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(54) Title: TOY ROLLER COASTER ASSEMBLY

(57) Abstract: An embodiment of the present invention provides a toy roller coaster assembly having magnetically attachable track sections and an integrated audiovisual system. The assembly can include a magnetic lift, a magnetic bridge, and a magnetic U-turn. A controller can control the frequency by which a magnetic lift delivers balls to an uppermost track section and can produce audio and/or visual effects in response to signals from sensors that detect passing balls. Joint members of the assembly can magnetically connect the track sections to each other and to a plurality of vertical supports, to provide a variety of configurations. The controller can generate voice and music samples, sound effects, graphic displays, animation sequences, and video clips in conjunction with the motion of the balls through the circuit of the roller coaster assembly.

TOY ROLLER COASTER ASSEMBLY

[0001] This application claims the benefit of U.S. Provisional Application No. 60/756,265, filed January 4, 2006, and U.S. Patent Application No. _____filed January 3, 2007, entitled, "TOY ROLLER COASTER ASSEMBLY" (Attorney Docket No. RAI-110-US) which is herein incorporated by reference in its entirety.

BACKGROUND

Field of the Invention

[0002] The present invention relates to toy roller coaster assemblies. More particularly, the present invention relates to a toy roller coaster assembly having magnetically attachable track sections, metallic balls for travel thereon, and a variety of structural and audiovisual features.

Background of the Invention

[0003] Toy roller coaster assemblies are known in the toy and model fields. Such toy assemblies may include a variety of interlocking track pieces, support and connection means for building a roller coaster from the track pieces, and a small object such as a marble or ball, which is conveyed along the tracks of the roller coaster. Assemblies having multiple interchangeable elements are especially desirable, as such toys engage children's creativity and ingenuity. Toy roller coaster assemblies may further include special structural features that enhance their visual appearance and create exciting effects when the ball engages the feature. These features may include, for example, a "loop-the-loop" track section or a ball drop.

[0004] Notwithstanding these special structural features, toy designers are continually in search of new features that can enhance the visual and audio impact of toy roller coaster assemblies to provide interesting, interactive, and captivating play patterns.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention provides a toy roller coaster assembly with visually striking magnetic features and with an integrated audiovisual system. More particularly, the roller coaster assembly can include magnetically attachable track sections of different shapes, including special track sections such as a "loop-the-loop," a ball drop, a magnetic bridge, and a magnetic U-turn;

metallic balls that travel on the track sections; and an audiovisual system that that produces audio and visual effects when activated by the motion of the balls. Joint members can magnetically connect the track sections to each other and to a plurality of vertical supports, thereby facilitating a wide array of possible configurations. The audiovisual system can include a controller, a plurality of sensors positioned throughout the roller coaster assembly, and audio and video output devices. The audiovisual system is programmed to output voice and music samples, sound effects, graphic displays, animation sequences and video clips in conjunction with the motion of the balls through the circuit of the roller coaster assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For a more complete understanding of the present invention, reference is made to the following detailed description of an exemplary embodiment considered in conjunction with the accompanying drawings, in which:

[0007] FIG. 1 is a schematic diagram of a front perspective view of a toy roller coaster assembly constructed in accordance with an embodiment of the present invention;

[0008] FIG. 2 is a schematic diagram of a right side perspective view of the roller coaster assembly shown in FIG. 1;

[0009] FIG. 3A is a schematic diagram of a top plan view of a straight track section employed by the roller coaster assembly shown in FIG. 1, a portion of the straight track section shown in cross-section for illustration purposes;

[0010] FIG. 3B is a schematic diagram of a top plan view of a curved track section employed by the roller coaster assembly shown in FIG. 1, a portion of the curved track section shown in cross-section for illustration purposes;

[0011] FIG. 4A is a schematic diagram of a top perspective view of a joint member employed by the roller coaster assembly shown in FIG. 1;

[0012] FIG. 4B is a schematic diagram of a top plan view of the joint member shown in FIG. 4A;

[0013] FIG. 4C is a schematic diagram of a cross-sectional view, taken along section line 4C—4C and looking in the direction of the arrows, of the joint member shown in FIG. 4B, a metallic ball being illustrated in phantom for illustration purposes;

[0014] FIG. 5 is a schematic diagram of a side elevational view of a vertical support employed by the roller coaster assembly shown in FIG. 1;

[0015] FIG. 6 is a schematic diagram of an enlarged scale, longitudinal cross-section of a portion of the vertical support shown in FIG. 5;

[0016] FIG. 7A is a schematic diagram of a side elevational view of a lift track assembly employed by the roller coaster assembly shown in FIG. 1, with portions of the lift track assembly shown in cross section for illustration purposes;

[0017] FIG. 7B is a schematic diagram of a cross-sectional view, taken along section line A—A and looking in the direction of the arrows, of the top part of the lift track assembly shown in FIG. 7A;

[0018] FIG. 8 is a schematic diagram of an audiovisual system employed by the roller coaster assembly shown in FIG. 1;

[0019] FIG. 9 is a schematic diagram of a perspective view of a toy roller coaster assembly constructed in accordance with another embodiment of the present invention;

[0020] FIG. 10 is a schematic diagram of an exploded perspective view of an exemplary joint member connecting two track sections, according to an embodiment of the present invention;

[0021] FIG. 11A is a schematic diagram of an exemplary lift track assembly and ball separator, according to an embodiment of the present invention;

[0022] FIG. 11B is a schematic diagram of an exploded view of the lift track assembly of FIG. 11A;

[0023] FIG. 12 is a schematic diagram of an exploded view of the ball separator of FIG. 11A;

[0024] FIG. 13 is a schematic diagram of an exemplary magnetic bridge, according to an embodiment of the present invention; and

[0025] FIG. 14 is a schematic diagram of an exemplary magnetic U-turn track section, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0026] FIGS. 1 and 2 illustrate a toy roller coaster assembly 10 constructed from multiple basic structural elements; namely, a plurality of track sections 12, a plurality of columnar vertical supports 14, and a plurality of joint members 16,

which connect the track sections 12 to each other and to the vertical supports 14. Also included is a plurality of metal marbles or balls 18 that removably engage the track sections 12. A lift track assembly 20 vertically conveys the balls 18 from the lowest level, or bottom B, of the roller coaster assembly 10 to the highest level, or top T, of the roller coaster assembly 10.

[0027] Referring now to FIGS. 3A and 3B, each of the track sections 12 comprises a pair of cylindrical rods 22 which are spaced in a parallel formation, so as to allow the balls 18 to roll thereon. The rods 22 are preferably made from a plastic material. Each rod 22 includes a disk 24 embedded in each of its opposed ends, the purpose of which will be discussed hereinafter. Each disk 24 is made from either a magnetic material or a magnetically conductive metal. The rods 22 are pre-formed to be straight (see FIG. 3A), curved (see FIG. 3B), or looped (not shown), which facilitates similar configurations of the various track sections 12. The rods 22 are preferably vacuum metallized and range in length from approximately two inches to about six inches. Each rod 22 can be approximately ¼" in diameter, so as to allow the balls 18 to roll unimpeded thereon (see FIGS. 1 and 2), where the balls can be approximately ½" in diameter.

[0028] Referring now to FIGS. 4A and 4B, each of the joint members 16 includes a pair of spaced parallel cylindrical rods 26 joined together by a connector 28. As illustrated in FIG. 4A, the joint member 16 is H-shaped, with the connector 28 attached to both rods 26 at their midpoints. The rods 26 and connector 28 are preferably monolithically formed, and may be fabricated from the same plastic as the rods 22 of the track sections 12, or from any other suitable material. The rods 26 have a preferred diameter of approximately one quarter inch like that of the rods 22, so as to allow the balls 18 to roll unimpeded thereon. Each rod 26 is provided with a pair of disks 30, one embedded in each of its opposed ends. Each disk 30 is made from either a magnetic material or a magnetically conductive metal. Each disk 30 magnetically engages a corresponding one of the disks 24 on a mating one of the rods 22, during construction of the roller coaster assembly 10. More particularly, three combinations are possible when mating one of the rods 22 having the disk 24 and one of the rods 26 having the disk 30: (1) the disk 24 is made of magnetic

material and the disk 30 is made of magnetically conductive metal; (2) the disk 24 is made of magnetically conductive metal and the disk 30 is made of magnetic material, or; (3) both the disk 24 and the disk 30 are made of magnetic material. In the third combination (*i.e.*, the magnetic disk-to-magnetic disk combination), the mating rods 22, 26 and their respective magnetic disks 24, 30 must be arranged so as to maintain proper polarity between the magnetic disks 24, 30 (*i.e.*, N to S or vice versa).

[0029] As shown in FIG. 4C, the connector 28 is flat and thin, and engages a lower surface of the rods 26. In other words, the connector 28 is positioned away from the surface of the rods 26 on which the balls 18 roll. For example, when viewed in a longitudinal cross-section of the rods 26, connector 28 can be positioned away from the inside upper quarter of the rods 26, the surfaces on which the ball 18 rolls. The connector 28 is formed this way so as not to impede the balls 18 when rolling on the rods 26 of the joint member 16. To illustrate this structural feature, a ball 18 is shown in phantom lines rolling along the joint member 16 without contacting the connector 28. In addition to the configuration of FIGS. 4B and 4C, connector 28 could be connected to rods 26 in any number of ways and could extend in any number of shapes. For example, connectors shaped as an arch could be affixed to the lowermost point of each rod 26 so as not to occupy any of the space between the rods 26.

[0030] Referring again to FIGS. 4A and 4B, each of the joint members 16 includes a C-shaped cuff member 32 that extends outwardly from one of the rods 26. Each of the cuff members 32 is dimensioned so as to removably engage a corresponding one of the vertical supports 14. More particularly, the cuff member 32 is sized and shaped so as to be clipped onto a vertical support 14 to maintain the desired position of the joint member 16 and its associated track sections 12, during operation of the roller coaster assembly 10. The vertical supports 14 may include guide markings thereon for indicating where to attach one of the cuff members 32, so as to aid in construction. The cuff members 32 are utilized throughout the roller coaster assembly 10 to suspend the track sections 12 between the successive vertical supports 14, as illustrated in FIGS. 1 and 2.

