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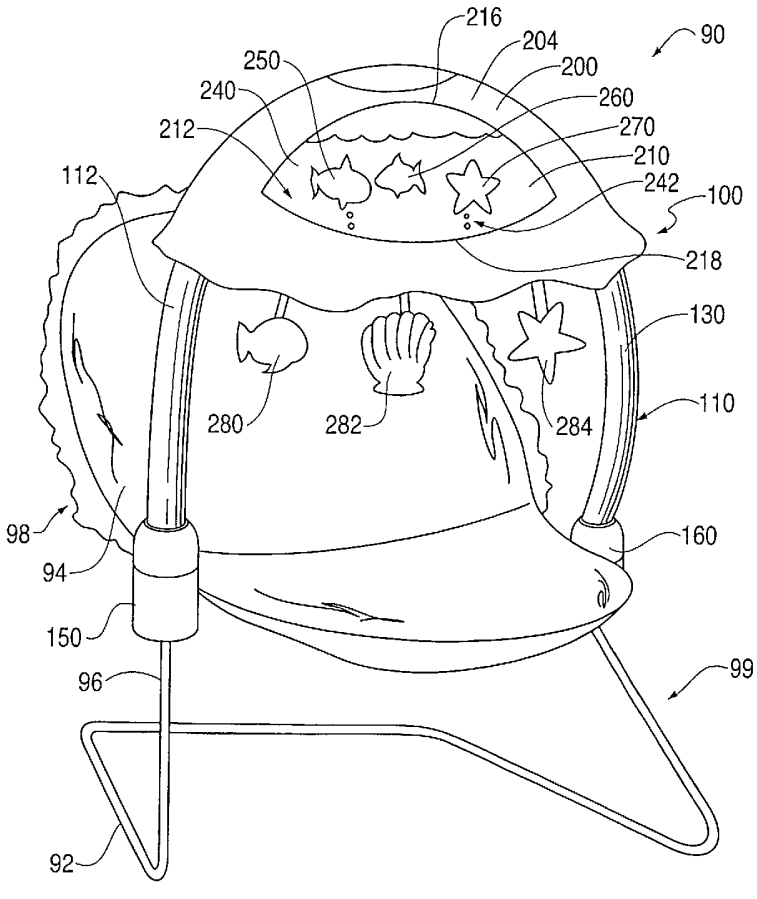
(54) Title: INFANT ENTERTAINMENT DEVICE WITH A TOY AQUARIUM



(57) Abstract: An infant support structure that may be used to pacify and/or entertain an infant is disclosed. In one embodiment, the infant support structure is an infant bouncer. In one embodiment, the infant support structure includes an entertainment device with toy aquarium. The entertainment device is removably coupled to the support structure.

WO 2006/096150 A1

Infant Entertainment Device With a Toy Aquarium

BACKGROUND OF THE INVENTION

This invention relates generally to an infant entertainment device, and in particular, to an infant support structure that includes a toy aquarium.

Conventional infant support structures may be used to pacify and relax infants. Some conventional infant support structures include entertainment devices that provide entertainment to an infant positioned on the infant support structure. Such conventional entertainment devices include some form of output to attract and retain the attention of the infant positioned thereon. However, infants quickly become disinterested in conventional entertainment devices.

A need exists for an entertainment device for an infant support structure that stimulates the senses of the infant. A need also exists for an entertainment device that is interactive and can be activated by the infant on the infant support structure.

SUMMARY OF THE INVENTION

The present invention relates to an infant support structure that may be used to pacify and/or entertain an infant. In one embodiment, the infant support structure is an infant bouncer. In one embodiment, the infant support structure includes an entertainment device with a toy aquarium. The entertainment device is removably coupled to the support structure.

In one embodiment, the entertainment device includes an output generating system that can be activated by an infant. The output generating system is connected to several input mechanisms that enable an infant to activate an output sequence. The entertainment device includes several output mechanisms that generate various outputs in response to a user activation or input. In one embodiment, the entertainment device includes a bubble-generating mechanism. In another embodiment, the entertainment device includes an illumination device or light source, such as a lamp or a bulb, that illuminates a portion of the device. In another embodiment, the entertainment device includes a sound generating system that generates audio outputs such as music and sound effects.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a schematic view of an infant entertainment device according to the present invention.

Fig. 2 illustrates an embodiment of an infant entertainment device according to the present invention.

Fig. 3 illustrates an exploded perspective view of the components of an entertainment member of the infant entertainment device of Fig. 2.

Figs. 4 and 5 illustrate rear views of embodiments of toy characters according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to an infant support structure that may be used to pacify and/or entertain an infant. In one embodiment, the infant support structure is an infant bouncer. In one embodiment, the infant support structure includes an entertainment device with a toy aquarium. The entertainment device is removably coupled to the support structure.

In one embodiment, the entertainment device includes an output generating system that can be activated by an infant. The output generating system is connected to several input mechanisms that enable an infant to activate an output sequence. The entertainment device includes several output mechanisms that generate various outputs in response to a user activation or input. In one embodiment, the entertainment device includes a bubble-generating mechanism. In another embodiment, the entertainment device includes an illumination device or light source, such as a lamp or a bulb, that illuminates the toy aquarium. In another embodiment, the entertainment device includes a sound generating system that generates audio outputs such as music and sound effects.

