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H04H 60/04 (2008.01)

(56) Documents Cited:
US 8085269 B1 **US 8073160 B1**
Gelineck et al, "Music Mixing Surface", Proceedings of the 2013 ACM international conference on Interactive Tabletops And Surfaces, 2013, pp 433 to 436, Association for Computing Machinery
De Man et al, "Comparing Stage Metaphor Interfaces As A Controller For Stereo Position And Level", 14 September 2018, Proceedings of the 4th Workshop on Intelligent Music Production, Huddersfield, UK

(58) Field of Search:
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Other: **WPI, EPODOC, Patent Fulltext, INTERNET**

(54) Title of the Invention: **Digital audio workstation**
Abstract Title: **A digital audio workstation with stage view and grouping of audio tracks**

(57) A Digital Audio Workstation (DAW) for adjusting spatial position (panning) and volume of audio tracks 346, wherein the audio tracks together comprise a group 351. Each audio track, and the group track, have a first spatial position value and a first volume value. The digital audio workstation comprises a user interface with a stage view which depicts one or more group track user interface objects 349. A user adjusts the first spatial position value and/or volume value of the group track wherein the digital audio workstation calculates a second spatial position value and/or volume value of each of the one or more audio tracks based on the adjusted spatial position and/or volume of the group track. Audio track user interface objects 347 are displayed on the stage view interface where the position of each of the audio track user interface objects represents the second spatial position value and/or volume value of that track. Also disclosed is a DAW where a segment of the stage boundary is highlighted and represents maximum and minimum values for spatial position and volume of a group track.

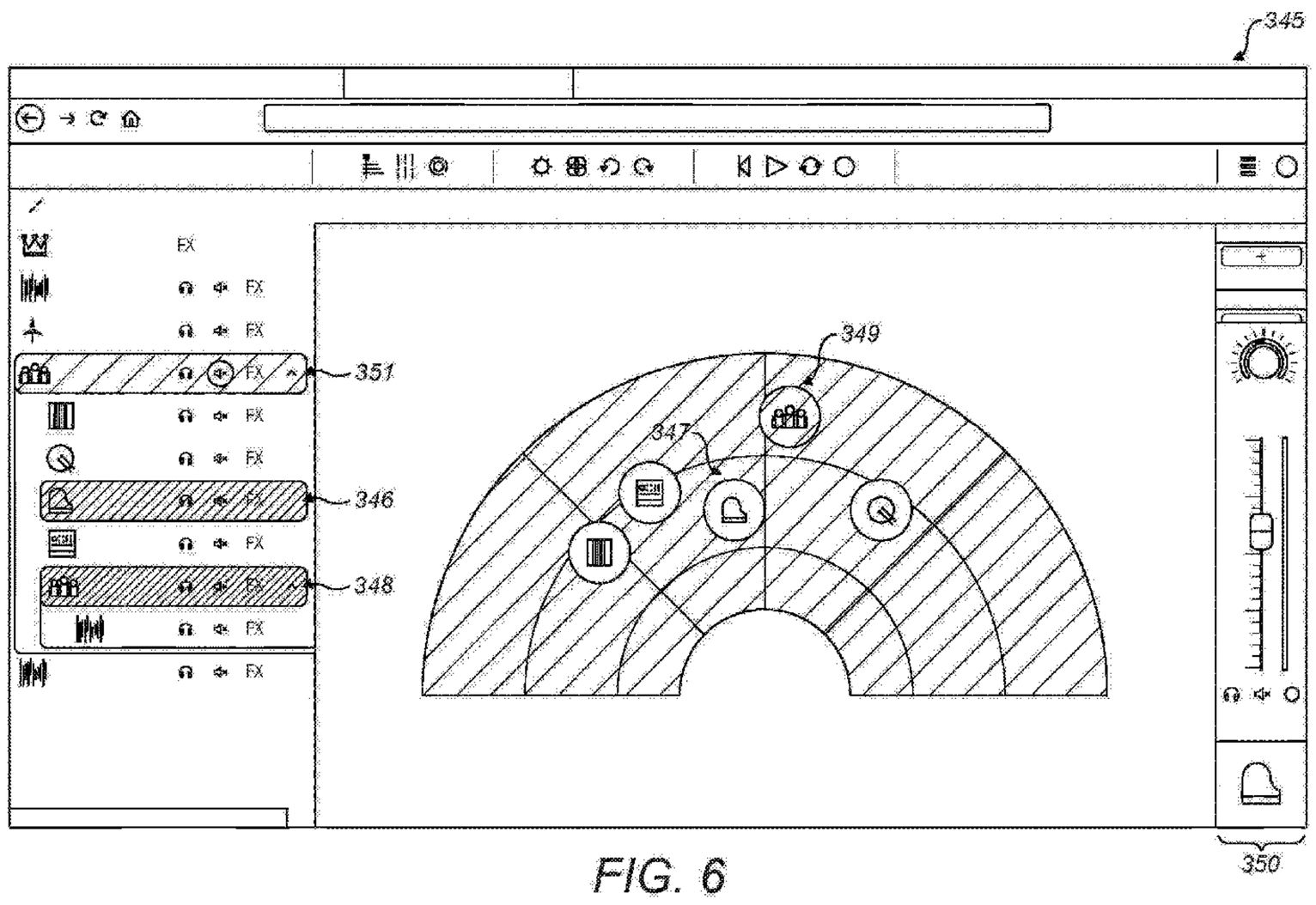

FIG. 6

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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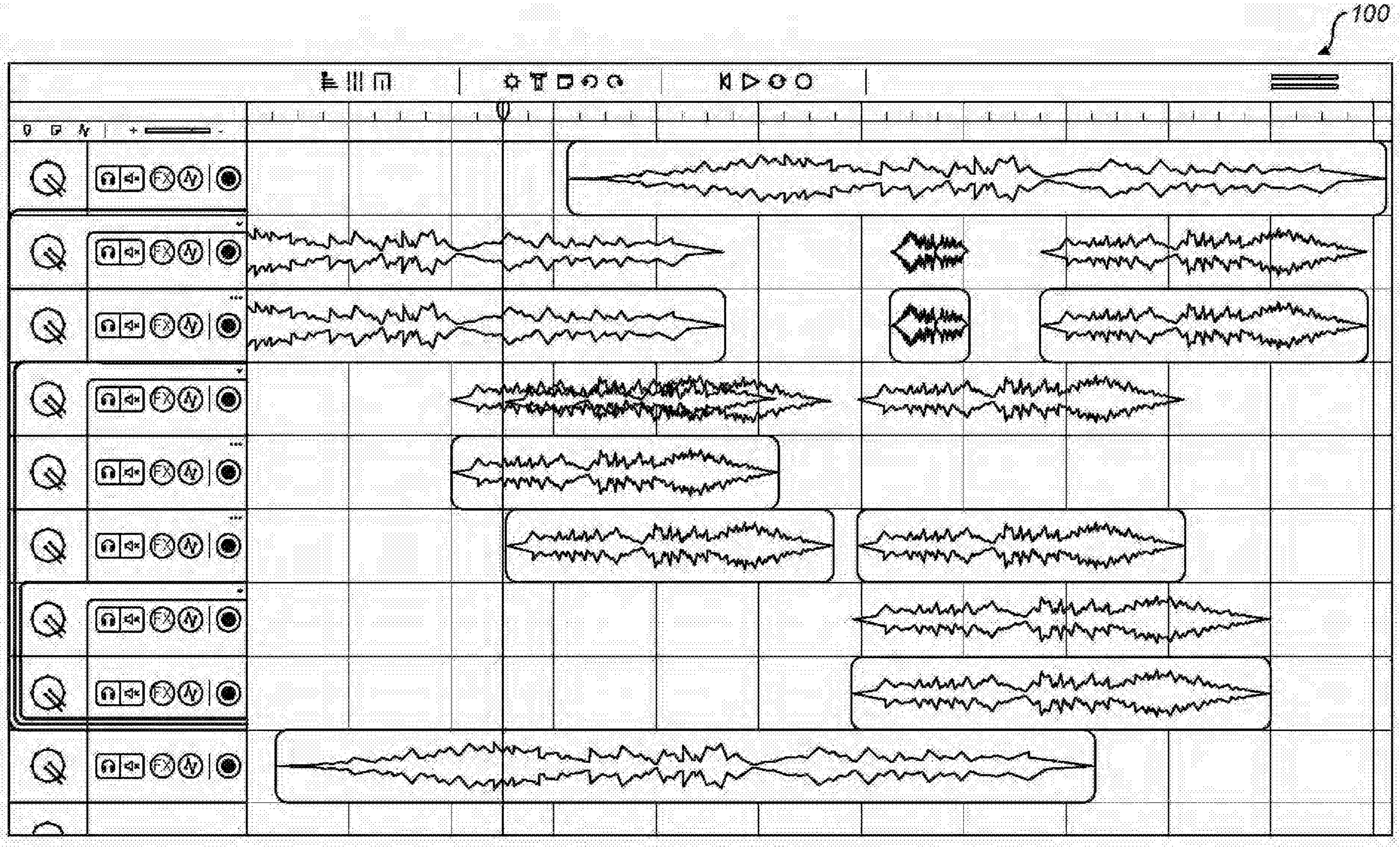


