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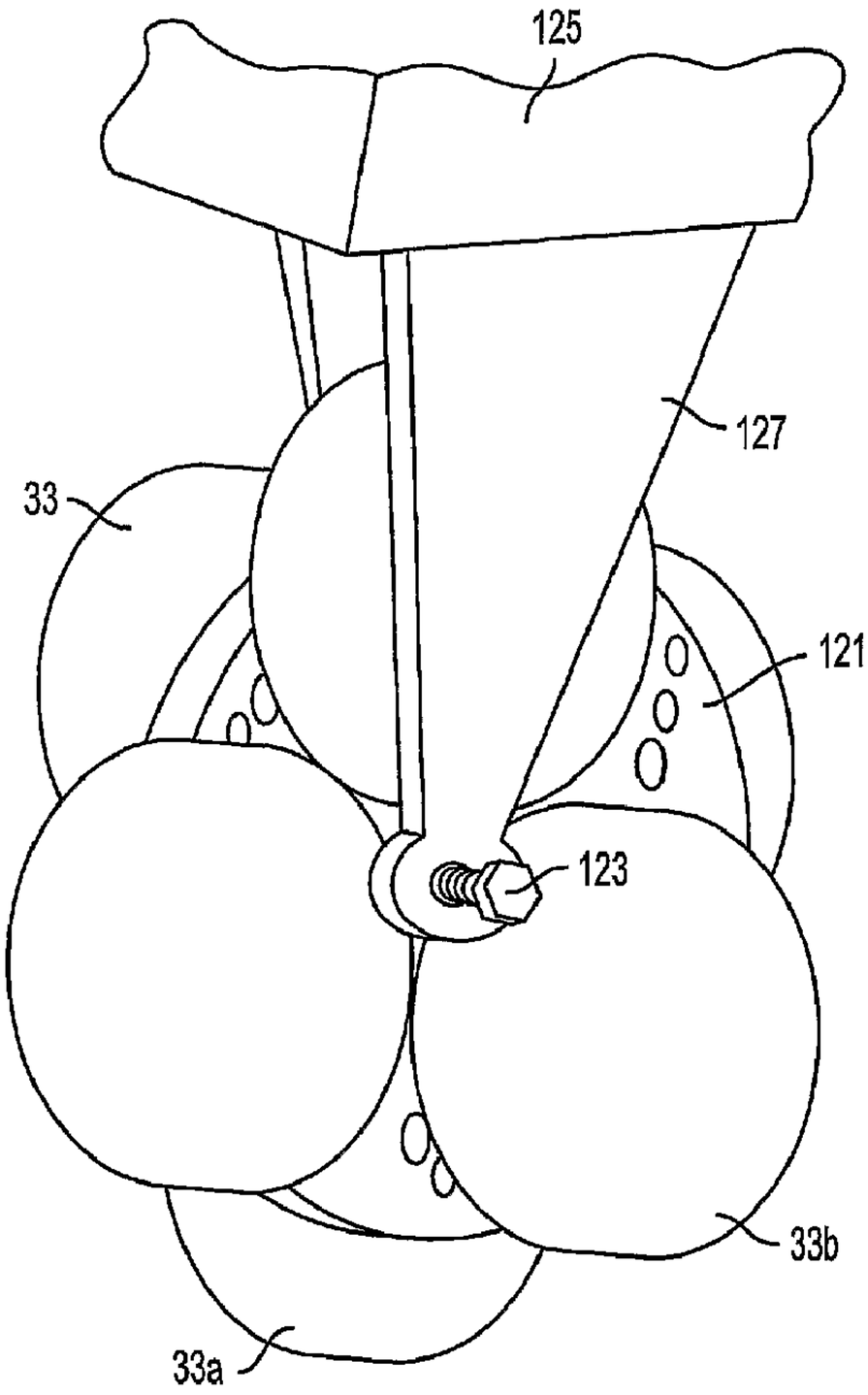
(72) Inventeur/Inventor:
HEIEN, TROY A., US

(73) Propriétaire/Owner:
HEIEN, TROY A., US

(74) Agent: BERESKIN & PARR LLP/S.E.N.C.R.L.,S.R.L.

(54) Titre : ENSEMBLE DE ROUES CAPABLE DE ROULER SUR DES OBSTACLES
(54) Title: OBSTACLE TRAVERSING WHEEL ASSEMBLY



(57) Abrégé/Abstract:
An obstacle traversing wheel assembly includes a primary wheel (121) having an even number, at least four and preferably six or eight, of secondary wheels (33) mounted at equal-spaced, fixed locations thereon. The diameter of each secondary wheel is

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(57) Abrégé(suite)/Abstract(continued):
greater than is the distance between locations, and adjacent secondary wheels (33a, 33b) are arranged to roll in separate, parallel paths. The primary wheel (121) is mounted on a yoke (127) that supports a load-bearing frame (125).

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(71) Applicant and
(72) Inventor: **HEIEN, Troy, A.** [US/US]; 5704 South View Road, Laramie, WY 82070 (US).

(74) Agent: **SHUBERT, Roland, H.**; P.O. Box 2339, Reston, VA 20195-0339 (US).

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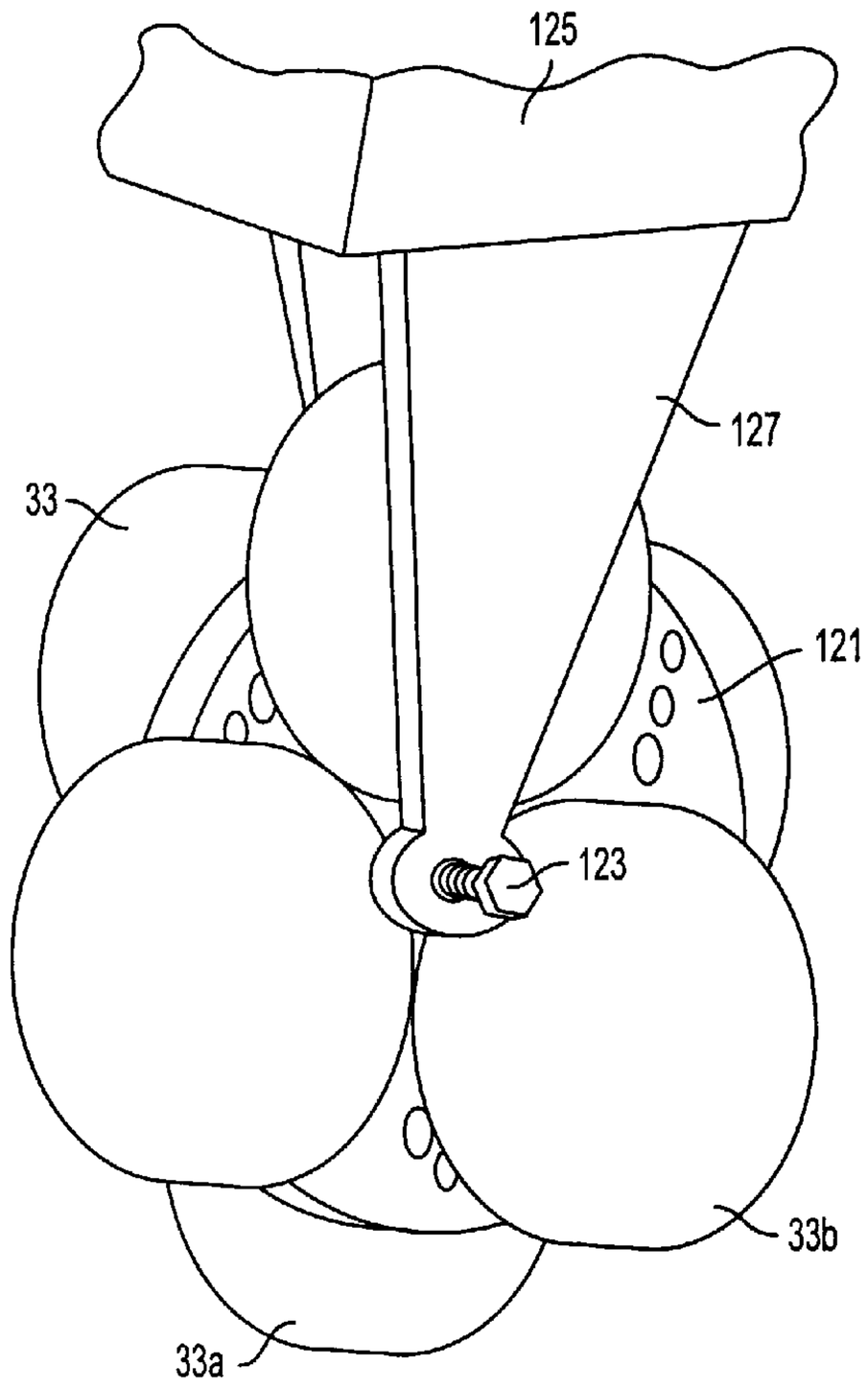

(57) Abstract: An obstacle traversing wheel assembly includes a primary wheel (121) having an even number, at least four and preferably six or eight, of secondary wheels (33) mounted at equal-spaced, fixed locations thereon. The diameter of each secondary wheel is greater than is the distance between locations, and adjacent secondary wheels (33a, 33b) are arranged to roll in separate, parallel paths. The primary wheel (121) is mounted on a yoke (127) that supports a load-bearing frame (125).