A schematic view of an embodiment of an infant entertainment device according to the present invention is illustrated in Fig. 1. In the illustrated embodiment, the infant entertainment device 10 includes a support frame 20 and an entertainment member 30 coupled to the support frame 20. The support frame 20 can be any type of infant support structure. For example, the support frame 20 can be a bouncer, a high

chair, a stroller, a swing, a rocker, a play yard, or any other structure that can be used to support an infant.

The entertainment member 30 includes a mounting component 40 and an output component 50. The output component 50 is coupled to the mounting component 40, which is coupled to the support frame 20.

In the illustrated embodiment, the mounting component 40 includes an arm 42 and a coupler 22. The coupler 22 is mounted on the support frame 20 and the arm 42 is mounted on the coupler 22.

Coupler 22 may be any structure that allows the entertainment member 30 to be removably coupled to the support frame 20. For example, coupler 22 can be a housing with an opening to receive a portion of the mounting component. Alternatively, coupler 22 can be a strap into which a portion of the mounting component is inserted.

In alternative embodiments, the entertainment component 30 may be coupled to the support structure 20 by a mounting component with multiple arms. A coupler may be used for each mounting component arm to support the entertainment component.

In the illustrated embodiment, the entertainment member 30 includes an output component 50. In this embodiment, the output component includes visual displays, including an interactive toy aquarium or tank 52. The tank 52 contains a fluid 53 and several characters 56 disposed in the fluid 53. Some of the characters 56 are mounted in the tank 52 for movement. In alternative embodiments, the characters may be freely disposed in the fluid.

The entertainment member 30 includes an output generating system 60 and an actuator 70. The output generating system 60 has several components that are used to entertain and stimulate an infant. The actuator 70 is connected to the output generating system 60 so that activation of the actuator 70 causes the output generating system 60 to generate an output.

In the illustrated embodiment, the output generating system 60 includes an audio output device or transducer 64, an air bubble-generating mechanism or pump 66, and an illumination device or light source 68. In alternative embodiments, the output generating system can include one or more of these components. The output generating

system 60 also includes a power source (not shown) such as batteries and an on/off power switch (not shown).

As illustrated in Fig. 1, the output generating system 60 includes a processor 62 that receives input signals from the actuator 70. The processor 62 is connected to the audio output device 64 through which audio outputs such as music and sound effects stored in the memory of the processor can be played.

The processor 62 is connected to the pump 66 that supplies air bubbles 54 to the tank 52. The pump 66 forms a closed system with the tank 52. The pump 66 is connected via one or more tubes 67 to the top of the tank 52. Air is drawn through tubes 67 and supplied to the tank via openings 58A and 58B aligned with two of the characters in the tank 52.

The processor 62 is also connected to the illumination device 68 that illuminates the tank 52. The illumination device 68 includes two bulbs that are illuminated in response to an activation of the actuator. In an alternative embodiment, the illumination device 68 includes a lamp.

The actuator 70 can be activated by the occupant of the support frame or other user. In the illustrated embodiment, the actuator 70 includes several switches 72, 74, and 76 that can be closed to activate the output generating system 60.

The actuator 70 may include hanging toys 80, 82, and 84 that are connected to switches 72, 74, and 76. A switch is closed when the corresponding hanging toy is moved. For example, when toy 80 is moved from its resting position, switch 72 is closed and an input signal is sent to the processor 62.

In the illustrated embodiment, the actuator switches may be any conventional switch that is closed upon the movement of a toy or object connected to it. In alternative embodiments, the switches may be located in the hanging toys and electrically connected to the processor.

An embodiment of an infant entertainment device implementing the concepts of the schematic embodiment discussed above is illustrated in Figs. 2-5. The infant entertainment device 90 includes a support frame 92. In this embodiment, the support frame 92 is a frame for an infant bouncer. The support frame 92 includes a wire frame 96 with an infant support member 94, such as a fabric material, located thereon.

The support frame 92 includes an upper frame portion 98 and a lower frame portion 99. The upper frame portion 98 supports an infant and the lower frame portion 99 is placed on a support surface.

The infant entertainment device 90 includes an activity bar or entertainment member 100. The entertainment member 100 includes a mounting component 110 and an output component 200 that includes a toy aquarium 210. The entertainment member 100 has a first or front side facing the support member 94 and a second or rear side 204 opposite the first side.

In the illustrated embodiment, the mounting component 110 includes arms 112 and 130 and couplers 150 and 160. Arm 112 is removably coupled to the support frame 92 via coupler 150. Similarly, arm 130 is removably coupled to the support frame 92 via coupler 160.

The toy aquarium 210 is a tank or compartment 212 defining an interior region or chamber. The tank 212 has a top end 216 and a bottom end 218. The tank 212 includes transparent walls that enable the contents of the tank 212 to be viewed from either side of the entertainment member 100. In an alternative embodiment, the front side of the tank 212 is transparent and the opposite side of the tank 212, corresponding to the outer side 204 of the output component 200, is opaque.

