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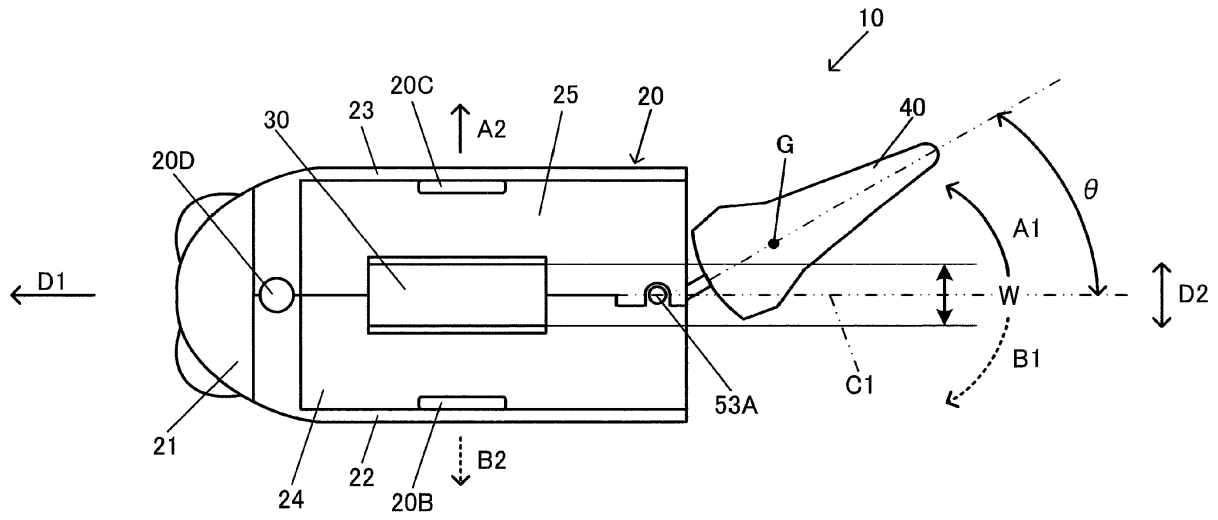
(54) **MANUAL TRAVELING TOY**

(57) A manual traveling toy includes a toy body, at least one wheel that projects downward further than a bottom surface of the toy body, is in contact with a traveling surface, and rotates about an axle shaft, a swing part that is swung in directions about a swing vertical shaft supported at a rear end side position in a traveling direction of the toy body to apply external force to the toy body and move the toy body in directions that cross the traveling direction, and a rotation-swing converting mechanism that converts rotary movement of the at least one wheel into swinging movement of the swing part.

FIG. 1



EP 3 075 428 A2

Description

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present invention contains subject matter related to Japanese Patent Application No. 2015-074665 filed in the Japan Patent Office on March 31, 2015, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present disclosure relates to a manual traveling toy, which includes a wheel and is caused to travel by being pushed and released by hand.

2. Description of the Related Art

[0003] Japanese Examined Utility Model Registration Application Publication No. 7-37675 describes a traveling toy that includes a spring-loaded power source. Front wheels and rear wheels are attached to a body casing of the toy, which is formed in imitation of a goldfish for example, and the toy includes a caudal fin supported at the rear end of the body casing so as to be able to swing. When the wheels rotate and the toy travels through the driving force caused by the spring that has been wound up, the caudal fin is swung by the to-and-fro motive force based on the movement of an eccentric rotor plate. When the toy travels, in addition to the swing of the caudal fin, a tongue is caused to appear from and disappear into a mouth and two pectoral fins are swung.

[0004] As regards the above-described toy, while the caudal fin and the pectoral fins swing with respect to the body casing, the body casing itself, which is made in imitation of a goldfish, travels forward but has no other variations in the movements. When for example, a body casing shaped like a fish is used, merely swinging the caudal fin is insufficient to express more realistic swimming patterns of a fish.

SUMMARY OF THE INVENTION

[0005] According to an aspect of the present disclosure, a manual traveling toy includes a toy body, at least one wheel that projects downward further than a bottom surface of the toy body, is in contact with a traveling surface, and rotates about an axle shaft, a swing part that is fixed to a swing vertical shaft supported at a rear end side position in a traveling direction of the toy body so that the swing part is swingable about the swing vertical shaft, and a rotation-swing converting mechanism that converts rotary movement of the at least one wheel into swinging movement of the swing part.

[0006] Further, in the manual traveling toy, the wheel may be heavier than the swing part, and when in a plan view, the swing part is at a position to which the swing part swings at maximum toward at least one side, a center of gravity of the swing part may be positioned outside a range of a width between outer edges positioned at both ends of a contact surface of the at least one wheel in a direction orthogonal to the traveling direction.

[0007] Further, in the manual traveling toy, a distance from the center of gravity of the swing part to the swing vertical shaft may be shorter than a distance from a position at which an entire length of the swing part is divided into equal lengths to the swing vertical shaft.

[0008] Further, in the manual traveling toy, in the plan view, the at least one wheel and part of the rotation-swing converting mechanism may be arranged side by side in the direction orthogonal to the traveling direction.

[0009] Further, in the manual traveling toy, the at least one wheel may include two wheels supported apart on an axis identical to the axle shaft and part of the rotation-swing converting mechanism is arranged between the two wheels.

[0010] Further, in the manual traveling toy, in the contact surface of the at least one wheel, a central portion of the width in the direction orthogonal to the traveling direction may project further than the both ends.

[0011] Further, in the manual traveling toy, the at least one wheel may include a base and a covering material that covers the base and forms the contact surface, and frictional force caused between the covering material and an identical traveling surface is larger than frictional force caused between the base and the identical traveling surface.

[0012] According to another aspect of the present disclosure, a manual traveling toy includes a toy body, at least one wheel that projects downward further than a bottom surface of the toy body, is in contact with a traveling surface, and rotates about an axle shaft, a swing part that is fixed to a swing vertical shaft supported at a rear end side position in a traveling direction of the toy body so that the swing part is swingable about the swing vertical shaft, a rotation-swing converting mechanism that converts rotary movement of the at least one wheel into swinging movement of the swing part, and two sideward fall preventing members that in a plan view, project downward further than the bottom surface of the toy body by a first height and are positioned on both sides more outside than most outer surfaces of the at least one wheel, the most outer surfaces of the at least one wheel being positioned at both ends of the at least one wheel in a direction orthogonal to the traveling direction, the first height being smaller than a second height from a contact surface of the at least one wheel to the bottom surface of the toy body.

[0013] Further, in the manual traveling toy, the toy body may include a forward fall preventing member that in the plan view, projects downward further than the bottom surface at a position on a more front side than the at least one wheel in the traveling direction.

[0014] Further, in the manual traveling toy, the toy body

may include a rearward fall preventing member that in the plan view, projects downward further than the bottom surface at a position on a more rear side than the at least one wheel in the traveling direction.

[0015] The aspects of the present disclosure provide a manual traveling toy that performs more interesting movements by giving variety to the movements of the toy body itself through the movements of the parts added to the toy body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a bottom view illustrating a manual traveling toy according to an embodiment of the present disclosure, which is shaped in imitation of a fish;

FIG. 2 is a plan view illustrating the manual traveling toy;

FIG. 3 is a rear view obtained when the manual traveling toy is seen from the rear in a traveling direction;

FIG. 4 is a side view illustrating a wheel, a rotation-swing converting mechanism, a swing driving part, and a swing part;

FIG. 5 is a plan view illustrating the wheel, the rotation-swing converting mechanism, the swing driving part, and the swing part;

FIG. 6A is a front view illustrating the swing driving part and the swing part;

FIG. 6B is a plan view illustrating the swing driving part and the swing part;

FIG. 6C schematically illustrates a relation among a maximum swing angle, an eccentric amount of an eccentric cam, and a distance between the centers of a swing vertical shaft and a shaft part;

FIG. 7A is a plan view illustrating a variation of the rotation-swing converting mechanism;

FIG. 7B is a side view illustrating a variation of the rotation-swing converting mechanism;

FIG. 8 illustrates a variation of a contact surface of the wheel;

FIG. 9 is a plan view that schematically illustrating a manual traveling toy that includes three wheels;

FIG. 10 is a cross-sectional view illustrating the wheel that uses a composite material;

FIG. 11 illustrates a variation in which a swing vertical shaft of the swing part is set at a position that deviates from the center of the width of the wheel; and

FIG. 12 illustrates a variation in which the swing vertical shaft of the swing part is set at a position outside the range of the width of the wheel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] A preferred embodiment of the present disclosure is described in detail below. The present embodiment described below is not intended to improperly limit the contents of the present disclosure, which are recited in the claims, and it is not necessarily essential to include all the constituents described in the present embodiment as a solution according to the present disclosure.

[0018] FIG. 1 is a bottom view of a manual traveling toy 10 shaped in imitation of a fish and FIG. 2 is a plan view of the manual traveling toy 10. FIG. 3 is a rear view obtained when the manual traveling toy 10 is seen from the rear in a traveling direction D1. As illustrated in FIGs. 1 to 3, the manual traveling toy 10 includes, for example, a toy body 20 that includes shapes of a head, a trunk, a dorsal fin, and a pectoral fin of a fish, a wheel 30 that projects downward further than a bottom surface 20A of the toy body 20 and is in contact with a traveling surface 1, and a swing part 40 that includes a shape of, for example, a caudal fin supported at a rear end side position in the traveling direction D1 of the toy body 20.

[0019] When the manual traveling toy 10 according to the present embodiment is pushed and released by hand, the wheel 30 rotates and the manual traveling toy 10 travels in the traveling direction D1 in FIGs. 1 and 2. With the rotation of the wheel 30, the swing part 40 performs to-and-fro swinging movements in directions A1 and B1 indicated by arrows. In the manual traveling toy 10 according to the present embodiment, the swing part 40 applies external force to the toy body 20, that is, energizes the toy body 20 by performing the to-and-fro swinging movements and accordingly, the toy body 20 traveling is caused to perform the to-and-fro movements or in the present embodiment, the to-and-fro tilting movements in directions A2 and B2 indicated by arrows, in which the swing part 40 swings.