[0031] Referring now to FIGS. 1, 2, 5, and 6, each of the vertical supports 14 has an upper end 34 and a lower end 36. The C-shaped cuff member 32 engages the vertical supports 14 intermediate to the upper and lower ends 34, 36 thereof (see FIG. 5). Furthermore, the lower end 36 of each of the vertical supports 14 removably engages a base 38, which has a plurality of upwardly-extending tubes 40. The tubes 40 are dimensioned so as to have a diameter slightly larger than that of the lower end 36 of each of the vertical supports 14, so that a secure friction fit is attained when the lower end 36 is inserted into one of the tubes 40. The upper ends 34 of the vertical supports may removably support decorative elements, such as a flag 42, and/or functional elements, such as a sensor 44 (see FIGS. 1 and 2), the purpose of which will be discussed hereinafter. The vertical supports 14 are made of clear or translucent plastic, and preferably contain a plurality of LED lights 46 to illuminate the roller coaster assembly 10 for an enhanced aesthetic experience, as shown in FIGS. 5 and 6.

[0032] Referring now to FIGS. 1, 2, 7, and 7A, the lift track assembly 20 includes an elongate, inclined housing 48 with a top roller 50 and a bottom roller 52 positioned at opposed ends thereof. The top roller 50 is positioned adjacent to, or attached to, one of the track sections 12 positioned at the top T of the roller coaster assembly 10. The top roller 50 is preferably barbell-shaped, having a center portion 51 and two side portions 53 on either side thereof (see FIG. 7B), the purpose of which will be discussed hereinafter. The center and side portions 51, 53 are substantially cylindrical, and the diameter of the side portions 53 is greater than that of the center portion 51. The bottom roller 52, which has a similar barbell shape, engages a C-shaped support 54 at the bottom B of the roller coaster assembly 10 and is positioned adjacent another of the track sections 12 positioned proximate the C-shaped support 54. An endless belt 56 is contained within the housing 48 and is trained over the top and bottom rollers 50, 52. A battery-operated motor (not shown) contained within the housing 48 drives the rollers 50, 52 to move the belt 56 in a clockwise direction, as viewed in FIG. 7A. Magnets 58 are affixed to the center of the interior surface of the belt 56, the magnets 58 being narrower than the belt 56. The belt 56 travels under, and in a plane substantially parallel to, an inclined top surface 59 of the housing 48 on which the balls 18 travel. The inclined top surface 59 is

preferably made of a thin layer of non-magnetically conductive material with low friction-producing properties, such as a smooth plastic. The magnets 58 attract the balls 18 through the belt 56 and secure them to the center of the inclined top surface 59 as the balls 18 are conveyed from the bottom B to the top T of the roller coaster assembly 10 with a sliding motion (see arrows A and B in FIG. 7A). This creates the illusion that the balls 18 are independently rolling up the stationary inclined top surface 59.

[0033] Now referring to FIGS. 1 and 2, the roller coaster assembly 10 further includes special track sections or elements, such as a "loop-the-loop" 60, a ball drop 62, and a full loop 64. Other special track sections and elements could include trampolines, bridges, and pendulums. These special track sections may be included with the roller coaster assembly 10, or made available in an "expansion set" package for purchase and use at a later time. The rods that comprise the special track sections or elements have disks embedded in each of their ends like the disks 24 of rods 22 (*i.e.*, they are made of either a magnetic material or a magnetically conductive metal), so that they may engage the respective disks 30 embedded in the corresponding ends of the rods 26 of mating joint members 16.

[0034] Still referring to FIGS. 1 and 2, the roller coaster assembly 10 is also provided with an audiovisual system which includes a master controller 66, a series of the sensors 44 (only one of the sensors 44 being shown being FIGS. 1 and 2 for illustrative clarity), and a plurality of output devices (not shown in FIGS. 1 and 2, but to be described below). The audiovisual system is designed to introduce an array of dynamic audiovisual features to further enhance the use and operation of the roller coaster assembly 10. More particularly, the controller 66 is electronically programmed with voice and music samples and sound effects. The controller 66 preferably incorporates a "flash" memory so as to accept and store additional samples and sound effects from Internet downloads and other sources, such as MP3 and other digital media players. The sensors 44 are affixed to the track sections 12 and/or to the vertical supports 14 at various locations on the roller coaster assembly 10. Each sensor 44 preferably corresponds to a predetermined musical or sound element in the controller 66 such as, but not limited to, rhythm, melody, riffs, voice, and sound effects. The

sensors 44 are triggered by the movement of the balls 18 rolling along an adjacent track section 12. Once triggered, the sensors 44 transmit signals to the controller 66, which in turn activates an audio output device 68 (not shown) connected to the controller 66, whereupon the audio output device 68 plays one or more of the programmed voice or music samples or sound effects. In an embodiment of the present invention, the controller 66 can control the speed of the lift track assembly 20, which can determine the frequency by which balls are placed on the track assembly 10, and the frequency by which the balls pass the sensors.

[0035] Reference is now made to FIG. 8, which is a schematic diagram of the audiovisual system components of the roller coaster assembly 10. Each sensor 44 is programmed to activate at least one sample or sound effect (via the controller 66) when triggered by the motion of the ball 18. The speed and tempo of the balls 18 also determines which musical or sound element is played. Once triggered, the sensor 44 activates the controller 66, which in turn plays the programmed sample or sound effect through the audio output device 68, which may be a speaker, for example.

[0036] Still referring to FIG. 8, a visual element, such as a graphic display, animation sequence or video clip, may also be programmed into the controller 66 for playing in response to signals from the sensors 44. As in the production of the sample or sound effect described above, the sensor 44 transmits a signal to the controller 66 when triggered by the motion of the balls 18, whereupon the controller 66 plays a programmed visual element on an attached video output device 70. The video output device 70 may be a video monitor or a computer screen, for example.

[0037] Construction of the roller coaster assembly 10 may begin by connecting the disks 24 on proximate ends of the rods 22 of one of the track sections 12 to the respective disks 30 on the corresponding ends of the rods 26 of one of the joint members 16. As previously described, at least one of the mating disks 24, 30 is made of a magnetic material, and the other one is either made of a magnetically conductive metal, or is also made of a magnetic material. Another of the track sections 12 may then be similarly connected to the opposite proximate ends of the rods 26 of the same joint member 16 (see FIGS. 1 and 2).

One of the special track sections or elements (*e.g.*, the "loop-the-loop" 60, the ball drop 62, or the full loop 64) may be connected to one of the joint members 16 in a similar fashion.

[0038] The interconnected track sections 12 (and/or special track sections) are then suspended by way of clipping each of the cuff members 32 of the joint members 16 onto a respective vertical support 14 at a point intermediate the upper and lower ends 34, 36 of the vertical support 14 (the lower ends 36 of the vertical supports 14 should already have been secured within the respective tubes 40 of the bases 38 at this time). The top and bottom rollers 50, 52 of the lift track assembly 20 may then be positioned adjacent to, or attached to the track sections 12 suspended at the top T and bottom B of the roller coaster assembly 10, respectively (see FIGS. 1, 2, and 7). The interchangeability of the various structural elements allows a user to create many different coaster configurations of the roller coaster assembly 10.

[0039] Once the structural elements of the roller coaster assembly 10 have been interconnected as described above, the audiovisual system components may be set up. More particularly, each of the sensors 44 is secured to one of the track sections 12 or to one of the vertical supports 14. The controller 66, the audio output device 68 and the video output device 70 (some or all of which may be contained in one housing), are positioned proximate the assembled structural elements, within signal transmission range of the plurality of the sensors 44 (see FIGS. 1 and 2).

[0040] In operation, the power source(s) for the controller 66, the sensors 44, the audio output device 68, the video output device 70, and the LED lights 46 is/are activated. The battery-powered internal motor of the lift track assembly 20 is started, which rotates the top and bottom rollers 50, 52 (as indicated by arrows C in FIG. 7A), moving the belt 56 and the magnets 58 affixed thereto in a clockwise direction, as viewed in FIG. 7A. Once on the track section 12 at the bottom B of the roller coaster assembly 10, the balls 18 are attracted by the magnets 58 and are dragged onto the inclined top surface 59 of the housing 48, as indicated by arrow A in FIG. 7A. The belt 56 conveys, or slides the magnetically-engaged balls 18 upwardly on the inclined top surface 59 towards the top roller 50, as indicated by arrow B in FIG. 7A. During such movement of

the belt 56, the magnets 58 pass over the center portion 51 of the top roller 50, while opposite edge portions of the belt 56 ride on the side portions 53 of the top roller 50 (see FIG. 7B).

[0041] Immediately after negotiating the top roller 50, the belt 56 and magnets 58 begin a descent towards the bottom roller 52. Simultaneously, the balls 18 reach the top T of the roller coaster assembly 10 and roll onto the adjacent track section 12, thereby separating the balls 18 from the lift track assembly 20. Due to gravitational force, the balls 18 then descend along the track sections 12, as indicated by arrow D in FIG. 7A. During their descent along the track sections 12, the joint member 16 and the other structural elements, the balls 18 trigger the sensors 44, which in turn transmit signals to the controller 66 and play sound samples and effects and/or visual effects and video clips on the audio and video output devices 68, 70, respectively. The balls 18 negotiate the special track sections along the circuit of the roller coaster assembly 10 to loop, drop, or engage in other unusual movement, further enhancing the visual display. Once the balls 18 complete the circuit, they return to the bottom roller 52 of the lift track assembly 20, whereupon the circuit may be repeated.

[0042] It should be appreciated that the present invention provides numerous advantages over conventional toy roller coaster assemblies discussed above. For instance, the inclusion of LED lights 46 and the audiovisual system enhance the aesthetic appearance of the roller coaster assembly 10, and add a sonic/musical dimension to the action of the balls 18, making it more attractive to children.

[0043] Another advantage of the present invention is the ability of the controller 66 to mix and match signals from the sensors 44 to an exhaustive selection of voice and song samples, sound effects, graphic displays, animation sequences, and video clips, all of which may be programmed into the controller 66. The extensive variety of audiovisual outputs, combined with the many possible structural configurations make possible a virtually infinite number of variations and combinations of the sight, sound, and operation of the roller coaster assembly 10.

[0044] It will be understood that the embodiment described herein is merely exemplary, and that a person skilled in the art may make many variations and modifications without departing from the spirit and scope of the invention. Such

variations, for example, include the sizes and materials of the various structural components of the roller coaster assembly 10. The magnets 58 affixed to the belt 56 in the lift track assembly 20 may be embedded within the belt 56 instead or on a side of belt 56 opposite to the side on which the magnets are shown in FIG. 7A. Additional structural and audiovisual features, including those not discussed in the foregoing detailed description, may be available in a compatible but separate expansion package or packages. Sound and/or video cards, amplifiers and other components may also be incorporated into the audiovisual system. These and all other such variations and modifications are intended to be included within the scope of the invention.