As illustrated, the toy aquarium 210 includes a fluid 240, such as water, in the tank 212. The toy aquarium 210 also includes several toy characters 250, 260, and 270 that are disposed in the tank 212.

In the illustrated embodiment, the entertainment member 100 includes a pump fluidically coupled to the tank 212 to supply air bubbles 242 to the fluid 240. The lower end of the tank 212 has two openings that are aligned with characters 250 and 270. Air bubbles 242 exit the two openings and cause characters 250 and 270 to move as described in more detail below.

The tank 212 is a closed system. The pump is connected to the top end 216 and the bottom end 218 of the tank 212. The pump draws air from the top end 216 and supplies air to the bottom end 218 to form bubbles 242 in a conventional manner. The pump and its related connections to the tank 212 may be any conventional pump and connections used in toy aquariums.

As illustrated in Fig. 2, several toys 280, 282, and 284 hang from the lower portion of the output component 200. Hanging toys 280, 282, and 284 form a part of an actuator of the entertainment member 100. The toys 280, 282, and 284 are connected to switches (not shown) in the same manner as toys 80, 82, and 84 described above. While the toys are illustrated as aquatic characters and elements, the toys may have any shape or configuration.

An exploded perspective view of entertainment member 100 is illustrated in Fig. 3. Entertainment member 100 includes a housing 102 and mounting arms 112 and 130. The mounting arms 112 and 130 are coupled to the housing 102 and to the frame 92.

In an alternative embodiment, entertainment member 100 is supported on a single arm that extends from or is cantilevered from the frame 92. The single arm may be coupled to the frame 92 using any type of coupler. While arms 112 and 130 of the illustrated embodiment are discussed below in detail, a mounting arm similar to either one of the arms 112 and 130 may be used to support the entertainment member on the frame.

In the illustrated embodiment, arm 112 includes a front member 122 and a rear member 124 that can be coupled together by any conventional connector. The arm 112 has a lower end 114 and an upper end 116. When the front member 122 and rear member 124 are coupled together, the arm 122 has a coupling portion 118 proximate to its upper end 112 and a mounting portion 120 proximate to its lower end 114. As illustrated in Fig. 3, the front member 122 includes an opening 126 proximate to its upper end 116.

Similarly, arm 130 includes a front member 140 and a rear member 142 that can be coupled together. The arm 130 has a lower end 132 and an upper end 134. When the front member 140 and the rear member 142 are coupled together, the arm 130 has a coupling portion 136 proximate to its upper end 134 and a mounting portion 138 proximate to its lower end 132. The particular configuration and size of the arms 112 and 130 depends on the desired location of the output portion 200 relative to the frame 92.

The mounting component 110 includes couplers 150 and 160 that are used to mount the arms 112 and 130 to the frame 92. Each coupler 150 and 160 is mounted on the wire frame 96.

As illustrated in Fig. 3, coupler 150 includes a top portion 152 and a bottom portion 158. The top portion 152 includes an opening 154 into which the mounting portion 120 of arm 112 is inserted. The top portion 152 also includes a groove 156 that is configured to receive the wire frame 96 of the frame 92.

Similarly, coupler 160 includes a top portion 162 and a bottom portion 168. The top portion 162 includes an opening 164 into which the mounting portion 138 of arm 130 is inserted. The top portion 162 also includes a groove 166 that is configured to receive the wire frame 96 of the frame 92.

The mounting portion 120 of the arm 112 and the mounting portion 138 of arm 130 are inserted into the openings 154 and 164 of the couplers 150 and 160, respectively.

In the illustrated embodiment, the housing 102 includes a front housing 170 and a rear housing 180. The front and rear housings 170 and 180 are coupled together using any conventional connectors or fasteners, such as screws.

Front housing 170 includes a frame 172 that defines an opening 174 through which the toy aquarium 210 can be viewed. The frame 172 includes receiving portions 176 and 178 that are configured to receive coupling portions 118 and 136 of arms 112 and 130, respectively. The frame 172 also includes a top recess 175 and speaker holes 179 that are located proximate to opening 126 in the arm 112. A transducer or audio output device can be positioned adjacent to speaker holes 179 so audio output can be played through the speaker holes 179.

Rear housing 180 includes a frame 182 that defines an opening 184 through which the toy aquarium can be viewed. The frame 182 includes receiving portions 186 and 188 that are configured to receive coupling portions 118 and 136 of arms 112 and 130, respectively. The frame 182 also includes a top recess 185 that corresponds to the top recess 175 on frame 172. When the front and rear housings 170 and 180 are coupled together, coupling portions 118 and 136 are captured between the front and rear housings 170 and 180 and top recesses 175 and 185 are aligned with each other.

As illustrated in Fig. 3, the toy aquarium 210 includes plates 220 and 230 that are positioned adjacent to each other to form the tank 212. Plates 220 and 230 are retained together between front and rear housings 170 and 180. Plate 230 includes openings 235 though which fasteners can be inserted to secure plate 220 to plate 230.

In the illustrated embodiment, plate 220 includes a body 222 that has a wall 224 extending around the perimeter of the body 222. The body 222 has an outer surface 226 and an inner surface (not shown) opposite the outer surface 226.