FIG. 1

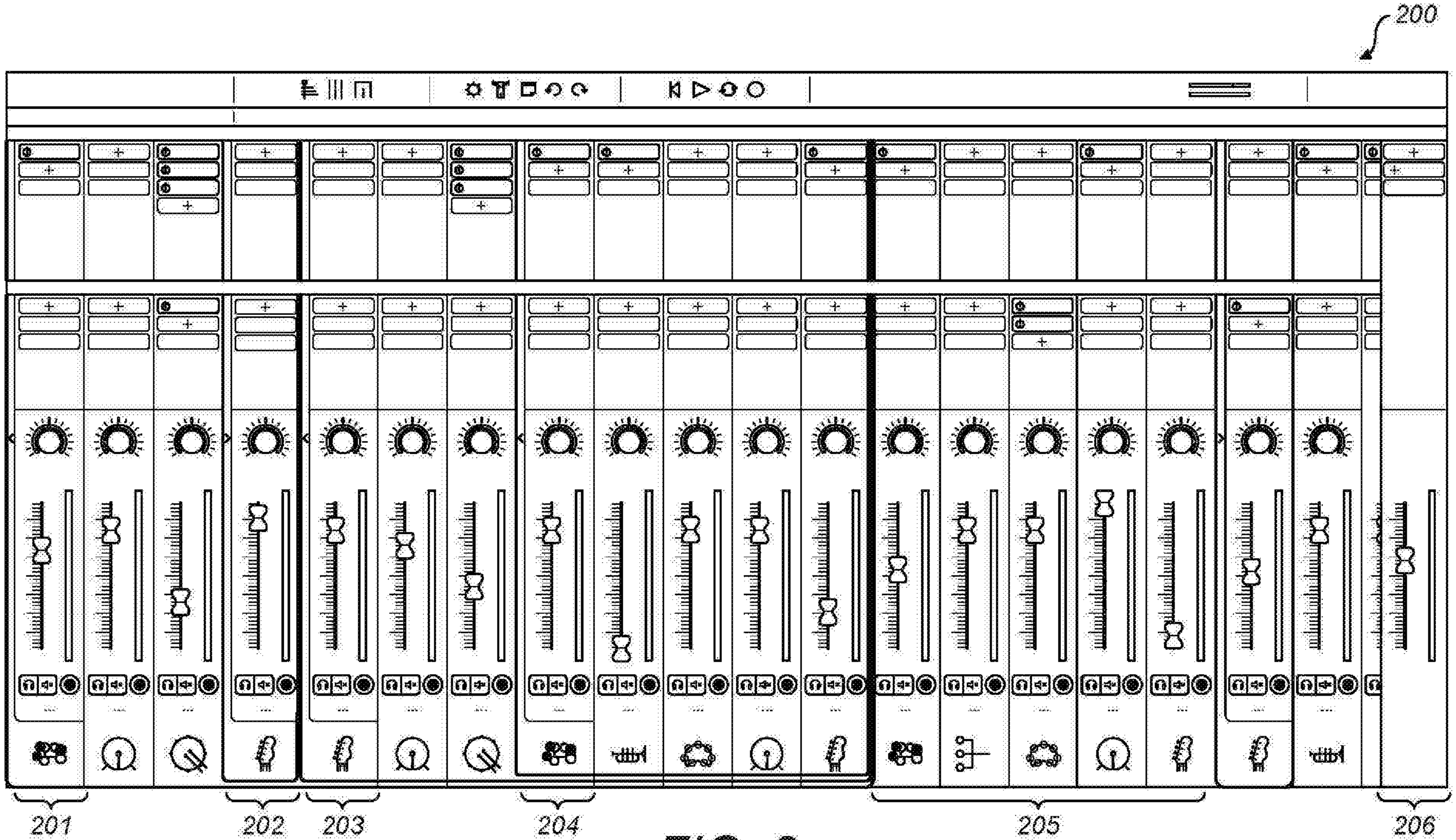


FIG. 2

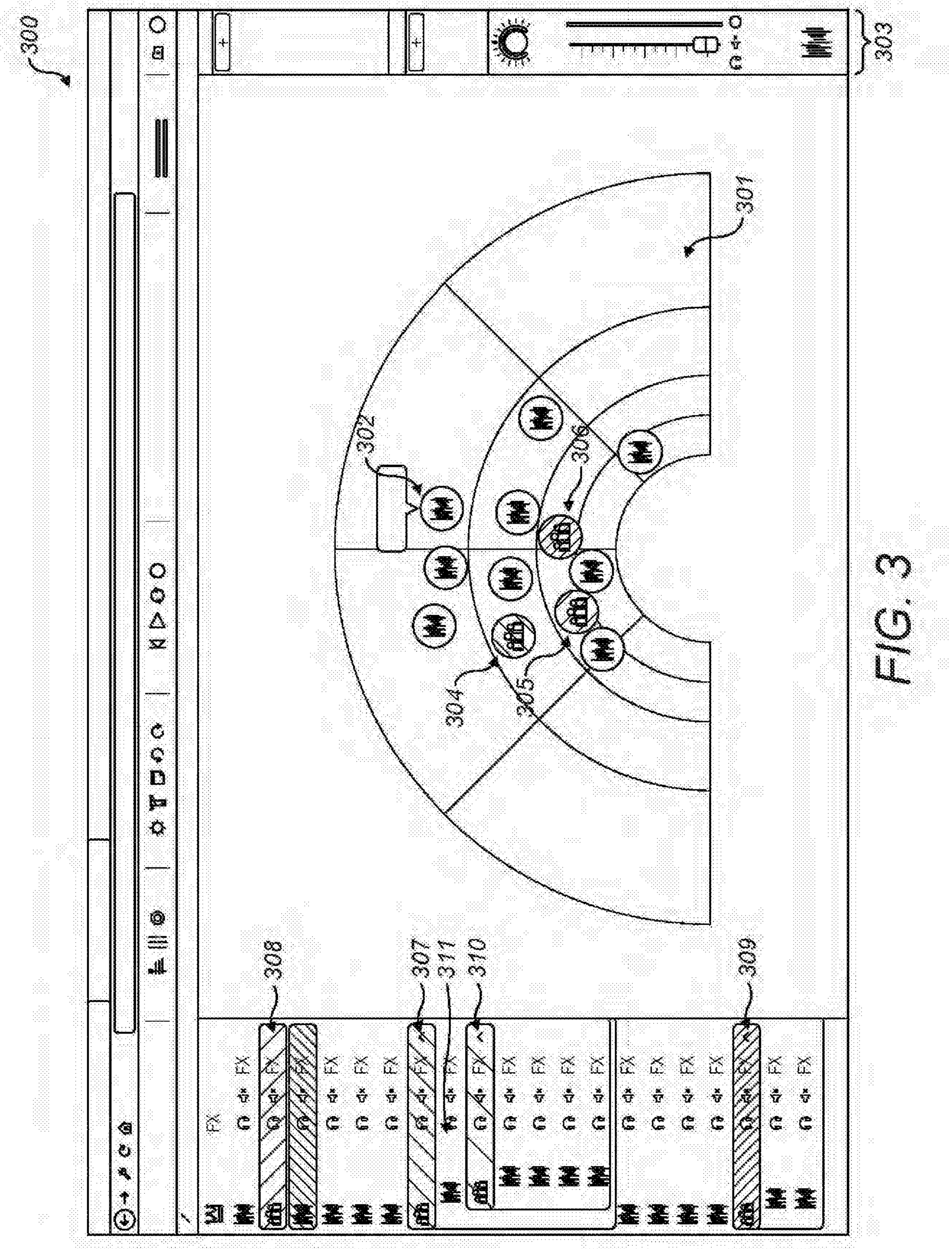


FIG. 3

11 01 21