[0045] FIG. 9 illustrates a toy roller coaster assembly 100 according to another embodiment of the present invention. As shown, assembly 100 includes various structural elements including a plurality of track sections 120, a plurality of columnar vertical supports 140, and a plurality of joint members 160, which connect the track sections 120 to each other and to the vertical supports 140. Also included is a plurality of metal marbles or balls 180 that removably engage the track sections 120. A lift track assembly 200 vertically conveys the balls 180 from the lowest level, or bottom B, of the roller coaster assembly 100 to the highest level, or top T, of the roller coaster assembly 100. In this embodiment, lift track assembly 200 lifts the balls 180 vertically straight up, in a direction perpendicular to the horizontal surface on which the assembly 100 sits.

[0046] Referring to FIGS. 9 and 10, each of the track sections 120 comprises a pair of rods 220 that are spaced apart from each other in a parallel formation a distance sufficient to hold the balls 180 and allow the balls 180 to roll over and in between the rods 220. The rods can be held together by at least one connecting member, such as end connector 280 or intermediate connector 281, as shown in FIG. 10. The connectors 280 and 281 are configured to connect the rods 220 without obstructing the travel of a ball 180 over the rods 220. As shown best in FIG. 10, in this embodiment, the upper surface of connector 280 in between rods 220 has the shape of a partial cylinder. The channel created by this partial cylinder enables a ball 180 to pass over the connector 280 without obstruction. The connectors 280 and 281 could, of course, be connected to rods

220 using other shapes and configurations, as described above with reference to connector 28 of FIGS. 4A and 4B.

[0047] In one implementation of the present invention, track sections 120 are assembled magnetically, with at least one magnet or ferromagnetic element disposed at each end of a track section. Preferably, as shown in FIG. 10, a magnet 240 is disposed at the end of each rod 220. In this example, magnets 240 are cylindrical magnets and are embedded in the hollow bodies of the connectors 280 that connect the ends of rods 220. Covers 241 retain the magnets within the hollow connectors 280.

[0048] The rods 220 are pre-formed in any number of shapes and sizes suitable for conveying balls 180, including straight sections, curved sections, and circular or looped sections. The rods 220 are preferably made of plastic over which a thin layer of metal is deposited by vacuum metallization. A transparent topcoat can be applied over the metallic coating to improve its abrasion resistance and protect it against environmental influences, such as humidity. The rods 22 can range in length from approximately two inches to approximately six inches. Each rod 22 can be, for example, ¼" in diameter, which can accommodate an approximately ½" diameter ball without impeding the ball.

[0049] In magnetically assembling coaster assembly 100, track sections 120 can be connected directly to each other. Alternatively, track sections 120 can be connected using joint members 160, which also enable the connection of track sections 120 to vertical supports 140 to achieve different elevations for each of the track sections 120. As shown in FIG. 10, an exemplary joint member 160 includes two spaced apart projecting members 320 connected by a connector 283. In this example, projecting members 320 are C-shaped so as to partially wrap around a vertical support 140. These C-shaped members 320 can be configured to tightly snap around vertical supports 140 by an interference fit, to secure the joint member 160 on the vertical support 140 without sliding down.

[0050] Alternatively or in addition to the interference fit, the C-shaped members 320 can include a projection 321 configured to engage cooperating projections 323 on a vertical support (as shown in FIG. 9). In this manner, the hook-shaped projection 321 can hang on the projections 323 of the vertical supports 140. The vertical supports 140 can be generally rectangular in shape as shown in FIG. 9,

with pairs of projections 323 located at incremental elevations to enable a variety of configurations for supporting and joining track sections 120. Each vertical support 140 is removably connected to a base 380, which is of a dimension and stiffness suitable for supporting the vertical supports 140 upright along with the joined track sections 120.

[0051] As shown in FIG. 10, a joint member 160 magnetically couples two track sections 120. As such, joint member 160 can be magnetic or ferromagnetic, depending on the particular magnetic or ferromagnetic elements provided in the ends of the track sections 120. In one embodiment, joint member 160 provides ferromagnetic surfaces to which magnetic ends of the track sections 120 magnetically bond. To provide a superior bond, however, joint member 160 can contain at least one magnet. As shown in FIG. 10, magnets 284 can be disposed in the hollow body of the connector 283, with a cover 285 holding the magnets 284 within connector 283. The connector 283 of joint member 160 can be sized and shaped similarly to the connectors 280 of the track sections 120, which provides continuous surfaces that enable a substantially seamless connection between the components, enabling a ball 180 to roll over each component without obstruction. To provide the magnetic bond, the polarities of the magnets in the track sections 120 and joint member 160 alternate, as shown in FIG. 10. Joint member 160 may be fabricated from the same plastic as track sections 120, or from any other suitable material.

[0052] FIGS. 11A and 11B illustrate a lift track assembly 200 according to an embodiment of the present invention. As shown, lift track assembly 200 rests on a base 201 from which it extends vertically upward. Balls 180 enter the lift track assembly 200 through a ball separator assembly 202 and magnetically bond to magnets revolving within the assembly, which carry the balls 180 up the assembly 200 and deliver the balls to a highest track section 120 (see FIG. 9). As shown in the exploded view of FIG. 11B, this exemplary lift track assembly 200 includes motorized pulleys 203, an endless belt 204 routed around the pulleys 203, a plurality of magnets 205 affixed to the belt 204 by magnet holders 206, belt housing covers 207, and assembly end caps 208. Magnet holders 206 are affixed to the belt 204 by adhesive, for example. In turn, magnets 205 are affixed to the magnet holders by, for example, adhesive, injection molding, or an

interference fit. The magnets 205, magnet holders 206, and belt 204, and the means by which they are fastened to each other, are flexible enough to travel around the radius of the pulleys 203. Alternatively, instead of using separate magnets 205, the belt 204 itself could be made of a flexible magnetic material. In addition, belt 204 could be configured as described above in reference to the embodiments of FIGS. 7A and 7B.

[0053] Lift track assembly 200 could operate with belt 204 and its magnets 205 exposed. However, to provide the visually striking appearance of balls 180 magically traveling up a vertical column, an embodiment of the present invention covers the belt 204 with belt housing covers 207. Covers 207 can be made of a thin, smooth non-magnetic material that does not interfere with the magnetic coupling between the magnetic belt and the ferromagnetic balls, and enables the balls 180 to freely travel. By using a magnet and a ball (as opposed to some other toy vehicle), the ball freely rolls over the cover and contributes to the illusion that the toy object is rolling upward by itself. To complete the finished appearance of assembly 200 and protect its moving parts, assembly 200 can also include end caps 208.

[0054] An embodiment of the present invention provides a ball separator 202 that controls the passage of balls 180 onto lift track assembly 200. As shown in the exploded view of FIG. 12, ball separator 202 includes a track section 1200, a ball spacer 1206, a ball separator magnet 1208, a ball separator cap 1210, and a ball arch 1212. Track section 1200 can be configured similarly to the track sections described above, including a pair of spaced apart rods joined by a connector 1202, which has magnets for joining track section 1200 to other track sections or joint members. Track section 1200 is configured to slope down towards the bottom of lift track assembly 200. In this embodiment, track section 1200 has at its end opposite connector 1202 a base 1204 that is positioned near the bottom of lift track assembly 200. Base 1204 can attach to lift base 201 to maintain a distance and alignment appropriate for magnetically transferring balls 180 from ball separator 202 to lift track assembly 200.

[0055] Proximate to the exit end of track section 1200, ball arch 1212 is connected to the pairs of rods of the track section 1200. Ball arch 1212 spans the rods and is sized and shaped to lightly contact the balls 180 as they pass through

the arch 1212. The friction created by this light contact slows the balls down and prevents them from bumping into each other and interfering with the transfer of balls onto the lift track assembly 200. The size, shape, and material of the ball arch 1212 can be adjusted to provide the friction appropriate for good operation of the ball separator 202.

[0056] Beyond the arch 1212, ball spacer 1206 is pivotably connected to track section 1200 so that it can pivot into and out of the path of the balls, for example, pivoting from below, from the side, or from above the ball path. In this example, ball spacer 1206 pivots from below the rods and can rise into the path of the balls. Ball spacer 1206 contains ball separator magnet 1208 and is preferably biased (*e.g.*, by a spring or by gravity) to remain below the rods. When a ferromagnetic ball passes over the magnet 1208, the magnetic attraction between the ball and the magnet 1208 lifts the projecting member of the ball spacer 1206 above the rods, which separates the ball from the other balls lined up behind the ball waiting to enter the lift track assembly 200. When the lift track assembly 200 pulls the ball off of the ball separator 202, the ball spacer 1206 pivots back down, which removes the projecting member from the ball path and allows the next ball to pass over the rods and above the magnet 1208. This process then repeats for each ball. As shown in FIG. 12, ball separator 202 can include a cap 1210 at its exit end for covering the ball spacer 1206 and magnet 1208, and for providing a connection to the lift base 201.

[0057] Referring again to FIG. 9, toy roller coaster assembly 100 can include special track features such as a loop-the-loop 600, a trampoline 602, a magnetic U-turn 606, and a magnetic bridge 604. These components can be incorporated in the track sections of assembly 100 and provided with magnetic couplings as described above for track sections 120. For example, as shown in FIG. 9, a track section 120 can include a pair of rods formed in a full loop 640. As another example, a track section 120 can include a pair of rods having an integrally formed trampoline 602, with the rods shaped to deliver a ball off of the rods, onto the trampoline, and then back onto the rods. In other words, the ball leaves the pair of rods, bounces on the trampoline, and lands back on a lower part of the pair of rods. The trampoline can be made of a thin elastic membrane, such as a sheet of rubber.

[0058] FIG. 13 illustrates a magnetic bridge 604 according to an embodiment of the present invention. As shown, magnetic bridge 604 includes two pairs of rods 1300 connected by a single magnetic rod 1302. Two brackets 1304 support magnetic rod 1302 over the pairs of rods 1300, preferably centered longitudinally in between the rods. Brackets 1304 can be in the shape of an arch or half of an arch, under which balls 180 can pass. Brackets 1304 each include at least one magnet 1306, retained inside the housings of the brackets 1304 by a cap 1308. The magnets 1306 transfer magnetism to the rod 1302 to make rod 1302 magnetic, so that the ferromagnetic balls 180 adhere to rod 1302. As shown in FIG. 13, the open ends of the pairs of rods 1300 are curved away from rod 1302, which facilitates the transfer of the balls 180 to and from the rod 1302. Thus, for example, looking at a ball traveling through the magnetic bridge 604 of FIG. 13 from left to right, a ball passes underneath the bracket 1306 on the left, magnetically adheres to and rolls along the rod 1302 (as shown in FIG. 9, for example), drops off of the rod 1302 at the bracket 1306 on the left, and lands on the pairs of rods 1300 on the right, continuing to roll along the track assembly. Alternatively, instead of having a rod magnetically charged by separate magnets, rod 1302 itself could be made of magnetic material.