Similarly, plate 230 includes a body 231 that has a wall 232 extending around the perimeter of the body 231. The body 231 has an inner surface 233 and an outer surface (not shown) opposite the inner surface 233.

As illustrated, plate 230 includes posts 234, 236, and 238 extending from its inner surface 233. Toy characters 250, 260, and 270 may be mounted on the posts 234, 236, and 238. In the illustrated embodiment, the posts 234 and 238 form pivot points for characters 250 and 270.

The plate 230 also includes two openings 244 and 246 through which air bubbles are supplied from the pump into the tank 212. The openings 244 and 246 are aligned with posts 234 and 238 and the toy characters 250 and 270 positioned on the posts 234 and 238, respectively.

The particular locations of the posts and corresponding openings in the plate 230 may vary depending on the desired positions of the toy characters. Similarly, any number of posts may be provided on the inner surface of one or both of the plates.

When the plates 220 and 230 are coupled together, the perimeter wall 224 and perimeter wall 232 contact each other to define the perimeter of the tank 212 formed between the corresponding inner surfaces of the plates 220 and 230. While the plates 220 and 230 are plastic, the perimeter walls 224 and 232 may be either plastic or a resilient material such as rubber. In an alternative embodiment, a sealing ring may be placed between the perimeter walls of the plates 220 and 230 to seal the fluid within tank 212.

In the illustrated embodiment, the entertainment member 100 includes a dome lens 190 or reflector. Dome lens 190 is disposed in the top recesses 175 and 185 of the frames 172 and 182.

The entertainment member 100 includes two bulbs 192 and 194, such as "grain of wheat" bulbs, located between the housings 170 and 180 and beneath the dome lens 190. The bulbs 192 and 194 are located above the plates 220 and 230. When illuminated, the bulbs 192 and 194 shine light up into the dome lens 190 and down into the tank 212.

Rear views of embodiments of toy characters are illustrated in Figs. 4 and 5. As illustrated in Fig. 4, toy character 250 has a rear surface 252 on which ridges 254 are disposed. Each ridge 254 includes a contact surface 255 that is engaged by air bubbles in the tank. The toy character 250 includes a mounting structure 256, such as a sleeve 257 with an opening 258. The sleeve 257 is positioned so that any of the posts 234, 236 and 238 on plate 230 can be inserted into opening 258.

During operation, air bubbles flow upwardly along the direction of arrow "A" and engage the contact surface 255 of each curved ridge 254. As the air bubbles engage the contact surface 255, the air bubbles ride upwardly along the contact surface 255 and cause the toy character 250 to rotate along the direction of arrow "B." When the toy character 250 rotates a particular amount, the air bubbles disengage from and continue upwardly beyond the contact surface 255. The toy character 250 then rotates along the direction of arrow "C" back to its resting or equilibrium position.

Similarly, toy character 270 has a rear surface 272 on which ridges 274 are disposed as illustrated in Fig. 5. In this embodiment, multiple ridges 274 are located around the perimeter of the toy character 270. The toy character 270 includes a mounting structure 276, such as a sleeve 277 with an opening 278. The sleeve 277 is positioned so that any of the posts 234, 236, and 238 on plate 230 can be inserted into opening 278.

During operation, air bubbles flow upwardly along the direction of arrow "D" and engage the contact surface 275 of the uppermost ridge 274. The ridge 274 is curved and as the air bubbles engage the contact surface 275, the air bubbles ride upwardly along the contact surface 275 and the toy character 270 rotates along the direction of arrow "E." When the toy character 270 rotates a particular amount, the air bubbles disengage from and continue upwardly beyond the contact surface 275. The

toy character 270 rotates and the next ridge 274 is engaged by air bubbles and the process repeats.

In the illustrated embodiment, the toy characters 250 and 270 are mounted for movement relative to the central character 260 and each other. The toy character 260 is fixedly mounted on post 236 in the aquarium. The toy character 260 may be prevented from rotating about post 236 either by the shape of post 236, such as a square profile of the post 236, or a connector or adhesive.

In the illustrated embodiment, character 250 is a large fish, character 260 is a small fish, and character 270 is a starfish. Adjacent characters 250 and 260 are positioned so that as bubbles contact character 250, character 250 moves proximate to character 260 to create the appearance that the characters are touching or kissing each other.

Now the operation of the entertainment member is described. In the illustrated embodiment, the entertainment member 100 has two modes of operation. In a first mode of operation, a parent or caregiver turns on the device and an output sequence is started. In the output sequence, the output generating device plays music and the bulbs are illuminated and light shines into the tank 212. The pump is turned on and supplies air bubbles to the tank 212 during this sequence as well. This output sequence lasts for a predetermined amount of time, such as ten minutes.

The second mode of operation is an interactive mode in which inputs from the infant on the support structure are used to activate the output generating system. This mode of operation may also last a predetermined amount of time, such as ten minutes. During this mode, when the infant causes a hanging toy 270, 272, or 274 to move either by contacting the toy or by moving the support frame sufficiently to cause movement of the toy, the output generating system is activated.

In the second mode, any combination of outputs may be generated. For example, in one embodiment, bubbles and light are generated for the ten minute period and music is generated for a shorter period of time and restarted upon subsequent activations of the actuator. In an alternative embodiment, music is continuously played and light and bubbles are generated for a short period of time upon each activation of the actuator.