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OBSTACLE TRAVERSING WHEEL ASSEMBLY

Technical Field:

This invention relates to a wheel assembly that can traverse rough surfaces and roll over small obstacles without dragging.

More specifically, this invention relates to a wheel assembly that comprises a wheel holder that is rotatable about a central axis, the wheel holder having mounted thereon at least four independently rotatable wheels.

Background Art:

Hand trucks or dollies used to transport loads up and down stairways have long used a wheel arrangement consisting of a pair of star-shaped plates that rotate about a main axle and include a number of wheels, usually three or four, mounted on stub axles. Such a wheel arrangement is often referred to as a spider or star wheel. The plates and wheels are sized such that two of the stub axle mounted wheels can be in simultaneous contact with the lands of two adjacent steps.

A stair climbing hand truck that is equipped with a pair of star wheels, each having four radially projecting arms spaced at 90° one to another, is described in U.S./ Patent No. 2,706,640 to Marshall. Roller wheels are mounted at the arm ends. The star wheel used by Marshall is sized such that two adjacent roller wheels can simultaneously contact the lands of two adjacent steps when the hand truck ascends or descends a stairway.

Another hand truck having stair climbing capabilities is described in the Boyd patent, U.S. 4,142,732. The Boyd truck employs a pair of star-like plates journaled on a main axle with each plate carrying three stub axles, one on each projecting plate leg. A wheel is mounted on each stub axle and the plate and wheels are sized such that wheels are in contact with the lands of two adjacent steps at all times while the truck is on a stairway.

Other background art includes French patents, Nos. 2,640,204, to Goguey and 672,078 to Despature-Cousin, U.S. patents, Nos. 795,620, to Jones, 1,326,679 to Macbeth et al and 5,720,529 to Barron. Goguey discloses a wheel assembly having satellite wheels that are mounted on a flask, or primary wheel, for use on an all-terrain vehicle. The edge or tread portion of each satellite wheel is in

frictional contact with the periphery of a rotating drum, causing each satellite wheel to interdependently rotate as the flask is caused to rotate. The other patents disclose various configurations of satellite, or secondary, wheels mounted upon one or more primary wheel means.

None of the prior art devices provide a simple and inexpensive wheel assembly that can smoothly traverse small obstructions such as hose lines, electrical cords, twigs and small branches, gravel, sidewalk irregularities and the like, and this invention fills that need.

DISCLOSURE OF INVENTION

The wheel assembly of this invention includes a primary wheel member that is rotatable about a central axis. At least four smaller secondary wheels of equal diameter are mounted on axles attached around the circumference of the primary wheel at fixed locations equidistant from each other and from the central axis. Each secondary wheel has a diameter that is greater than is the distance between adjacent wheel locations, and each wheel is free to rotate about its axle. The wheel assembly rolls easily, without wheel drag, across electrical cords, pneumatic lines and other small obstructions. It finds particular use on luggage, tool carts, test equipment, skates, chairs, and the like.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a partially broken away side view of the wheel assembly of this invention showing the primary wheel member with six secondary wheels mounted thereon rolling on an obstructed surface;

Figure 2 is an end-on view showing a first embodiment of the wheel assembly of Figure 1;

Figure 3 is a detail view of a secondary wheel used in the embodiment of Figure 2;

Figure 4 is an end-on view showing a second embodiment of the wheel assembly of Figure 1;

Figure 5 is an end-on view showing a third embodiment of the wheel assembly of Figure 1;

Figure 6 is a side view showing a fourth embodiment of the wheel assembly of Figure 1;

Figure 7 is an end-on view of the wheel assembly of Figure 6;

Figure 8 is an oblique view of the wheel assembly of Figure 6 displayed in a load carrying attitude;

Figure 9 shows an element of the primary wheel member that may be used in the Figure 2, Figure 4, or Figure 6 embodiment;

Figure 10 illustrates the wheel assembly of this invention mounted upon the frame of a carrier module that might be a piece of luggage, a tool holder, an electronic test device, or similar article;

Figure 11 shows the wheel assembly of this invention in use with furniture, specifically an office chair;

Figure 12 depicts the wheel assembly of this invention as used in a shopping cart; and

Figure 13 shows the inventive wheel assembly used as the front, or lead, wheel of an in-line skate.

MODES FOR CARRYING OUT THE INVENTION

Referring first to Figures 1 and 2, there is shown a first preferred embodiment of the obstacle surmounting wheel assembly 10 of this invention. Assembly 10 includes a primary wheel comprising a pair of wheel holders 12 and 14 arranged to rotate about a central axis 15. Wheel holders 12 and 14 preferably are formed as two parallel, spaced apart, generally circular, plate-like members having a central bore to accommodate an axle about which the primary wheel rotates. At least four secondary, equal diameter, wheels 18 are rotatably mounted between holders 12 and 14 by means of a journaled axle 20 extending between holders 12 and 14 and secured in place by a nut or other locking means 21. Wheels 18 are spaced apart a distance that is less than one wheel diameter, and are located at fixed points that are equidistant from each other and from axle 20.

In this embodiment, secondary wheels 18 may be configured as shown in the view of Figure 3. Wheel 18 of Figure 3 includes a circular disk-like portion 23 having a generally flat or textured edge bearing surface 24. A cylindrical boss 26 projects coaxially outward from one side of disk portion 23 for a distance

somewhat greater than the thickness of disk portion 23. A bore 27, to accept axle 20, extends axially through both boss 26 and disk portion 23. Wheels 18 are then arranged in assembly 10 with boss 26 of adjacent wheels alternating in direction as is shown to provide clearance for the overlap between the disk portion 23 of adjacent wheels. The wheels may be machined from circular stock of a suitable material or preferably may be molded from a construction plastic such as polyurethane.

Figure 4 illustrates another embodiment of wheel assembly 10. This embodiment may use the same wheel holders 12 and 14 as does the embodiment of Figure 2. However, in this embodiment the two wheel holders are secured one to the other in a held apart relationship by way of a cylindrical spacer and bearing member 31 disposed axially between the two wheel holders. Wheels 33 of this embodiment are disk shaped without the projecting boss of wheels 18. The wheels 33 are mounted on stub axles 35 that extend inwardly from the wheels holders 12 and 14, and are arranged so that adjacent wheels are journaled one from holder 12 and the next from holder 14. Axles 35 are secured to the wheel holders as by locking nut 37 or other suitable means. As with the embodiment of Figure 2, wheels 33 are located at fixed points equidistant one from the other and from the center of bearing member 31 at a distance less than the diameter of the wheels.

A third embodiment of the wheel assembly is illustrated in Figure 5. That embodiment employs but a single wheel holder 41 that is provided with a central bore 43 journaled for rotation about a shaft or axle. An even number of stub axles 45, one for each wheel, are fixed to holder 41 and the disk-like wheels 33 of the Figure 4 embodiment are mounted on the axles alternating with the wheels 18 of Figure 2 to thereby obtain an overlapping arrangement as is shown. As in the embodiments of Figures 2 and 4, wheels 33 and 18 are all the same diameter and are equi-spaced, one from another, at a distance less than that of the wheel diameter.

Figures 6, 7 and 8 illustrate yet another embodiment of the wheel assembly 10. That wheel assembly includes but a single wheel holder that, in its simplest form, may be constructed as a flat, circular plate 121 having a centered bore for the passage of an axle 123 about which the plate rotates. Plate 121 may

alternatively comprise wheel holder 50 that is shown in Figure 9. An even number of secondary wheels 33, either four, six or eight, and preferably six in number are mounted upon plate 121 by means of stub axles 45 at locations equidistant from each other and from axle 123. Adjacent wheels 33a, 33b, are mounted on opposite sides of plate 121. Individual wheel assemblies 10 may be attached to a frame or other structural element 125 through yoke 127 as is shown in Figure 8.

Figure 9 illustrates a wheel holder 50 that may be used in any of the Figure 2, Figure 4, or Figure 6 embodiments. Holder 50 comprises a flat, generally circular plate 51 having a centered bore 53 to allow rotation of the wheel holder about an axle. Plate 51 is provided with a plurality of equi-spaced, grouped openings 55, 56, 57, 58, 59 and 60, each opening adapted for the mounting of a stub axle therein. As shown in Figure 9, each group of openings comprises a plurality, suitably three, axle accepting holes bored through plate 51 at differently spaced radial distances from the central bore 53. The outermost holes of each grouping are spaced apart an equal distance one from another, and from central bore 53 as well. A similar relationship holds among the center and innermost holes of each grouping. It is preferred that the holes of each grouping not be located along a common radial line of plate 51 in order to obtain maximum structural strength. That arrangement allows installation of different sized groups of secondary wheels onto the same wheel holders.