[0059] FIG. 14 illustrates an exploded view of the magnetic U-turn 606 shown in FIG. 9, according to an embodiment of the present invention. As shown, magnetic U-turn 606 includes a rod section 1400, a magnet 1402, an upper connector 1404, a lower connector 1406, and caps 1408. Rod section 1400 can include a pair of spaced apart, U-shaped rods, held together by a magnet housing 1410. Magnet 1402 is dispose inside magnet housing 1410. Lower connector 1406 attaches to the lower ends of the rods and provides a cover over magnet housing 1410. Upper connector 1404 attaches to the upper ends of the rods.

[0060] Upper and lower connectors 1406 can include magnetic or ferromagnetic components for connecting magnetic U-turn 606 to other track sections as described above. Caps 1408 can seal such components inside connectors 1404 and 1406. Connectors 1404 and 1406 can also include means for connecting magnetic U-turn 606 to vertical supports 140, such as the C-shaped members 1412 shown in FIG. 9.

[0061] In operation, magnetic U-turn 606 transfers a ball traveling on an upper track section in one direction, to a lower track on which the ball travels in the opposite direction. As the ball travels onto the rod section 1400, the magnet 1402 holds the ball against the rods as ball rolls around the U-turn. When the ball rolls around to the lower part of the rod section 1400, the magnetic attraction diminishes and allows the ball to drop from the rods while it is still traveling in generally the reverse direction. The ball drops from the lower part of the rod section 1400 and lands on a lower track section (such as section 1414 in FIG. 9) to continue on in the track assembly. In this manner, U-turn 606 provides a visually interesting effect in which the ball appears to steer itself around the U-turn to an upside down position, and then jump from underneath the U-turn to the next track section.

[0062] As shown in FIG. 9, an embodiment of the toy roller coaster assembly 100 can include a controller 250, which can control the speed of lift track assembly 200 and can provide audiovisual effects using sensors 251, as described above in reference to controller 66 of FIG. 1. Controller 250 can control the pace of the balls and can generate audiovisual effects in response to balls passing sensors 251. A user can also customize the timing and content of the effects by placing sensors at different locations throughout the assembly 100, and by supplying personal digital media content to the controller 250. For example, a user can download digital music to a flash memory in the controller 250, or can plug an MP3 player or other digital music player into the controller 250.

[0063] In one aspect of the invention, controller 250 plays background music while the assembly 100 is in operation, with the lift track assembly 200 revolving and lifting balls to the highest track section. The user can then add beats or other musical effects to the background music by placing sensors 251 along the track, which activate the beat or effect when a ball passes by. The user can change the background music and the music effects using the controller 250. The controller 250 can also provide a "shuffle mode" in which the user's musical settings are randomly reconfigured.

[0064] Controller 250 can include an integrated speaker, a headphone jack and headphones, lights, and a display panel, for generating the audiovisual effects.

Sensors 251 can be magnetic, optical (*e.g.*, infrared), or mechanical (*e.g.*, spring lever switch), or can use any other means appropriate for detecting the passing balls.

[0065] In a further aspect of the present invention, a toy roller coaster assembly includes track sections formed from bendable, repositionable rods. In this manner, a user can create any desired track configuration as long as two corresponding pairs of rods are shaped to adequately carry the balls. The bendable rods can be separate pieces that are joined by connectors (such as the embodiment of FIGS. 3A-4B) or can include integral connectors that enable the bending of an entire track section (such as in the embodiment of FIGS. 9 and 10). For example, with integral connectors, the entire track section can be twisted into helical shapes. To enable repositioning, the rods of this embodiment can be made of a material that flexes and bends, yet maintains sufficient sturdiness and rigidity in its new position.

[0066] In a further aspect of the present invention, the balls 180 are magnetic in addition to or instead of the components of the toy roller coaster assembly. For example, in one embodiment, a lift track assembly could provide a ferromagnetic belt that attracts and carries magnetic balls. As another example, magnetic balls could adhere to the ferromagnetic rods of a track section.

[0067] The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be apparent to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims, and by their equivalents.

[0068] Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that the method or process does not rely on the particular order of steps set forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps

set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.

WHAT IS CLAIMED IS:

1. A toy roller coaster assembly comprising:

a ball;

a plurality of track sections including an upper track section and a lower track section; and

a lift track assembly comprising

a lower end proximate the lower track section,

an upper end proximate the upper track section, and

a rotating belt configured to magnetically carry the ball from the lower track section to the upper track section.

2. The assembly of claim 1, wherein the ball is ferromagnetic, wherein the belt contains a plurality of magnets longitudinally spaced apart along the belt, and wherein a magnet of the magnets carries the ball.

3. The assembly of claim 2, wherein the lift track assembly further comprises a housing cover over the belt, wherein the magnet holds the ball to the cover and the ball rolls over the cover and up the lift track assembly.

4. The assembly of claim 2, wherein the lift track assembly further comprises at least one pulley around which the belt rotates, wherein the at least one pulley defines a recess in its outer surface over which the belt travels, wherein the belt has an interior face and an exterior face, wherein the plurality of magnets is disposed on the interior face of the belt, and wherein the magnets pass through the recess as the belt passes over the at least one pulley.

5. The assembly of claim 1, wherein the lift track assembly comprises a straight vertical member standing on a horizontal surface, and wherein the lift track assembly carries the ball in a direction perpendicular to the horizontal surface.

6. The assembly of claim 1, wherein the ball is one of ferromagnetic and magnetic,

wherein the assembly further comprises a ball spacer pivotably connected to the lower track section,

wherein the ball spacer has a projecting member that is biased to remain removed from the ball path of the lower track section in a first pivot position and is adapted to project into the ball path of the lower track section in a second pivot position, and

wherein the ball spacer contains a magnet that pivots the ball spacer to the second pivot position when the ball passes the ball spacer, such that the projecting member is in the ball path between the ball and a successive ball.

7. The assembly of claim 6, further comprising an arch connected over the lower track section, the arch adapted to contact and slow the ball traveling on the lower track section before the ball reaches the ball spacer.

8. The assembly of claim 1, wherein each track section of the plurality of track sections comprises a pair of spaced apart rods and at least one magnet disposed at each end of the each track section, for joining the plurality of track sections.

9. The assembly of claim 8, further comprising:

a vertical support;

a joint member adjustably attached to the vertical support, the joint member containing a magnet and having a first face and a second face opposite the first face,

wherein a first track section of the plurality of track sections magnetically adheres to the first face,

wherein a second track section of the plurality of track sections magnetically adheres to the second face,

wherein the magnet of the first track section, the magnet of the joint member, and the magnet of the second track section alternate in polarity.

10. The assembly of claim 9, wherein the joint member has a projection, and wherein the vertical support has a plurality of incremental projections on any of which the projection of the joint member can be placed to set an elevation of the joint member.

11. The assembly of claim 8, wherein the rods can be bent into different positions.

12. The assembly of claim 1, wherein a track section of the plurality of track sections comprises:

an entry track portion;

an exit track portion; and

a magnetic rod section suspended over and connecting the entry track section to the exit track portion,

wherein the ball is one of magnetic and ferromagnetic, and

wherein the ball rolls over the entry track portion, magnetically suspends from and rolls along the magnetic rod, and drops off of the magnetic rod and onto the exit track portion.

13. The assembly of claim 1, wherein the ball is one of magnetic and ferromagnetic, and wherein a track section of the plurality of track sections comprises:

an entry track portion;

an exit track portion longitudinally spaced apart a distance from the entry track portion;

a first bracket attached to the entry track portion;

a second bracket attached to the exit track portion; and

a magnetic rod having a first end connected to the first bracket and a second end connected to the second bracket, the rod suspended over and spanning the distance between the entry track portion and the exit track portion.

14. The assembly of claim 13, wherein the entry and exit track portions each have an open end disposed under the rod, wherein the open end curves away from the rod.

15. The assembly of claim 13, wherein the magnetic rod comprises a ferromagnetic rod in magnetic communication with a magnet disposed in at least one of a housing of the first bracket and a housing of the second bracket.

16. The assembly of claim 13, wherein the entry track portion and the exit track portion each comprise a pair of spaced apart rods, and wherein the first and second brackets center the rod over the spaced apart rods, longitudinally in between the spaced apart rods.

17. The assembly of claim 1, wherein the ball is one of magnetic and ferromagnetic, and wherein a track section of the plurality of track sections comprises:

a U-shaped track section having an outer surface over which the ball rolls, the outer surface transitioning from a horizontal position, to a vertical position, and to an upside down horizontal position; and

a magnet disposed inside the U-shaped track section, wherein the magnet holds the ball to the outer surface in the vertical position such that the ball rolls around the U-shaped track and drops from the U-shaped track section to a lower track section of the plurality of track sections.

18. The assembly of claim 17, wherein the U-shaped track section comprises a pair of spaced apart U-shaped rods and a housing connecting the rods, wherein the magnet is disposed inside the housing.

19. The assembly of claim 1, further comprising:

a plurality of balls;

a sensor proximate to a track section of the plurality of track sections, wherein the sensor detects passage of a ball of the plurality of balls and sends a signal; and

a controller in communication with the sensor, wherein the controller receives the signal and, in response, produces one of an audio effect and a visual effect.

20. The assembly of claim 19, wherein the controller controls the speed at which the belt rotates.

21. The assembly of claim 19, wherein the controller is adapted to receive and play digital media content from an external source.

22. The assembly of claim 1, wherein a trampoline track section of the plurality of track sections comprises an entry track portion and exit track portion connected by a trampoline portion, wherein the trampoline track section is configured such that the ball rolls over the entry track portion, drops off of the entry track portion, bounces on the trampoline portion, lands on the exit track portion, and continues on rolling on the exit track section.