[0020] In other words, according to the present embodiment, when the wheel 30 is rotated and a rotation-swing converting mechanism 50 causes the swing part 40 to perform the to-and-fro swinging movements in the directions A1 and B1, the swing part 40 applies external force to the toy body 20 in the directions in which the swing part 40 is caused to swing, that is, the swing part 40 energizes the toy body 20 in the direction in which the swing part 40 is swung, and the toy body 20 traveling is moved in the directions A2 and B2 that cross the traveling direction D1 or in the present embodiment, tilted. Thus, the manual traveling toy 10 that performs more interesting movements, such as movements that mimic how a fish swims, can be offered by giving variety to the movements of the toy body 20 itself through the movements of the swing part 40 added to the toy body 20.

[0021] The manual traveling toy 10 that performs such movements may include two sideward fall preventing members 20B and 20C that are positioned on both sides outside a width W of the wheel 30 in a direction D2 orthogonal to the traveling direction D1 in the plan view illustrated in FIG. 1, and as illustrated in FIG. 3, project downward further than the bottom surface 20A of the toy body 20 by a height H2, which is smaller than a height H1 from the contact surface of the wheel 30 to the bottom surface 20A of the toy body 20.

[0022] When the toy body 20 illustrated in FIG. 3 tilts in the direction B2, the sideward fall preventing member 20B comes into contact with the traveling surface 1 and restricts the tilt. Similarly, when the toy body 20 illustrated in FIG. 3 tilts in the direction A2, the sideward fall preventing member 20C comes into contact with the traveling surface 1 and restricts the tilt. When the two sideward fall preventing members 20B and 20C are provided, the toy body 20 can keep traveling in the traveling direction D1 without falling while giving variety to the behavior of the toy body 20 itself through the movements of the swing part 40 added to the toy body 20. Other than the wheel 30, traveling resistance may be decreased by localizing the contact between the sideward fall preventing members 20B and 20C and the traveling surface 1. To decrease the traveling resistance, a surface-contact area in which each of the two sideward fall preventing members 20B and 20C is in contact with the traveling surface 1 may be reduced or each of the two sideward fall preventing members 20B and 20C may be formed so as to have a point-contact shape or a line-contact shape.

[0023] Particularly when the single wheel 30 illustrated in FIG. 1 is provided, the toy body 20 may include a forward fall preventing member 20D, which projects downward further than the bottom surface 20A illustrated in FIG. 3 at a position on the more front (downstream) side than the wheel 30, which is the more front end side in the traveling direction D1 of the toy body 20 than the wheel 30, in the traveling direction D1 in the bottom view illustrated in FIG. 1. The degree of the projection from the bottom surface 20A of the forward fall preventing member 20D may be set so as to be the same as or smaller than the height H1 by which the wheel 30 projects from the bottom surface 20A. Thus, even if the toy body 20 is likely to fall forward when the toy body 20 is pushed and released by hand, the forward fall preventing member 20D comes into contact with the traveling surface 1 and can restrict the forward fall of the toy body 20. Other than the wheel 30, the traveling resistance can be decreased by localizing the contact between the forward fall preventing member 20D and the traveling surface 1. Similarly, to decrease the traveling resistance, a surface-contact area in which the forward fall preventing member 20D is in contact with the traveling surface 1 may be reduced or the forward fall preventing member 20D may be formed so as to have a point-contact shape or a line-contact shape.

[0024] The forward fall preventing member 20D is preferably provided to prevent the toy body 20 from falling forward when the toy body 20 is pushed and released by hand. However, particularly when the single wheel 30 illustrated in FIG. 1 is provided, a rearward fall preventing member, which is not illustrated and projects downward further than the bottom surface 20A illustrated in FIG. 3, may be provided instead of the forward fall preventing member 20D or together with the forward fall preventing member 20D at a position on the more rearward (upstream) side than the wheel 30, which is the more rear end side in the traveling direction D1 of the toy body 20 than the wheel 30, in the traveling direction D1 in the bottom view illustrated in FIG. 1. The rearward fall preventing member is useful when a vertical center line C2 of the wheel 30 is positioned on the more front end side in the traveling direction D1 of the toy body 20 than the position of the center of gravity of the total weight of the manual traveling toy 10. Similar to the forward fall preventing member 20D, the rearward fall preventing member may also be formed so as to decrease the traveling resistance.

[0025] The wheel 30 illustrated in FIG. 1 is positioned in the direction D2 orthogonal to the traveling direction D1 in FIG. 1 on a center line C1, which divides the width of the toy body 20 into two approximately equal widths, and is provided as for example, a single wheel. The wheel 30 has the width W divided into two approximately equal widths by the center line C1.

[0026] Part of the toy body 20, which is exposed in a region except an underside, is divided into for example, a head part 21, a left side part 22, and a right side part 23. The left side part 22 is provided with a left pectoral fin 22A and the right side part 23 is provided with a right pectoral fin 23A and a dorsal fin 23B.

[0027] Holding parts 24 and 25, which can be divided into two parts and are illustrated in FIGs. 1 and 3, are accommodated between the left side part 22 and the right side part 23. The holding parts 24 and 25 are exposed only at the rear and through the underside relative to the traveling direction D1.

[0028] FIGs. 4 and 5 are a side view and a plan view, respectively, which illustrate the wheel 30, the rotation-swing converting mechanism 50, and the swing part 40. As illustrated in FIGs. 4 and 5, the wheel 30 includes an axle shaft 30A that projects from both side surfaces. As illustrated in FIG. 5, the axle shaft 30A is provided in the direction D2 orthogonal to the traveling direction D1 in the plan view. The axle shaft 30A is rotatably held by the two holding parts 24 and 25. The rotation-swing converting mechanism 50 that converts the rotary movement of the wheel 30 into the swinging movement of the swing part 40 is provided together with the wheel 30 between the two holding parts 24 and 25.

[0029] The rotation-swing converting mechanism 50 includes an eccentric cam 51 fixed to a side surface of the wheel 30 illustrated in FIG. 4. For example, a cam surface of the eccentric cam 51 has a circular outline. A center P2 of the eccentric cam 51 is eccentric from a center P1 of the wheel 30 by a distance $\delta 1$. The eccentric cam 51 is fixed to the wheel 30 and rotates together with the wheel 30.

[0030] FIGs. 6A and 6B are a front view and a plan view, respectively, which illustrate the rotation-swing converting mechanism 50 and the swing part 40. The rotation-swing converting mechanism 50 further includes a cam follower 52 and a swing driving part 53 illustrated in FIGs. 4 and 5. The cam follower 52 includes a first engaging part, which engages with a circumferential sur-

face of the eccentric cam 51 and is for example, a first groove part 52A, and a second engaging part, which engages with the swing driving part 53 and is for example, a second groove part 52B. The cam follower 52 is driven for one cycle of to-and-fro movement with 2 x δ1 of stroke when the eccentric cam 51 turns substantially 360 degrees. Specifically, as illustrated in FIG. 4, when the wheel 30 is turned substantially 90 degrees in a direction A3 while the center P2 of the eccentric cam 51 is at the highest position on the vertical center line C2, the cam follower 52 including the first groove part 52A that engages with the eccentric cam 51 is driven forward in a direction A4 by the distance δ1. Subsequently, when the wheel 30 is further turned substantially 90 degrees in the direction A3, the center P2 of the eccentric cam 51 is set at the lowest position on the vertical center line C2. Thus, the cam follower 52 is driven rearward in a direction B4 by the distance δ1. Subsequently, when the wheel 30 is further turned substantially 90 degrees in a direction B3, the center P2 of the eccentric cam 51 is set at a traveling rear end side position from the vertical center line C2 and the cam follower 52 is driven rearward in the direction B4 by the distance δ1. Subsequently, when the wheel 30 is further turned substantially 90 degrees in the direction B3, the center P2 of the eccentric cam 51 returns to the highest position on the vertical center line C2 and the cam follower 52 is driven forward in the direction A4 by the distance δ1. Thus, while the wheel 30 turns substantially 360 degrees, the swing part 40 swings in the direction A1, returns in the direction B1, swings in the direction B1, and returns in the direction A1.

[0031] When the cam follower 52 is driven, the swing driving part 53 illustrated in FIGs. 4, 5, 6A, and 6B swings about a swing vertical shaft 53A and causes the swing part 40 joined to the swing driving part 53 via a joining part 41 to swing. The swing vertical shaft 53A that projects upward and downward from a body part 53B of the swing driving part 53 as illustrated in FIG. 4 is rotatably held by the two holding parts 24 and 25 as illustrated in FIG. 1, and FIG. 1 depicts the support at the lower end of the swing vertical shaft 53A. As illustrated in FIGs. 6A and 6B, the body part 53B includes a shaft part 53C parallel to the swing vertical shaft 53A at a position eccentric from the swing vertical shaft 53A by a distance δ2. As illustrated in FIG. 5, the second groove part 52B of the cam follower 52 engages with the shaft part 53C of the swing driving part 53. Thus, as illustrated in FIGs. 5 and 6B, when the cam follower 52 is driven forward in the direction A4, the body part 53B of the swing driving part 53 swings about the swing vertical shaft 53A and causes the swing part 40 to swing in the direction A1. When the cam follower 52 is driven rearward in the direction B4, the body part 53B of the swing driving part 53 swings about the swing vertical shaft 53A and causes the swing part 40 to swing in the direction B1.

[0032] Described below are conditions for moving, or tilting in the present embodiment, the toy body 20, which is traveling, in the directions A2 and B2 that cross the traveling direction D1 by applying external force with the swing part 40 to the toy body 20 in the direction in which the swing part 40 is swung, that is, by energizing the toy body 20 with the swing part 40 in the direction in which the swing part 40 is swung with the rotation of the wheel 30.