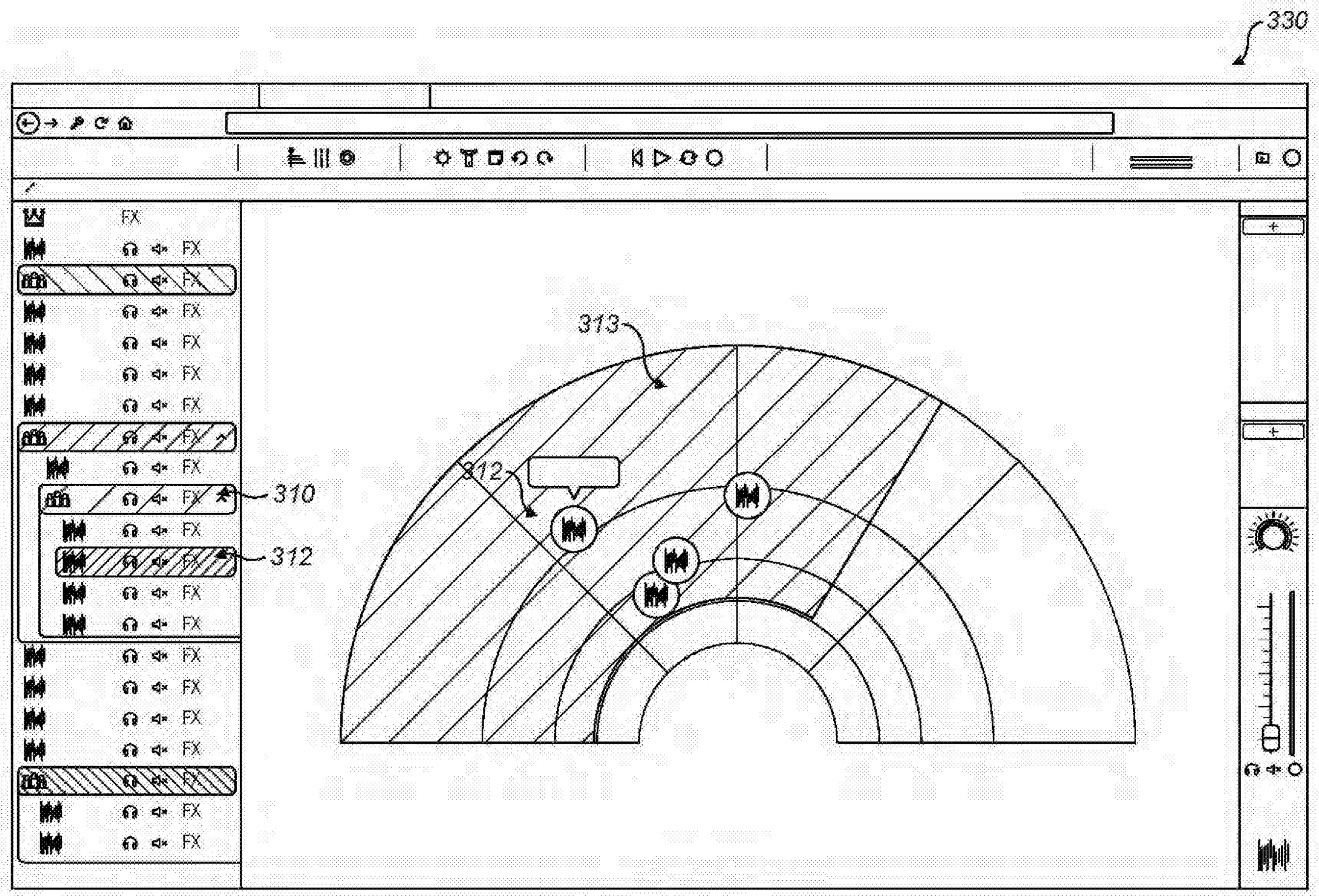


FIG. 4

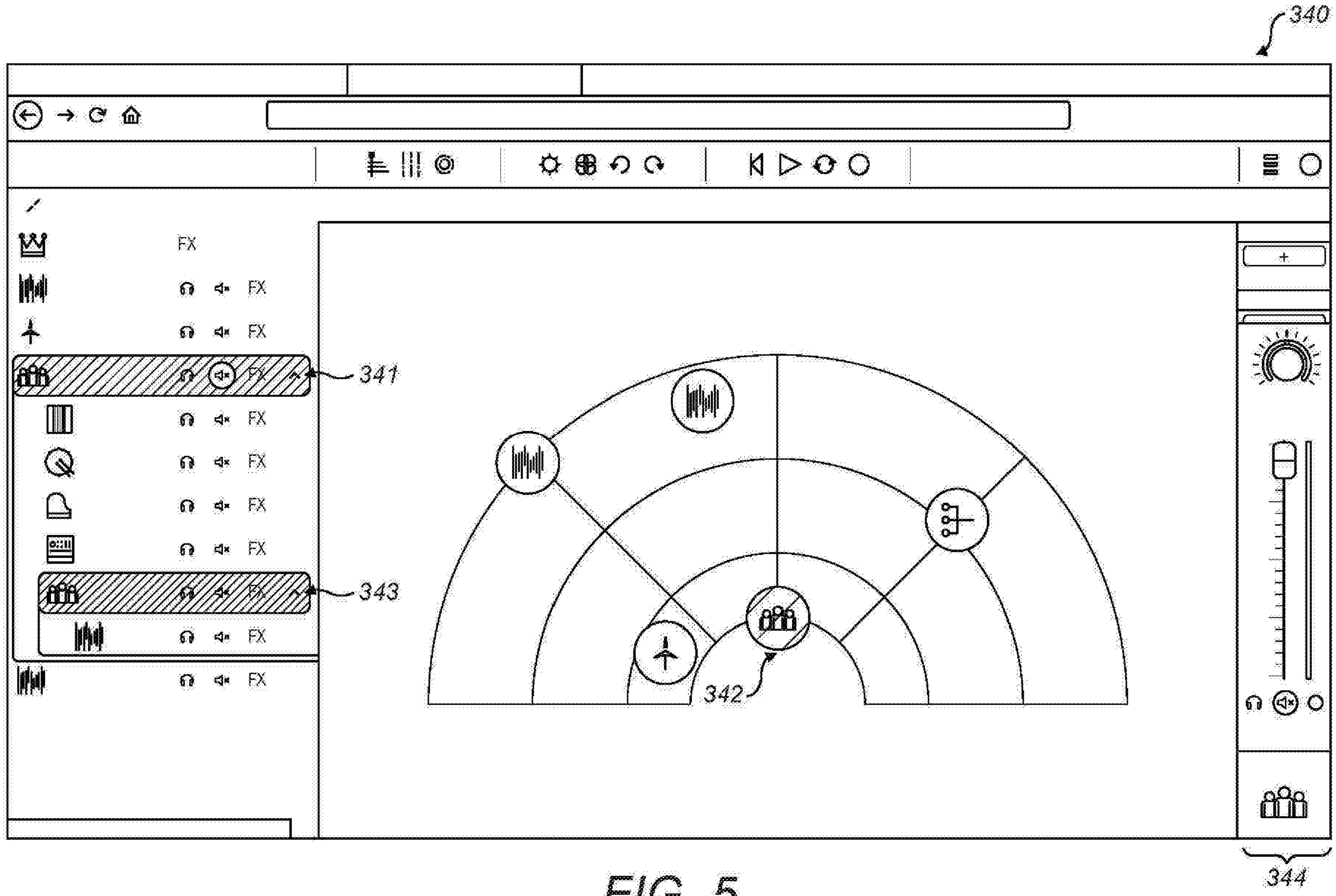


FIG. 5

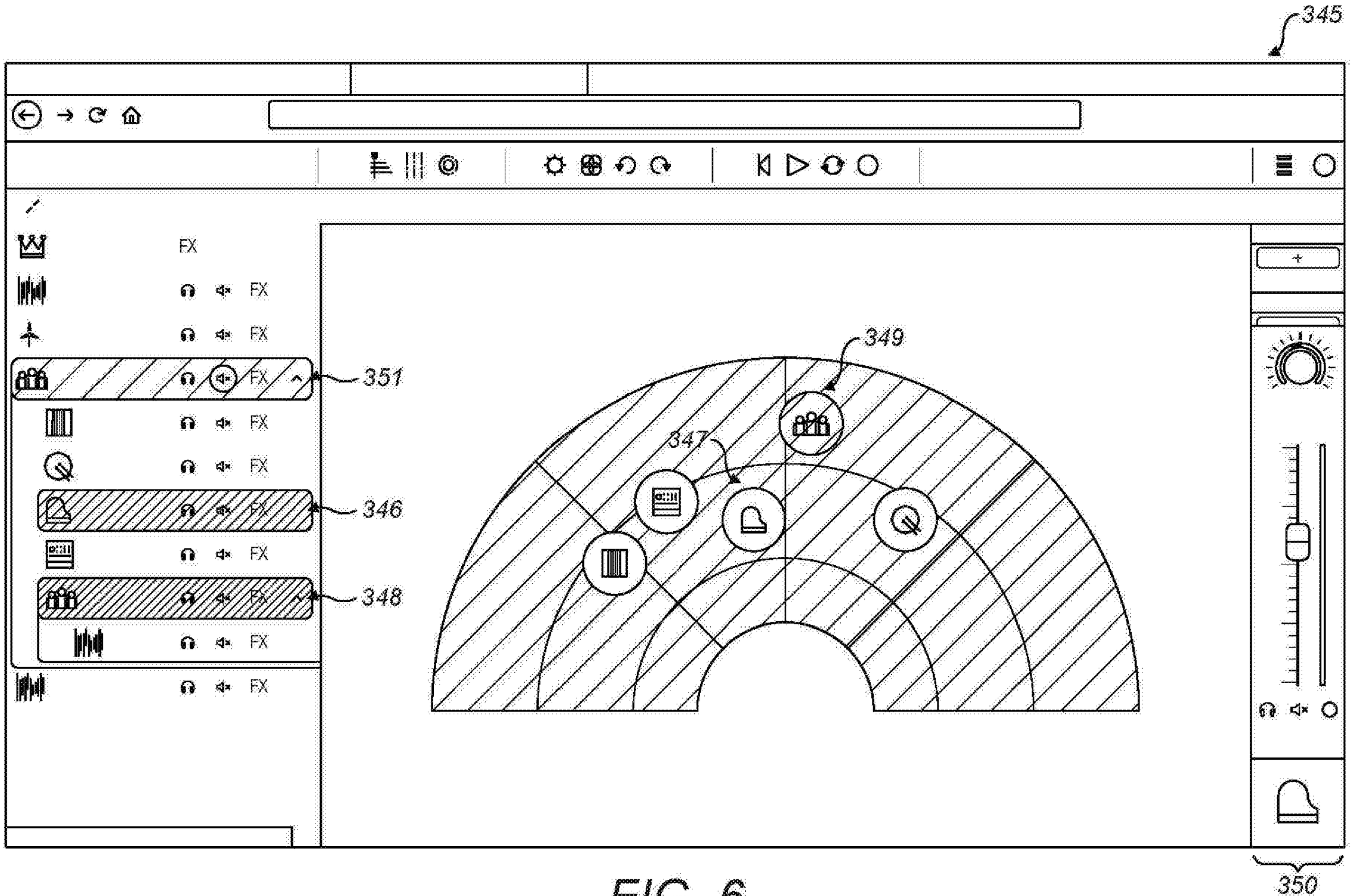