23. A toy roller coaster assembly comprising:

a ferromagnetic ball;

a plurality of track sections including a lowermost track section and an uppermost track section;

a lift track assembly having a bottom end proximate the lowermost track section and a top end proximate the uppermost track section, the lift track assembly comprising

at least one pulley,

a magnetic belt rotating around the at least one pulley,

a housing cover covering the belt,

wherein the magnetic belt attracts the ball, holds the ball against the cover, and pulls the ball up along the cover such that the ball rolls along the cover from the lowermost track section to the uppermost track section;

a vertical support; and

a joint member adjustably attached to the vertical support, the joint member having a first face and a second face and a first magnet disposed between the first face and the second face,

wherein a first track section of the plurality of track sections comprises a pair of spaced apart rods having a second magnet at an end of the first track section,

wherein a second track section of the plurality of track sections comprises a pair of spaced apart rods having a third magnet at an end of the second track section,

wherein the first magnet and the second magnet hold the first track section to the first face of the joint member,

wherein the first magnet and the third magnet hold the second track section to the second face of the joint member,

wherein the second magnet, the first magnet, and the third magnet alternate in polarity, and

wherein the first track section, the joint member, and the second track section provide continuous surfaces over which the ball rolls.

24. A toy roller coaster assembly comprising:

a plurality of ferromagnetic balls;

a plurality of track sections including a lowermost track section and an uppermost track section;

a lift track assembly having a bottom end proximate the lowermost track section and a top end proximate the uppermost track section, the lift track assembly comprising

at least one pulley,

a magnetic belt that magnetically carries the balls from the lowermost track section to the uppermost track section;

a first sensor that detects passage of a ball at a first location on the toy roller coaster assembly and, in response, sends a first signal;

a second sensor that detects passage of a ball at a second location on the toy roller coaster assembly and, in response, sends a second signal;

a controller in communication with the lift track assembly, the first sensor, and the second sensor,

wherein the controller comprises an output device, wherein the output device provides one of audio output and visual output,

wherein the controller controls the speed of the belt,

wherein, in response to the first signal, the controller generates a first effect, wherein the first effect is one of an audio effect and a visual effect, and

wherein, in response to the second signal, the controller generates a second effect different from the first effect, wherein the second effect is one of an audio effect and a visual effect.

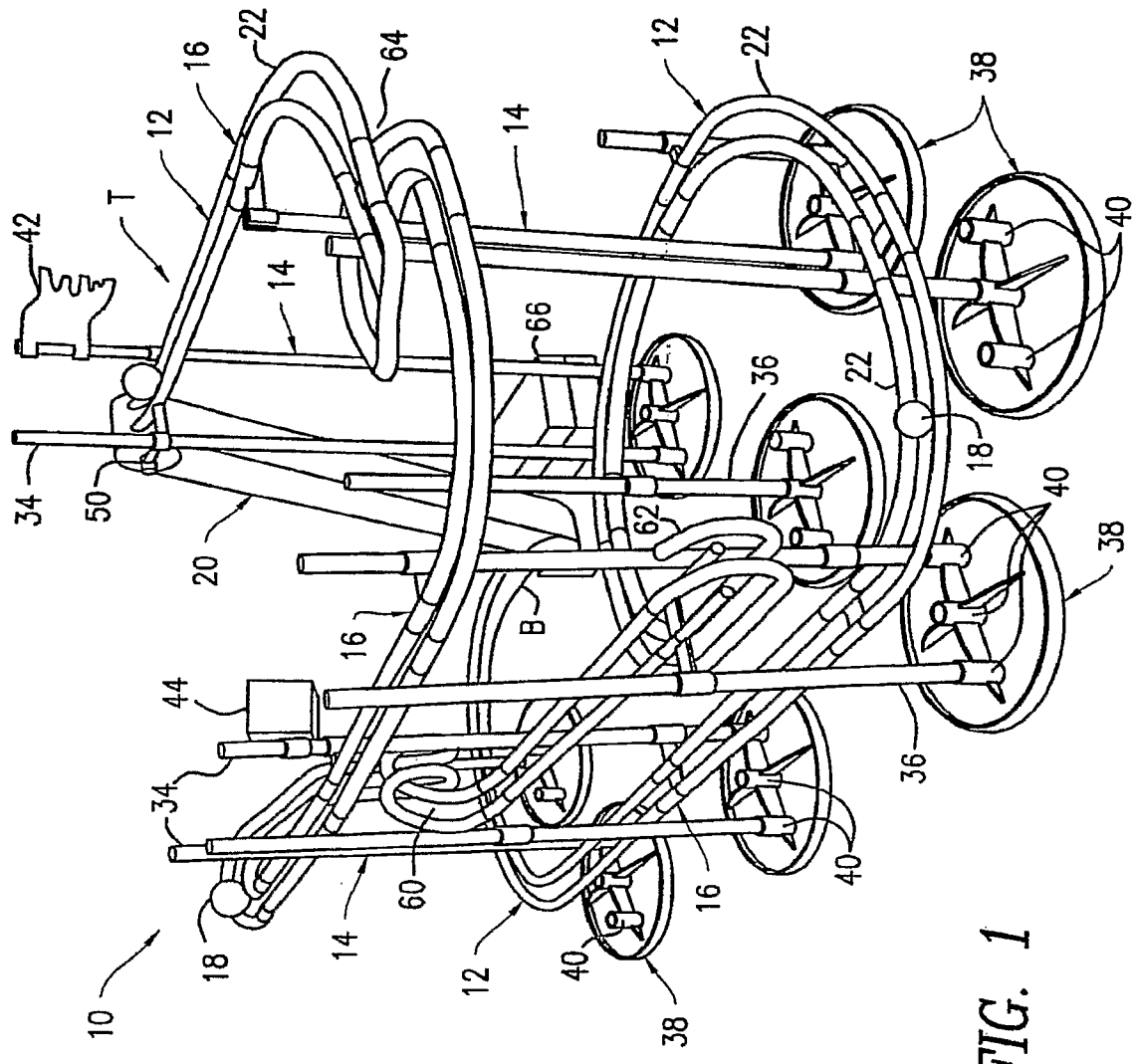

FIG. 1

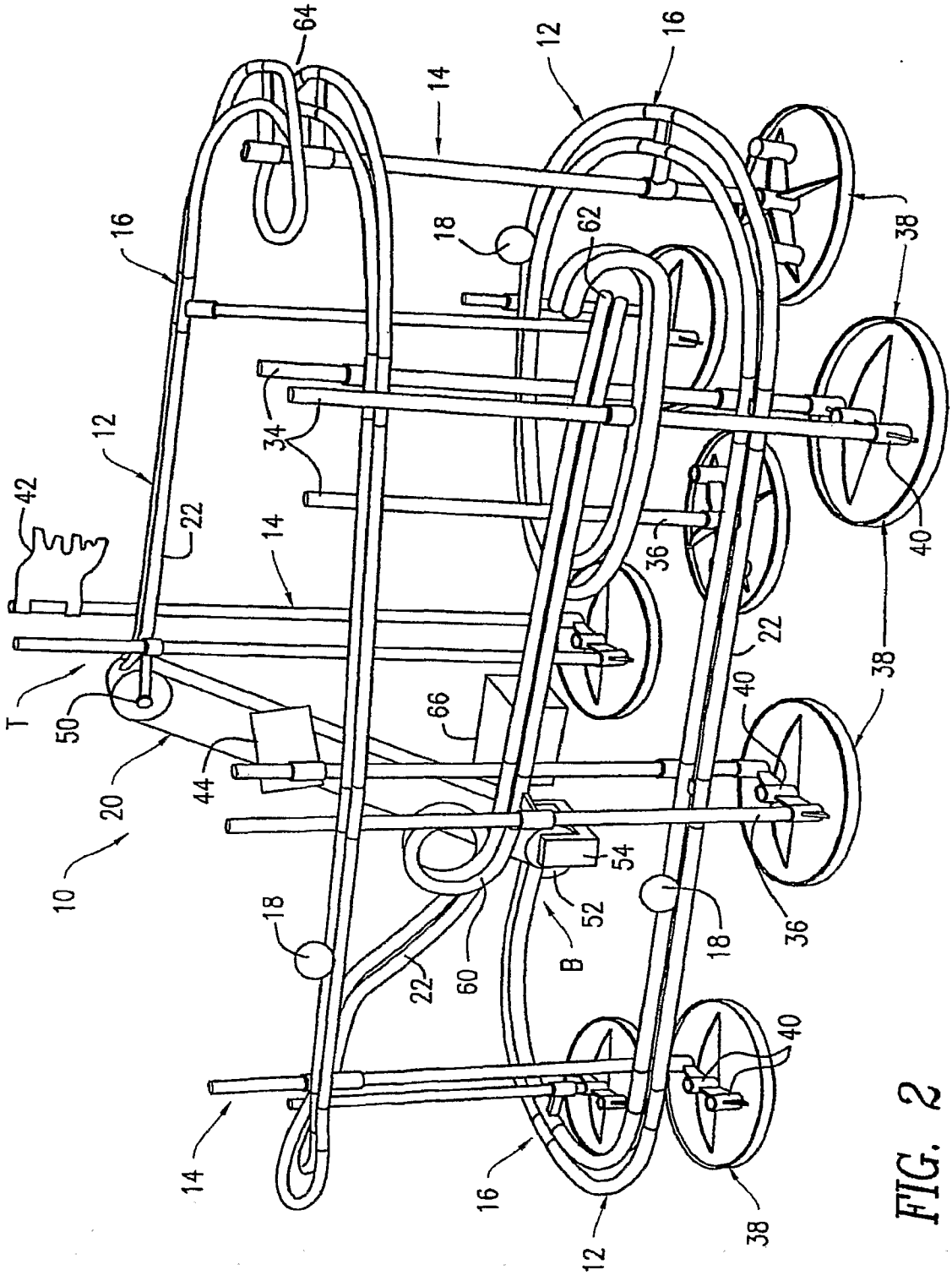
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FIG. 2