[0033] Load that the wheel 30 receives from the swing part 40 during the travel is proportional to the weight (mass) of the swing part 40 and a distance L1, which is a distance from the center of gravity G of the swing part 40 to the swing vertical shaft 53A as illustrated in FIG. 5. When the load is too large, the wheel 30 fails to rotate or stops immediately after starting to rotate. Thus, the swing part 40 is made light. In addition, the wheel 30 is made heavier than the swing part 40. Since kinetic energy generated for the wheel 30 through the travel is proportional to the mass of the wheel 30, when the mass of the wheel 30 increases, energy usable to move the swing part 40 increases as well, and kinetic energy needed to move the swing part 40 at a certain speed is small when the mass of the swing part 40 is small, and thus, the swing part 40 can swing for a long time when there is a large difference between the mass of the wheel 30 and the mass of the swing part 40. If the swing part 40 is heavier than the wheel 30, the kinetic energy needed to swing the swing part 40 relative to the kinetic energy generated for the wheel 30 increases and the length of time during which the swing part 40 swings decreases.

[0034] When it is taken into account that the swing part 40 is typically formed of resin, the wheel 30 preferably employs a material heavier than the swing part 40, such as metal or a composite material that includes metal. The wheel 30 needs to ensure relatively large frictional force or grip, which occurs between the wheel 30 and the traveling surface 1. In view of the load that the wheel 30 receives from the swing part 40, when the frictional force is small, there is apprehension that the wheel 30 slides and stops rotating on the traveling surface 1, and as a result, the swing part 40 is no more able to swing. Particularly, since it is assumed that the traveling surface 1 is a slippery surface, such as a table surface or a floor surface, the material of the wheel 30 needs to be determined by taking both the weight and frictional force caused between the wheel 30 and the contact surface into account. Although in the present embodiment, the wheel 30 is formed of brass and the contact surface is processed so as to have a moderate surface roughness, this is a mere example and as described above, the material of the wheel is desirably determined by taking both the weight and frictional force caused between the wheel and the contact surface into account.

[0035] In the present embodiment, the swing part 40 easily applies the external force large enough to move the toy body 20 in the directions A2 and B2 that cross the traveling direction D1 to the toy body 20. Thus, in the plan view illustrated in FIG. 1, the position of the center of gravity G of the swing part 40 at the time when the swing part 40 is at the position to which the swing part

40 swings at the maximum toward at least one side is outside the range of the width W of the contact surface of the wheel 30. When the center of gravity G of the swing part 40 moves to the position apart from the width W of the wheel 30 as described above, the wheel 30 easily loses equilibrium. Thus, the toy body 20 easily moves, or easily tilts in the present embodiment, in the direction A2 when the swing part 40 swings in the direction A1, and moves, or easily tilts in the present embodiment, in the direction B2 when the swing part 40 swings in the direction B1.

[0036] In the present embodiment, as illustrated in FIG. 1, a swing angle θ is equal to for example, 30°, by which the swing part 40 swings at the maximum toward one side. The swing angle θ can be provided through the trigonometric function schematically illustrated in FIG. 6C such that θ is approximately equal to arctan ($\delta 1/\delta 2$) when an eccentric amount of the eccentric cam 51, which is the distance $\delta 1$ (see FIG. 4), and the distance $\delta 2$ between the centers of the swing vertical shaft 53A and a shaft part 63C (see FIG. 6B) are used and it is taken into account that the shaft part 53C swings about the swing vertical shaft 53A, or to be precise, moves horizontally by a distance shorter than $\delta 1$.

[0037] As illustrated in FIG. 5, the distance L1 from the center of gravity G of the swing part 40 to the swing vertical shaft 53A is preferably shorter than a distance L2 from a position P3 at which the entire length of the swing part 40 is divided into equal lengths to the swing vertical shaft 53A. Accordingly, the load that the wheel 30 receives from the swing part 40 when the wheel 30 travels, which is proportional to the weight of the swing part 40 and the distance L1 from the center of gravity G of the swing part 40 to the swing vertical shaft 53A, can be reduced and the manual traveling toy 10 can travel for a longer distance.

[0038] To allow the toy body 20 to move easily, that is, to allow the swing part 40 to energize the toy body 20 in the directions A2 and B2 that cross the traveling direction D1 using the external force to move or in the present embodiment, tilt the toy body 20 in the directions A2 and B2 that cross the traveling direction D1, the total weight of the toy body 20, the wheel 30, and the rotation-swing converting mechanism 50 needs to be small. In the present embodiment, the above-described total weight is made light by forming the parts other than the wheel 30 from resin.

[0039] The position of the vertical center line C2 of the wheel 30 illustrated in FIG. 4 in the traveling direction D1 is preferably set at the center of gravity of the total weight of the manual traveling toy 10 (not illustrated), that is, the total weight of the toy body 20, the wheel 30, the swing part 40, and the rotation-swing converting mechanism 50, or is preferably close to the above-described center of gravity so as to be more to the front or the rear. Accordingly, the external force large enough to move the toy body 20 in the directions A2 and B2 that cross the traveling direction D1 can easily act on the wheel 30, that is, the toy body 20 can easily be energized in the directions A2 and B2 that cross the traveling direction D1 and the toy body 20 can easily move, or easily tilts in the present embodiment.

[0040] A radius r of the wheel 30 may be determined by the relation with the weight of the swing part 40 and the travel distance per 360-degree turn of the wheel 30. Although the wheel 30 is desirably made as large as possible, if the wheel 30 is too heavy, the total weight of the manual traveling toy 10 is too large and the external force applied from the swing part 40, that is, the energization by the swing part 40 might fail to move the manual traveling toy 10 in the direction A2 or B2 so an upper limit of the radius r is set in relation to the weight of the wheel 30. While the width W of the wheel 30 may be made small so as to increase the radius r of the wheel 30 and reduce the weight of the wheel 30, a lower limit of the width W is also set so as to ensure stability in the sideward swing during the travel.

[0041] The radius r of the wheel 30 is determined in view of the travel distance per 360-degree turn of the wheel 30 in addition to the above. The travel distance per 360-degree turn of the wheel 30 can be indicated as $2\pi r$. As described above, every time the wheel 30 turns substantially 360 degrees, the swing part 40 is swung in the directions A1 and B1 and performs one cycle of to-and-fro movement. If the travel distance $2\pi r$ per 360-degree turn of the wheel 30 is short, the toy body 20 performs one cycle of to-and-fro movement in the directions A2 and B2 every time the wheel 30 turns substantially 360 degrees, and the tilting movements are difficult to be visually recognized. Thus, the radius r of the wheel 30 is set so as to be larger than or equal to 9 mm and the travel distance $2\pi r$ is set so as to be larger than or equal to at least 56.5 mm so that the toy body 20 moves, or tilts in the present embodiment, to perform one cycle of to-and-fro movement in the directions A2 and B2. When the toy body 20 is tilted in the directions A2 and B2 as in the present embodiment, increasing the radius r of the wheel is advantageous because the increase raises the position of the center of gravity of the wheel 30 and facilitates the tilt of the toy body 20 in the directions A2 and B2.

[0042] A variation of the rotation-swing converting mechanism 50A is described with reference to FIGs. 7A and 7B. When two wheels 31 are provided around an identical axis as illustrated in FIG. 7A, the eccentric cam 51A illustrated in FIG. 7B may be arranged between the two wheels 31 and part of the rotation-swing converting mechanism 50A that includes the eccentric cam 51A may be arranged between the two wheels 31. Accordingly, the equilibrium of the rotation-swing converting mechanism 50A at rest in the direction D2 orthogonal to the traveling direction D1 is enhanced and the position at rest can be stabilized. In the embodiment illustrated in FIG. 5, in the direction D2 orthogonal to the traveling direction D1 in the plan view, the wheel 30 and part of the rotation-swing converting mechanism 50 are ar-

ranged side by side. Accordingly, the equilibrium of the toy body 20 at rest easily becomes lost in the width direction D2 orthogonal to the traveling direction and the toy body 20 during the travel easily tilts because of the external force from the swing part 40, compared to FIG. 7B.

[0043] Although the rotation-swing converting mechanism 50A illustrated in FIGs. 7A and 7B may use the rotation-swing conversion principle illustrated in FIG. 5, a rack and pinion system is employed instead. A cam follower 54 of the rotation-swing converting mechanism 50A includes a groove 54A that engages with the eccentric cam 51A (see FIG. 7B) and a rack 54B (see FIG. 7A). A swing driving part 55 of the rotation-swing converting mechanism 50A includes a swing vertical shaft 55A, a drive gear 55B fixed to the swing vertical shaft 55A, a shaft part 55C parallel to the swing vertical shaft 55A, and a pinion gear 55D that is fixed to the shaft part 55C and meshes with the rack 54B and the drive gear 55B.

[0044] When the cam follower 54 moves rearward in the direction A4 with the rotation of the wheels 31, the rack 54B causes the pinion gear 55D to rotate in a direction A5 and accordingly, the drive gear 55B is rotated and the swing part 40 swings in the direction A1. Similarly, when the cam follower 54 moves forward in the direction B4 with the rotation of the wheels 31, the rack 54B causes the pinion gear 55D to rotate in a direction B5 and accordingly, the drive gear 55B is rotated and the swing part 40 swings in the direction B1. Thus, similar to the rotation-swing converting mechanism 50, the rotation-swing converting mechanism 50A also enables the swing part 40 to swing. To reduce the weight of the rotation-swing converting mechanism 50, the cam follower 54 and the swing driving part 55 may be formed of resin.

