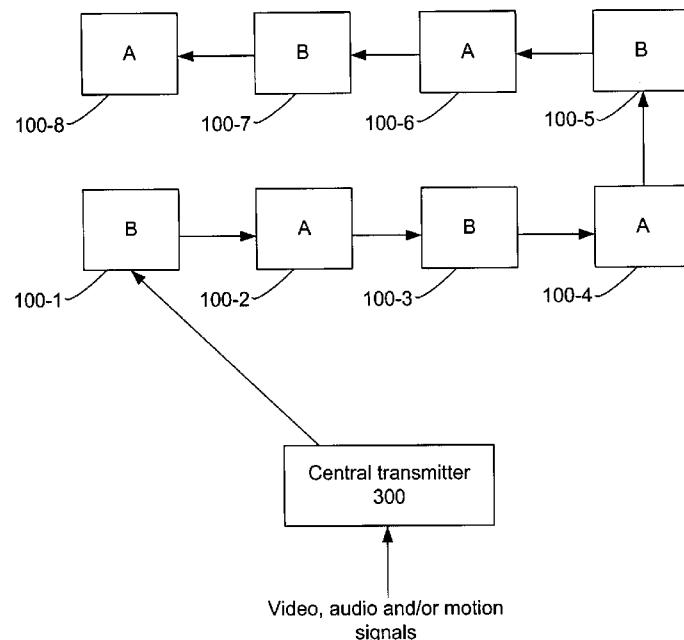
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(54) Title: METHOD AND SYSTEM FOR REDUCING VIBRATION OF MOTION- ENABLED CHAIRS



(57) Abstract: In a building equipped with a plurality of motion-enabled chairs such as a movie theatre, the vibration of the motion-enabled chairs adds up and may damage the foundation of the building especially at the resonance frequency. The present application describes a system and method for controlling the resulting vibration by introducing an alteration such as a delay or an inversion in the motion signals sent to the motion-enabled chairs. This delay causes the vibration of some motion-enabled chairs to be de-phased from the vibration of the other motion-enabled chairs. Whereby, the intensity (magnitude) of the resulting vibration is reduced. Control of the motion-enabled chairs may be done centrally through a central controller, or locally at selected motion-enabled chairs.

FIGURE 8

METHOD AND SYSTEM FOR REDUCING VIBRATION OF MOTION-ENABLED CHAIRS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from US patent application no. 13031779 filed on February 22, 2011.

BACKGROUND

(a) Field

[0002] The subject matter disclosed generally relates to the field of motion-enabled chairs.

(b) Related Prior Art

[0003] Motion-enabled chairs are becoming more and more popular in theatres. An example of such motion-enabled chairs is described in co-owned U.S. Patent Publication No. 20100090507 entitled Motion-Enabled Movie theatre Seat, which is incorporated herein by reference in its entirety.

[0004] Generally, motion-enabled chairs include one or more actuators connected to the base of the seat to produce vibrations and movements which are synchronized with and corresponding to the events displayed on the screen. The motion-enabled chairs are usually installed in a building and controlled by a central controller to induce and synchronize the vibrations/movements with the events displayed on the screen. A broad definition of motion-enabled chairs also includes tactile transducers and inertial shakers. This description therefore applies to such devices.

[0005] While advantageous and fun to use, when two or more motion-enabled chairs are provided on a certain platform, the vibration of these motion-enabled chairs add up and may damage the foundation of the building especially at the resonance frequency.

[0006] In particular, since all the motion-enabled chairs are synchronized with each other, when a certain event occurs on the screen which triggers the production of vibrations in the motion-enabled chairs, e.g. a car driving on an unpaved road, etc., all the motion-enabled chairs would vibrate in the same manner so that the users obtain the same feeling. Depending on the number of motion-enabled chairs and the floor on which the motion-enabled chairs are installed, the resulting vibration may damage the foundation or transfer the vibrations to other floors.

[0007] Therefore, there is a need for a system and method for controlling the movements of motion-enabled chairs to reduce the resulting vibration, without affecting the user's enjoyment and/or experience.

SUMMARY

[0008] According to an embodiment, there is provided a method for controlling an intensity of a vibration resulting from a set of motion-enabled chairs receiving motion signals that are synchronized. The method comprising: selecting, from the set, one or more motion-enabled chairs to control; and altering motion signals for the selected motion-enabled chairs to de-phase the vibration of the selected motion-enabled chairs from the vibration of non-selected motion-enabled chairs, thereby reducing the intensity of the vibration resulting from the set of motion-enabled chairs.

[0009] According to another embodiment, there is provided a central transmitter for controlling an intensity of a vibration resulting from a set of motion-enabled chairs receiving motion signals that are synchronized. The central transmitter comprising:

- a processing module for altering the phase of motion signals sent to selected motion-enabled chairs from the set; and
- an output module for sending the altered motion signals to selected motion-enabled chairs, and non-altered motion signals to non-selected

motion-enabled chairs, thereby reducing the intensity of the vibration resulting from the set of motion-enabled chairs.

[0010] According to another embodiment, there is provided a set of motion-enabled chairs attached to a structure and configured for reducing, in the structure, an intensity of a vibration resulting from movement of the set of motion-enabled chairs receiving motion signals. The set of motion-enabled chairs comprising:

- a first group of motion-enabled chairs; and
- a second group of motion-enabled chairs;
- the first group of motion-enabled chairs producing altered vibrations de-phased, in a given frequency range, with respect to the vibrations produced by the second group of motion-enabled chairs, thereby reducing the intensity of the vibration resulting from movement of the set of motion-enabled chairs.

[0011] Features and advantages of the subject matter hereof will become more apparent in light of the following detailed description of selected embodiments, as illustrated in the accompanying figures. As will be realized, the subject matter disclosed and claimed is capable of modifications in various respects, all without departing from the scope of the claims. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not as restrictive and the full scope of the subject matter is set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0013] Figure 1 is a perspective view illustrating an example of a motion-enabled chair that may be controlled by the present embodiments;

[0014] Figure 2 is a schematic diagram illustrating a system for controlling the motion signals of two motion-enabled chairs in accordance with an embodiment;

[0015] Figures 3A and 3B are schematic diagrams illustrating different embodiments of a system for transmitting de-phased motion signals for controlling the motion of two motion-enabled chairs;

[0016] Figure 4 is a schematic diagram illustrating a system for controlling the motion of two motion-enabled chairs, in accordance with a further embodiment;

[0017] Figure 5 is a schematic diagram illustrating an embodiment, in which, the motion signal for the motion-enabled chairs mounted on one platform is de-phased with regard to the motion signals mounted on the other platform;

[0018] Figure 6 is a schematic diagram illustrating an embodiment, in which, selection of the motion-enabled chairs is done on the basis of the weight of the occupants;

[0019] Figure 7 is a schematic diagram illustrating a system for controlling the motion of two motion-enabled chairs, in accordance with a further embodiment; and

[0020] Figure 8 is a schematic diagram illustrating an arrangement of motion-enabled chairs which are divided in two groups for receiving differently delayed motion signals according to an embodiment of the invention.

[0021] Figure 9 is a schematic diagram illustrating a method for controlling a vibration intensity resulting from a multitude of motion-enabled chairs.

[0022] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] In a building equipped with a plurality of motion-enabled chairs such as a movie theatre, the vibrations of the motion-enabled chairs add up and may damage the foundation of the building especially at the resonance frequency. The present application describes a system and method for controlling the resulting vibration by introducing an alteration such as a delay or an inversion in the motion signals sent to the motion-enabled chairs. This delay causes the vibration of some motion-enabled chairs to be de-phased from the vibration of the other motion-enabled chairs. Whereby, the intensity (magnitude) of the resulting vibration is reduced. Control of the motion-enabled chairs may be performed centrally through a central controller, or locally at selected motion-enabled chairs.

[0024] Figure 1 illustrates an example of a motion-enabled chair 100 as shown in co-owned U.S. Patent Publication No. 20100090507. In the example shown in Figure 1, the base (not shown) of the motion-enabled chair 100 is covered by a protective cover 101. The seating portion of the motion-enabled chair 100 is very similar to a standard movie chair or seat and comprises a seat base 102, a backrest 103 and armrests 104-105. Between the protective cover 101 and the seat base 102 there may be a protection skirt (not shown) for preventing users from injury while viewing a movie comprising motion effects. The protection skirt is horizontally wrinkled and made of flexible material to adjust itself during the actuating (movement of the motion-enabled chair).