FIG. 6

FIG. 7a

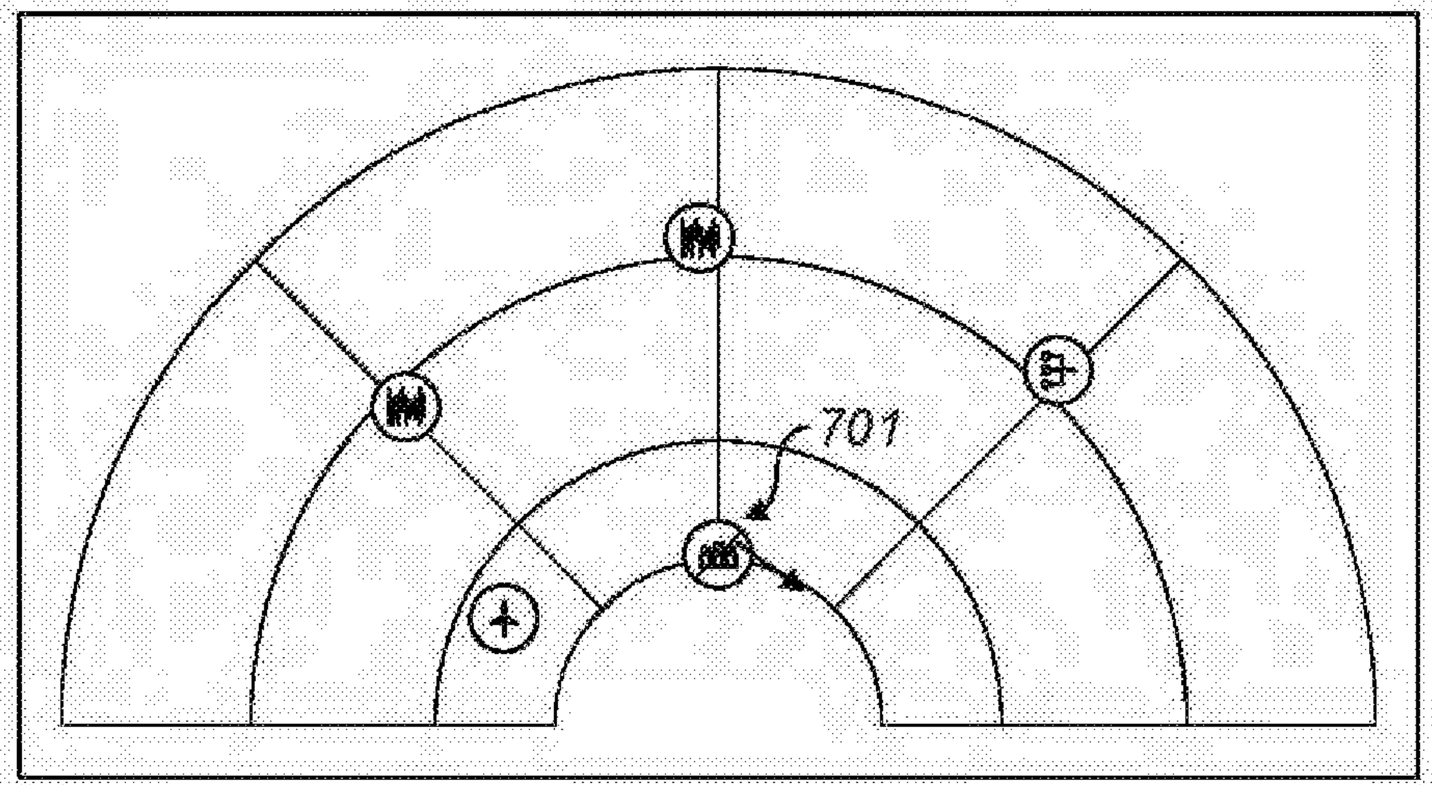
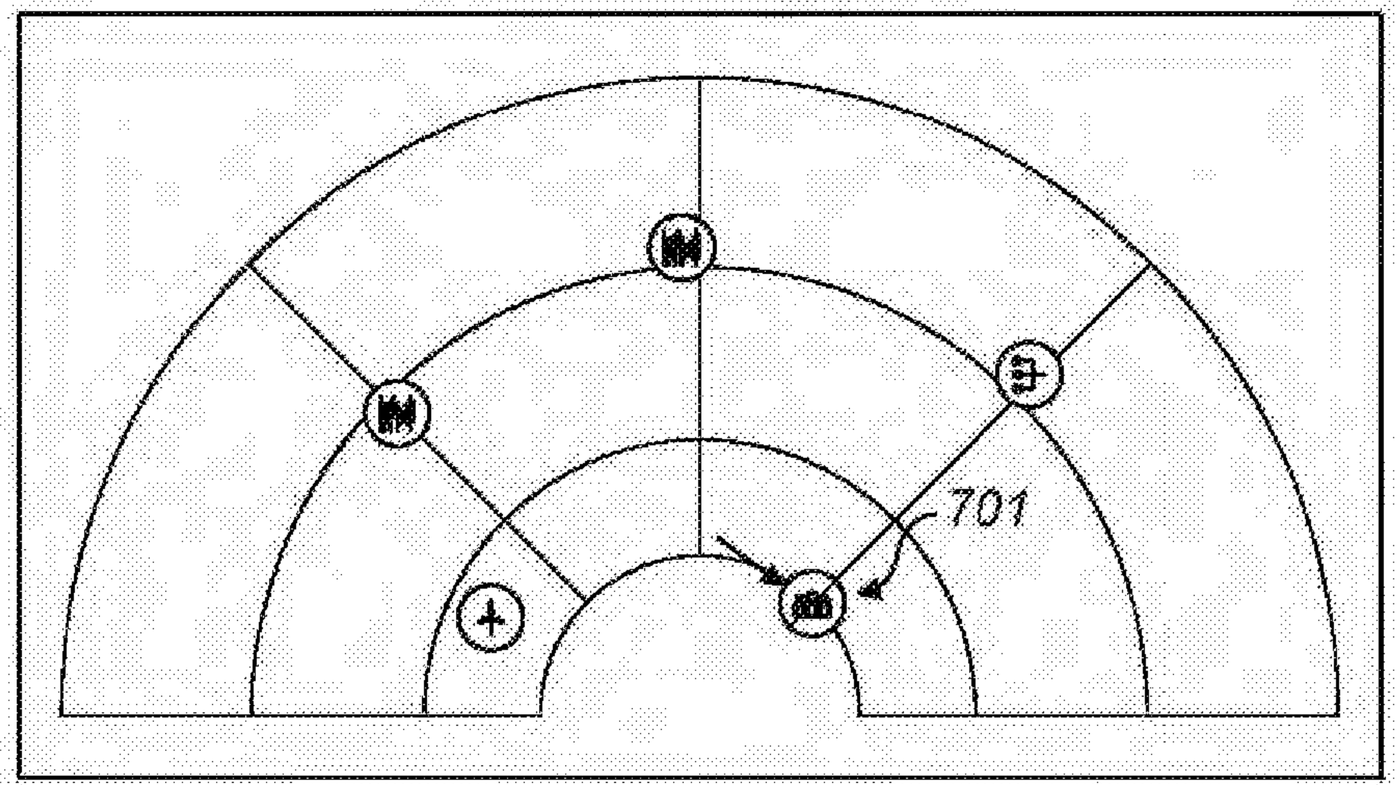