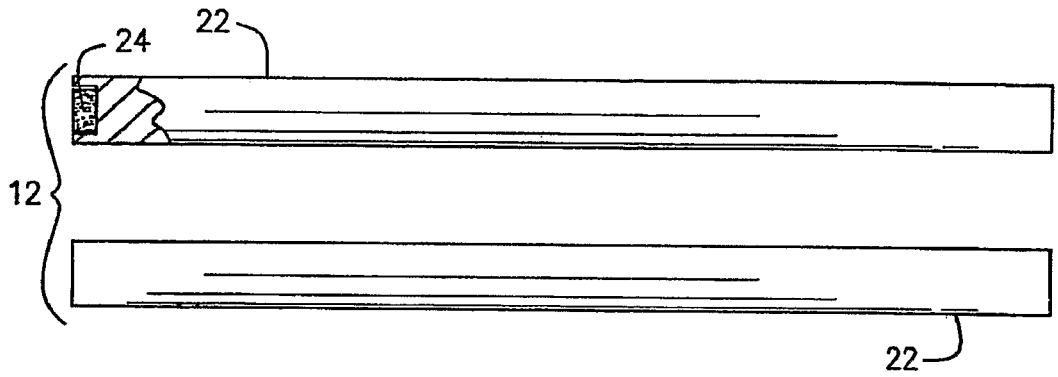

FIG. 3A

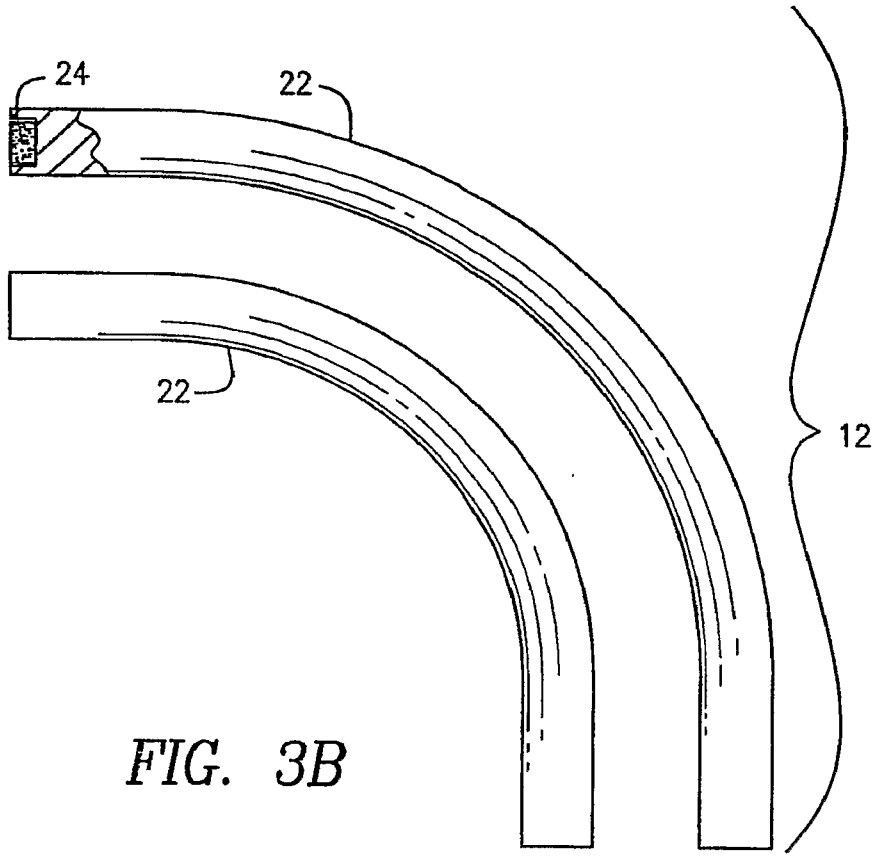

FIG. 3B

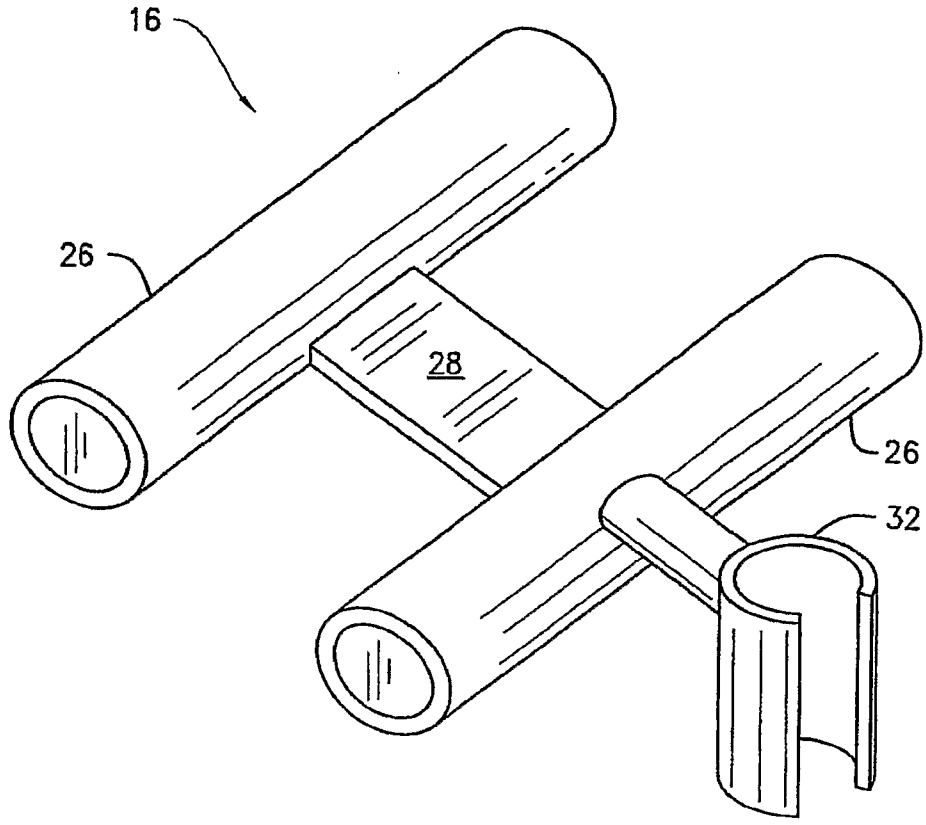

FIG. 4A

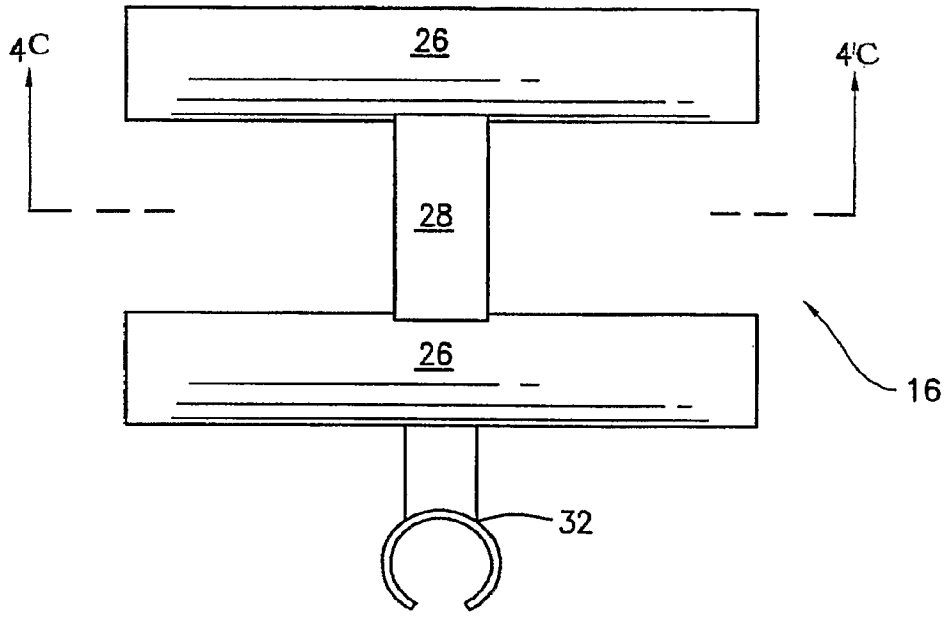

FIG. 4B

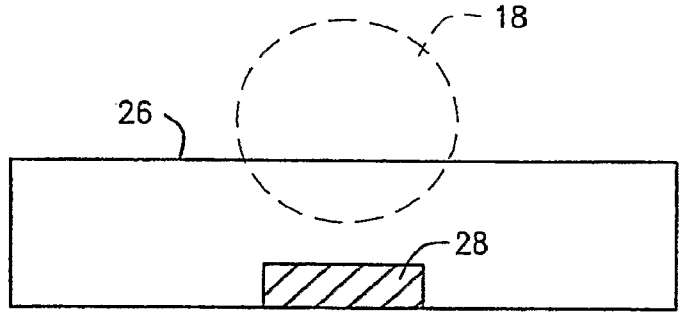

FIG. 4C

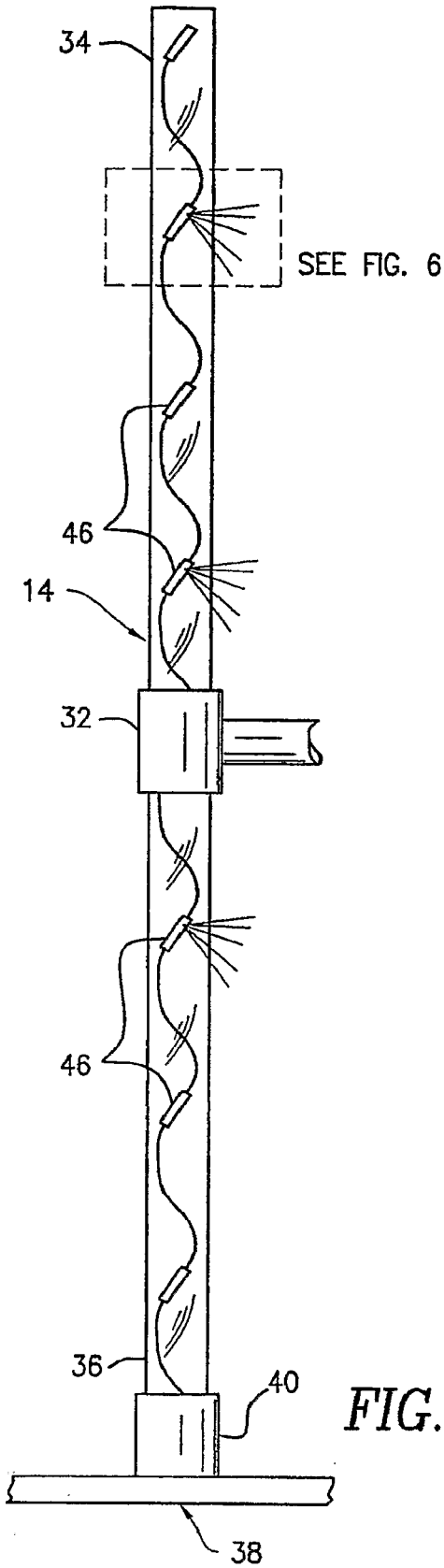