Referring again to Figure 1, there is shown a partially broken away side view of the wheel assembly 10 rolling along a surface 70 as it bumps into obstruction 72. Obstruction 72 typically might be an electrical cord or pneumatic line lying on a workplace floor, a small stone or branch on a parking lot or pavement surface, or an irregularity in a sidewalk. As assembly 10 moves to the right along an unobstructed surface only the lowermost two, 18a and 18b, of the secondary wheels are in rolling contact with surface 70. The remaining secondary wheels and the primary wheel are motionless. As secondary wheel 18b strikes obstruction 72 it stalls and causes a rightward rotational tilt of the entire wheel assembly 10, bringing secondary wheel 18c downward to roll over obstruction 72. The force required to cause that rotational tilt is modest, amounting to little more than the force required to lift the wheel assembly (and the weight that it supports) a short distance. That distance comprises a span amounting to the difference in

distance 77 between the centerpoint 75 of wheel assembly 10 and surface 70 and the longest distance 79 between centerpoint 75 and the circumference of the wheel 18b in contact with the obstruction 72. Distance 77 may be considered as being the effective radius of the wheel assembly, and twice that distance then constitutes the effective diameter of the wheel assembly. As may be appreciated, the structure of the wheel assembly allows it to literally walk over small obstructions.

As has been set out before, the wheel assembly of this invention requires a minimum of four secondary wheels equi-spaced around the circumference of a primary wheel means. Because the diameter of each secondary wheel is greater than is the distance between wheels, adjacent wheels overlap and are offset one to another. Thus, when the wheel assembly traverses a surface, the two wheels in contact with that surface follow separate but parallel tracks, one wheel in each track. That geometry, separate and parallel tracking of adjacent wheels, tends to increase the stability of a wheel assembly that is pivotally attached to a load-supporting frame through a conventional yoke or horn arrangement. It can further be appreciated that the overlapping arrangement of adjacent secondary wheels can best be obtained through use of an even number of secondary wheels, preferably four, six or eight, and most preferably six. It is conceptually possible to utilize an odd number of secondary wheels, say five or seven, but an odd number secondary wheels, placed so that adjacent wheels overlap, requires three rather than two parallel tracks. Such an arrangement necessitates a wider wheel assembly to accommodate the three tracks, is more complicated in construction, and has less rolling stability than does a wheel assembly having an even number of secondary wheels.

Figures 10 – 13 illustrate a group of preferred applications for the wheel assembly of this invention. Figure 10 depicts wheel assembly 10 in use with a carrier module that may be any load carrying container, for example, a piece of luggage, medical or electronic test equipment, a tool chest, or items of a similar nature that are moved from place to place across obstructed surfaces. A plurality, typically three or four, of wheel assemblies 10 are mounted to the bottom load supporting member or frame 82 of carrier module 80. The wheel assemblies may

be fixedly or pivotally mounted to frame 82 as is desired. A handle means 84 may be attached to module 80 for ease of towing or pushing the module.

Figure 11 illustrates wheel assemblies 10 in use with a piece of furniture, in this case an office chair 90. One wheel assembly 10 is pivotally mounted to each chair leg member 92 by means of a conventional horn bracket 93, thus allowing the chair to be freely rolled in any direction.

Figure 12 shows the wheel assembly 10 of this invention used with a grocery or shopping cart 95. In many parts of the United States, purchased goods such as groceries are carried from the store to an automobile that may be parked in a lot some distance from the store using the same shopping cart that was used to gather goods in the store. Conventional wheels, particularly the two front swiveled wheels, tend to stall and drag when the cart is pushed over debris, such as gravel and small branches that are commonly found in parking lots. Wheel drag is substantially eliminated by replacing the two front cart wheels with the wheel assemblies 10 of this invention as is shown in the Figure. The two rear cart wheels 97 may be replaced as well, but the drag problem is not as severe with the rear wheels as it is with the front.

Figure 13 depicts another preferred use for the wheel assembly of this invention. That Figure shows an in-line skate 101 comprising a boot 104 having a linear chassis 105 attached to the boot sole by means of brackets 107 and 108. Chassis 105 supports a plurality of wheels 10, 111, 112, and 113 that are arranged one behind the other to track in the same path. A drag brake 115 projects downwardly from the chassis at the rear thereof. The front, or lead, wheel 10 comprises the wheel assembly of this invention while the trailing wheels 111, 112 and 113 are conventional. The three trailing wheels are all the same diameter, and it is preferred that the effective diameter of wheel assembly 10 to be equal to that of the other three wheels. Effective diameter here is defined as was set out earlier in the discussion of Figure 1.

Users of in-line skates risk falling when a skate hits an obstacle that the front, or lead, wheel cannot surmount or which causes that wheel to drag. Wheel assembly 10 easily rides over obstacles that cause an ordinary wheel to jam or drag, and the trailing wheels of the skate then tend to ride over the obstacle as well, thus enhancing skating safety. Similar advantages are obtained by the use of

wheel assembly 10 on scooters. In that embodiment, frame 82 comprises a platform on which the scooter user stands.

The wheel assembly of this invention has been shown and described with respect to certain embodiments thereof and that description is for the purpose of illustration and not of limitation. Other variations and modifications of the described invention will be apparent to those skilled in the art and are included within the scope of the invention as set out in the appended claims.

Claims:

1. In a wheel assembly having a primary wheel that is rotatable about a central axis and a plurality of secondary wheels of equal diameter mounted thereon, the improvement comprising:

providing an even number, at least four and no more than eight, secondary wheels mounted on said primary wheel at fixed locations thereon, said locations equidistant apart, one from the next, and equidistant as well from the central axis of said primary wheel, each of said secondary wheels arranged to freely rotate independently of any other secondary wheel and independently as well of said primary wheel, the diameter of each secondary wheel being greater than the distance between adjacent fixed locations and greater also than the distance between each of said fixed locations and the central axis of said primary wheel, said, adjacent secondary wheels overlapping and being offset one to another so that adjacent secondary wheels follow separate but parallel tracks.

2. The wheel assembly according to claim 1 wherein said wheel holder comprises two parallel, spaced apart plates, said plates supporting a plurality of axles extending therebetween, one axle for each secondary wheel.

3. The wheel assembly according to claim 2 wherein each said secondary wheel includes a cylindrical, disk-like section having a generally flat, edge bearing surface, and having a cylindrical boss extending coaxially from one side thereof, the length of said boss being equal to or greater than the thickness of said disk-like section, and wherein adjacent secondary wheels are mounted such that the boss portion of each wheel is oriented in an opposite direction whereby adjacent wheels are caused to roll in two separate and parallel tracks.

4. The wheel assembly according to claim 1 wherein said wheel holder comprises two parallel, spaced apart plates, said plates supporting a plurality of inwardly directed stub axles, one for each secondary wheel, wherein adjacent stub axles are mounted on opposite plates of said wheel holder, and wherein each secondary wheel is formed as a generally cylindrical disk, the maximum thickness

of each secondary wheel being less than one-half the spacing between the two wheel holder plates.

5. The wheel assembly according to claim 1 wherein said wheel holder comprises a single plate having a plurality of stub axles extending outwardly from one side thereof, one axle for each secondary wheel, wherein half of said secondary wheels are configured as a cylindrical disk having a cylindrical boss extending coaxially from one side thereof, the length of said boss being equal to or greater than is the thickness of the disk portion of said wheel, and wherein the other half of said secondary wheels are configured as generally cylindrical disks, and wherein each pair of adjacent wheels includes one that is configured as a cylindrical disk and one that has a cylindrical boss, said boss mounted to be adjacent said plate, thereby causing each pair of adjacent secondary wheels to roll in separate and parallel tracks.

6. The wheel assembly according to claim 1 wherein said wheel holder comprises a single plate having a plurality of stub axles mounted thereon, one axle for each secondary wheel, wherein adjacent stub axles extend outwardly from opposite sides of said plate, and wherein said secondary wheels are configured as a generally cylindrical disk, thereby causing each pair of adjacent secondary wheels to roll in separate and parallel tracks.

7. The wheel assembly according to claim 1 having four secondary wheels.

8. The wheel assembly according to claim 1 having six secondary wheels.

9. The wheel assembly according to claim 1 having eight secondary wheels.

10. The wheel assembly according to claim 1 wherein said primary wheel is mounted on a yoke that supports a load bearing frame.