[0045] The center of gravity G of the swing part 40 at the time when the swing part 40 is at the position to which the swing part 40 swings at the maximum may be positioned outside the range of the width W between outer edges positioned at both ends of the contact surfaces of the two wheels 31 illustrated in FIG. 7A in the direction D2 orthogonal to the traveling direction D1. When the center of gravity G of the swing part 40 is moved to the position off the width W between the outer edges of the two wheels 31 positioned at the both ends positioned in the direction D2 as described above, the wheel easily loses the equilibrium. Thus, the toy body 20 can easily move, or easily tilt in the present embodiment, in the direction A2 when the swing part 40 is swung in the direction A1, and the toy body 20 can easily move, or easily tilt in the present embodiment, in the direction B2 when the swing part 40 is swung in the direction B1.

[0046] FIG. 8 illustrates a variation related to the shape of the contact surface of the wheel 30 or 31 described above. In the contact surface of the wheel 30 or 31 illustrated in FIG. 8, a center position P4 of the width in the direction D2 orthogonal to the traveling direction D1 projects from both ends P5 by a height $\delta 3$. While various shapes that satisfy such conditions are conceivable, in the present embodiment, the shape of the contact surface is curved so as to satisfy the above-described conditions. Accordingly, the toy body 20 easily tilts even at rest and the external force caused by the swing of the swing part 40 enables the toy body 20 traveling to easily tilt. A flat surface with a small width, which includes the center position P4, may be provided in a central portion of the wheel 30 or 31.

[0047] The structure that allows the toy body 20 to easily tilt is applicable to a case in which the toy body 20 includes a front wheel and a rear wheel. FIG. 9 is a plan view schematically illustrating a manual traveling toy that includes, for example, a front wheel and two rear wheels 33 and 34. The two rear wheels 33 and 34 illustrated in FIG. 9 may be arranged together with the rotation-swing converting mechanism 50A that is illustrated in FIG. 7A and applied to the two wheels 31. Instead of the two rear wheels 33 and 34, a single rear wheel may be provided, which may be arranged together with the rotation-swing converting mechanism 50 illustrated in FIGs. 4 and 5. Even when the manual traveling toy illustrated in FIG. 9 is used, the external force of the swing part 40 swung by the rotation-swing converting mechanism 50 illustrated in FIGs. 4 and 5 or the rotation-swing converting mechanism 50A illustrated in FIG. 7A, that is, the energization by the swing part 40 enables the toy body 20 to move, or tilt in the present embodiment. In this case, the three wheels 32, 33, and 34 may have substantially the same outside diameters. Further, the rear wheels 33 and 34 may each have the contact surface illustrated in FIG. 8, which is curved. To enhance the erect (freestanding) property of the toy body 20 at rest, at least the central portion of the contact surface of the front wheel 32 or each of the rear wheels 33 and 34 may be made as a flat surface and the contact surface of the other wheel may have the curved shape illustrated in FIG. 8. When the central portion of each of the rear wheels 33 and 34 has a flat surface with a small width, which includes the center position P4, the toy body 20 may be moved easily or in the present embodiment, tilted easily by making the flat surface of each of the rear wheels 33 and 34 narrower than the flat surface provided in the central portion of the front wheel 32 in the width direction. Thus, while the erect (freestanding) property of the toy body 20 at rest is stabilized by the front wheel 32, the external force from the swing part 40, that is, the energization by the swing part 40 caused during the travel of the toy body 20 ensures the function of moving or in the present embodiment, tilting the toy body 20.

[0048] FIG. 10 illustrates the wheel 30 formed of a composite material. In FIG. 10, the wheel 30 includes a base 30B that has the axle shaft 30A, and a covering material 30C that covers the base 30B and forms the contact surface. The base 30B is formed of a material different from the covering material 30C, and frictional force that occurs between the covering material 30C and an identical traveling surface is larger than frictional force that occurs between the base 30B and the identical traveling surface.

Thus, the frictional force (grip) that occurs between the contact surface and the wheel 30 may be increased. For example, the base 30B may use polyacetal (POM) resin and the covering material 30C may use chloroprene rubber. The total weight of the base 30B and the covering material 30C, that is, the total weight of the wheel 30 is desirably larger than the weight of the swing part 40. In this case, any one of the base 30B and the covering material 30C may be formed of a material larger in specific gravity than the swing part 4. Accordingly, the wheel 30 is easily made heavier than the swing part 40.

[0049] FIGs. 11 and 12 illustrate variations in which the movement or in the present embodiment, the tilt of the toy body 20 in one direction, with the swing of the swing part 40 is increased. In the plan view in FIG. 11, the swing vertical shaft 53A is at a position that deviates from the center line C1 of the wheel 30 in the width direction D2. In this case, the movement or in the present embodiment, the tilt of the toy body 20 in the direction A1 with the swing of the swing part 40 is increased and variety can be given to the movement of the toy body 20 traveling and at least the movement in the direction A1 is increased while facilitating the visual recognition. In the plan view in FIG. 12, the swing vertical shaft 53A is at a position outside the range of the width W of the wheel 30. In this case, the movement or in the present embodiment, tilt of the toy body 20 in the direction A1 with the swing of the swing part 40 is further increased and more variety can be given to the movement of the toy body 20 traveling and the movement in the direction A1 is increased while facilitating the visual recognition.

[0050] According to the above-described embodiment, the rotation-swing converting mechanism 50 converts the rotary movement of at least one wheel into swinging movement of the swing part 40 and the swing part 40 applies external force to the toy body 20, that is, energizes the toy body 20 in the direction in which the swing part 40 is swung, and thus, the toy body 20 is moved, or tilted in the present embodiment, in the direction in which the swing part 40 swings, which is the direction D2 that crosses the traveling direction D1. In other words, the manual traveling toy 10 according to the present embodiment travels while moving, or tilting in the present embodiment, alternately in the directions in which the swing part 40 swings. Accordingly, the manual traveling toy 10 that performs more interesting movements, such as movements that mimic how a fish swims, can be offered by giving variety to the movements of the toy body 20 itself through the movements of the swing part 40 added to the toy body 20. In addition, since extra arrangement of a driving source, a component for tilting the toy body 20, and the like is unnecessary according to the present embodiment, material costs can be reduced.

[0051] Further, in the above-described embodiment, when a single wheel is provided, the position of the center of gravity G of the swing part 40 during the swing is set outside the range of the width of the contact surface of the wheel. When a plurality of wheels are provided, the position of the center of gravity G of the swing part 40 during the swing is set outside the range of the width between outer edges positioned at both ends of each contact surface of the plurality of wheels in the direction D2 orthogonal to the traveling direction.

[0052] The load that the wheel receives from the swing part 40 during the travel is proportional to the weight (mass) of the swing part 40 and the distance L1 from the center of gravity of the swing part to the swing vertical shaft. When the load is too large, the wheel fails to rotate or stops immediately after starting to rotate. Thus, the swing part 40 is made light. In addition, the wheel is made heavier than the swing part 40. Since kinetic energy generated for the wheel 30 through the travel is proportional to the mass of the wheel 30, when the mass of the wheel 30 increases, energy usable to move the swing part 40 increases as well, and kinetic energy needed to move the swing part 40 at a certain speed is small when the mass of the swing part 40 is small, and thus, the swing part 40 can swing for a long time when there is a large difference between the mass of the wheel and the mass of the swing part 40. The wheel easily loses equilibrium by shifting the center of gravity of the swing part 40 to a position apart from the above-described width of the wheel, and the toy body 20 easily moves, or easily tilts in the present embodiment, in the direction in which the swing part 40 swings.

[0053] Further, in the above-described embodiment, the distance L1 from the center of gravity of the swing part 40 to the swing vertical shaft is shorter than the distance L2 from the position P3 at which the entire length L of the swing part 40 is divided into equal lengths to the swing vertical shaft. Accordingly, the load that the wheel receives from the swing part 40 during the travel, which is proportional to the weight of the swing part 40 and the distance L1 from the center of gravity of the swing part 40 to the swing vertical shaft 53A, can be reduced and the manual traveling toy 10 can travel for a longer distance.

[0054] Further, in the above-described embodiment, in a plan view, the at least one wheel and part of the rotation-swing converting mechanism are arranged side by side in the direction D2 orthogonal to the traveling direction D1. Accordingly, the equilibrium of the toy body 20 at rest in the width direction D2 orthogonal to the traveling direction D1 is lost, and the toy body 20 tilts during the travel because of the external force from the swing part 40, that is, the energization from the swing part 40.

[0055] Further, in the above-described embodiment, the at least one wheel includes two wheels supported apart on an axis identical to the axle shaft and part of the rotation-swing converting mechanism is arranged between the two wheels. Accordingly, the equilibrium of the toy body 20 at rest in the width direction D2 orthogonal to the traveling direction D1 is enhanced and the position at rest is stabilized.

[0056] Further, in the above-described embodiment,

in the contact surface of the at least one wheel, a central portion of the width in the direction D2 orthogonal to the traveling direction D1 projects further than the both ends. Accordingly, the toy body 20 easily tilts even at rest so that the axle shaft deviates from the horizontal state and due to the external force caused by the swing of the swing part 40, that is, the energization by the swing of the swing part 40, the toy body 20 during the travel moves, or tilts in the present embodiment.

[0057] Further, in the above-described embodiment, the at least one wheel includes the base 30B and the covering material 30C that covers the base 30B and forms the contact surface, and frictional force caused between the covering material 30C and an identical traveling surface is larger than frictional force caused between the base 30B and the identical traveling surface. Accordingly, the frictional force (grip) caused between the wheel and the contact surface can be enhanced because of the covering material 30C.