FIG. 7c



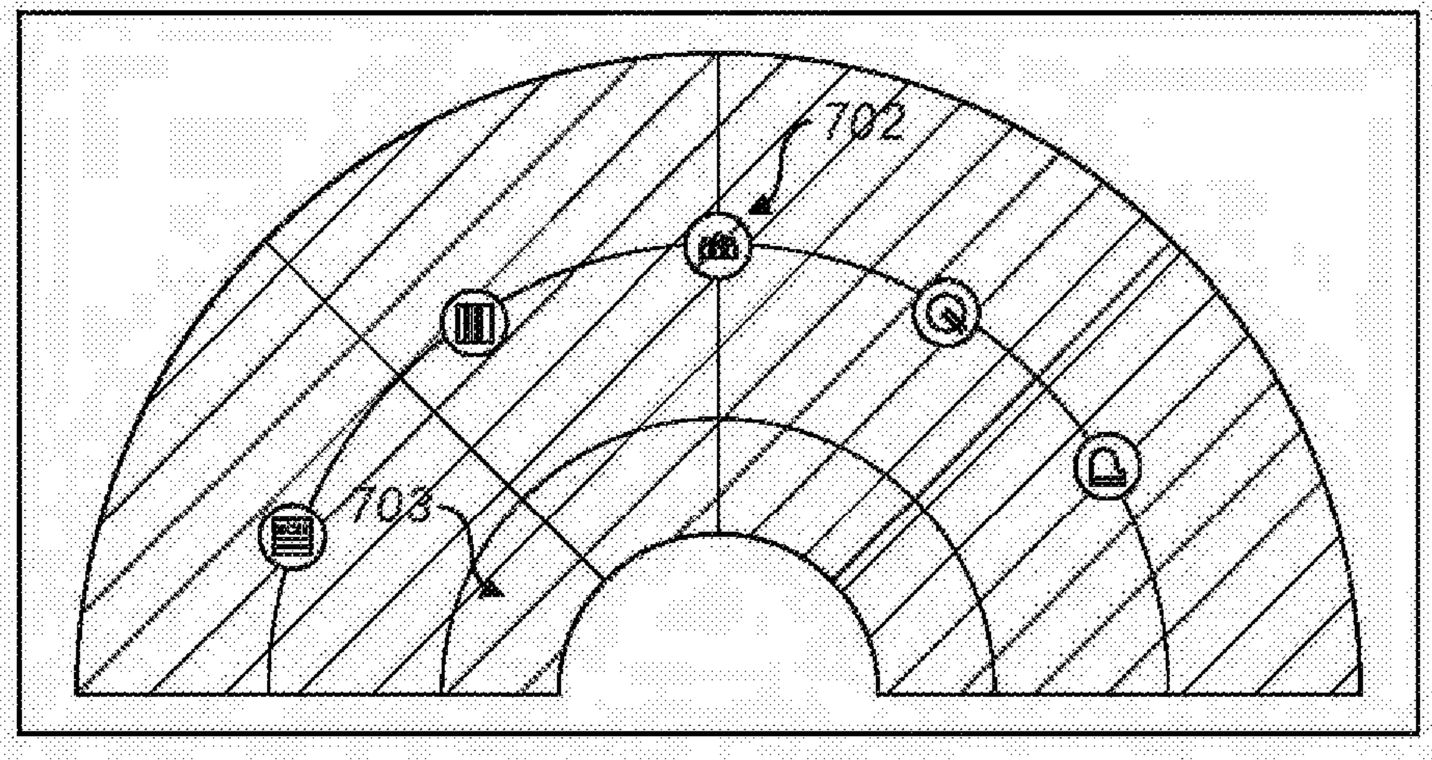


FIG. 7b

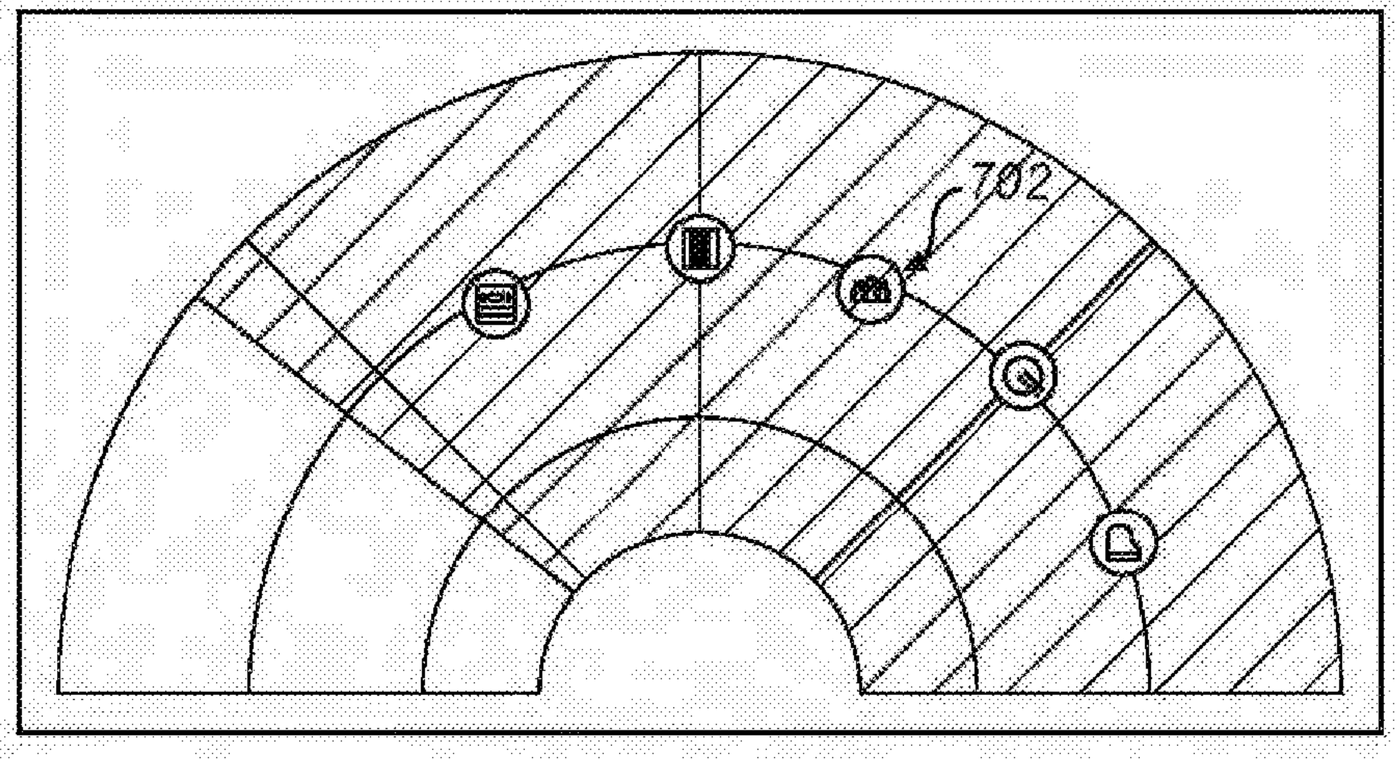


FIG. 7d

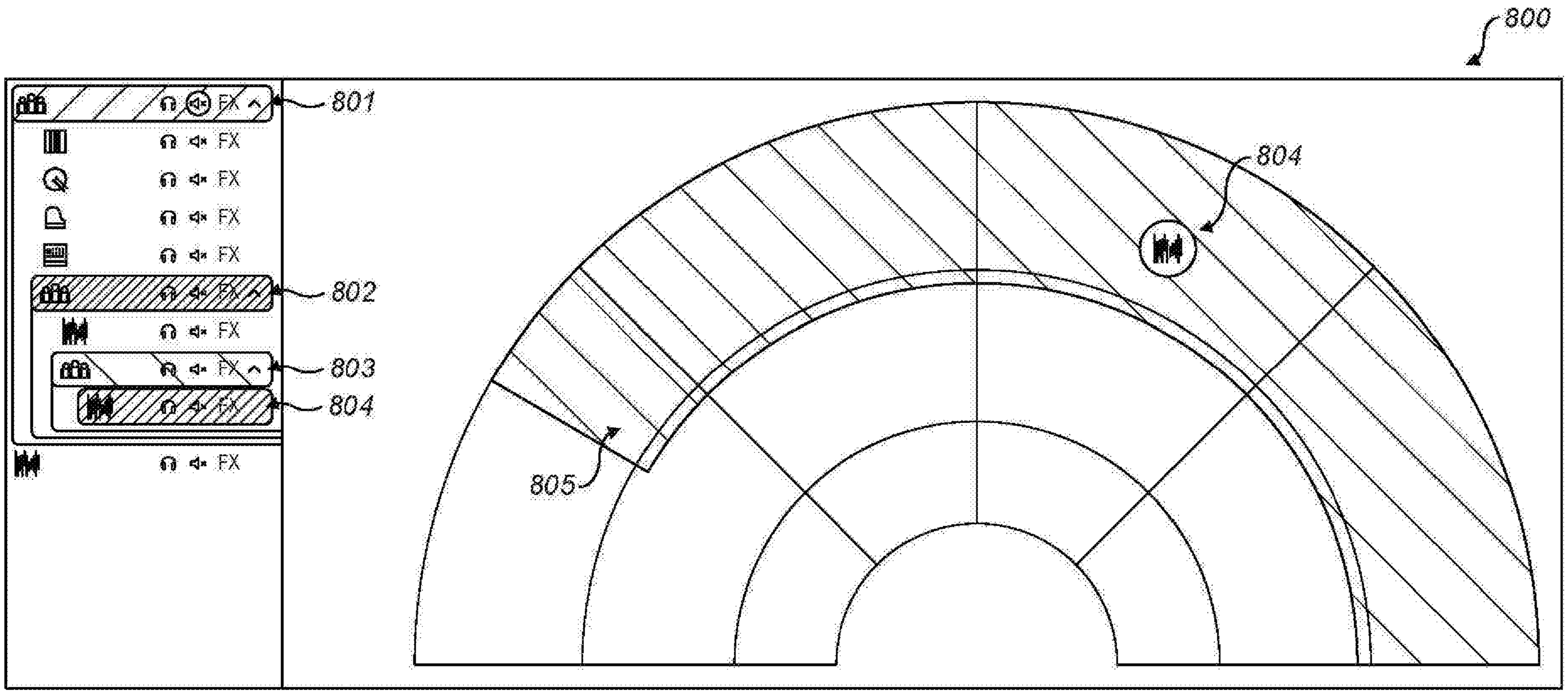


FIG. 8

Digital Audio Workstation

Technical field of the invention

The present invention relates to a digital audio workstation for the intelligent processing of audio data, and, more specifically, a digital audio workstation having enhanced session organisation features.

Background to the invention

There are many digital tools available for audio manipulation, ranging from audio effects processors, synthesizers, and mixers. A comprehensive collection of such tools is often referred to as a Digital Audio Workstation (DAW). Different DAWs are often specifically aimed at users of different production experience and/or intended for use for specific types of projects. Existing DAWs include GarageBand (Apple Inc., US), Live (Ableton Inc., Germany), and Protools (Avid Technology, US).

Many DAWs are aimed at the experienced user with extensive audio processing skills and experience. The increased interest in independent, individual audio data generation and production, often referred to as the democratisation of audio processing, such as podcasts and music, has highlighted the need for DAWs which are accessible to such users and which are easy to use. There have been many studies and academic research on the visualization of audio parameters which facilitate ease of use. In particular, it has previously been identified that a 'stage view' of tracks, in which tracks are presented to a user as user interface objects in a stage-like space provide an intuitive way of visualising such tracks. This is discussed in the paper '*Comparing Stage Metaphor Interfaces as a Controller for Stereo Position and Level*' (Brecht De Man, Nicholas Jillings and Ryan Stables, Proceedings of the 4th Workshop of Intelligent Music Productions, Huddersfield, UK, 14 September 2018). Currently available stage view controllers include Line 6 StageScape, and, as a plugin, iZotope Visual Mixer. However, the stage view controllers of existing DAWs do not facilitate effective session management for complex mixing arrangements.