While the components of the entertainment member 100, such as the housing, the arms, the plates, and the toy characters, are made from plastic, any suitable material may be used.

In alternative embodiments, the length of time and various outputs generating during the output sequences can vary.

In alternative embodiments, the number of ridges as well as the location and shape of the ridges on each toy character may vary. Similarly, the types and number of toy characters in the toy aquarium and hanging from the entertainment member may vary.

In alternative embodiments, the overall shape and the depth of the tank of the toy aquarium may vary. Moreover, the shape and configuration of the components of the housing may vary as well.

In another embodiment, the fluid in the tank is replaced by a reflective material, such as a mylar film, that creates the appearance of fluid in the tank.

Structures other than posts may be used in the tank to mounted the toy characters for movement. For example, two parallel rails or tracks may be used to define a path of movement of a toy character. In this arrangement, a mounting element on the toy character can be located between the rails and the toy character can move along the rails.

In another embodiment, a drive mechanism may be used to cause movement of the toy characters in response to an input to the actuator. For example, the drive mechanism can include magnets that are moved or rotated when the actuator receives an input.

In alternative embodiments, the number of air bubble openings and characters moved by bubbles may vary.

The support frame 20 can be any type of infant support structure. In alternative embodiments, the support frame 20 can be a bouncer, a high chair, a stroller, a swing, or any other structure that can be used to support an infant.

While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications may be made therein without departing from the spirit and scope

thereof. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An infant bouncer comprising:

a bouncer frame, said bouncer frame including an upper frame portion and a lower frame portion coupled to said upper frame portion, said upper frame portion configured to support an infant; and

an activity bar coupled to said bouncer frame, said activity bar including a toy aquarium, said toy aquarium including a tank, fluid disposed in said tank, and an aquatic character disposed in said fluid.

2. The infant bouncer of claim 1, said activity bar including an output generating system and an actuator, said output generating system being responsive to activation of said actuator.

3. The infant bouncer of claim 2, said activity bar including a hanging toy, said hanging toy being connected to said output generating system, movement of said hanging toy activating said output generating system.

4. The infant bouncer of claim 2, said activity bar including a light source proximate to said tank and a pump in communication with said tank, said light source being illuminated upon activation of said actuator, and said pump supplying air to said tank upon activation of said actuator.

5. The infant bouncer of claim 4, said toy aquarium including a plurality of walls defining said tank, said aquatic character being mounted to one of said walls for movement relative to said one of said walls, said air engaging said aquatic character and causing movement of said aquatic character.

6. An infant support comprising:

a frame configured to support an infant; and

an entertainment member coupled to said frame, said entertainment member including an output generating system, an actuator and a toy aquarium, said actuator being disposed on said entertainment member, said toy aquarium including a tank containing fluid and a character disposed in said tank, activation of said actuator activating said output generating system and causing said character to move in said tank.

7. The infant support of claim 6, said entertainment member including a toy mounted for movement relative to said toy aquarium, movement of said toy activating said output generating system.

8. The infant support of claim 7, said toy aquarium including a pump in communication with said tank, activation of said actuator causing said pump to supply air bubbles to said tank.

9. The infant support of claim 8, said character having an engagement element and being pivotally coupled to said tank, said air bubbles engaging said engagement element of said character and causing said character to move relative to said tank.

10. The infant support of claim 8, said toy aquarium including a light source proximate to said tank, activation of said actuator causing said light source to illuminate said fluid.

11. The infant support of claim 6, said frame being an infant bouncer and said entertainment member being an activity bar that is removably coupled to said infant bouncer.

12. The infant support of claim 6, movement of said frame causing activation of said actuator.

13. An infant entertainment structure, comprising:

a support frame, said support frame including a support member being configured to support an infant thereon; and

an activity bar, said activity bar including:

an elongate member, said elongate member having a first end and a second end, said elongate member being coupled to said support frame at its first end; and

an output component, said output component being coupled to said second end of said elongate member, said output component including a housing having:

a plurality of walls defining an interior region therebetween, one of said plurality of walls being a side wall and being transparent;

a first side facing said support member of said support frame; and

a fluid disposed in said interior region, wherein said substantially transparent wall is located on said first side of said housing, thereby enabling an infant disposed on said support member to view said fluid in said housing.

14. The infant entertainment structure of claim 13, said output component including a character disposed in said fluid.

15. The infant entertainment structure of claim 13, said output component including an aquatic character disposed in said fluid, said aquatic character being pivotally coupled to one of said plurality of walls.

16. The infant entertainment structure of claim 13, said activity bar including an output generating system and an actuator, said output generating system being responsive to activation of said actuator.

17. The infant entertainment structure of claim 16, said actuator including an object mounted to said output component and a switch connected to said output generating system, said switch being activated upon movement of said object relative to said output component.

18. The infant entertainment structure of claim 16, said output generating system including an illumination device, said illumination device being responsive to the activation of said actuator.

19. The infant entertainment structure of claim 18, said illumination device being located above said housing and disposed to supply light into said interior region.