[0058] Further, in the above-described embodiment, the manual traveling toy 20 includes the toy body 20, at least one wheel that projects downward further than the bottom surface of the toy body 20, is in contact with a traveling surface, and rotates about an axle shaft, the swing part 40 that is fixed to the swing vertical shaft supported at a rear end side position in the traveling direction of the toy body so that the swing part 40 is swingable about the swing vertical shaft, the rotation-swing converting mechanism that converts the rotary movement of the at least one wheel into the swinging movement of the swing part 40, and the two sideward fall preventing members 20B and 20C that in a plan view, project downward further than the bottom surface of the toy body 20 by the height H2 and are positioned on both sides more outside than the most outer surfaces of the at least one wheel, the most outer surfaces of the at least one wheel being positioned at both ends of the at least one wheel in the direction D2 orthogonal to the traveling direction D1, the height H2 being smaller than the height H1 from the contact surface of the at least one wheel to the bottom surface of the toy body 20. Accordingly, the rotation-swing converting mechanism converts the rotary movement of the at least one wheel into the swinging movement of the swing part 40 and the swing part 40 applies external force to the toy body 20 in the direction in which the swing part 40 is swung, that is, the toy body 20 is moved, or tilted in the present embodiment, in the direction in which the swing part 40 swings, which is the direction D2 that crosses the traveling direction D1. In other words, the travel is performed while moving, or tilting in the present embodiment, the manual traveling toy 10 alternately in the swing directions. Accordingly, the manual traveling toy 10 that performs more interesting movements can be offered by giving variety to the movements of the toy body 20 itself through the movements of the swing part 40 added to the toy body 20. In addition, when the two sideward fall preventing members 20B and 20C are provided, the toy body 20 can keep traveling in the traveling direction D1 without falling while variety is given to the movements of the toy body 20 itself through the movements of the swing part 40 added to the toy body 20. Other than the wheel 30, the traveling resistance may be decreased by localizing the contact between the sideward fall preventing members 20B and 20C and the traveling surface.

[0059] Further, in the above-described embodiment, the toy body 20 includes the forward fall preventing member 20D that in the plan view, projects downward further than the bottom surface at a position on a more front side than the at least one wheel in the traveling direction D1. Accordingly, even if the toy body 20 is likely to fall forward when the toy body 20 is pushed and released by hand, the forward fall preventing member 20D comes into contact with the traveling surface and can restrict the forward fall of the toy body 20. Moreover, other than the wheel 30, the traveling resistance can be decreased by localizing the contact between the forward fall preventing member 20D and the traveling surface.

[0060] Further, in the above-described embodiment, the toy body 20 includes the rearward fall preventing member that in the plan view, projects downward further than the bottom surface at a position on a more rear side than the at least one wheel in the traveling direction D1. The rearward fall preventing member may be provided instead of or in addition to the forward fall preventing member 20D. Particularly, the rearward fall preventing member is useful in a structure that easily falls rearward, such as in a case where the vertical center line (the center of gravity) of the wheel is positioned on a more front end side in the traveling direction D1 of the toy body 20 than the position of the center of gravity of the total weight of the manual traveling toy 10.

[0061] Although the present embodiment is described above in detail, those skilled in the art will readily understand that many variations that do not depart from new matters and advantages of the present disclosure substantially are possible. Therefore, it should be noted that such variations are all included in the scope of the present disclosure. For example, a term used at least once in the specification or drawings together with a different term that has the broader or the same sense can be replaced with the different term in any portion in the specification or drawings.

Claims

1. A manual traveling toy comprising:

a toy body;
at least one wheel that projects downward further than a bottom surface of the toy body, is in contact with a traveling surface, and rotates about an axle shaft;
a swing part that is fixed to a swing vertical shaft supported at a rear end side position in a traveling direction of the toy body so that the

swing part is swingable about the swing vertical shaft; and

a rotation-swing converting mechanism that converts rotary movement of the at least one wheel into swinging movement of the swing part.

2. The manual traveling toy according to Claim 1, wherein

the wheel is heavier than the swing part, and

when in a plan view, the swing part is at a position to which the swing part swings at maximum toward at least one side, a center of gravity of the swing part is positioned outside a range of a width between outer edges positioned at both ends of a contact surface of the at least one wheel in a direction orthogonal to the traveling direction.

3. The manual traveling toy according to Claim 1 or 2, wherein

a distance from the center of the gravity of the swing part to the swing vertical shaft is shorter than a distance from a position at which an entire length of the swing part is divided into equal lengths to the swing vertical shaft.

4. The manual traveling toy according to any one of Claims 1 to 3, wherein

in the plan view, the at least one wheel and part of the rotation-swing converting mechanism are arranged side by side in the direction orthogonal to the traveling direction.

5. The manual traveling toy according to any one of Claims 1 to 3, wherein

the at least one wheel includes two wheels supported apart on an axis identical to the axle shaft and part of the rotation-swing converting mechanism is arranged between the two wheels.

6. The manual traveling toy according to any one of Claims 1 to 5, wherein

in the contact surface of the at least one wheel, a central portion of the width in the direction orthogonal to the traveling direction projects further than the both ends.

7. The manual traveling toy according to any one of Claims 1 to 6, wherein

the at least one wheel includes a base and a covering material that covers the base and forms the contact surface, and frictional force caused between the covering material and an identical traveling surface is larger than frictional force caused between the base and the identical traveling surface.

8. A manual traveling toy comprising:

a toy body;

at least one wheel that projects downward further than a bottom surface of the toy body, is in contact with a traveling surface, and rotates about an axle shaft;

a swing part that is fixed to a swing vertical shaft supported at a rear end side position in a traveling direction of the toy body so that the swing part is swingable about the swing vertical shaft;

a rotation-swing converting mechanism that converts rotary movement of the at least one wheel into swinging movement of the swing part; and

two sideward fall preventing members that in a plan view, project downward further than the bottom surface of the toy body by a first height and are positioned on both sides more outside than most outer surfaces of the at least one wheel, the most outer surfaces of the at least one wheel being positioned at both ends of the at least one wheel in a direction orthogonal to the traveling direction, the first height being smaller than a second height from a contact surface of the at least one wheel to the bottom surface of the toy body.

9. The manual traveling toy according to Claim 8, wherein

the toy body includes a forward fall preventing member that in the plan view, projects downward further than the bottom surface at a position on a more front side than the at least one wheel in the traveling direction.

10. The manual traveling toy according to Claim 8 or 9, wherein

the toy body includes a rearward fall preventing member that in the plan view, projects downward further than the bottom surface at a position on a more rear side than the at least one wheel in the traveling direction.