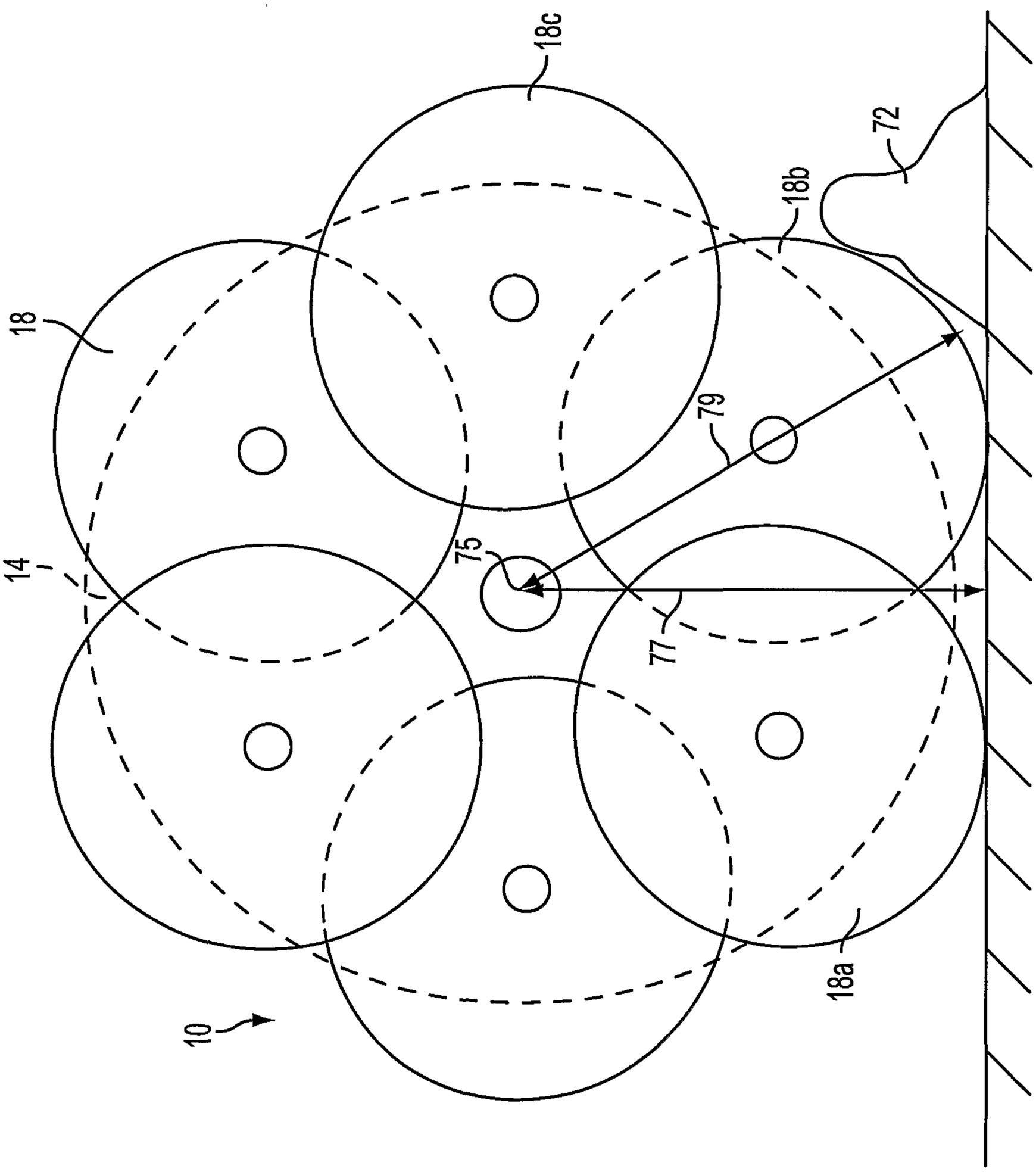


FIG. 1

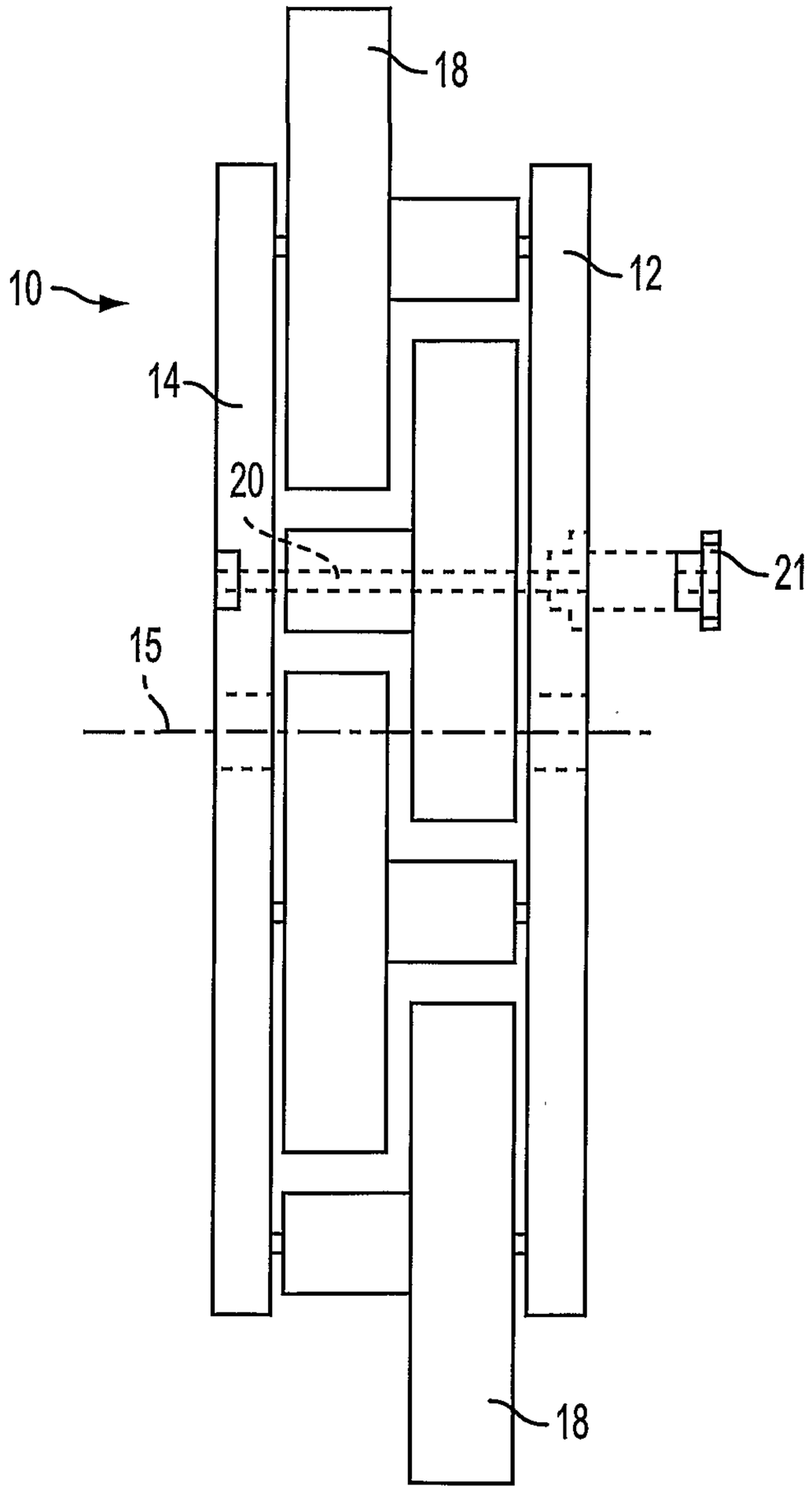


FIG. 2

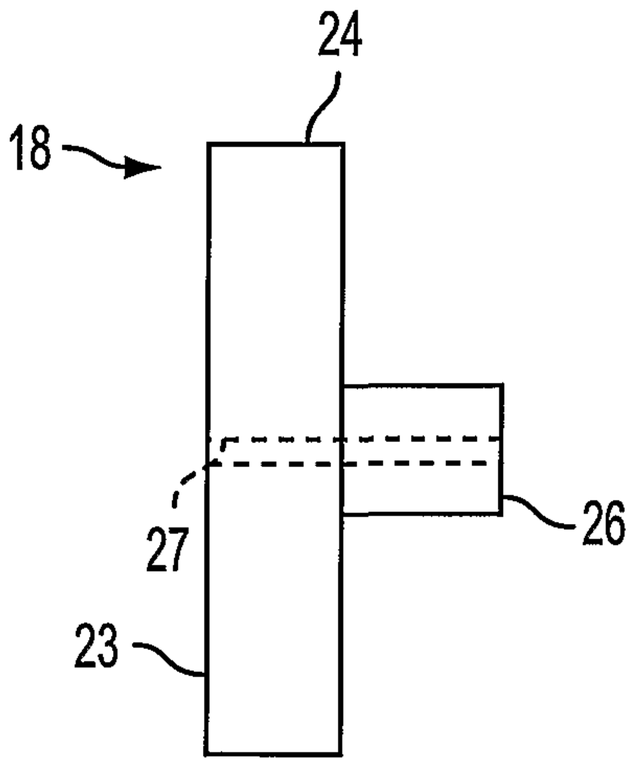


FIG. 3