[0025] The motion-enabled chair includes one or more actuators 106 connected to the seat base 102, and a controller (not shown) to receive motion signal from a central transmitter 300 and interpret and transform the motion signal into drive signals for driving each actuator 106. The central transmitter 300 receives or generates the motion signal in accordance with the video and or audio signals of a feature length movie. In an embodiment, motion-enabled chair 100 comprises three actuators 106, two of which are not shown in Fig. 1.

[0026] Below the right armrest 104, a control panel 107 is accessible to the user for controlling the intensity (e.g., the amplitude range of the actuators 106) of the motion effect inducing in the motion-enabled chair 100. Some of the options (i.e., modes of operation) include "Off" (i.e., no motion), "Light" (i.e., reduced motion), "Normal" (i.e., regular motion), "Heavy" (i.e., maximum motion), "Discreet" (i.e., fully controllable motion level between "Off" and "Heavy"), and "Automatic". In the "Automatic" mode, the motion-enabled chair 100 uses a sensor (not shown) to detect a characteristic of the user (e.g., weight, height, etc.) and, based on the characteristic, determines the setting for the level of motion that will be induced in the motion-enabled chair 100.

[0027] The present embodiments aim at reducing the vibration resulting from a plurality of motion-enabled chairs 100 without effecting any hardware change to the motion-enabled chairs 100. It is also an object to reduce the resulting vibration of the motion-enabled chairs 100 in a manner that is unnoticeable by the user. Therefore, it is important to maintain the user's experience and enjoyment on the motion-enabled chair they occupy while at the same time not letting them notice any delay or difference in the movement between the motion-enabled chair they occupy and a neighboring motion-enabled chair. Therefore, at low frequencies all the motion-enabled chairs may move in the same manner especially such that the resulting vibration is negligible and causes no harm. The delay or inversion may be introduced, where appropriate/needed at higher frequencies where the user cannot detect the difference in motion between the motion-enabled chair they are on and the neighboring motion-enabled chair. For example, it is possible that a delay introduced between the motion signals of neighboring motion-enabled chairs causes the motion signals to be the inverse of each other at a given frequency. In which case, the movement of one motion-enabled chair may be the opposite of the other e.g. one motion-enabled chair moving up and the other one moving down. However, because the vibrations occur at high frequencies, the user

cannot notice the difference, and thus, the user's experience is not affected by the delay introduced.

Central Control

[0028] In one aspect, movement of the different motion-enabled chairs is controlled centrally in the central transmitter 300 which generates de-phased motion signals and sends these signals to selected motion-enabled chairs or groups of motion-enabled chairs for controlling the resulting vibration of the motion-enabled chairs. Figure 2 illustrates an embodiment of a system 250 for controlling the motion of two or more motion-enabled chairs centrally.

[0029] The system 250 comprises two (or more) motion-enabled chairs 100-1 and 100-2 (hereinafter motion-enabled chairs 100). The motion-enabled chairs 100 are mounted on a platform 260. The platform 260 may be the ground (e.g., concrete) or an actual board made of metal, plastic, wood or any other suitable material provided between the motion-enabled chairs and the ground. The controller of each of the motion-enabled chairs receives a motion signal from the central transmitter 300 to interpret and transform the motion signal into drive signals for driving each of the actuators 106 of the motion-enabled chair.

[0030] In order to reduce the resulting vibration of the motion-enabled chairs 100 on the platform 260, the central transmitter 300 introduces a delay between the motion signal of one motion-enabled chair and the motion signal of the other motion-enabled chair to de-phase the motion signals, whereby the resulting vibration (aka total vibration or sum of the vibrations) of the two motion-enabled chairs is reduced.

[0031] In an embodiment, the central transmitter computes a delay that cancels the total vibration at a certain frequency, e.g. the resonance frequency, and reduces the total vibration at the neighboring frequencies. In an embodiment, the delay T introduced is calculated in accordance with the following equation 1 in which F is the frequency at which the total vibration needs to be cancelled:

Equation 1: $T = 1 / (2F)$

The resonance frequency may vary between a building and the other depending on the number of floors, construction materials, etc. In an embodiment, the resonance frequency ranges between 10 Hz and 50 Hz. However, it is to be noted that the present embodiments are not limited to a certain frequency range.

[0032] In another embodiment, for a given frequency range (e.g., 10 Hz to 100 Hz), the motion signal input to one motion-enabled chair is the inverse of the motion signal input to the other motion-enabled chair, whereby the vibrations of one motion-enabled chair may be substantially cancelled by the other motion-enabled chair, and the resulting vibration transmitted to the ground is substantially eliminated.

[0033] Transmission of de-phased motion signals to the motion-enabled chairs **100** may be done in several ways.

[0034] In the embodiment shown in Figure 2, each motion-enabled chair **100** receives a dedicated motion signal directly from the central transmitter **300**. For example, motion-enabled chair **100-1** receives its motion signal on link **252**, and motion-enabled chair **100-2** receives its motion signals using link **254**. Motion signals sent via links **252** and **254** are de-phased with respect to each other in order to reduce the total vibration of the two motion-enabled chairs, as described above.

[0035] According to an embodiment, the central transmitter **300** includes a sensor (not shown) for detecting and for selecting a frequency at which the vibration is to be reduced. The sensor can be in the central transmitter **300** but it could also be located outside of the central transmitter **300**. In an embodiment, the detected and selected frequency varies over time. The altering of the motion signal is therefore adjusted accordingly. In an embodiment, the sensor is for detecting an amplitude of a vibration at multiple frequencies. The sensor is further for selecting a frequency at which the vibration is to be reduced based on

the amplitude of the vibration at a frequency from the multiple frequencies. The selected frequency can therefore be the one at which the amplitude of the vibration is the greatest, the one which produces the highest level of noise, or the one which would cause the greatest damage to the structure.

[0036] Figures 3A and 3B illustrate another embodiment, in which, de-phased motion signals dedicated to more than one motion-enabled chair are multiplexed and sent on the same link 256, e.g. as a demultiplexed/encoded signal to be demultiplexed/decoded at each motion-enabled chair in order for each motion-enabled chair to receive the corresponding motion signal designated to it by the central transmitter 300.

[0037] In the embodiments shown in Figures 3A & 3B, the central transmitter 300 de-phases the motion signals, encodes them, and sends the encoded de-phased motion signals simultaneously on the link 256 as a multiplexed signal. Each motion-enabled chair receives the modulated signal sent by the central transmitter 300 and demultiplexes the received signal to extract the corresponding motion signal dedicated to it. In one example of implementation, it is possible to assign a signal ID to each motion-enabled chair and use the signal ID in decoding the multiplexed signal using well-known techniques.

[0038] Demultiplexing of the multiplexed signal received on the link 256 may be done within the controller of each motion-enabled chair using a software program or using only a software modification as in the embodiment shown in Figure 3A, or by means of an external device (aka external processor) connected between the link 256 and the controller of the motion-enabled chair such as devices 262 and 264 shown in Figure 3B.

[0039] Another example of implementation is shown in Figure 4. In the example of Figure 4, the central transmitter 300 encodes a first and second de-phased motion signals on link 258 in a manner that regular motion-enabled

chairs (100-1) will detect the first motion signal and discard the second, and motion-enabled chairs which are connected to an external decoder 268 or motion-enabled chairs (100-2) which are equipped with an internal decoding program will detect the second motion signal and discard the first. This scenario allows for the reduction of the number of motion-enabled chairs to upgrade (software/hardware).

[0040] Figure 5 illustrates a further embodiment, in which the motion signal for the motion-enabled chairs mounted on one platform is de-phased with regard to the motion signals for the motion-enabled chairs mounted on the other platform. As shown in Figure 5, motion-enabled chairs 100-1 and 100-2 are mounted on a platform 262, while motion-enabled chairs 100-3 and 100-4 are mounted on a platform 264. In the embodiment shown in Figure 5, the motion-enabled chairs on the platform 262 receive a motion signal 280 while the motion-enabled chairs on the platform 264 receive a motion signal 282 which is de-phased from the motion signal 280. This way the vibration of the motion-enabled chairs on one platform can cancel the vibration of the motion-enabled chairs on other platforms, and the resulting vibration transmitted to the ground is cancelled/reduced. Transmission of the motion signals from the central transmitter 300 to the motion-enabled chairs 100 may be done using the embodiments described in any one of Figure 2 to 5, or in accordance with other techniques which are well known in the art.