FIG. 1

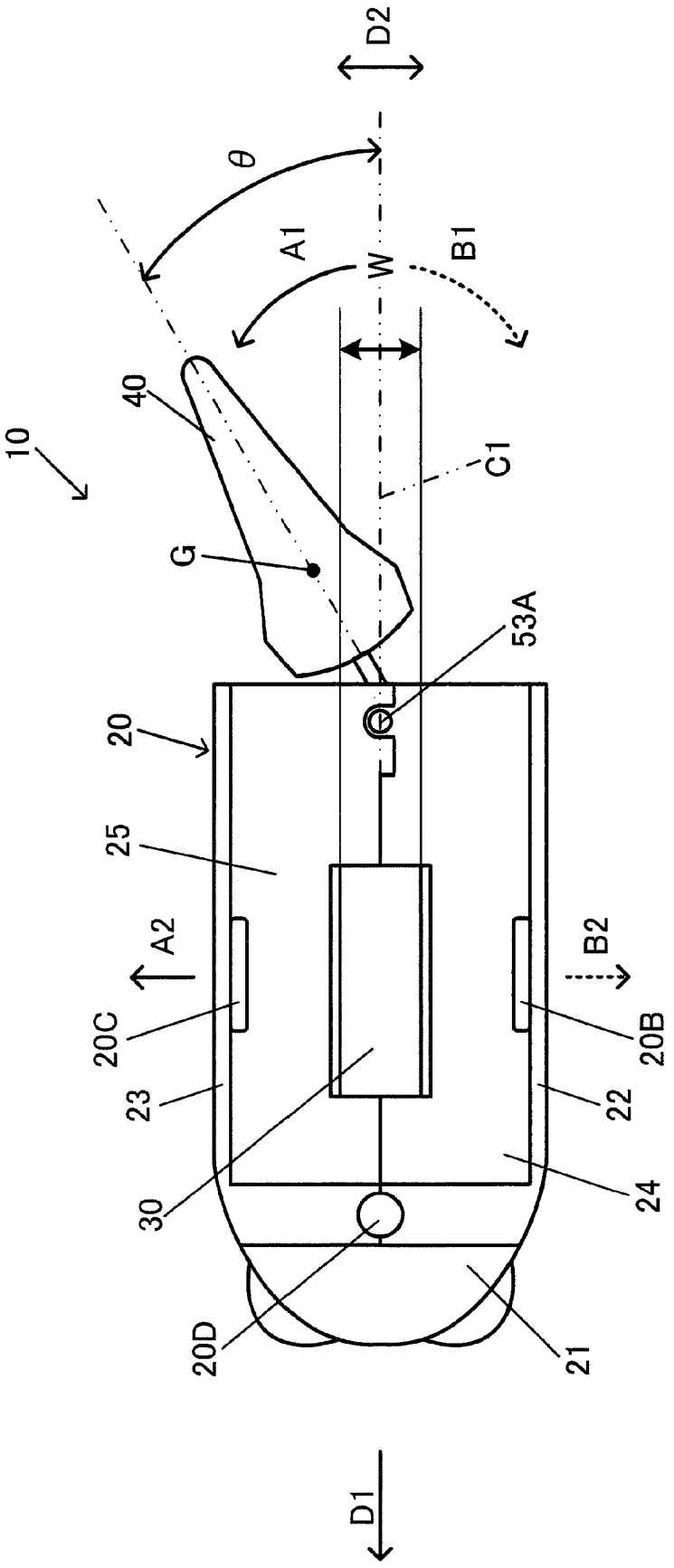


FIG. 2

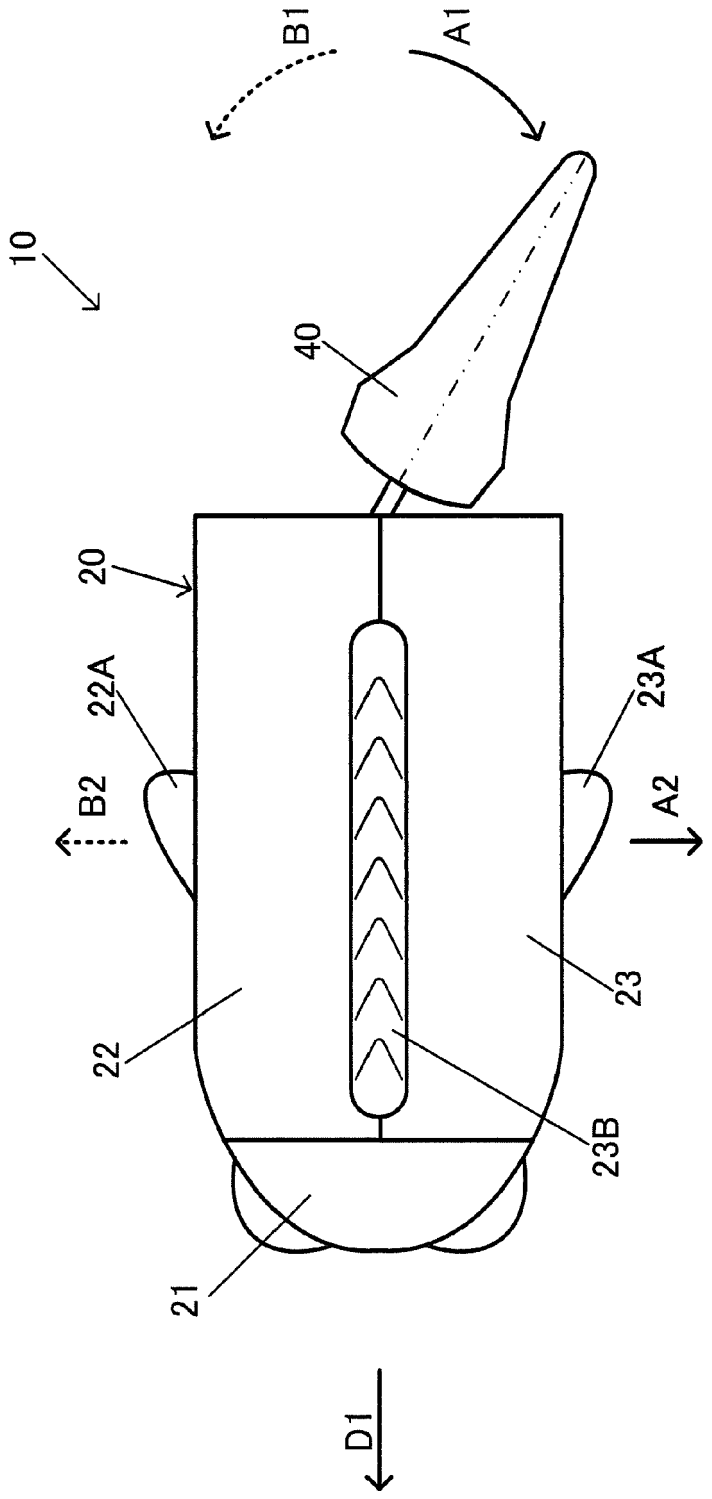


FIG. 3

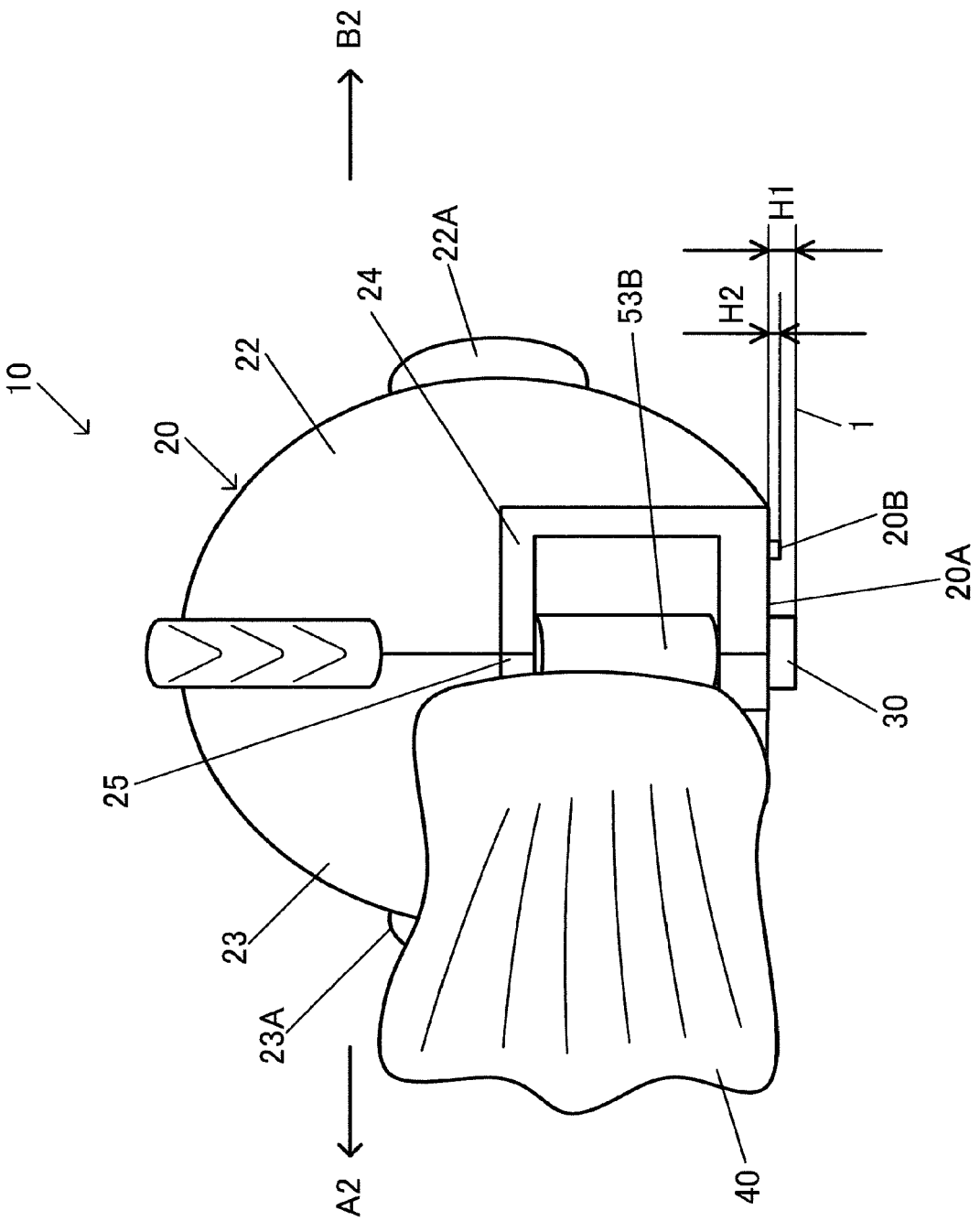


FIG. 4

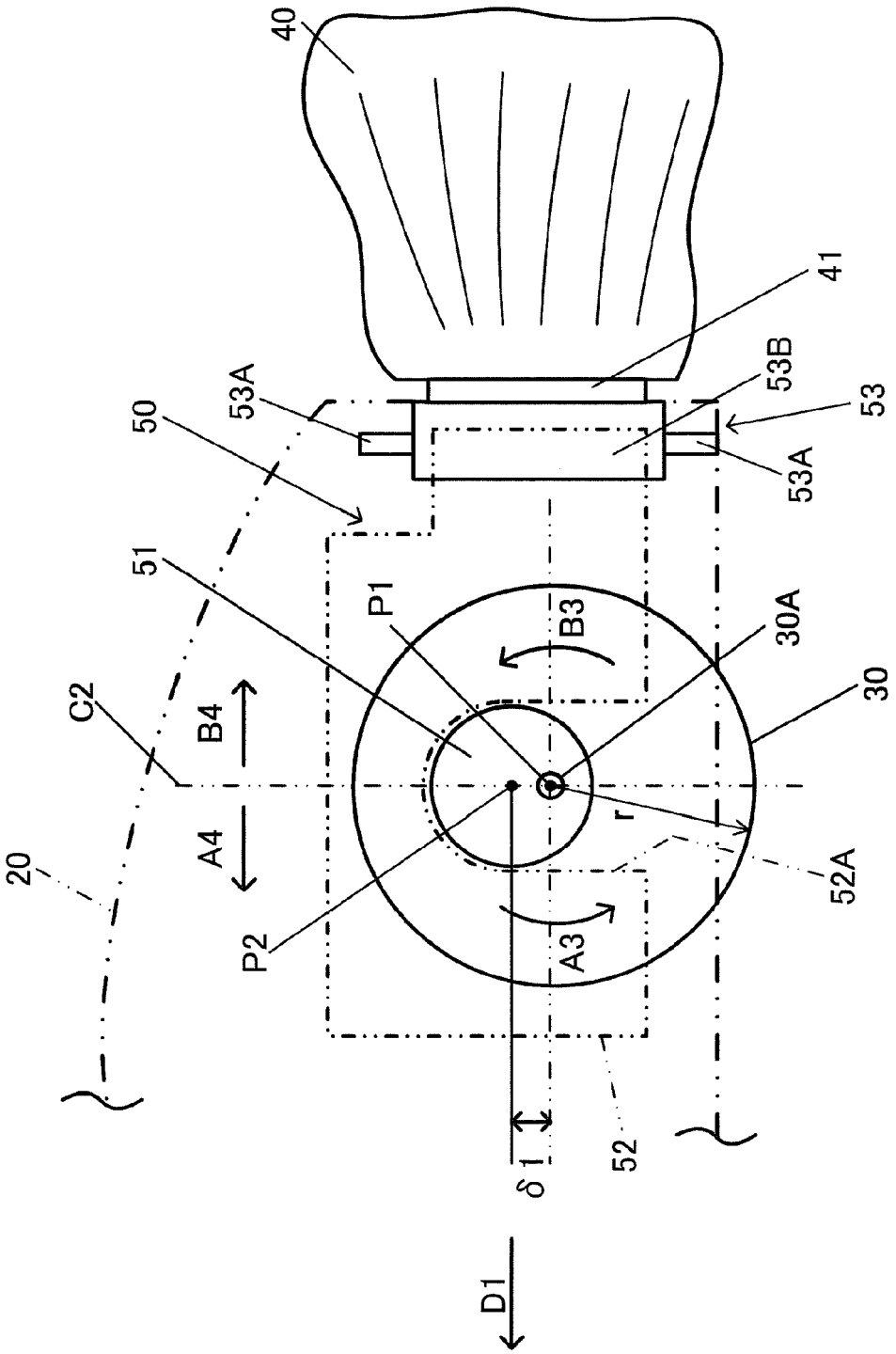

40
41
53A
53B
53
50
53A
51
P1
B3
30A
30
C2
B4
A4
r
20
52A
P2
A3
δ1
52
D1

FIG. 5

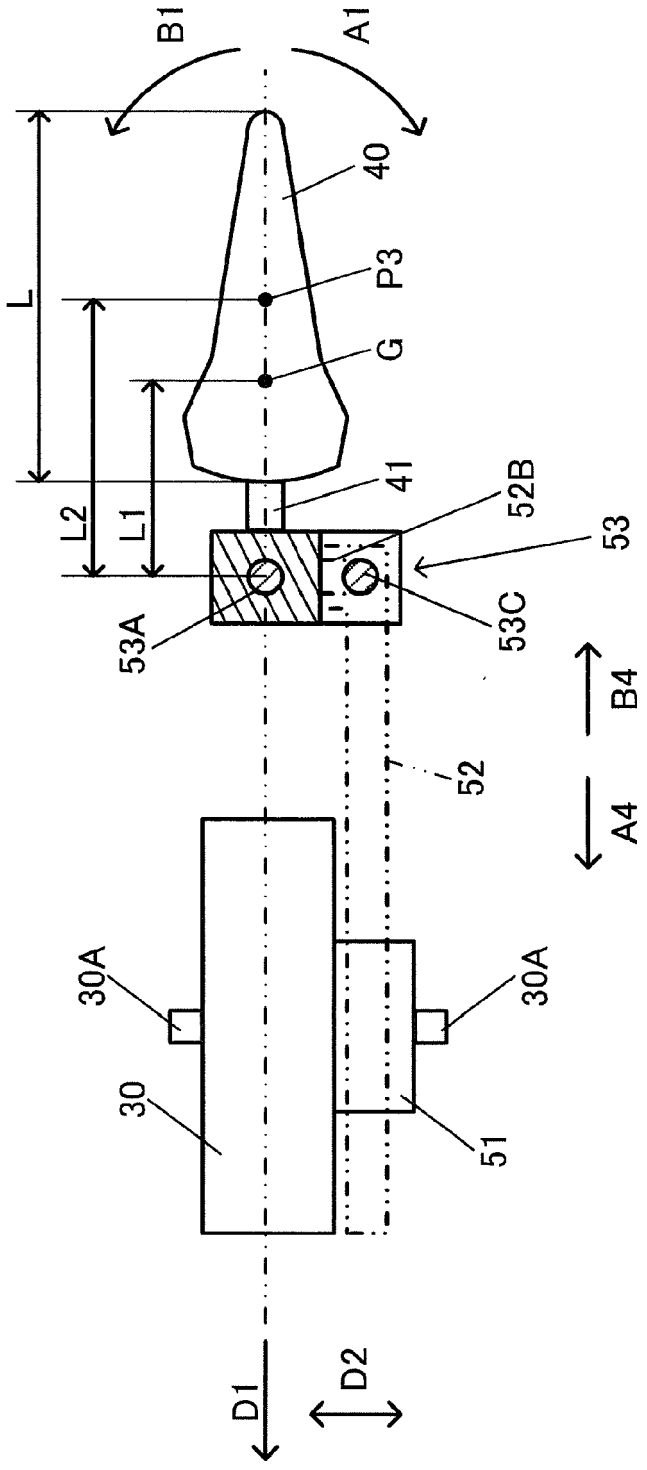