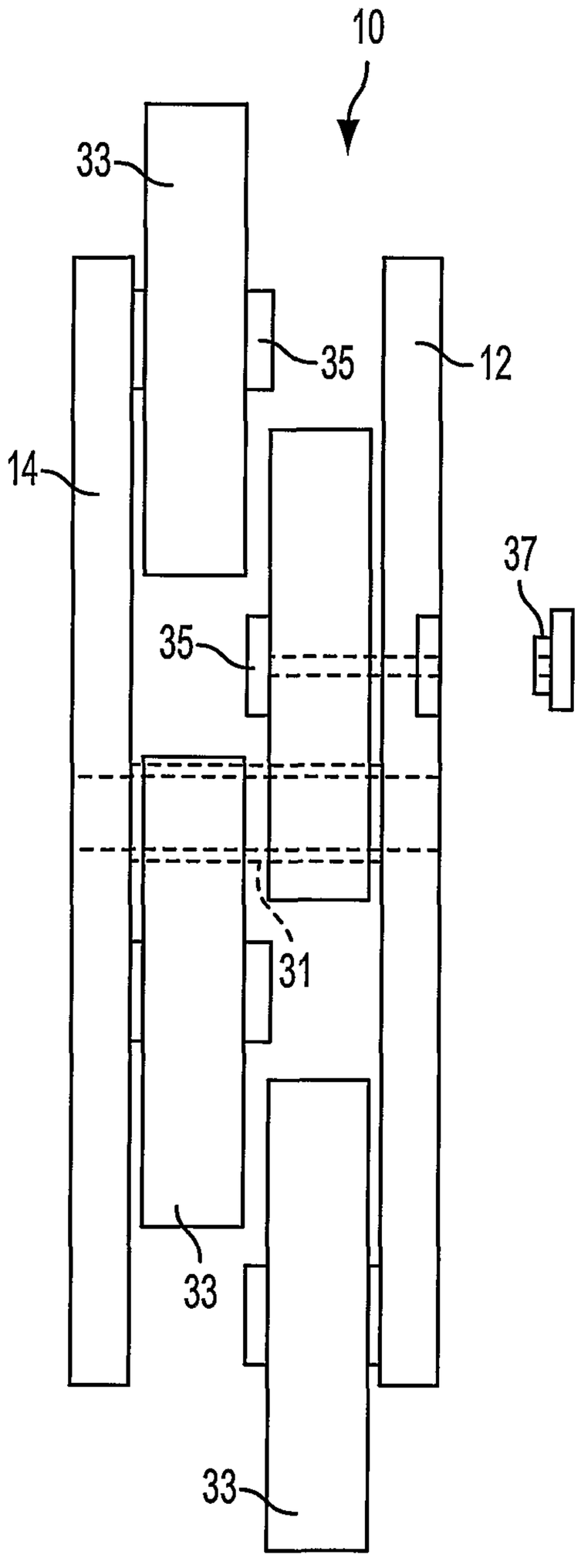


FIG. 4

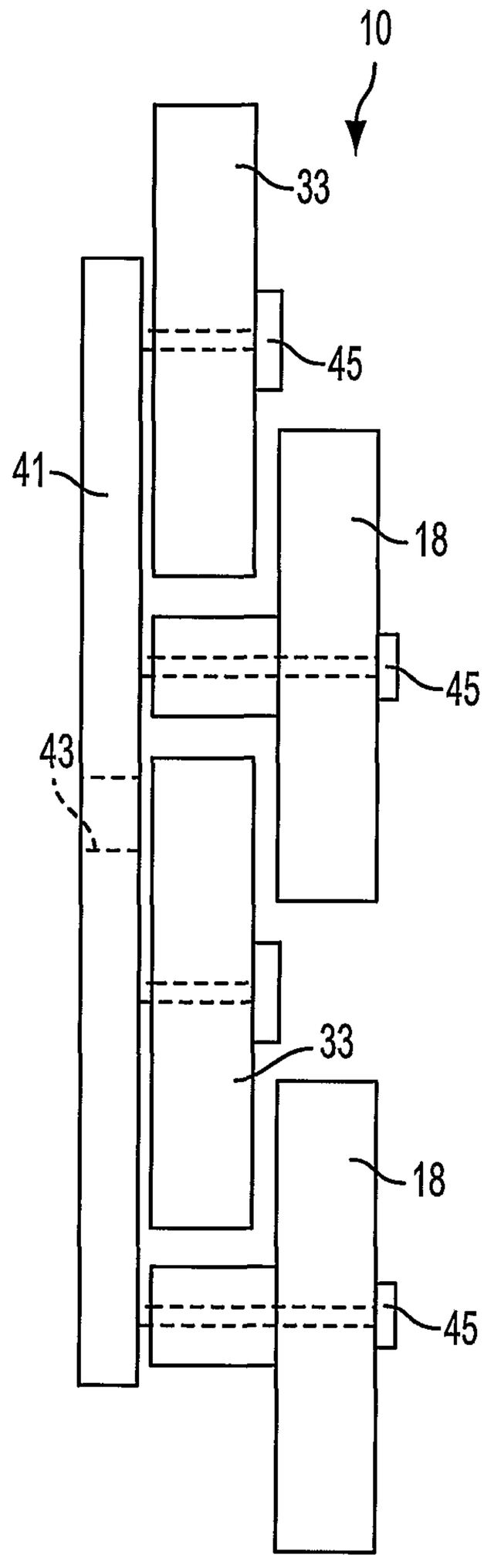


FIG. 5

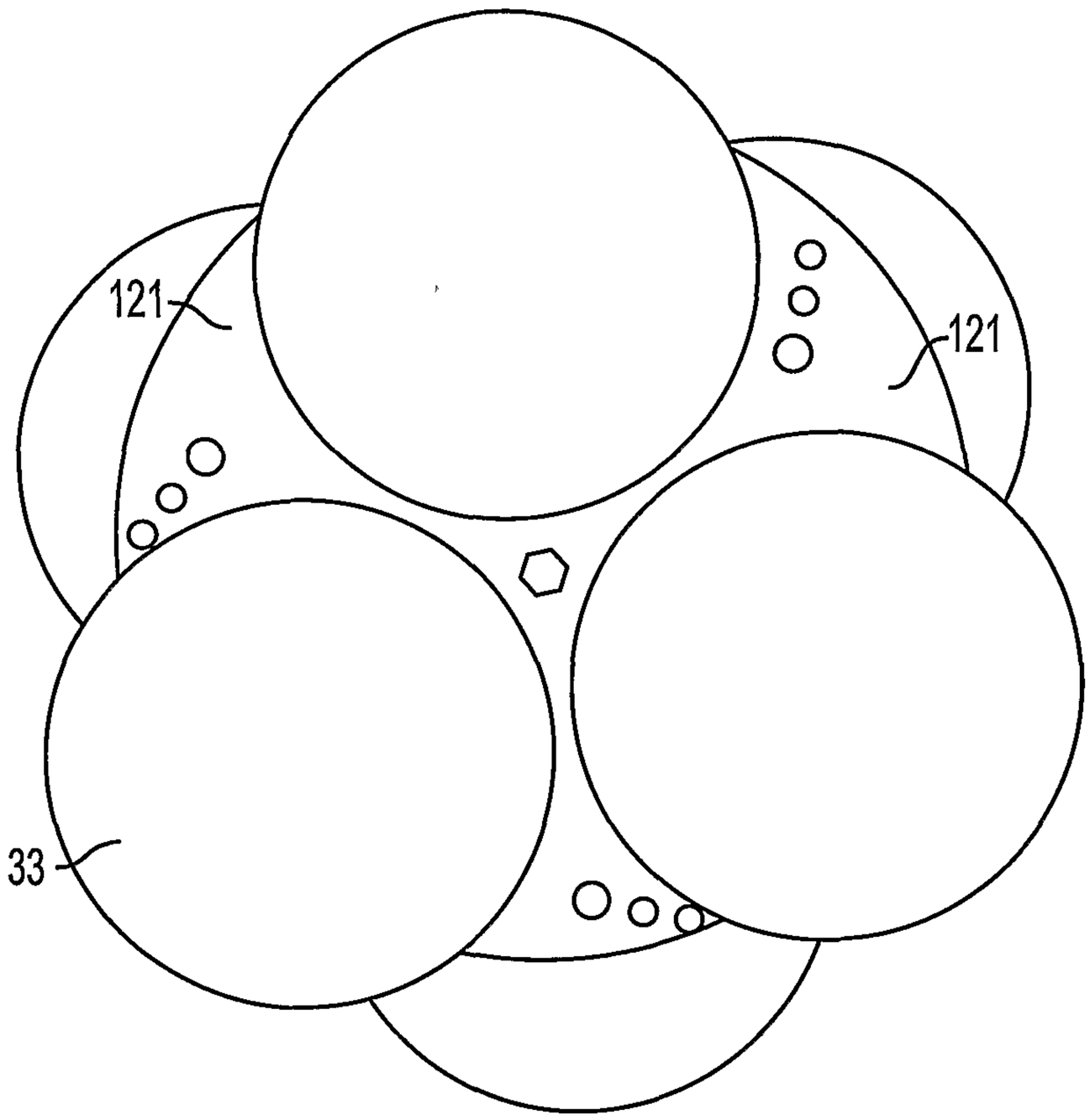


FIG. 6