[0041] Figure 7 illustrates an embodiment of a system 290 for controlling the motion of two or more motion-enabled chairs centrally. The system 290 comprises two (or more) motion-enabled chairs 100-1 and 100-2. The motion-enabled chairs 100-1 and 100-2 are mounted on a platform 260. Each motion-enabled chair receives motion signals to interpret and to transform into drive signals for driving each of the actuators 106 of the motion-enabled chair.

[0042] The motion signal is “daisy-chained” from one motion-enabled chair to the other. That is, the motion signals for all motion-enabled chairs are

encoded by central transmitter 300 and sent on the same link 284 to motion-enabled chair 100-1. Motion-enabled chair 100-1 picks up its own motion signal while the same signal send on link 284 is repeated / transmitted on link 286 to motion-enabled chair 100-2. Motion-enabled chair 100-2 will pick up its own signal which is delayed relative to the signal for motion-enabled chair 100-1.

[0043] In an embodiment of the central control aspect, selection of the motion-enabled chairs is done on the basis of the weight of the occupants. As explained above, the motion-enabled chairs may be equipped with weight sensors to detect the weight of the user and report this information to the central transmitter 300. The central transmitter 300 receives the information from the plurality of motion-enabled chairs, and processes this information centrally to divide the motion-enabled chairs in groups where all the motion-enabled chairs in one group receive the same motion signal, wherein the motion signal sent to one group is de-phased from the motion signal sent to the other group. This will be exemplified in the non-limiting example shown in Figure 6.

[0044] With reference to Figure 6, consider a scenario where the weight of the occupants of the motion-enabled chairs 100-1 to 100-4 is as follows:

100-1: 100 pounds;

100-2: 160 pounds;

100-3: 145 pounds;

100-4: 210 pounds;

When the weight of each use is used by the central processor, it processes the information to divide the motion-enabled chairs into groups on the basis of the weight and/or also the proximity of the motion-enabled chairs to each other in order to optimize the vibration cancellation process. In the present example, the occupants of motion-enabled chairs 100-1 and 100-4 weigh 310 pounds, and the occupants of motion-enabled chairs 100-2 and 100-3 together weigh 305

pounds. Therefore, the central transmitter 300 may group motion-enabled chairs 100-1 and 100-4 in one group and motion-enabled chairs 100-2 and 100-3 in another group, and provide the two groups with motion signals which are de-phased from each other.

Local Control

[0045] In another aspect, control of the movements and introduction of the delay is done locally at the motion-enabled chairs without changing the manner in which the central controller functions.

[0046] For example, it is possible that the controller of selected motion-enabled chairs introduces a delay to the motion signal received from the transmitter. The controller may be programmed to introduce the delay when detecting a pre-determined frequency. Alternatively, an external decoder may introduce the delay when detecting the pre-determined frequency. For example, the external decoder 268 of Figure 4 may be implemented to introduce the delay in the motion signal received at motion-enabled chair 100-2, whereby the total vibration of motion-enabled chairs 100-1 and 100-2 may cancel each other.

[0047] Figure 8 shows how motion-enabled chairs divided into groups of alternating neighboring motion-enabled chairs such that each motion-enabled chair will receive motion signals which are delayed as compared with motion signals received by its immediate neighbor.

[0048] As discussed above, a central transmitter 300 prepares the motion signals and forwards them to the motion-enabled chairs 100. In this embodiment, the motion signals are first sent to motion-enabled chair 100-1, then to motion-enabled chair 100-2, and so on until it reaches the last motion-enabled chair 100-8. Each motion-enabled chair 100 picks up the motion signals which are destined to it.

[0049] In the embodiment shown in Figure 8, the motion-enabled chairs are divided into group A and group B (i.e., alternating neighboring motion-

enabled chairs). The group A motion-enabled chairs receive motion signals which are inverted in a given frequency range relative to group B motion-enabled chairs. The result is that each motion-enabled chair 100 will produce vibrations in the given frequency range which are inverted as compared with motion signals produced by its immediate neighbor.

[0050] In another embodiment shown in Figure 8, the motion-enabled chairs are also divided into group A and group B (i.e., alternating neighboring motion-enabled chairs). Both groups of motion-enabled chairs receive the motion signals. Group A motion-enabled chairs apply locally a delay which is different from a delay applied locally by the group B motion-enabled chairs. The result is that each motion-enabled chair 100 will generate motion which is delayed as compared with motion generated by its immediate neighbor.

[0051] Now turning to Fig. 9, there is shown a method 90 for controlling a vibration intensity resulting from a multitude of motion-enabled chairs receiving synchronized motion signals. The method 90 comprises: selecting one or more motion-enabled chairs to control (step 92); and altering the motion signals for the selected motion-enabled chairs to de-phase the vibration of the selected motion-enabled chairs from the vibration of the non-selected motion-enabled chairs (step 94), thereby reducing the vibration intensity resulting from all the motion-enabled chairs.

[0052] According to an embodiment, the altering of the motion signals comprises at least one of delaying the motion signals for all frequencies or a in given frequency range to the selected motion-enabled chairs (step 96) and inverting the motion signals in a given frequency range to the selected motion-enabled chairs (step 98).

Variations

[0053] While the drawings provided in this application illustrate only two motion-enabled chairs on each platform, it is to be noted that the design is not

limited to only two motion-enabled chairs. Any number of motion-enabled chairs may be controlled as described in the present embodiments without departing from the scope of this disclosure.

[0054] According to another embodiment, it is to be noted that the design is also applicable to more than two platforms.

[0055] Furthermore, the term neighboring motion-enabled chair does not necessarily mean that the motion-enabled chairs have to be right beside each other. As discussed above, the motion-enabled chairs are generally equipped with a weight sensor. Therefore, when a motion-enabled chair is vacant the vibrations and/or movements would be disabled. Therefore, in the case where a vacant motion-enabled chair exists between two occupied motion-enabled chairs, the neighboring motion-enabled chairs could be the motion-enabled chairs that are occupied and not the vacant motion-enabled chairs.

[0056] It is also to be noted that the links on which the motion signals are sent may be selected from a wide variety of options available on the market. For example, the link may be a wired link such as a coaxial cable, fiber optic cable, CAT 5 cable, etc. or may be a wireless link including a transmitter at the central transmitter 300 and a receiver at some or all of the motion-enabled chairs.

[0057] Embodiments can be implemented as a computer program product for use with a computer system. Such implementation may include a series of computer instructions fixed either on a tangible medium, such as a computer readable medium (e.g., a diskette, CD-ROM, ROM, or fixed disk) or transmittable to a computer system, via a modem or other interface device, such as a communications adapter connected to a network over a medium. The medium may be either a tangible medium (e.g., optical or electrical communications lines) or a medium implemented with wireless techniques (e.g., microwave, infrared or other transmission techniques). The series of computer instructions embodies all or part of the functionality previously described herein. Those skilled in the art

should appreciate that such computer instructions can be written in a number of programming languages for use with many computer architectures or operating systems. Furthermore, such instructions may be stored in any memory device, such as semiconductor, magnetic, optical or other memory devices, and may be transmitted using any communications technology, such as optical, infrared, microwave, or other transmission technologies. It is expected that such a computer program product may be distributed as a removable medium with accompanying printed or electronic documentation (e.g., shrink wrapped software), preloaded with a computer system (e.g., on system ROM or fixed disk), or distributed from a server over the network (e.g., the Internet or World Wide Web). Of course, some embodiments of the invention may be implemented as a combination of both software (e.g., a computer program product) and hardware. Still other embodiments of the invention may be implemented as entirely hardware, or entirely software (e.g., a computer program product).

[0058] According to another embodiment, an instruction signal (e.g., instructions, metadata information) which accompanies the motion signals gives instructions to the chairs (i.e., on selected chairs or all chairs depending on the instruction signal). The instruction signal may include instructions for 1- reducing the volume to be played in advance of the motion signal to avoid locally processing the instruction signal thereby avoiding unnecessary processing delays; 2- cutting out the selected frequency (or given frequency range); or 3- mixing high frequencies and low frequencies.

[0059] While preferred embodiments have been described above and illustrated in the accompanying drawings, it will be evident to those skilled in the art that modifications may be made without departing from this disclosure. Such modifications are considered as possible variants comprised in the scope of the disclosure.