Grouping and sub-grouping audio tracks is a known technique to efficiently process audio tracks that are similar, such as those which relate to similar instruments. By grouping tracks together into groups, an audio engineer can (for example) apply a processing effect to a group which is propagated to the individual tracks in the group. The process of routing audio channels to groups per se can be automated by intelligent audio processing tools. A routing methodology which utilises semantic labels is described in the paper '*Automatic Channel Routing Using Musical Instrument Linked Data*' (Nicholas Jillings and Ryan Stables, Proceedings of the 3rd Workshop on Intelligent Music Productions, Salford, UK, 15th September 2017). However, existing DAWs do not facilitate the visualisation (and manipulation) of a hierarchical grouping structure in an effective way.

It is an aim of the present invention to address, or at least mitigate, deficiencies of the prior art by provision of a DAW interface which facilitates effective session organisation in a hierarchical grouping structure via a stage view interface.

Summary of the invention

According to a first aspect of the invention, there is provided a system for adjusting one or more parameters of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the system comprising: a server and a user application in communication with the server, wherein the user application comprises a user interface, wherein the user application is configured to display, in a stage view of the user interface, one or more group track user interface objects, wherein each group track user interface object represents a group track; means for receiving user input, via the user interface, to adjust the first spatial position value and/or a volume value of the group track to a second spatial position value and/or a volume value of the group track, wherein the user application is configured to calculate a second spatial position value and/or volume value of each of the one or more audio tracks based on the second spatial position and/or volume of the group track, and to display, on the stage view user interface, audio track user interface objects, wherein each audio track user interface object represents an audio track, wherein the position of each of the audio track user interface objects in the stage of the stage view user interface represents the second spatial position value and/or volume value of the track. Preferably, the user application is a digital audio workstation.

According to a second aspect of the invention, there is provided A method of adjusting one or more parameters of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the plurality of audio tracks has a first spatial position value and a volume value, displaying, in a stage view user interface of a digital audio workstation, a group track user interface object, wherein the group track user interface object represents a group track, receiving, via the user interface, a user input to adjust the first spatial position and/or volume of the group track to a second spatial position and/or volume of the group track, calculating, by the digital audio workstation, a second spatial position and/or volume of each of the one or more audio tracks based on the second spatial position and/or volume of the group track, outputting, to the stage view user interface, audio track user interface objects, wherein the position of each of the one or more audio track user interface objects in the stage of the stage view user interface represents the second spatial position and/or volume of the one or more audio tracks.

According to a third aspect of the invention, there is provided A method of adjusting one or more parameters of a group track, wherein the group track comprises one or more audio tracks, comprising receiving user input instructions to specify adjustment of the one or more parameters of the group track over a time period; adjusting, by a user application, the one or more parameters of the group track according to the instructions; displaying, in a stage view of a user interface, one or more track user interface objects, wherein each user interface object represents each of the one or more audio tracks, wherein the positions of each of the one or more audio user interface objects changes in real time during playback according to the input instructions.

According to a fourth aspect of the invention, there is provided A system for adjusting one or more parameters of a group of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the system comprising: a user application, wherein the user application is a digital audio workstation comprising a user interface, wherein the user application is configured to display, in a stage view of the user interface, one or more audio track user interface objects, wherein each audio track user interface object represents an audio track, and a highlighted stage segment having a boundary, wherein the boundary of the highlighted stage segment represents maximum and minimum values of the spatial position and volume of a group track, means for receiving user input, via the user interface, to adjust the boundary, wherein the user application is configured to calculate a second spatial position and/or volume value of the group track based on the adjustment of the boundary, and output, to the stage view user interface, a group track user interface object, wherein the group track user interface object represents a group track and wherein the position of the group track user interface object on the stage of the stage view user interface represents the second spatial position and/or volume value of the group track.

According to a fifth embodiment of the invention, there is provided a system for adjusting one or more parameters of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the system comprising: a user application, wherein the user application is a digital audio workstation comprising a user interface, wherein the user application is configured to display, in a stage view of the user interface, one or more group track user interface objects, wherein each group track user interface object represents a group track; means for receiving user input, via the user interface, to adjust the first spatial position value and/or a volume value of the group track to a second spatial position value and/or a volume value of the group track, wherein the user application is configured to calculate a second spatial position value

and/or volume value of each of the one or more audio tracks based on the second spatial position and/or volume of the group track, and to display, on the stage view user interface, audio track user interface objects, wherein each audio track user interface object represents an audio track, wherein the position of each of the audio track user interface objects in the stage of the stage view user interface represents the second spatial position value and/or volume value of the track. Preferably, the digital audio workstation is a user application programmed in the system.

Further preferable features are defined in the appended dependent claims.

Brief description of the figures

Embodiments of the invention will be described with reference to the figures in which:

Figure 1 is a screenshot of an exemplary timeline view showing hierarchical track groupings in a DAW according to an embodiment;

Figure 2 is a screenshot of an exemplary mixer view showing hierarchical track groupings in a DAW according to an embodiment;

Figure 3 is a screenshot of an exemplary stage view showing hierarchical track groupings in a DAW according to an embodiment;

Figure 4 is a screenshot of an exemplary stage view showing tracks in a stage segment in a DAW according to an embodiment;

Figure 5 is a is a screenshot of an exemplary stage view showing tracks and a group track in a stage segment in a DAW according to an embodiment;

Figure 6 is a is a screenshot of an exemplary stage view showing tracks of a group in a stage segment in a DAW according to an embodiment;

Figure 7 is a is a diagram showing the effect of altering a group's stereo position in a stage view of a DAW according to an embodiment;

Figure 8 is a is a screenshot of an exemplary stage view showing groups and sub-groups in a stage segment in a DAW according to an embodiment;

Detailed description

A digital audio workstation ('DAW') according to an embodiment of the invention having specific session management features will be described. The DAW according to a preferred embodiment of the invention is a web-based tool; i.e. it is hosted by a server and accessible to a user via a browser.

However, it may alternatively be a stand-alone user application which can be run on any suitable hardware. Each user may be required to have registered as a user of the platform to enable secure access to the DAW and may be required to purchase access to specific features. Means for registration and the purchase of all or some features are known in the art.

The DAW of the present invention comprises a set of tools which allow a user to generate audio mixes using recorded and synthesised audio. The audio is generally processed client-side, rather than server-side, via the user's browser, a desktop application or mobile application. Although most processing is done at the client, some specific tasks are done at the server, in which case one or more APIs running in the browser or application allow for client-server communication.

Once logged in to the DAW, a user can upload an audio file for processing. Audio files, whether processed, partially processed or unprocessed, can be stored at the server and accessed and downloaded by a user when requested. Using the DAW's interface, the user essentially instructs changes to the audio to be made (which may be made at the client or at the server). The changes are then returned to the client and, upon the user's confirmation to maintain the changes, the audio is updated to reflect the changes.

An audio mix generally comprises a number of audio tracks. The DAW of the present invention comprises a number of functions which allow for complex audio arrangements to be manipulated more efficiently. One such function is the automatic grouping of similar tracks in the audio. A track is a single audio channel, and is often, for complex musical arrangement, a recording of a single instrument in a multi-instrumental arrangement. There may be multiple tracks in the audio which are similar in some way and can be grouped together based on the similarly. A group may be 'strings', 'percussion', 'vocals' etc. Groups are represented in the DAW as tracks that take other tracks (or sub-groups) as inputs, and output to other groups or the master channel. A group track, sub-group track or sub-sub-group track (hereinafter referred to generally as a group track) is a collection of tracks that have been sub-mixed into a single track. For example, a group track (which may be referred to as a 'grandparent' track) may comprise one or more sub-group ('parent') tracks which in turn comprise one or more individual ('child') tracks. The 'master' track is the root-level track, representing the complete mix of all groups, sub-groups and non-grouped tracks. Whilst it is not common, it is possible to have a high number of nested groups, however this is often limited due to UI constraints.

Various methods for automatically grouping tracks are known in the art. In the DAW described herein, grouping is based on a semantic analysis of metadata of instrument tags and is discussed in further details in the paper '*Automatic Channel Routing Using Musical Instrument Linked Data*' by Nicholas

Jillings and Ryan Stables (as mentioned above), the contents of which are incorporated herein by reference where permitted.

In the DAW of the present invention, a user is able to manipulate the audio tracks via three main 'views' or interface arrangements; timeline (Figure 1), mixer (Figure 2) and stage (Figure 3). In an embodiment of the invention, the DAW allows a user to switch between these three views at any point. As the audio is processed via a particular view, the other views are automatically updated to reflect the changes such that the user can seamlessly switch between different views and each one will reflect the current state of audio processing.

The timeline view 100 of Figure 1 allows for the visualisation of progression of a mix over time, as is known in the art. Figure 1 shows a collection of tracks stacked vertically. The tracks are grouped in a hierarchical structure; group track (blue) (comprising a single track) comprises sub-group (orange), (comprising two tracks) which comprises sub-sub-group (pink) (comprising a single track). In the timeline and mixer views, groups are shown as collapsible tracks, whereby individual tracks are indented (and coloured the same as the group to which they belong).