20. The infant entertainment structure of claim 16, said output generating system including a bubble-generating device, said bubble-generating device being in communication with said interior region to supply air bubbles therein, said bubble-generating device being responsive to the activation of said actuator.

21. The infant entertainment structure of claim 20, said output component including a first character and a second character disposed in said fluid, said first character including a body having a rear surface and a ridge located on said rear surface.

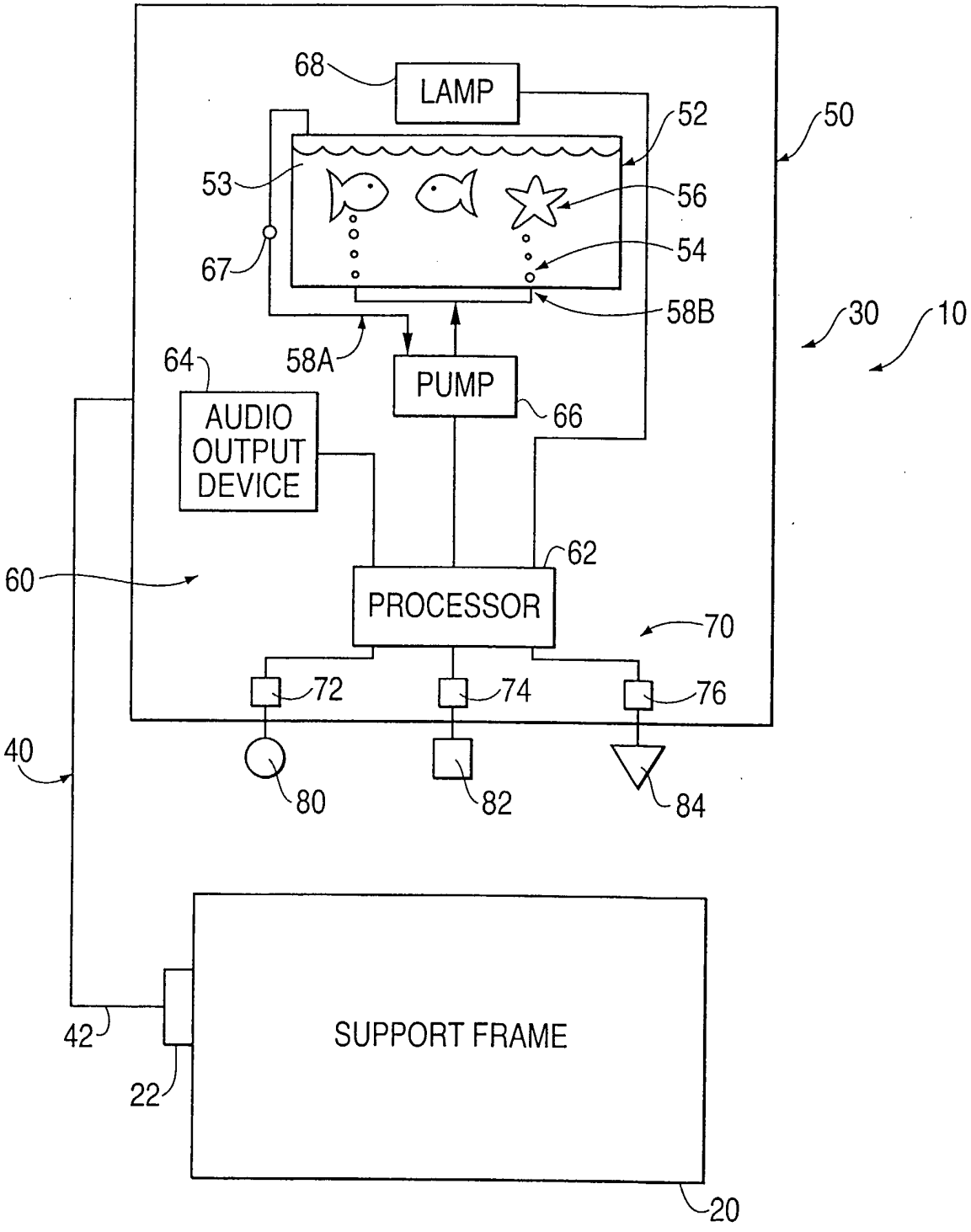
22. The infant entertainment structure of claim 21, said first character being pivotally coupled to one of said plurality of walls at a pivot point, said air bubbles

engaging said ridge on said first character to move said first character about said pivot point.

23. The infant entertainment structure of claim 13, said output component including a second side opposite said first side, another of said plurality of walls being a side wall and being transparent, said another of said plurality of walls being located on said second side of said output component.

24. The infant entertainment structure of claim 13, said elongate member being a first elongate member, and said activity bar including a second elongate member, said second elongate member having its own first end and a second end, said second elongate member being coupled to said support frame at its first end.