FIG. 6A

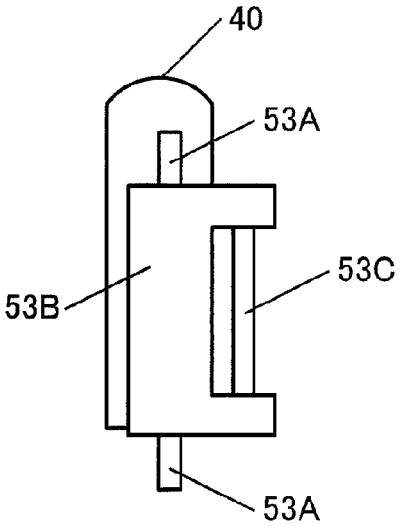


FIG. 6B

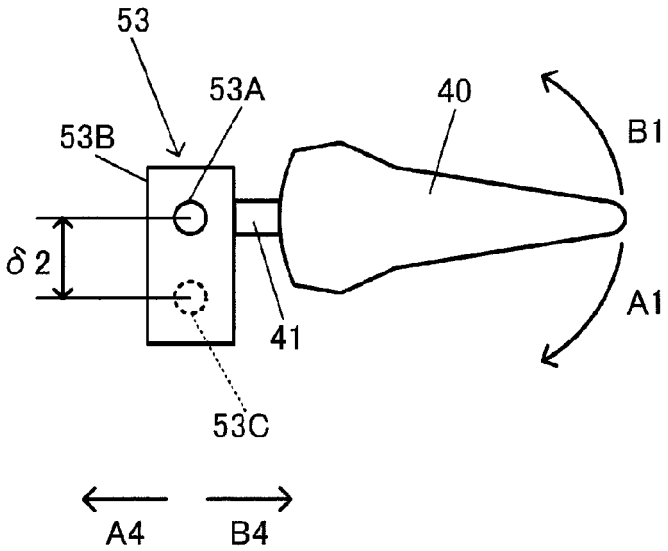


FIG. 6C

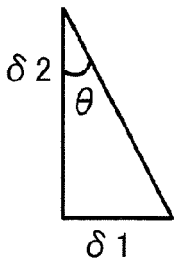


FIG. 7A

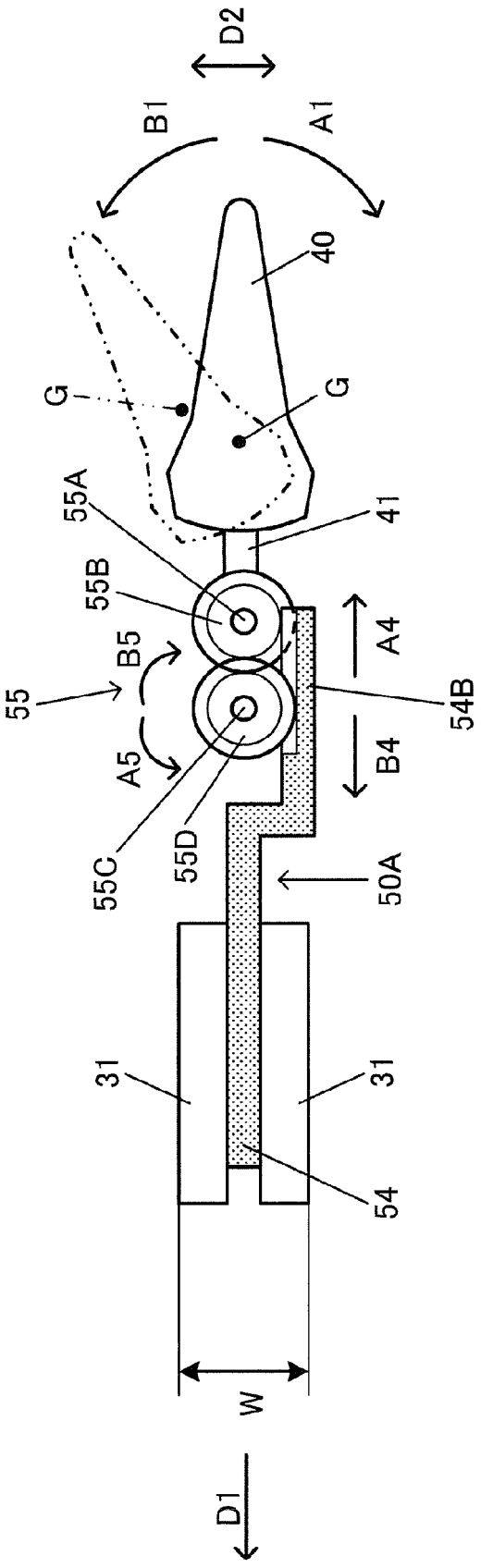


FIG. 7B

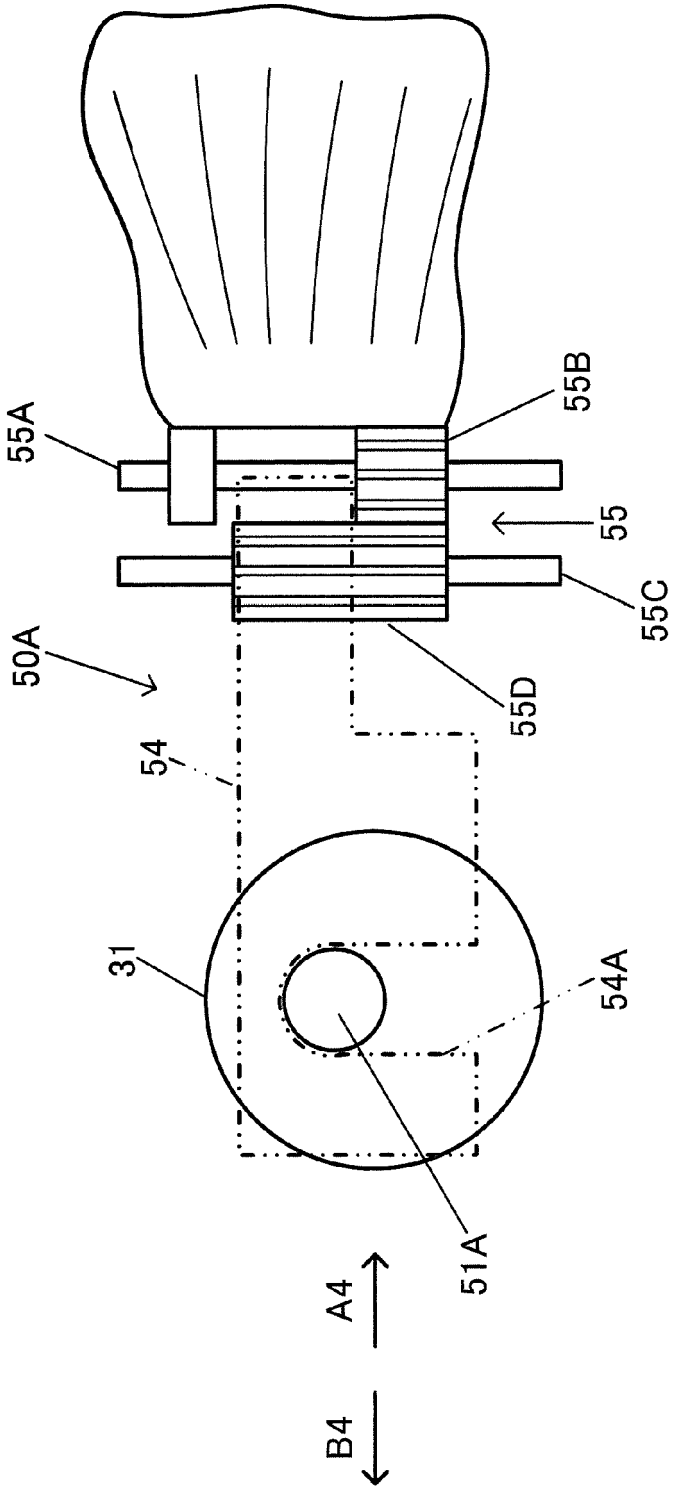


FIG. 8

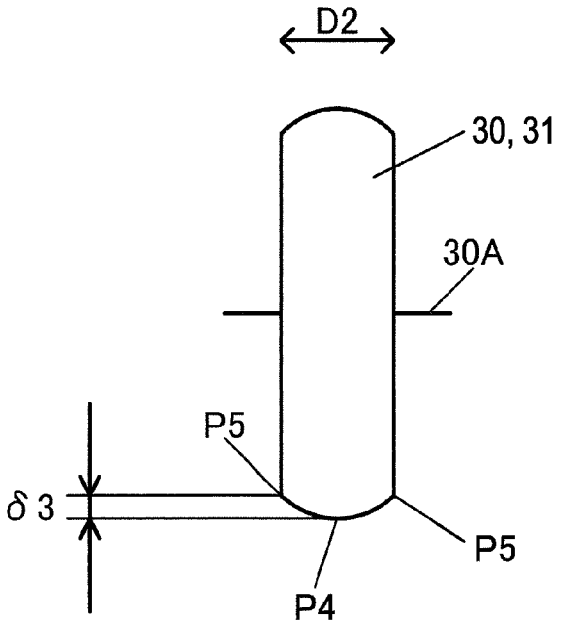


FIG. 9