Figure 2 shows mixer view 200. The mixer view represents the tracks analogously to a mixing desk. A plurality of tracks are arranged in a group, sub-group and sub-sub-group hierarchical structure. Group 201 comprises two individual tracks as well as sub-groups 202 and 203. Sub-group 203 comprises sub-sub-group 204. The audio mix also includes individual tracks 205. Parameters of the master track can be manipulated using channel strip 206.

In the stage view 300 (shown generally at Figure 3), each individual track, sub-group or group is represented as a user interface object on a representation of a stage. The user interface objects include an icon representative of the instrument or feature to which they relate. The objects can be moved around on 2-dimensional stage 301 under user control. Group, sub-group and sub-sub-group track objects are shaded to distinguish them from individual tracks. The colour of the shaded group objects is the same as the colour of the outline of each track within the group. The colours are persistent across all views and provide a quick way to identify the tracks.

The bottom-centre position of the stage represents the position of a nominal listener. The volume of a track can be adjusted by moving the track object relative to the listener position; the closer the track icon is to the listener position, the higher the volume. The stereo position (pan) of the track is altered by rotating the track icon about the listening position and is calculated by cartesian to polar mapping based on the pseudo-position of the track on a rectangular stage. Users are able to modify parameters of the groups and the parameters of the individual tracks within the same user interface. Throughout

this disclosure, ‘stereo position’ is synonymous with ‘spatial position’ and infers no limitation on the number of output channels.

The hierarchical arrangement of tracks and sub-groups is shown in a track-list region on the left side of the user interface and shows a list of all available tracks and groups, arranged in a hierarchical tree structure. Multiple tracks or groups can be selected in this region and the corresponding objects will be highlighted in the stage view (and vice versa). The stage view for a group can also be entered here by double-clicking a group object. If a track inside a group is selected, the contents of the group (the ‘track view’) will be shown on the stage, with the selected track object highlighted (as per track 302). The colour of the stage segment in a group view represents the colour of the parent group track (as per segment 313 of Figure 4). The track view can also be invoked by double clicking the group object. If a group is selected, the corresponding group object, and other tracks or objects at the same hierarchical level (which may, at the highest level, be the master track), will be shown (the ‘group view’). Shaded objects 304, 305 and 306 correspond to groups 307, 308 and 309 respectively. Group 310, shown in the track-list region, is a sub-group of group 307. Because the current view of the stage objects is the group view (in this case, the master view), there is no object on the stage which represents group 310. If group 310 were selected, or group 307 were double-clicked, an object representing group 310 would be shown on the stage, along with another object representing track 311 in the track view.

In some embodiments, a ‘tooltip’ menu is displayed above a track or group user interface object is selected. The tooltip menu is a user interface object which displays the volume and pan values for the selected track or group, and allows a user, to toggle on/off any automation settings that have been applied to volume or pan (as discussed further below).

Channel strip 303 is positioned on the right of the stage view interface and mimics a channel strip of the mixer view. Channel strip 303 corresponds to the track, group or sub-group that is currently selected (i.e. the strip changes to show the parameters of the selected object). The parameters of strip 303 change in real time when the corresponding track or group object on stage 301 is moved, and similarly the parameters of the track can be manipulated via channel strip 303 which causes the corresponding track or group object to move on stage 301 as necessary.

Figure 4 shows a group view 330 for group 310. Objects corresponding to the four individual tracks present in group 310 are shown on the stage. Shaded stage segment 313 denotes the extent to which the volume and pan of the individual tracks can be altered, as limited by the parameters of group track 310, as will be explained further below. Track 312 is highlighted in the track-list region and therefore the corresponding object is also highlighted on the stage.

The stage view 340 of Figure 5 is a further example of a hierarchical grouping structure. Group 341 is highlighted in the track-list region and its corresponding object 342 is also highlighted on the stage. Because group 341, a top-level group, is selected, the other objects on the stage represent the other groups and track in the master track. Channel strip 344 corresponds to the selected group track, i.e. group 341.

Figure 6 illustrates the effect of selecting a track or sub-group within a group. In the stage view 345 of Figure 6, track 346 is highlighted in the track-list region and the corresponding object 347 is highlighted on the stage. Shaded group object 349 is also shown on the stage, corresponding to sub-group 348. Since group 346 is selected, its parameters are represented in channel strip 350. The stage is shaded in the colour of group track 351 to denote that modification of the group 351 will affect the individual tracks in the group. This is discussed in more detail below with reference to Figure 7.

The position of the individual tracks or sub-group tracks are normalised to the stereo position and volume of the group track. The pan or volume of the individual track or sub-group track *(output_value)* is determined by:

$$output\_value = ((input\_value - t_{min}) * (p_{max}-p_{min})) \ / (t_{max}-t_{min})) + p_{min} \qquad \textbf{(1)}$$

where

input value is the starting value of pan or volume of the individual or sub-group track;

t_{min} and t_{max} are the minimum and maximum values of the individual track or sub-group track (this is -1 and +1 for pan, or -200dB and 10dB for volume), and

p_{min} and p_{max} are the minimum and maximum value of pan or volume of the group track.

The mapping to polar coordinates to determine the location on the stage to display the individual track or sub-group track having *output_value* will be accessible to those skilled in the art.

Accordingly, adjusting a parameter of a group track causes the values of p_{min} and/or p_{max} to change, which changes the output value (and therefore the position on the stage) of the individual or sub-group tracks, as well as the shaded/highlighted stage segment (discussed further with reference to Figures 7a-7d). The highlighted stage segment represents the limits/bounds of parameters of individual tracks or sub-groups due to parameters of the group track because the boundaries of the highlighted stage segment denote the maximum and minimum volume and the maximum and minimum pan of the group. Whilst a group track has specific values of volume and pan, the extent to which the group volume and pan can be adjusted is, in turn, set by the volume and pan of the group above it (which may be the master track).

Changing the position of individual tracks or sub-group tracks to beyond the boundary of the shaded stage segment, or dragging a boundary of the shaded stage segment to make the segment larger or smaller, causes the group object to move, since p_{min} and/or p_{max} have been adjusted.

Figures 7a-7d illustrate group-to-track interaction and the effect that adjustment of the group track has on the parameters of the tracks and sub-groups. Figures 7a and 7c are 'group views' and Figures 7b and 7d are 'track views'. Figures 7b and 7d show the individual tracks and sub-group 702 present in group 701 of Figures 7a and 7c. Figures 7c and 7d show the effect of adjusting the stereo position of group 701. In Figure 7c, the pan of group 701 to adjusted to the right (the volume remains the same). Figure 7d shows the effect of this on the contents of group 701; the pan position of each of the tracks and sub-group 702 has been shifted to the right to reflect the normalisation to group 701, and the boundaries of the highlighted stage segment has also been adjusted to reflect that p_{min} has changed. The volume and pan of the tracks represented by the objects of Figure 7d are now limited to values specified by the boundary of the highlighted stage segment.

Adjustment of parameters of individual tracks and sub-groups can, however, affect parameters of a group (track-to-group interaction). The volume or pan position of a group object (and consequently its parameters) can be adjusted from within the track view (i.e. the segmented stage view) by dragging one or more edges of the stage segment (i.e. dragging left or right about the listener position to affect pan or dragging the lower edge of the stage segment to increase or decrease the volume). Altering the limits of the stage segment in this way alters the values of p_{min} and/or p_{max} of the group track. The individual and sub-group track objects can also be dragged beyond the edge of the stage segment, which indirectly drags the boundary of the segment. When one or more parameters of the individual and sub-group tracks reach their maximum value, the corresponding parameter of the group track increases until it reaches the limit set by the group it belongs to (which may be the master track). This is discussed further with reference to Figure 8.

Adjustment of group track volume affects the volume of the individual and sub-group tracks within the group, and vice versa. For example, altering the volume of the master track (which can, in some embodiments, be achieved via a slider UI object in the upper area of the user interface), affects the volume of groups within the master track, according to (1). As the master volume is adjusted, the stage view UI adapts to reflect the total available gain. As a further example, if the volume of a group track is adjusted, the volume of the individual tracks and sub-group tracks within the group will be adjusted, and so the positions of the track and sub-group objects on the stage (in the track view/segmented stage view) will change, as well as the boundary of the highlighted stage segment. Conversely, adjusting the volume of the individual or sub-group tracks within a group, either by dragging the

volume boundary of the highlighted stage segment, or dragging the individual track/sub-group track objects past the boundary (which causes the boundary of the stage segment to change), p_{min}/p_{max} of the group track, and the position of the group object in group view, will change accordingly.

Figure 8 shows a stage view interface 800 in which a three-level grouping structure has group 801 which includes sub-group 802 which in turn includes sub-sub-group 803. Track 804 of sub-sub-group 803 is selected and therefore the individual track view/segmented stage view is displayed. Highlighted stage segment 805 denotes the limits of pan and volume that can be applied to track 804 based on the pan and volume of group tracks 802 and 801. The effect of the volume, at each level, is cumulative, in that each stage segment represents the cumulative effect of the volume. For example, if a track is in a sub-sub-group having two higher level groups, and a 2dB volume reduction is applied to each higher level group, the volume boundary (i.e. the lower curved edge) of the stage segment for the track will reflect a 4dB reduction. In Figure 8, the volume limits shown on the stage are +10dB and -∞dB. The lower curved boundary of the highlighted stage segment, however, is somewhere between the two as volume reduction has been applied to higher-level groups (ie. p_{max} has been adjusted for those groups). In a preferred embodiment, it is possible to increase volume by 12dB at each level, such that, for a three level group hierarchy, the outline of the stage, for each level, will represent a volume limit of 12dB. So, for a sub-sub-group track, whilst the volume limit on the stage outline will read +12dB (or +10dB in the case of Figure 8), (since +12dB is the maximum variation in volume for that track), the cumulative effect of maximum volume of the sub-group and group means that the maximum volume of the track is in effect +36dB. There is no cumulative effect of pan adjustment.