CLAIMS:

1. A method for controlling an intensity of a vibration resulting from a set of motion-enabled chairs receiving motion signals that are synchronized, the method comprising:
 - selecting, from the set, one or more motion-enabled chairs to control; and
 - altering motion signals for the selected motion-enabled chairs to dephase the vibration of the selected motion-enabled chairs from the vibration of non-selected motion-enabled chairs, thereby reducing the intensity of the vibration resulting from the set of motion-enabled chairs.
2. The method of claim 1, further comprising selecting a frequency at which the vibration is to be reduced.
3. The method of claim 2, wherein the altering comprises applying a delay that allows for a substantial cancellation of the vibration at the selected frequency.
4. The method of claim 3, further comprising calculating the delay in accordance with the following equation in which T represents the delay and F represents the selected frequency: $T = 1 / (2F)$.
5. The method of claim 2, wherein the frequency is selected in a range between 10 Hz and 50 Hz.
6. The method of claim 2, wherein the frequency is selected to be the resonance frequency of a building in which the set of motion-enabled chairs is located.

7. The method of claim 1, wherein for a given frequency range, the motion signals to the selected motion-enabled chairs is the inverse of the motion signals to the non-selected motion-enabled chairs.

8. The method of claim 7, wherein the given frequency range is between 10 Hz and 100 Hz.

9. The method of claim 1, further comprising:

- performing the altering centrally, at a central transmitter; and
- sending altered motion signals to the selected motion-enabled chairs from the central transmitter; and
- sending non-altered (original) motion signals to the non-selected motion-enabled chairs from the central transmitter.

10. The method of claim 1, wherein the selecting one or more motion-enabled chairs to control comprises dividing the set of motion-enabled chairs into groups of alternating neighboring motion-enabled chairs, wherein each motion-enabled chair will receive motion signals which are altered as compared with motion signals received by its immediate neighbor.

11. The method of claim 1, wherein the selecting one or more motion-enabled chairs to control comprises:

- receiving information relating to an occupant weight from each motion-enabled chair; and
- dividing the set of motion-enabled chairs in two groups, a first and a second group, based on the weight of each occupant wherein the sum of the weight each occupant in the first group is similar or substantially equal to the sum of the weight of each occupant in the second group.

12. A central transmitter for controlling an intensity of a vibration resulting from a set of motion-enabled chairs receiving motion signals that are synchronized, the central transmitter comprising:

- a processing module for altering the phase of motion signals sent to selected motion-enabled chairs from the set; and
- an output module for sending the altered motion signals to selected motion-enabled chairs from the set, and non-altered motion signals to non-selected motion-enabled chairs from the set, thereby reducing the intensity of the vibration resulting from the set of motion-enabled chairs.

13. The central transmitter of claim 12, wherein the processing module is further for selecting, from the set, the selected motion-enabled chairs and the non-selected motion-enabled chairs.

14. The central transmitter of claim 13, wherein the processing module is further for selecting a frequency at which the vibration is to be reduced.

15. The central transmitter 14, further comprising a sensor for detecting and for selecting a frequency at which the vibration is to be reduced.

16. The central transmitter of claim 15, wherein the detected and selected frequency varies over time.

17. The central transmitter of claim 14, further comprising a sensor for detecting an amplitude of a vibration at multiple frequencies, the sensor further for selecting a frequency at which the vibration is to be reduced based on the amplitude of the vibration at a frequency from the multiple frequencies.

18. A set of motion-enabled chairs attached to a structure and configured for reducing, in the structure, an intensity of a vibration resulting from movement of the set of motion-enabled chairs receiving motion signals, the set of motion-enabled chairs comprising:

- a first group of motion-enabled chairs; and
- a second group of motion-enabled chairs;
- the first group of motion-enabled chairs producing altered vibrations de-phased, in a given frequency range, with respect to the vibrations produced by the second group of motion-enabled chairs, thereby reducing the intensity of the vibration resulting from movement of the set of motion-enabled chairs.

19. The set of motion-enabled chairs of claim 18, wherein the set of motion-enabled chairs is configured such that there is an alternation of neighboring motion-enabled chairs between the first group of motion-enabled chairs and the second group of motion-enabled chairs, wherein each motion-enabled chair will produce vibrations which are altered as compared with vibrations produced by its immediate neighbor.