FIG. 5

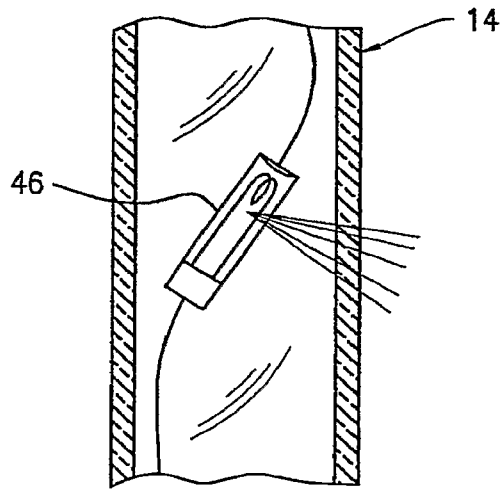

FIG. 6

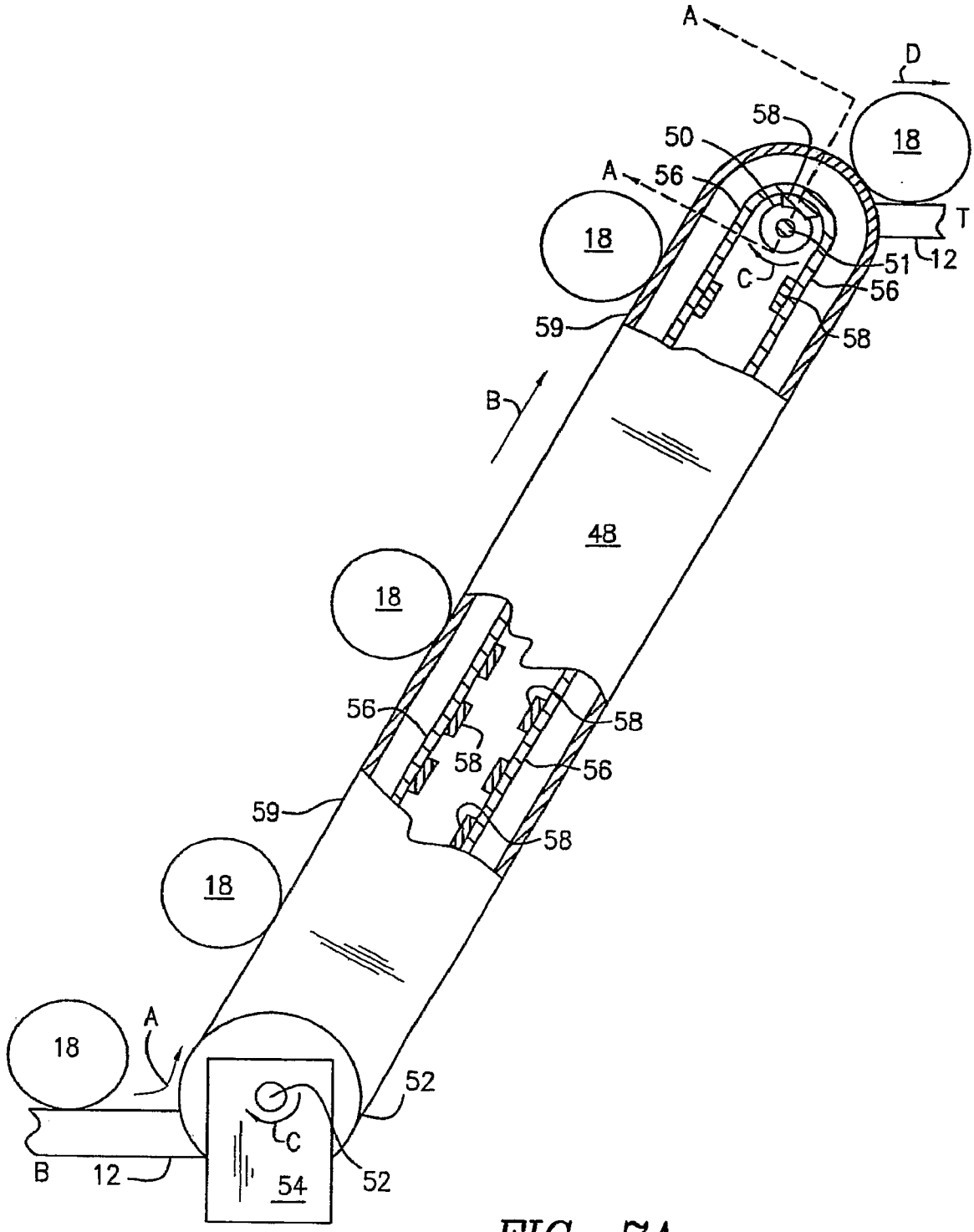
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FIG. 7A

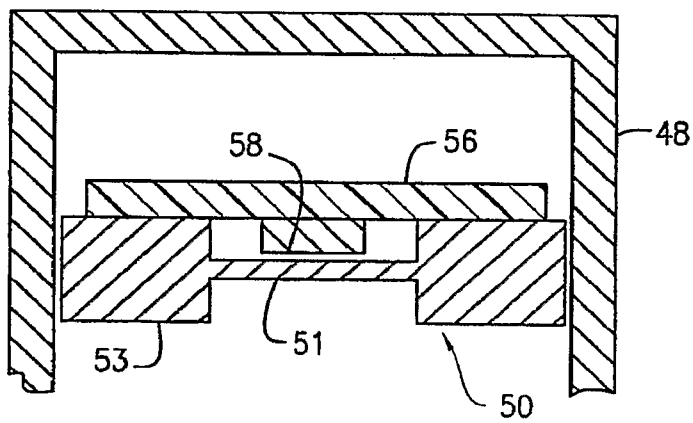


FIG. 7B

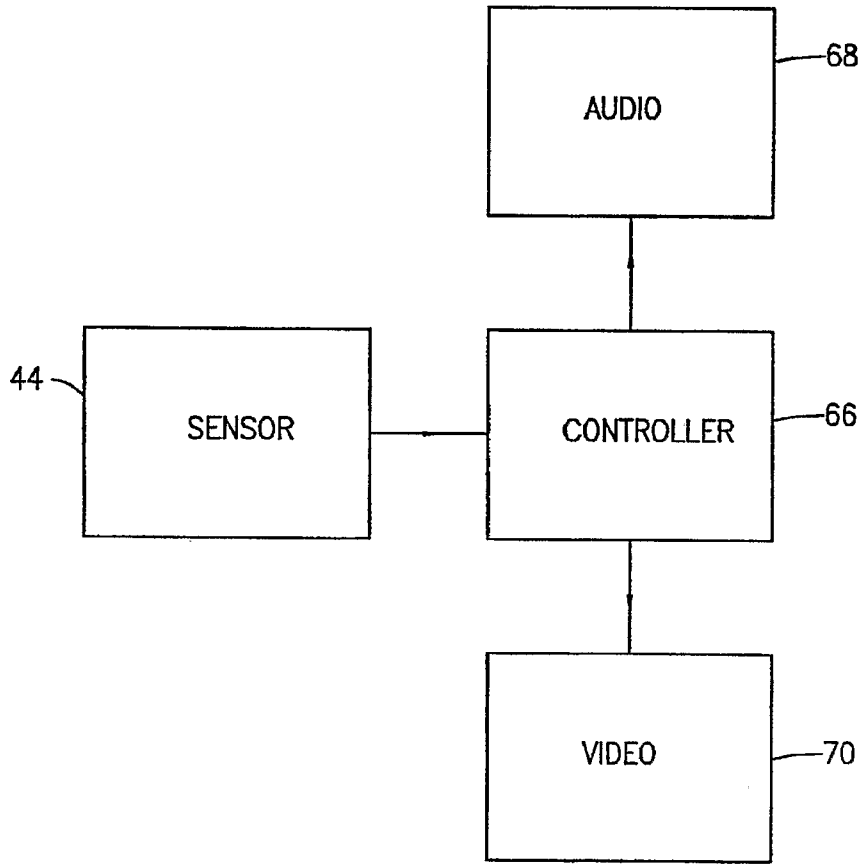
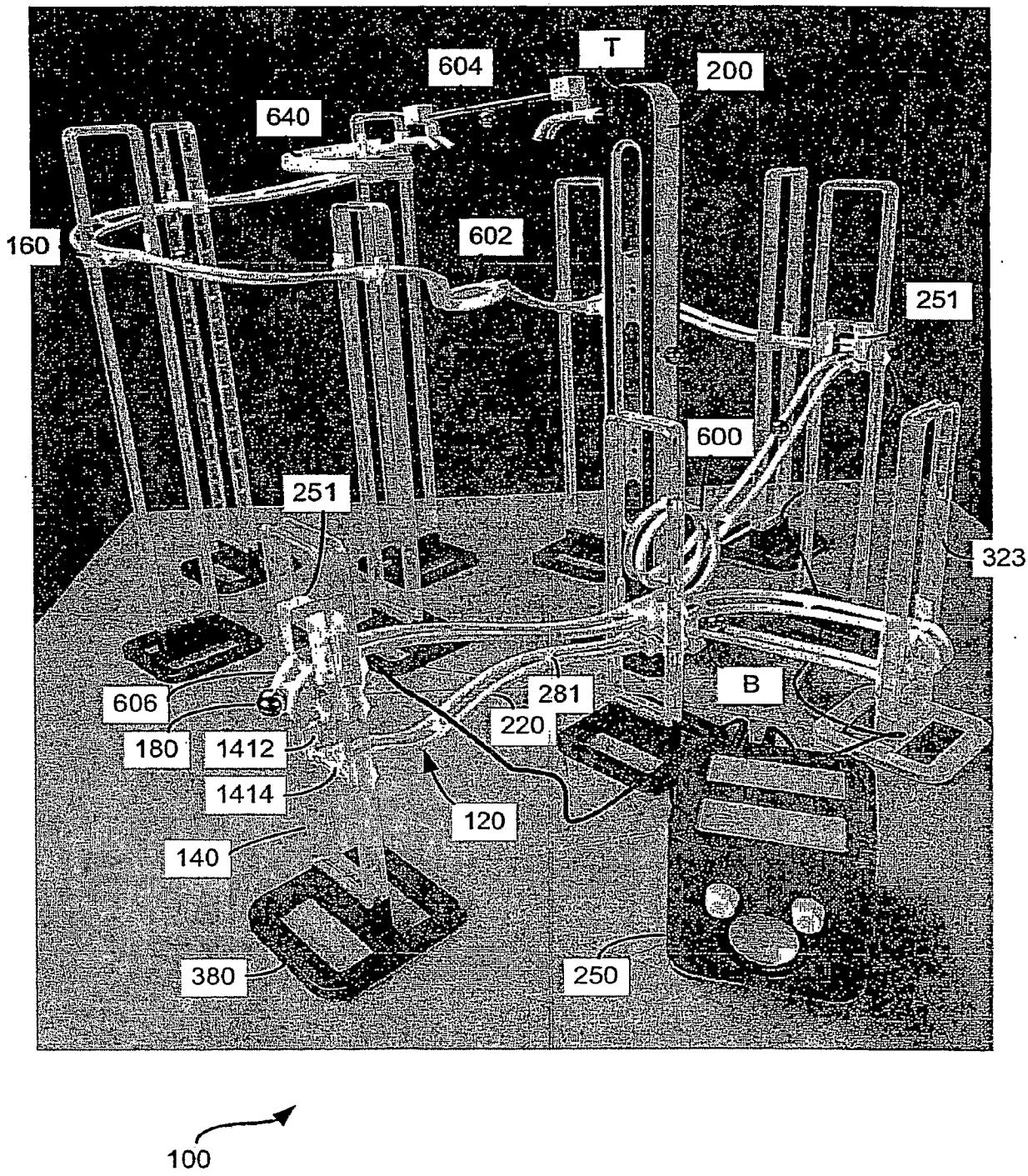