The DAW of the present invention allows for the automation of adjustment in pan and volume over the course of audio playback. To apply an automation feature, a user, in timeline view, is able to select either pan or volume automation and 'draw' in the timeline the adjustment to be made to pan or volume, applied to a track or a group track, over time. When the track is played back in stage view, the user interface object representing the automated-adjusted track will move around the stage in accordance with the automation, as set by the user.

Claims

1. A system for adjusting one or more parameters of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the system comprising:

a digital audio workstation comprising a user interface, wherein the digital audio workstation is configured to display, in a stage view of the user interface, one or more group track user interface objects, wherein each group track user interface object represents a group track;

means for receiving user input, via the user interface, to adjust the first spatial position value and/or a volume value of the group track to a second spatial position value and/or a volume value of the group track,

wherein the digital audio workstation is configured to calculate a second spatial position value and/or volume value of each of the one or more audio tracks based on the second spatial position and/or volume of the group track, and to display, on the stage view user interface, audio track user interface objects, wherein each audio track user interface object represents an audio track, wherein the position of each of the audio track user interface objects in the stage of the stage view user interface represents the second spatial position value and/or volume value of the track.

2. The system of claim 1, wherein the digital audio workstation is further arranged to display, in the stage view user interface, a channel strip, wherein the channel strip is arranged to display the second spatial position and/or volume value of the group.

3. A method of adjusting one or more parameters of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the plurality of audio tracks has a first spatial position value and a volume value,

displaying, in a stage view user interface of a digital audio workstation, a group track user interface object, wherein the group track user interface object represents a group track,

receiving, via the user interface, a user input to adjust the first spatial position and/or volume of the group track to a second spatial position and/or volume of the group track,

calculating, by the digital audio workstation, a second spatial position and/or volume of each of the one or more audio tracks based on the second spatial position and/or volume of the group track,

outputting, to the stage view user interface, audio track user interface objects, wherein the position of each of the one or more audio track user interface objects in the stage of the stage view user interface represents the second spatial position and/or volume of the one or more audio tracks.

4. The method of claim 3, further comprising

selecting, by a user, an option to view the audio track user interface objects in stage view, and

displaying, in the stage view user interface, the one or more audio tracks, wherein a segment of the stage is highlighted to denote the maximum and minimum spatial position and/or volume of the one or more audio tracks based on the second spatial position and/or volume of the group track.

5. The method of claim 4, further comprising

receiving, via the user interface, a user input to adjust the second spatial position and/or volume of the group track to a third spatial position and/or volume of the group track,

calculating, by the user application, a third spatial position and/or volume of each of the one or more audio tracks based on the third spatial position and/or volume of the group track,

outputting, to the stage view user interface, audio track user interface objects, wherein the position of each of the one or more audio track user interface objects in the stage of the stage view user interface represents the third spatial position and/or volume of the one or more audio tracks and

adjusting the area of the highlighted stage segment to denote the extent to which the volume or spatial position of the one or more audio tracks can be adjusted based on the third spatial position and/or volume of the group track.

6. The method of claim 5, wherein the adjusting is done in real-time.

7. The method of claim 3, further comprising

receiving a user input to adjust the master volume,

calculating an adjusted volume value of the group track based on the adjustment to the master volume,

outputting, to the stage view user interface, a group track user interface object, wherein the position of the group track user interface object on the stage based on the adjustment to

the master volume, wherein the position of the group track user interface object represents the adjusted volume value of the group track.

8. The method of claim 7, further comprising

calculating the minimum and maximum volume of the audio tracks associated with the group track based on the adjusted volume of the group track; and

adjusting the area of the highlighted stage segment to denote the extent to which the volume of the one or more audio tracks can be adjusted based on the adjusted volume of the group track.

9. The method of claim 8, wherein the adjusting is done in real-time.

10. The method of claim 3, wherein the group track is a sub-group of a higher-level group, and wherein the method further comprises

receiving, via the user interface, a user input to adjust a first spatial position and/or volume value of the higher-level group to a second spatial position and/or volume value of the higher-level group,

calculating, by the digital audio workstation, a second spatial position and/or volume value of the group track,

outputting, to the stage view user interface, a group user interface object, wherein the position of the group track user interface object in the stage of the stage view user interface represents the second spatial position and volume of the group tracks.

11. A method of adjusting one or more parameters of a group track, wherein the group track comprises one or more audio tracks, comprising

receiving user input instructions to specify adjustment of the one or more parameters of the group track over a time period;

adjusting, by a user application, the one or more parameters of the group track according to the instructions;

displaying, in a stage view of a user interface, one or more track user interface objects, wherein each user interface object represents each of the one or more audio tracks, wherein the positions of each of the one or more audio user interface objects changes in real time during playback according to the input instructions.

12. The method of claim 11, wherein the one or more audio tracks together comprise a group track, wherein the method further comprises displaying, in a stage view of a user interface, one or more audio track user interface objects corresponding to the one or more audio tracks and a highlighted stage segment, wherein adjustment of parameters of the group track causes the area of the highlighted stage segment to change in real time during play back, wherein the area boundary of the highlighted stage segment represents the spatial position limits and volume limits of the one or more tracks.

13. A system for adjusting one or more parameters of a group of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the system comprising:

a user application, wherein the user application is a digital audio workstation comprising a user interface, wherein the user application is configured to display, in a stage view of the user interface, one or more audio track user interface objects, wherein each audio track user interface object represents an audio track, and a highlighted stage segment having a boundary, wherein the boundary of the highlighted stage segment represents maximum and minimum values of the spatial position and volume of a group track,

means for receiving user input, via the user interface, to adjust the boundary,

wherein the user application is configured to calculate a second spatial position and/or volume value of the group track based on the adjustment of the boundary, and output, to the stage view user interface, a group track user interface object, wherein the group track user interface object represents a group track and wherein the position of the group track user interface object on the stage of the stage view user interface represents the second spatial position and/or volume value of the group track.

14. The system of claim 10, wherein the user application is further configured to calculate second spatial position and/or volume values for each of the one or more audio tracks and output, to the stage view user interface, audio track user interface objects, wherein each audio track user interface object represents each of the one or more audio tracks, wherein the position of each of the audio track user interface objects represents the second spatial position and volume of each of the audio tracks.

15. The system of any of claims 1, 2, 10 and 11, further comprising a server in communication with the user application.

16. A method of adjusting one or more parameters of a group of one or more audio tracks, wherein the one or more audio tracks together comprise a group track having a first spatial position value and a volume value, wherein each of the one or more audio tracks has a first spatial position value and a volume value, the method comprising

displaying, in a stage view user interface of a digital audio workstation, one or more audio track user interface objects, wherein each audio track user interface object represents an audio track, and a highlighted stage segment having a boundary, wherein the boundary of the highlighted stage segment represents maximum and minimum values of the spatial position and volume of a group track,

receiving, via the user interface, a user input to adjust the boundary,

calculating, by the user application, a second spatial position and/or volume value of the group track based on the adjustment of the boundary,

outputting, to the stage view user interface, a group track user interface object, wherein the group track user interface object represents a group track and wherein the position of the group track user interface object on the stage of the stage view user interface represents the second spatial position and/or volume value of the group track.

17. The method of claim 16, wherein the user input comprises dragging the boundary of the highlighted stage segment.

18. The method of claim 16, wherein the user input comprises dragging an audio track user interface object beyond the boundary of the highlighted stage segment.

19. A computer readable medium comprising executable instructions which, when executed by a processor, perform the method according to any of claims 3 to 12 and 16 to 18.

Intellectual Property Office

Application No:	GB1914571.3	**Examiner:**	Rhiannon Jenkins
Claims searched:	1-12 & 19 (in part)	**Date of search:**	8 April 2020

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-12	US 8085269 B1 (CLASSEN) - See in particular figures 1A & 2A and columns 4 to 12
X	1-3, 7 & 11	Gelineck et al, "Music Mixing Surface", Proceedings of the 2013 ACM international conference on Interactive Tabletops And Surfaces, 2013, pp 433 to 436, Association for Computing Machinery accessed 8/4/20

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

G10H; H04H

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, Patent Fulltext, INTERNET

International Classification:

Subclass	Subgroup	Valid From
G10H	0001/02	01/01/2006
G10H	0001/46	01/01/2006
H04H	0060/04	01/01/2008

Intellectual Property Office

Application No: GB1914571.3 **Examiner:** Rhiannon Jenkins

Claims searched: 13 & 16 **Date of search:** 22 September 2020

Patents Act 1977
Further Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	US 8073160 B1 (CLASSEN) - See figures 1 to 3 and column 4 line 52 to column 13 line 39
A	-	De Man et al, "Comparing Stage Metaphor Interfaces As A Controller For Stereo Position And Level", 14 September 2018, Proceedings of the 4th Workshop on Intelligent Music Production, Huddersfield, UK

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

G10H; G11B; H04H

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International Classification:

Subclass	Subgroup	Valid From
G10H	0001/02	01/01/2006
G10H	0001/46	01/01/2006
H04H	0060/04	01/01/2008