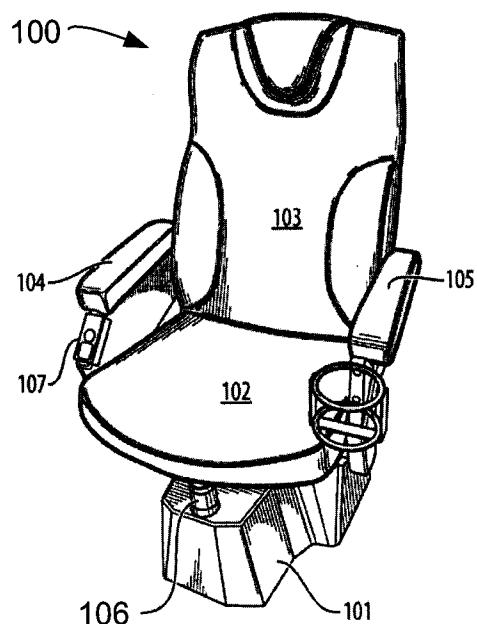
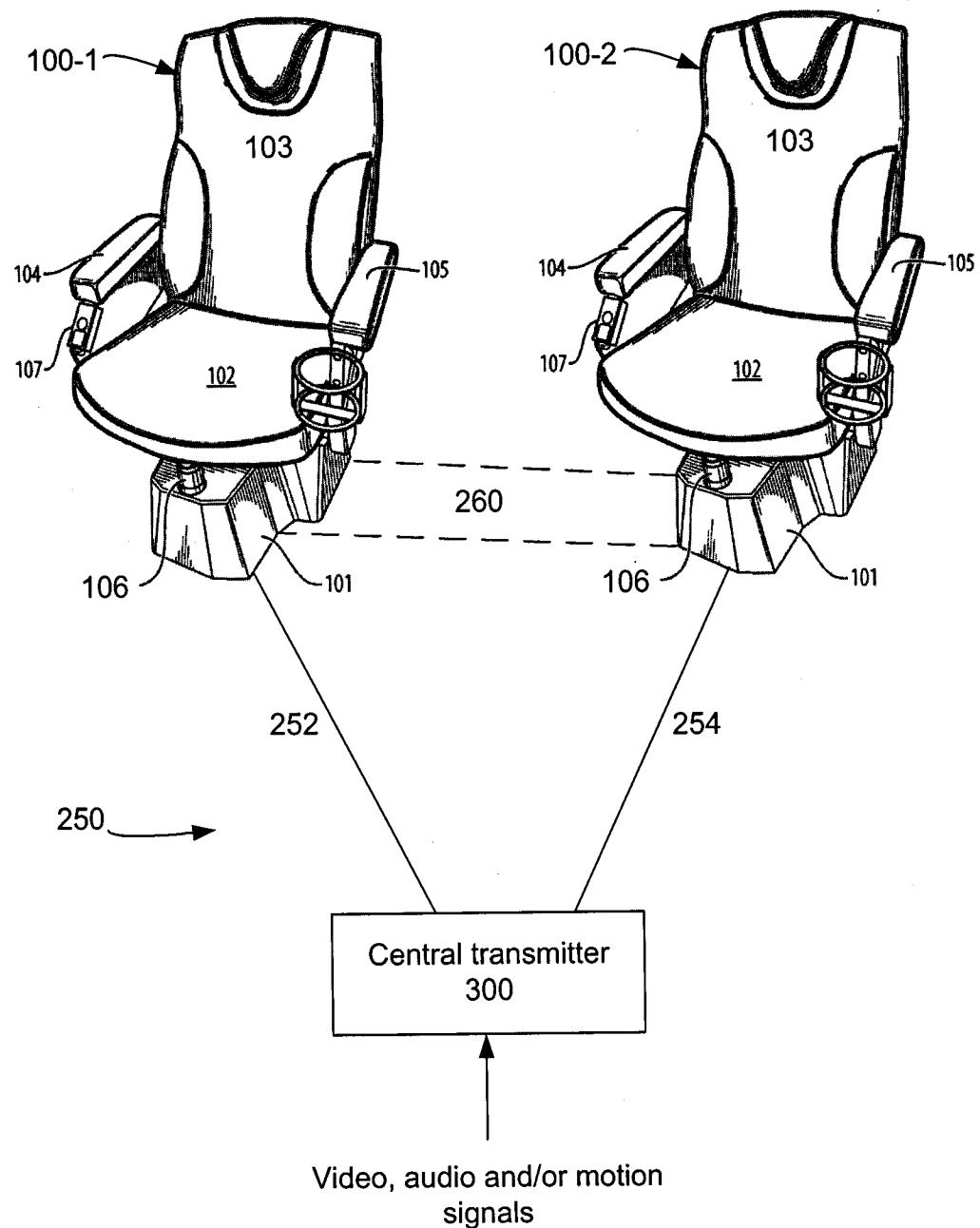
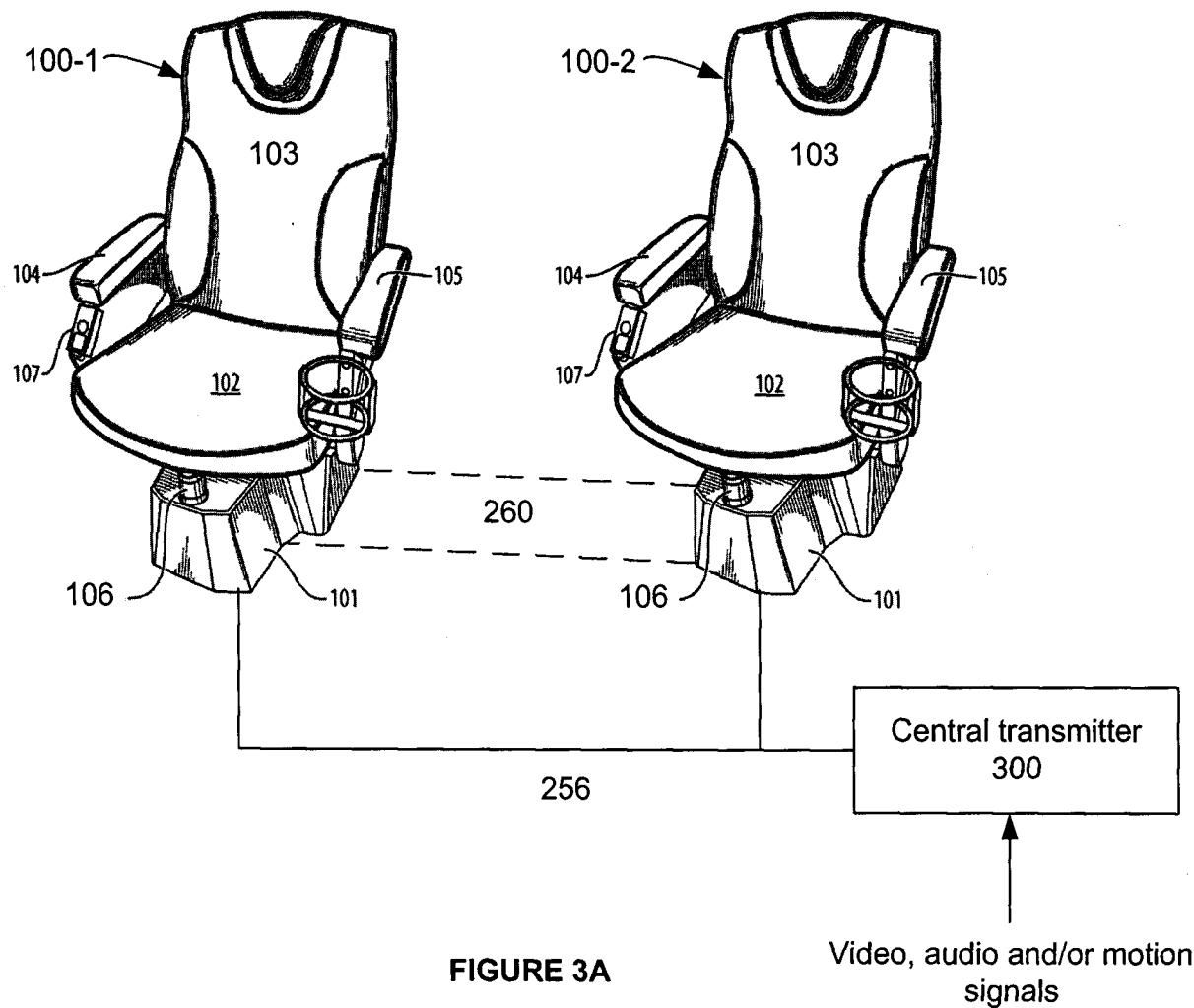