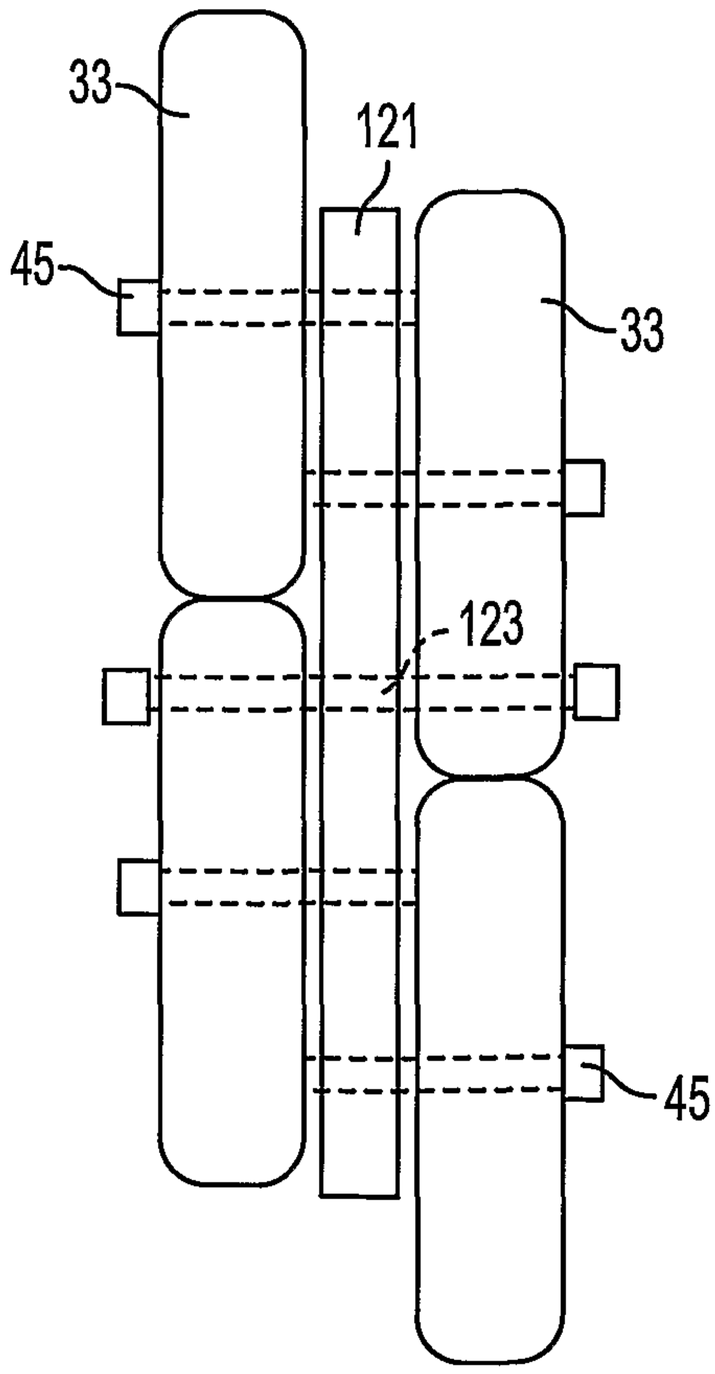


FIG. 7

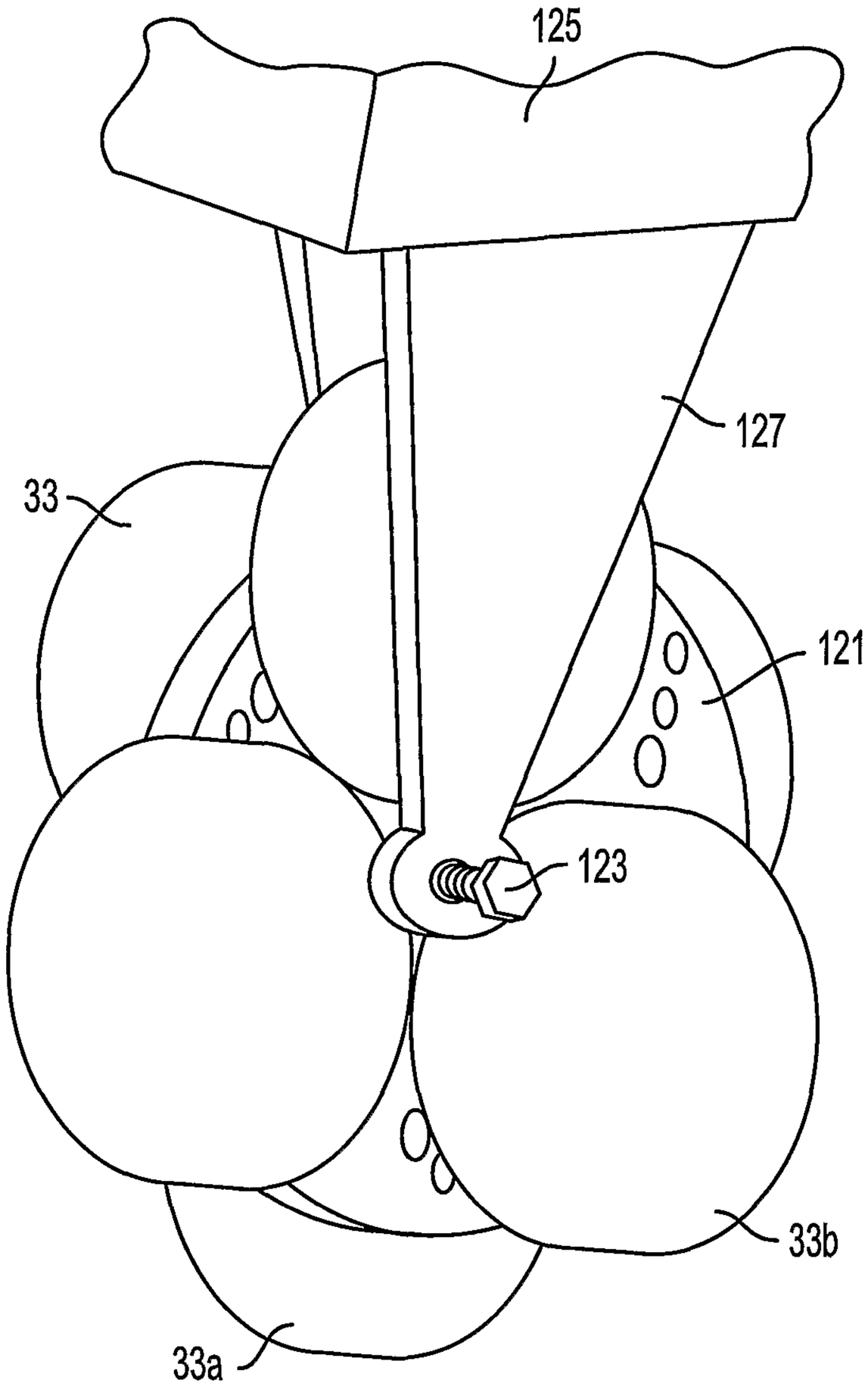


FIG. 8

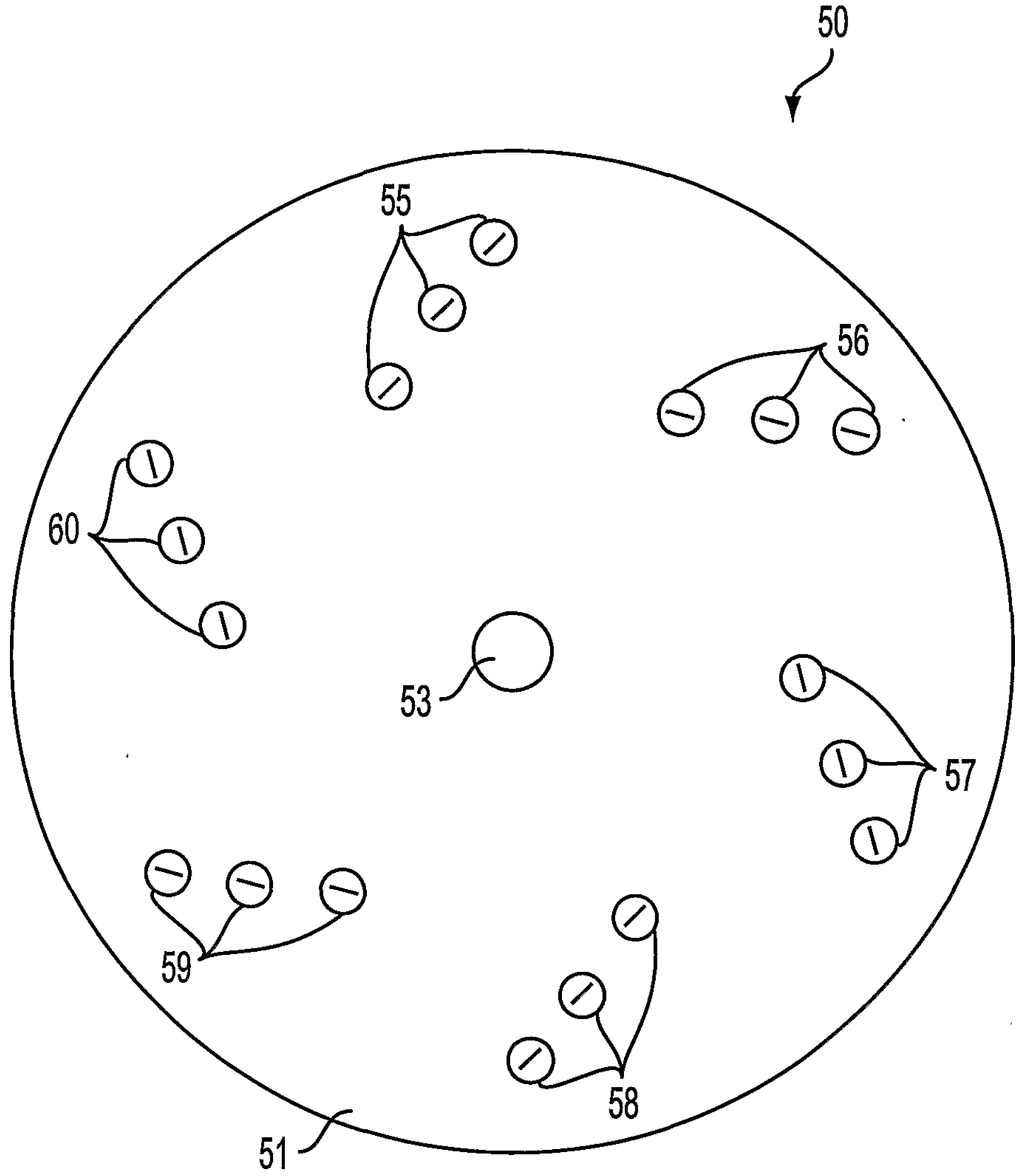


FIG. 9