FIG. 1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SUPPORT FRAME
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FIG. 2

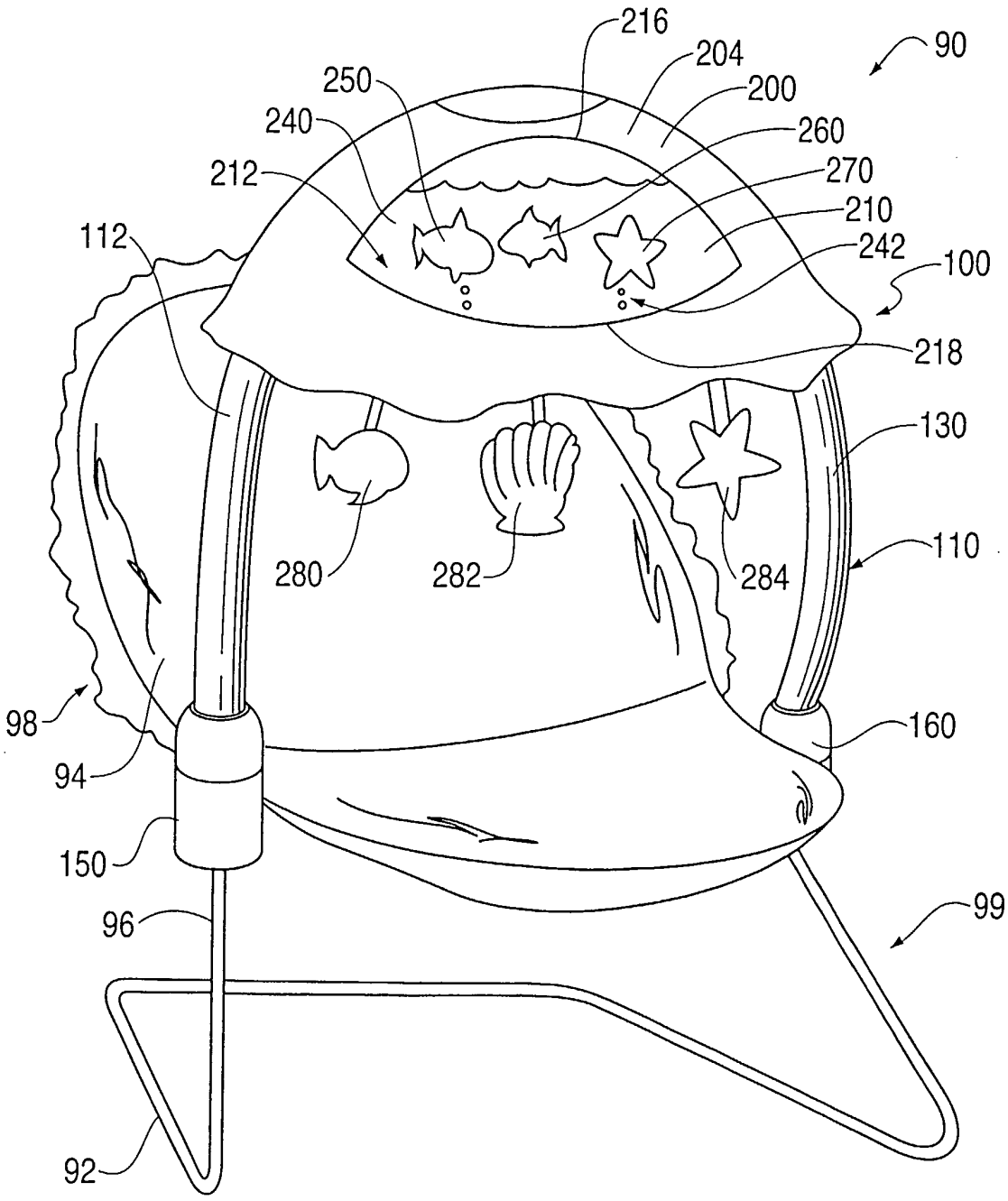
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FIG. 3