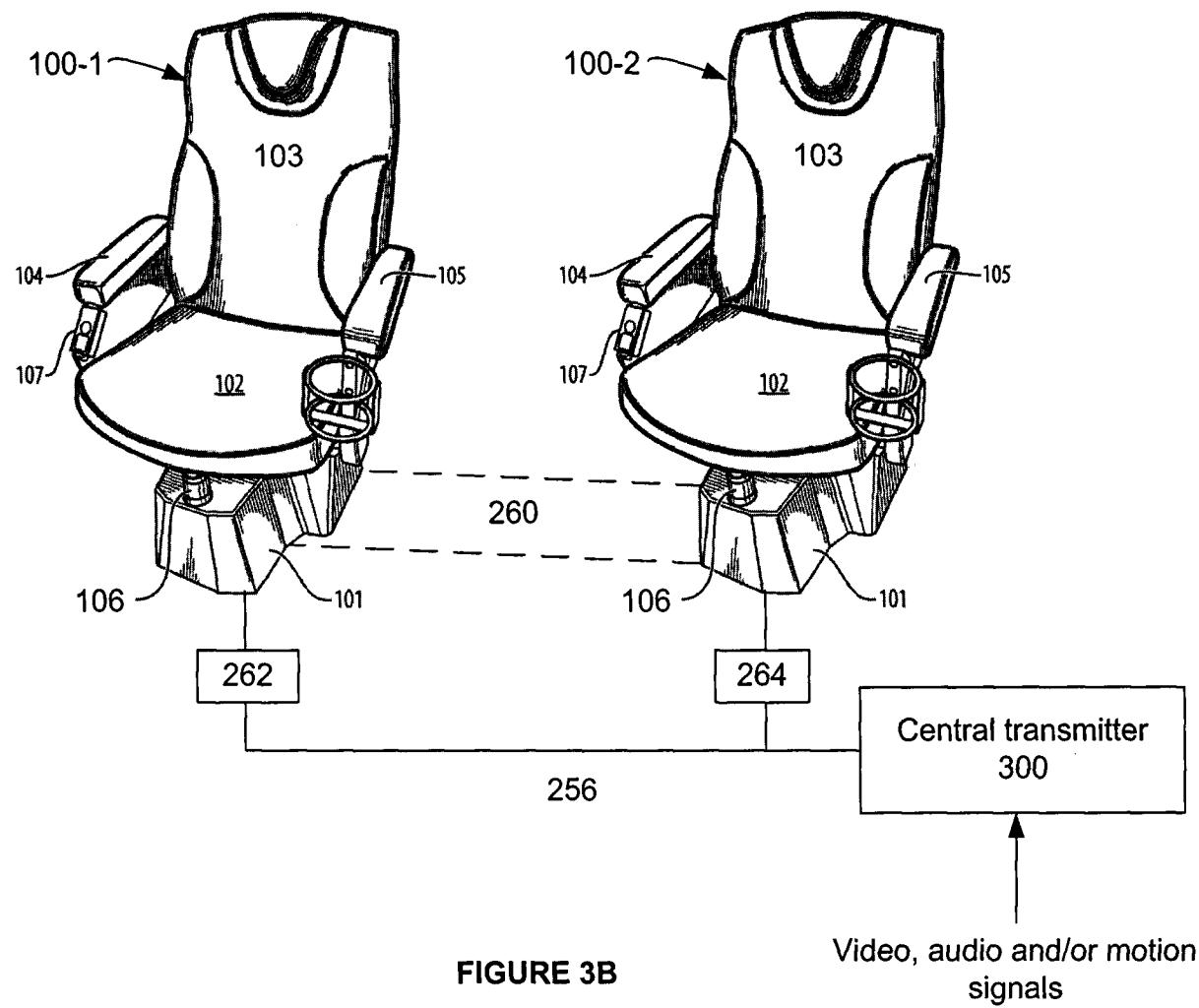
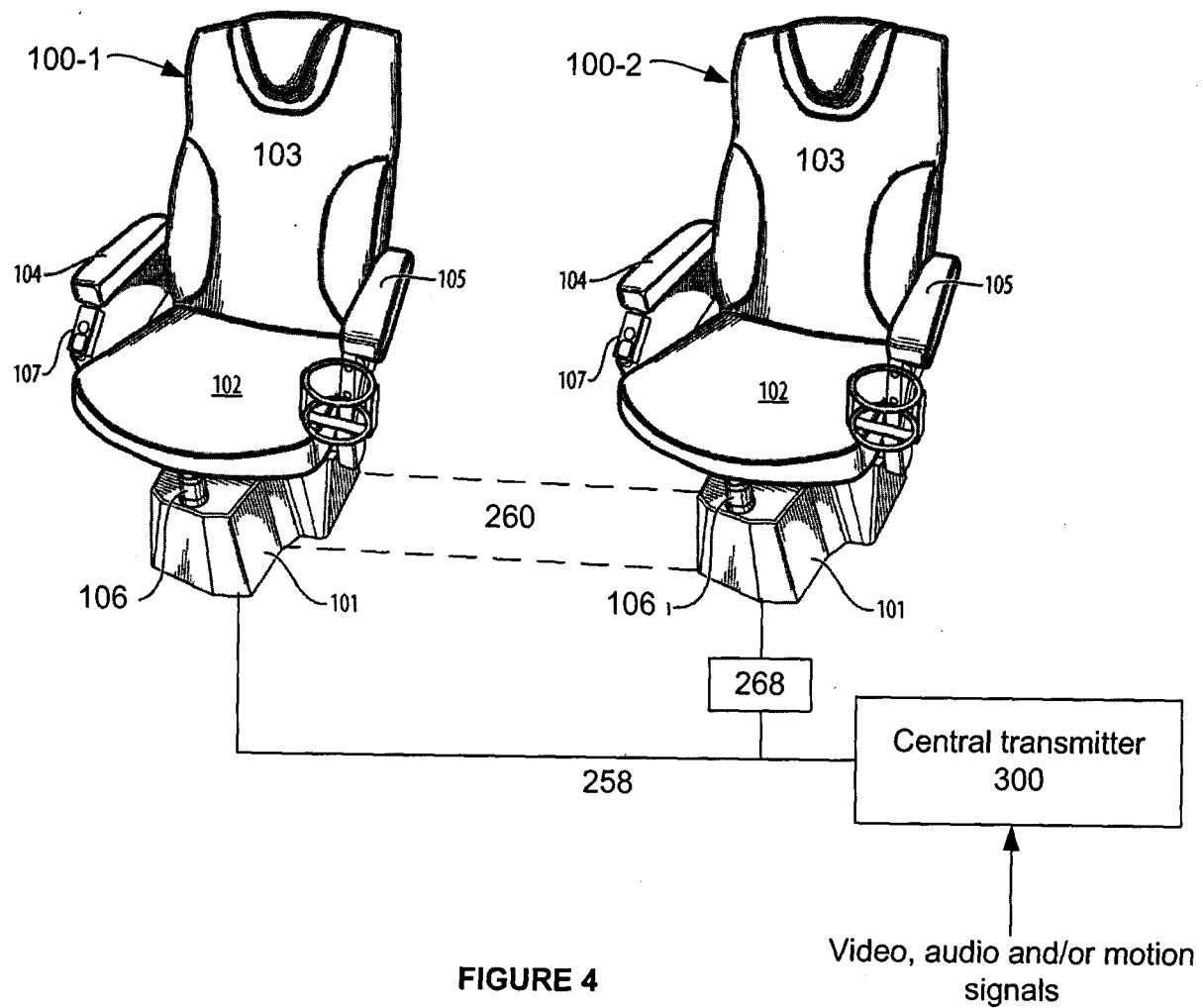