FIG. 8


604
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606
281
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FIG. 9

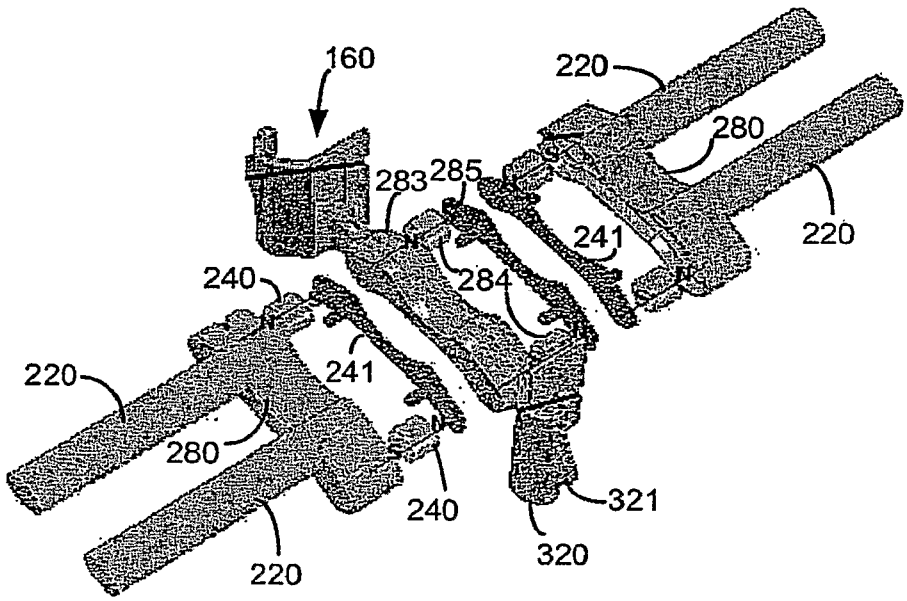

FIG. 10

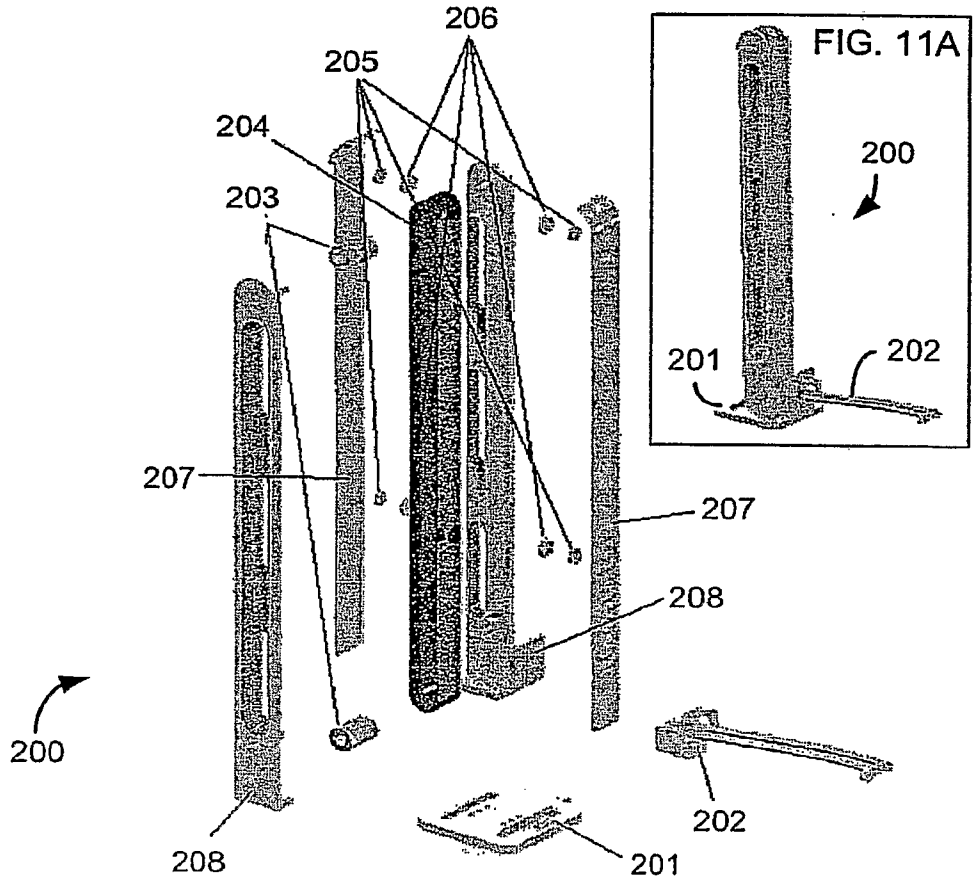

FIG. 11B

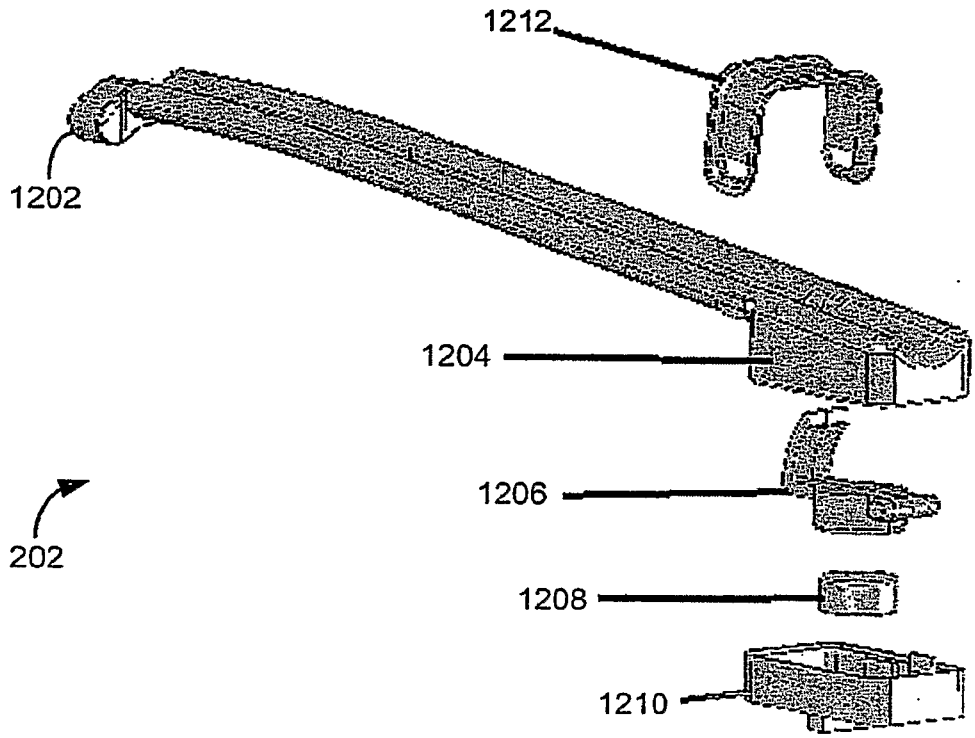

FIG. 12

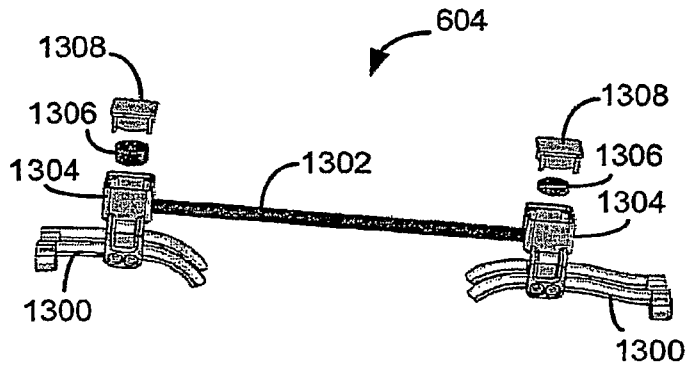
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FIG. 13

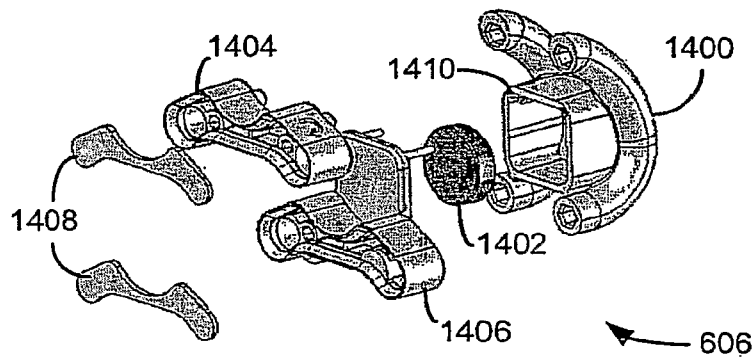
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FIG. 14