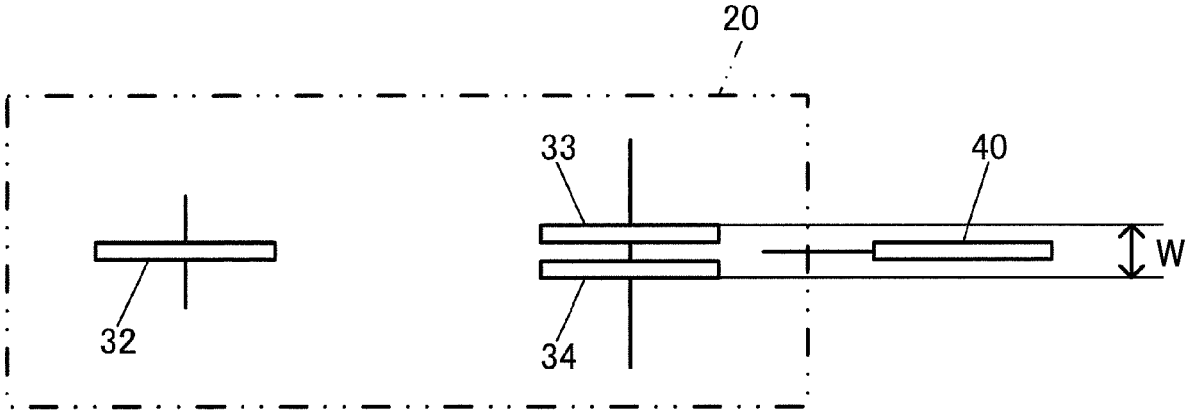


FIG. 10

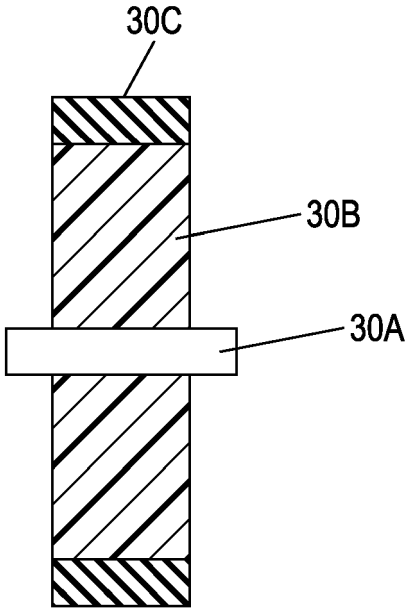


FIG. 11

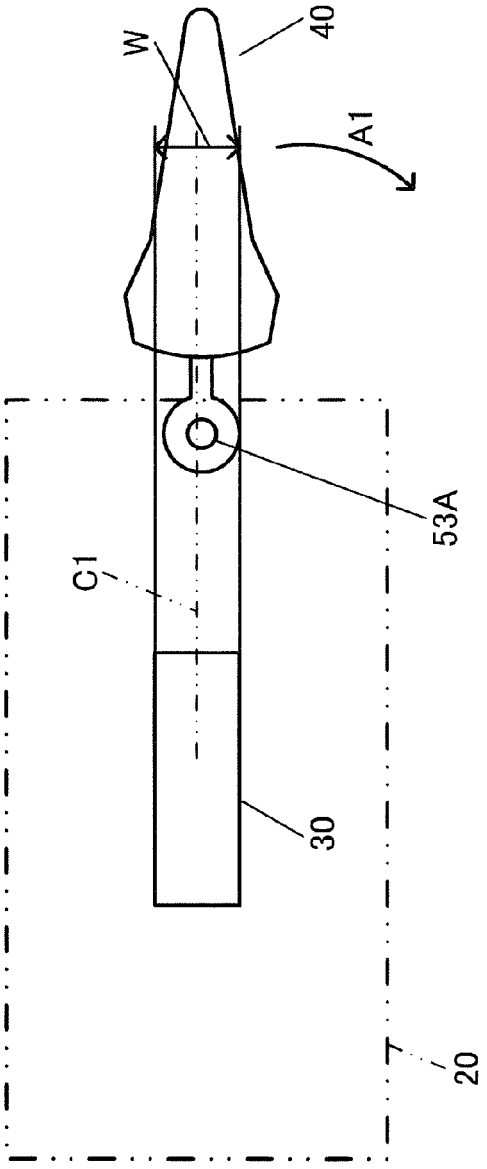
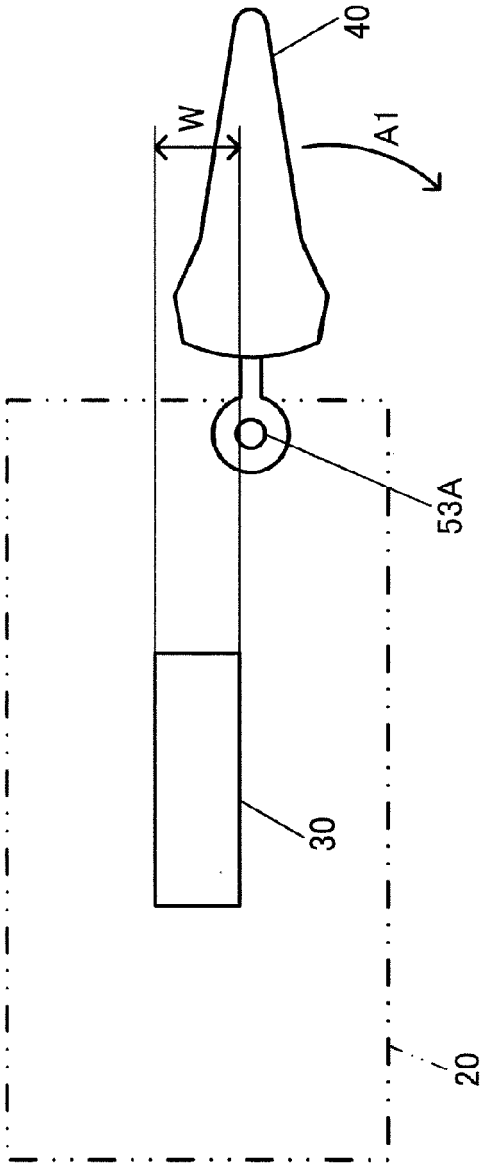


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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- JP 2015074665 A **[0001]**
- JP 7037675 A **[0003]**