FIGURE 1

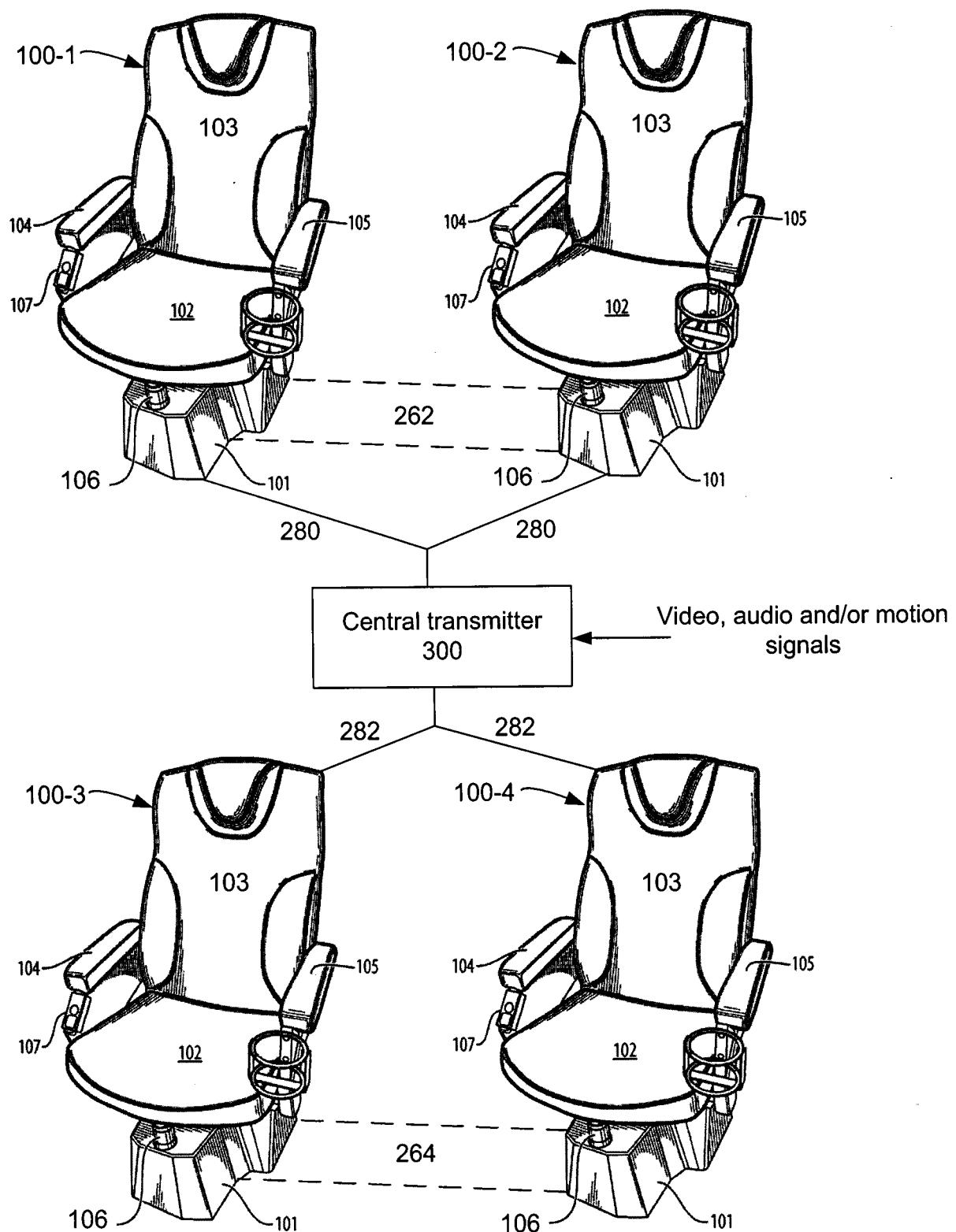
**FIGURE 2**

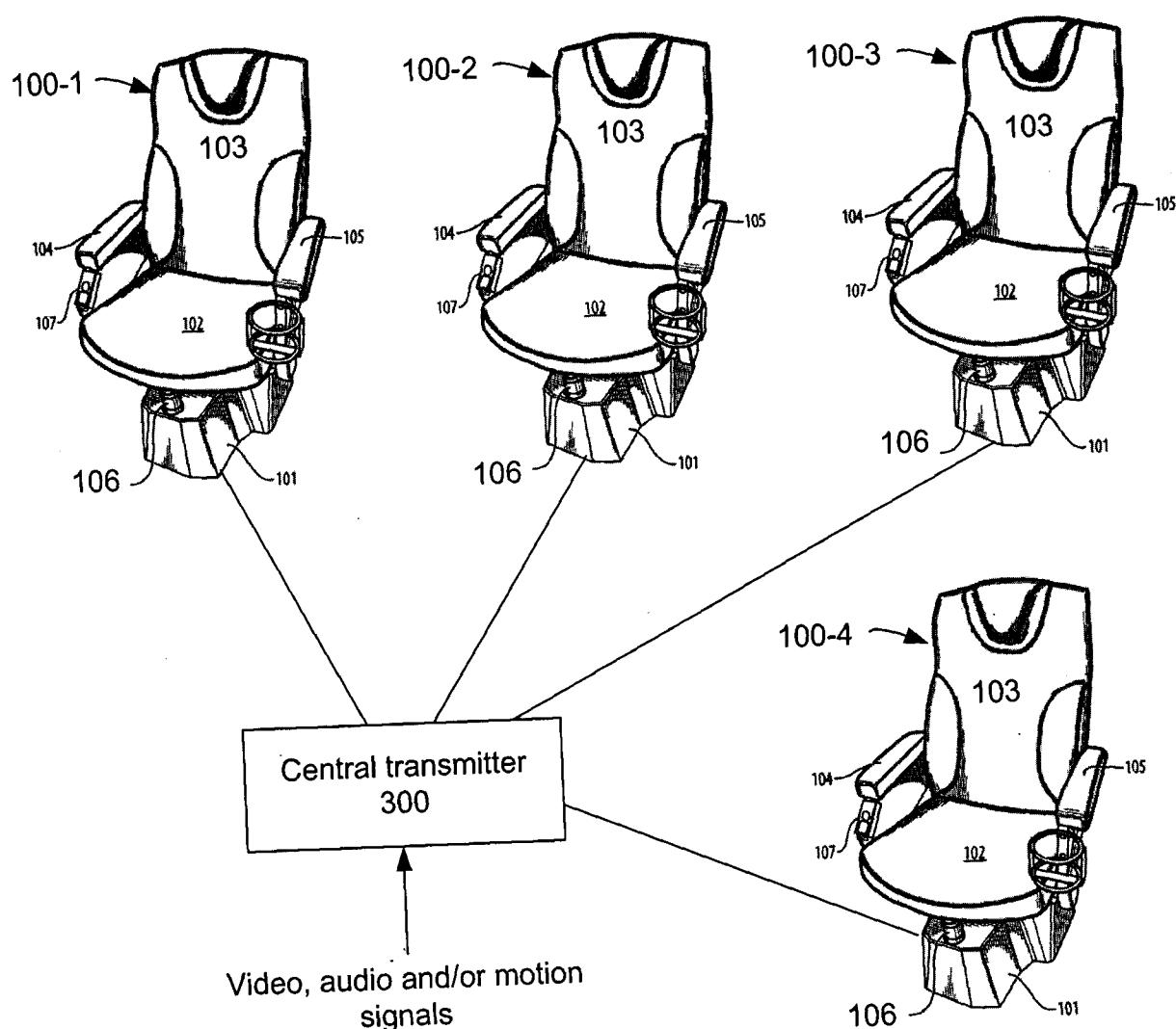


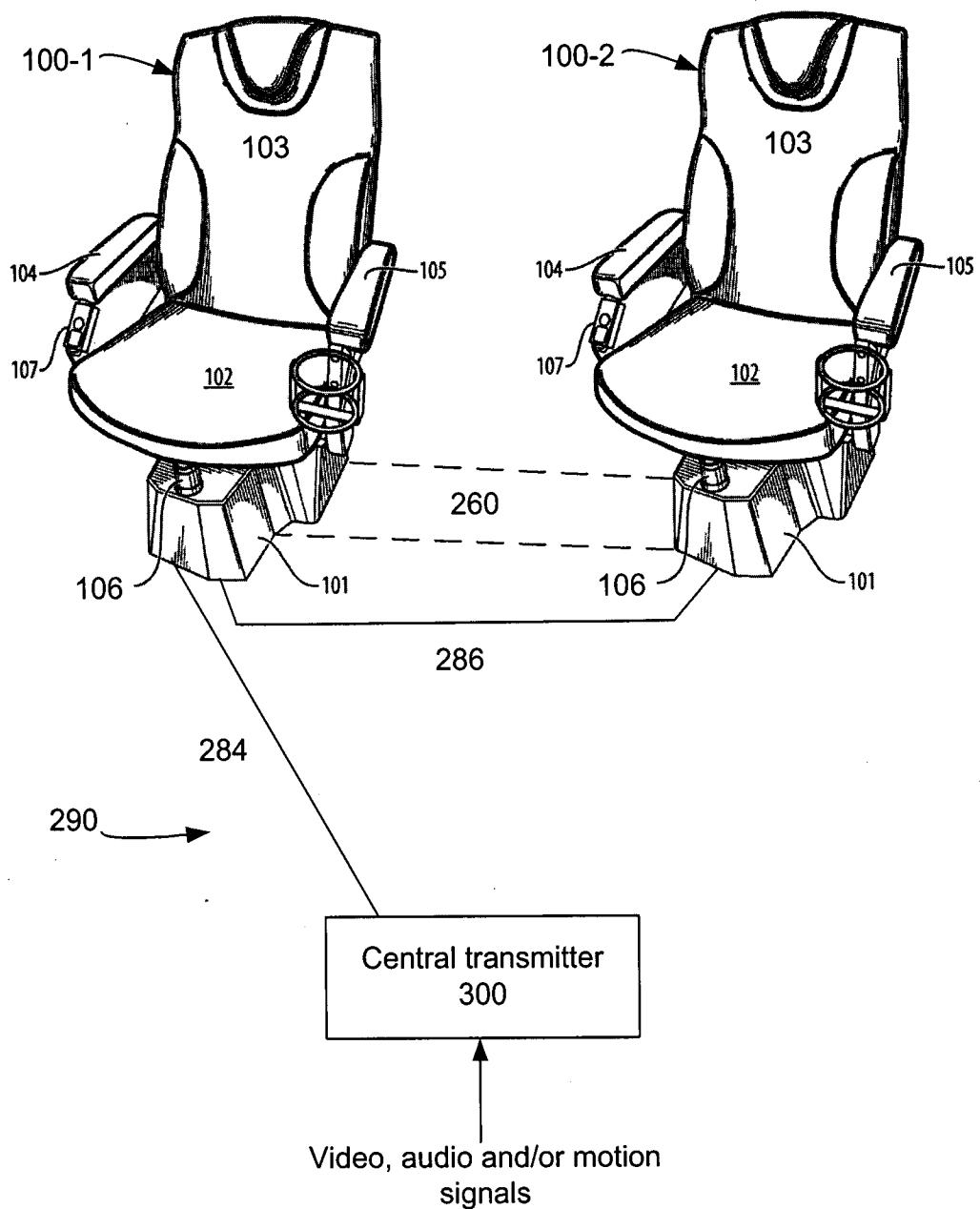


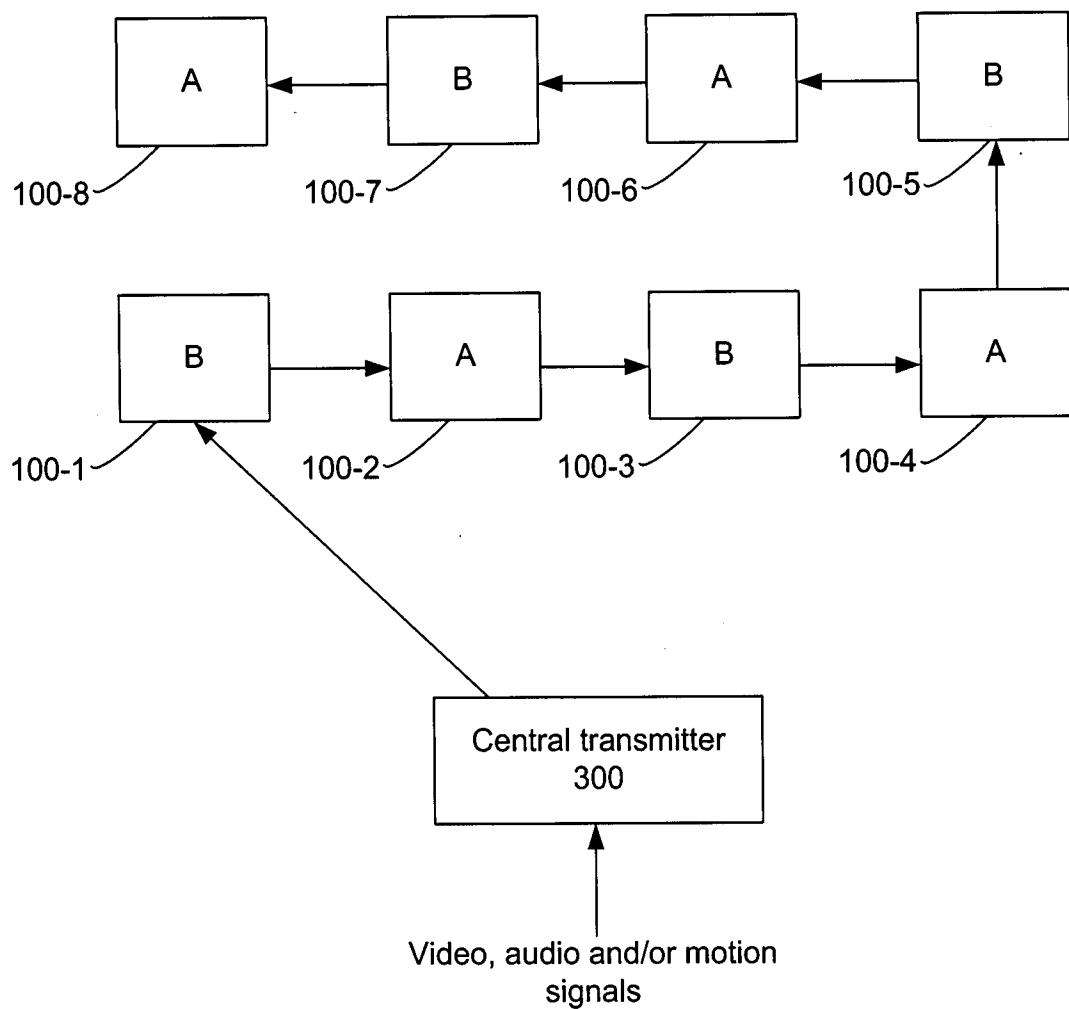


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**FIGURE 5**

**FIGURE 6**

**FIGURE 7**

**FIGURE 8**

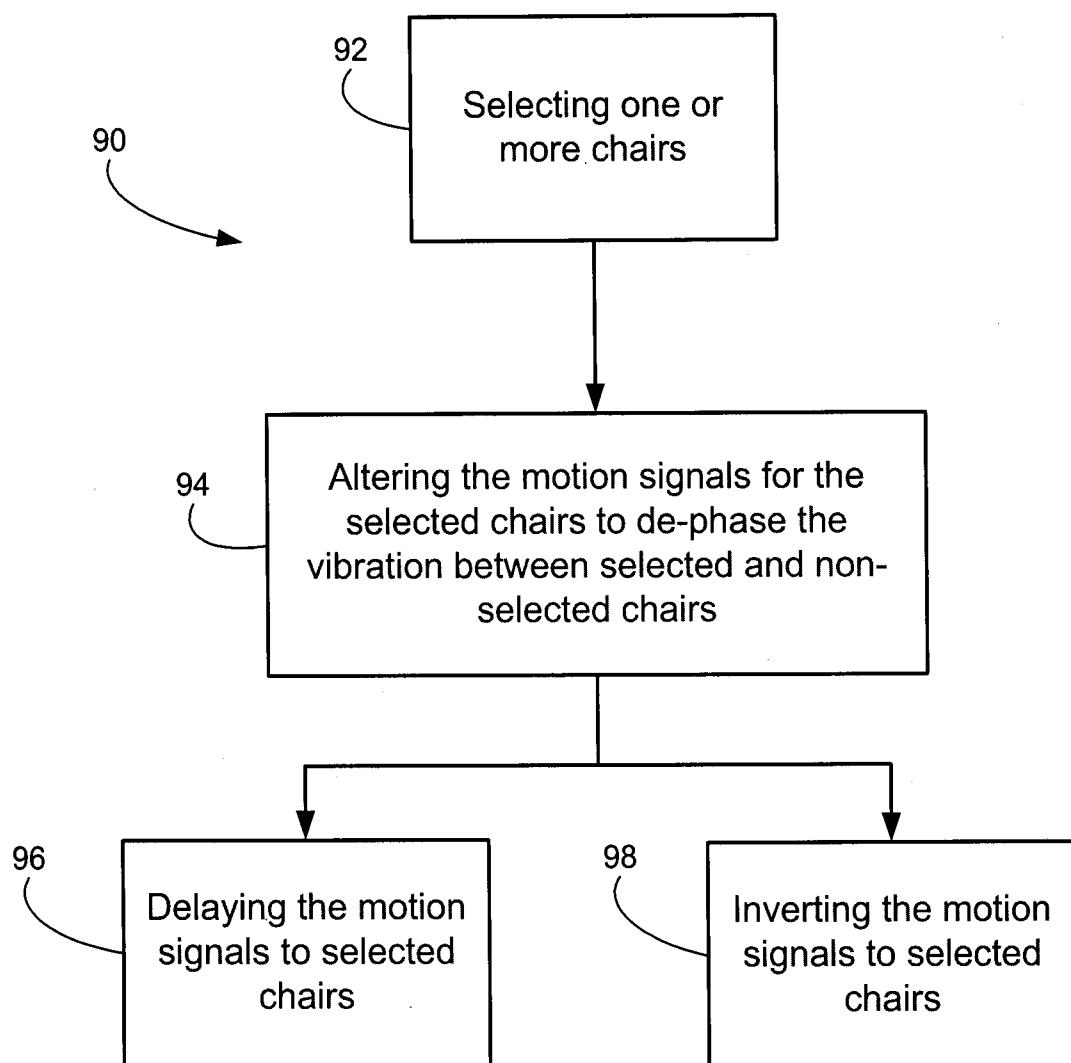


FIGURE 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2012/000156

A. CLASSIFICATION OF SUBJECT MATTER IPC: F16F 15/02 (2006.01), A47C 1/12 (2006.01), A47C 7/62 (2006.01), A63J 25/00 (2009.01), B06B 1/02 (2006.01), E04B 1/98 (2006.01), F16F 15/03 (2006.01), G05D 19/02 (2006.01) 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: F16F 15/02 (2006.01), A47C 1/12 (2006.01), A47C 7/62 (2006.01), A63J 25/00 (2009.01), B06B 1/02 (2006.01), E04B 1/98 (2006.01), F16F 15/03 (2006.01), G05D 19/02 (2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched None		
Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) Canadian Patent Database, Epodoc (EPOQUE)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5015933 A, (WATKINS, W et al.) 14 May 1991 (14-05-1991)	1-19
A	US 5629986 A, (SHOURESHI, R) 13 May 1997 (13-05-1997)	1-19
A	US 5651072 A, (NAKAO, N, et al.) 22 July 1997 (22-07-1997)	1-19
A	US 2010205867 A1, (PARK, K) 19 August 2010 (19-08-2010)	1-19
A	US 3923300 A, (TANUS, A) 02 December 1975 (02-12-1975)	1-19
A	WO 2011162448 A1, (LEE, J) 29 December 2011 (29-12-2011)	1-19
A	US 2010127442 A1, (MURAGISHI Y, et al.) 27 May 2010 (27-05-2010)	1-19
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
<p>* Special categories of cited documents :</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“B” earlier application or patent but published on or after the international filing date</p> <p>“C” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>“D” document referring to an oral disclosure, use, exhibition or other means</p> <p>“E” document published prior to the international filing date but later than the priority date claimed</p> <p>“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>“X” document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>“Y” document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>“&” document member of the same patent family</p>		
Date of the actual completion of the international search 10 May 2012 (10-05-2012)	Date of mailing of the international search report 01 June 2012 (01-06-2012)	
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Authorized officer Daniel Burwell	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2012/000156

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US2010127442A1	27 May 2010 (27-05-2010)	CN101557955A EP2090452A1 JP2007215400A JP2007216945A JP2008144781A JP2008256109A JP2008256110A KR20090086566A TW200842536A WO2008069282A1	14 October 2009 (14-10-2009) 19 August 2009 (19-08-2009) 23 August 2007 (23-08-2007) 30 August 2007 (30-08-2007) 26 June 2008 (26-06-2008) 23 October 2008 (23-10-2008) 23 October 2008 (23-10-2008) 13 August 2009 (13-08-2009) 01 November 2008 (01-11-2008) 12 June 2008 (12-06-2008)