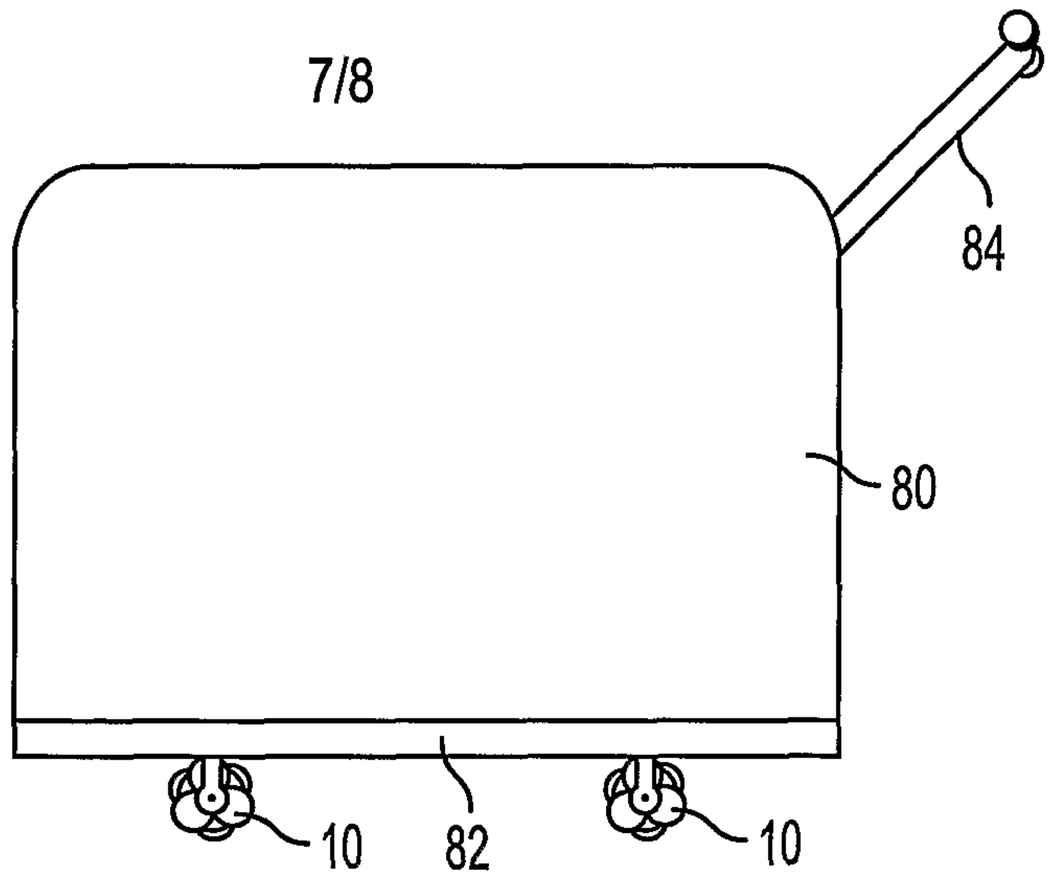


FIG. 10

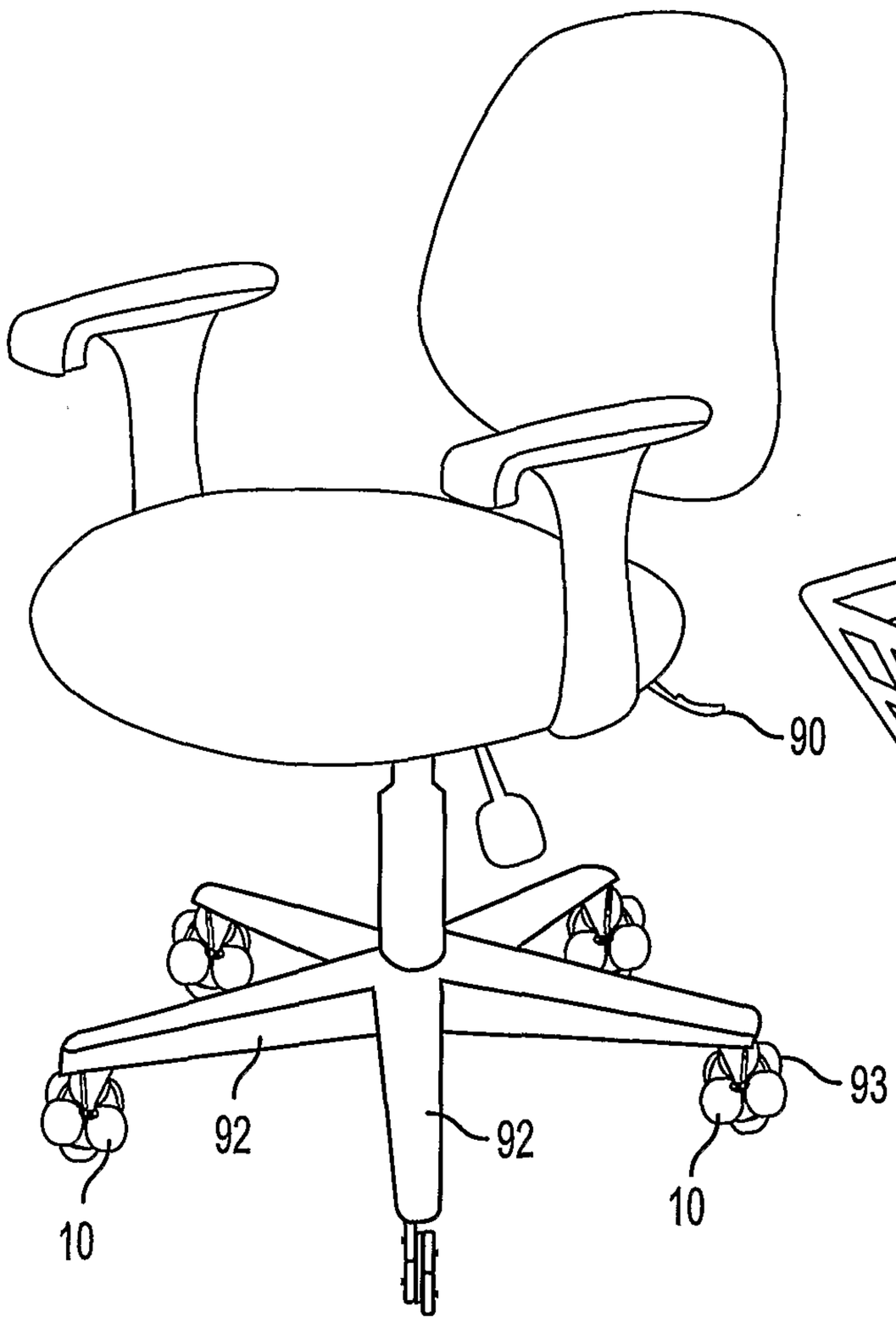


FIG. 11

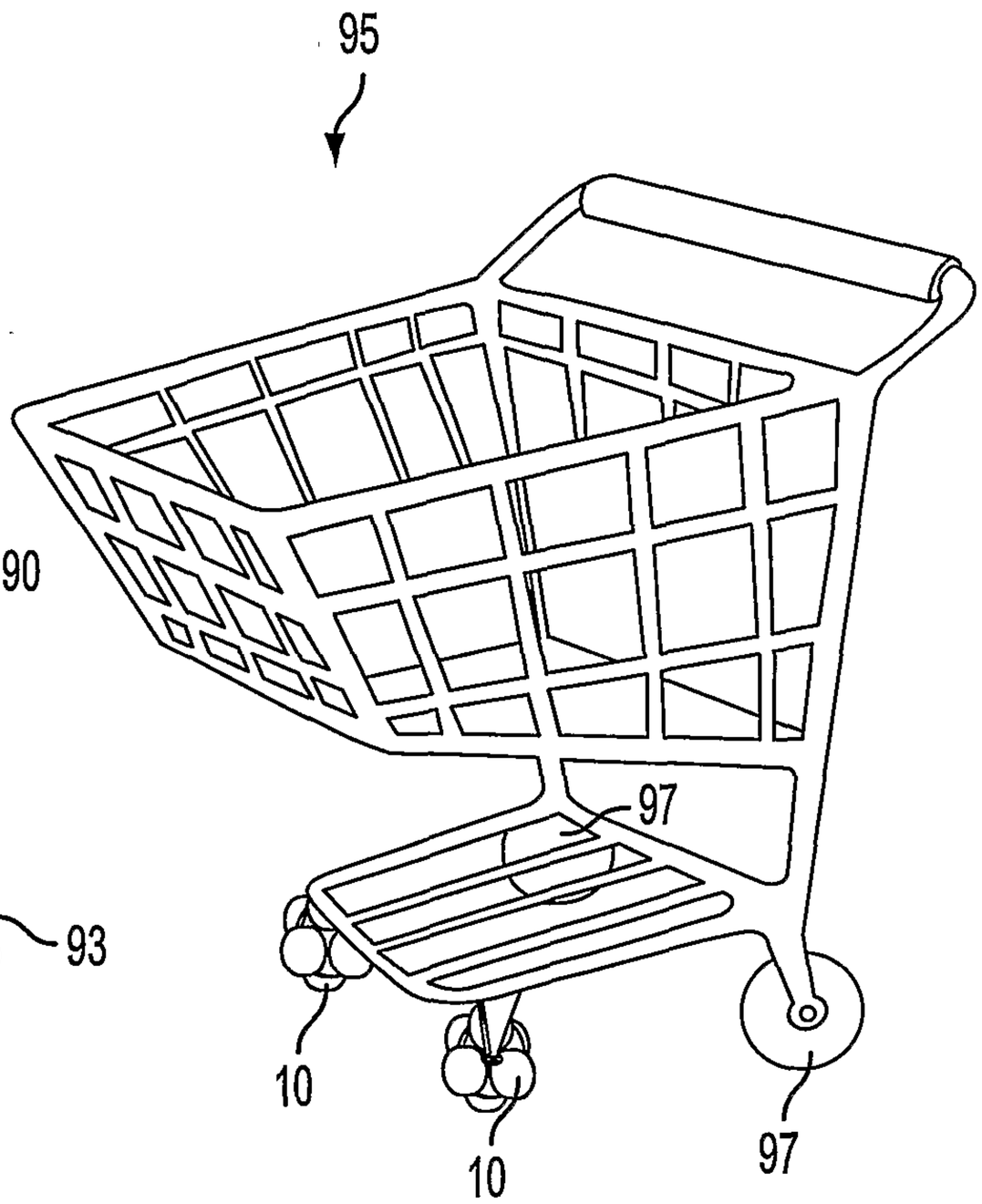