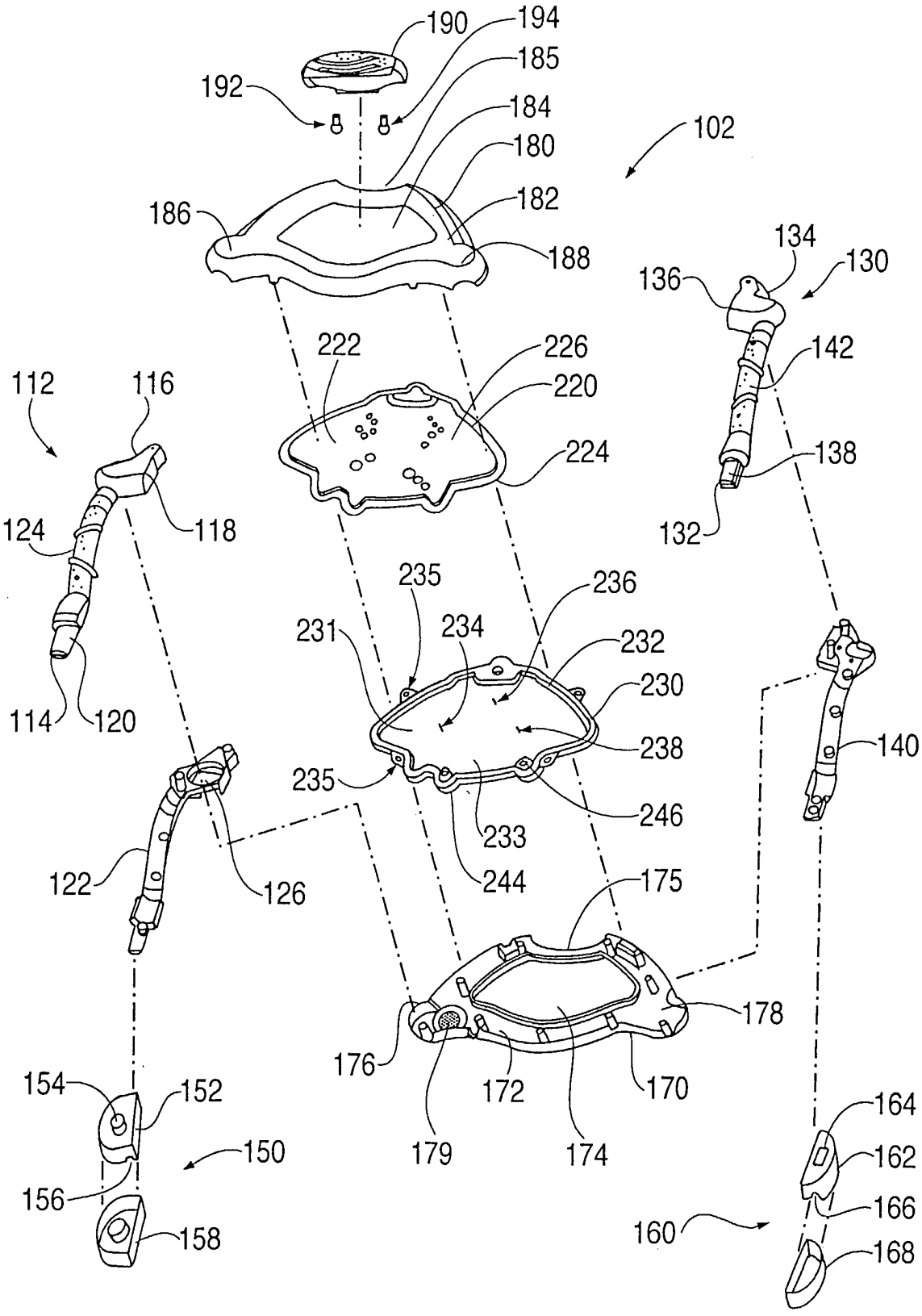
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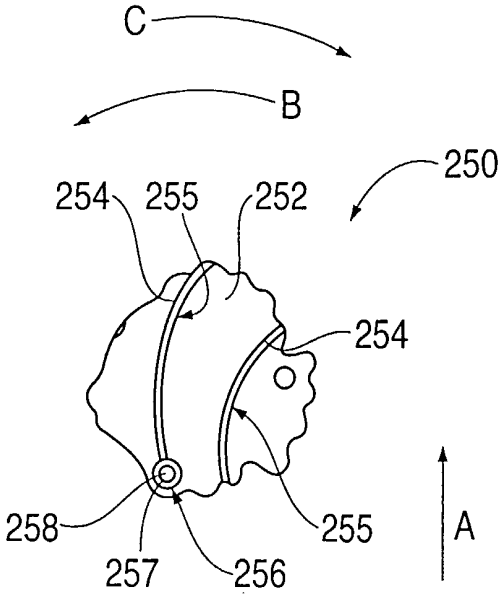
FIG. 4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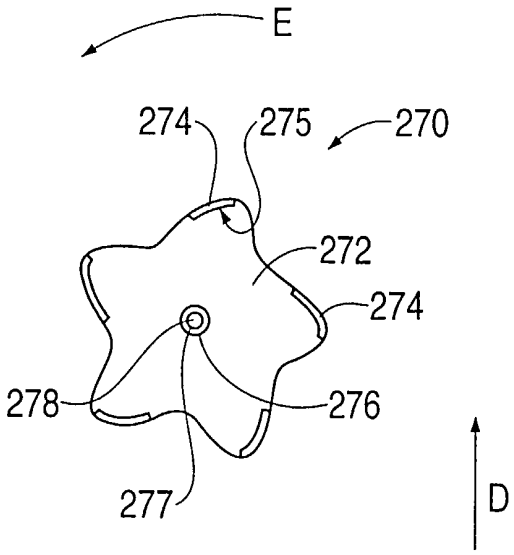
A

FIG. 5


E
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D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/13349

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A47C 31/00, 7/62
US CL : 297/217.3

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)
U.S. : 297/217.3, 274,258.1, DIG.11; 446/227, 175, 197, 134; 40/406, 426, 439; 362/101, 806, 96

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2003/0020317 A1 (KEEGAN ET AL) 30 January 2003, see entire document.	1-3,6-7,13-14,16, 23-24
Y	US 4,223,471 A (GREENBERG) 23 September 1980, see entire document.	1-3,6-7,13-14,16,23-24
A	US 5,584,531 A (BOWMAN) 17 December 1996	
A	US 2,282,881 A (OSTROW) 12 May 1942	
A	US 2,434,783 A (ATHEY) 20 January 1948	
A	US 6,113,455 A (WHELAN ET AL) 05 September 2000	

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" 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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search
13 May 2004 (13.05.2004)

Date of mailing of the international search report
22 JUN 2004

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