FIG. 12

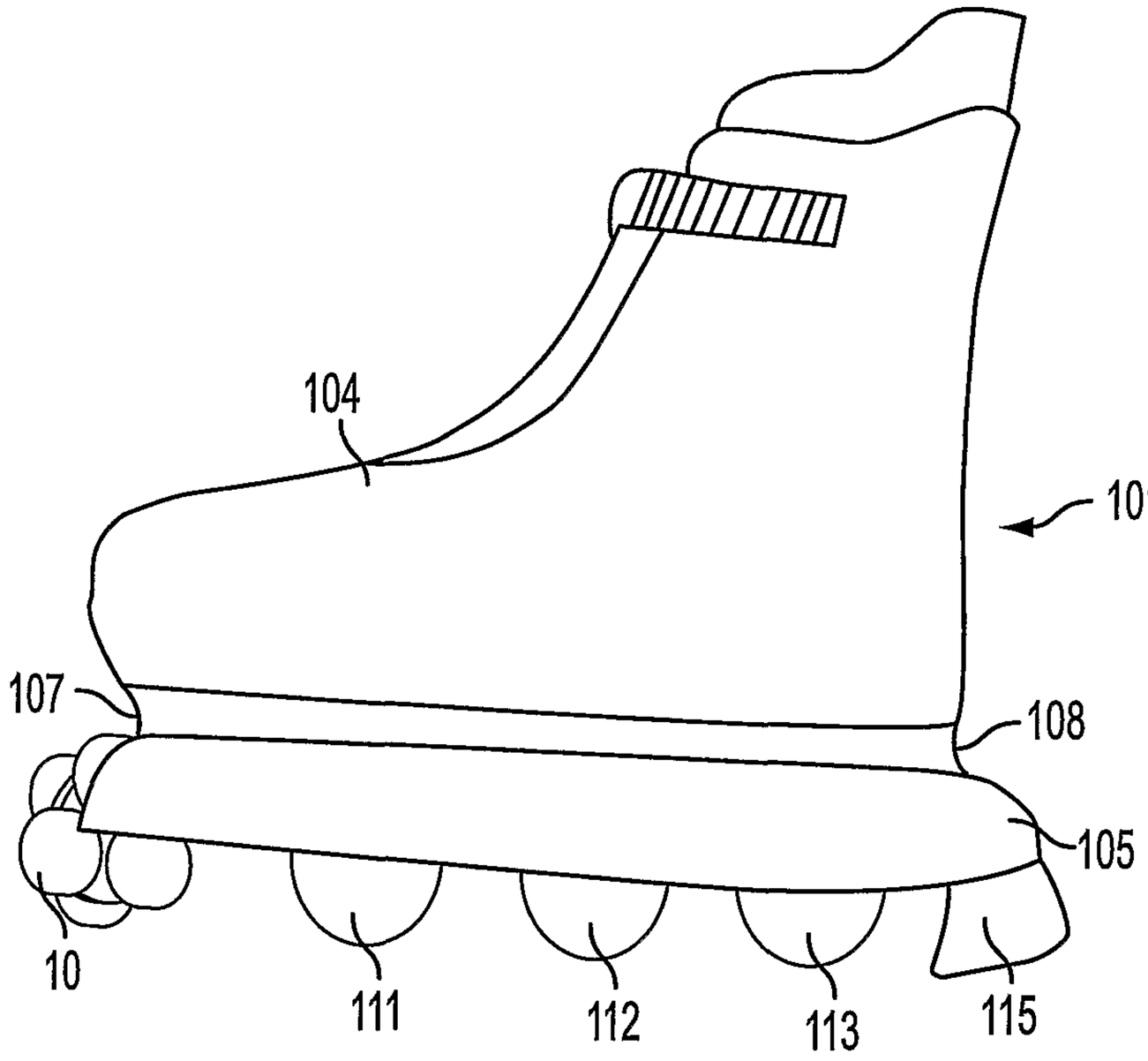
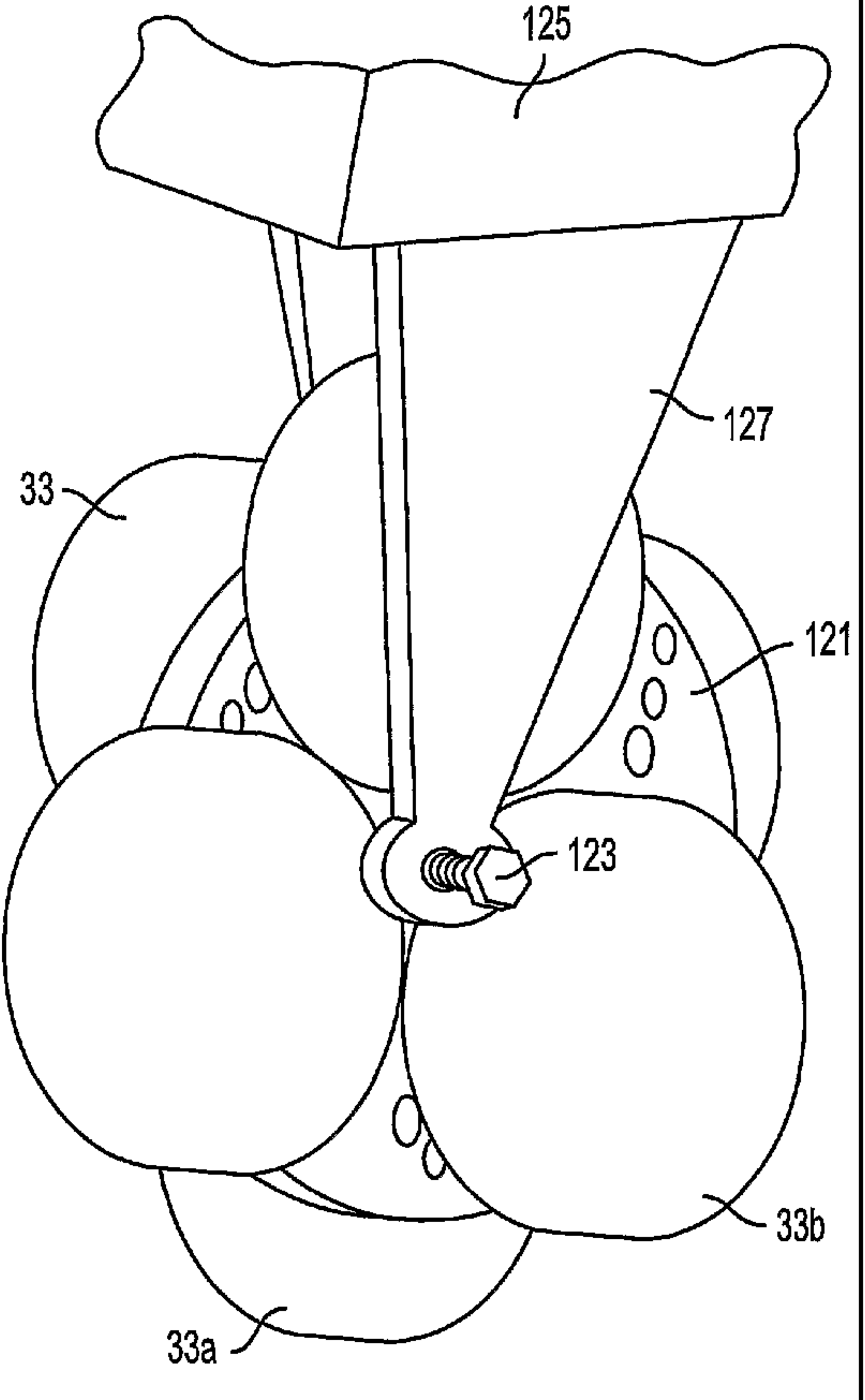


FIG. 13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