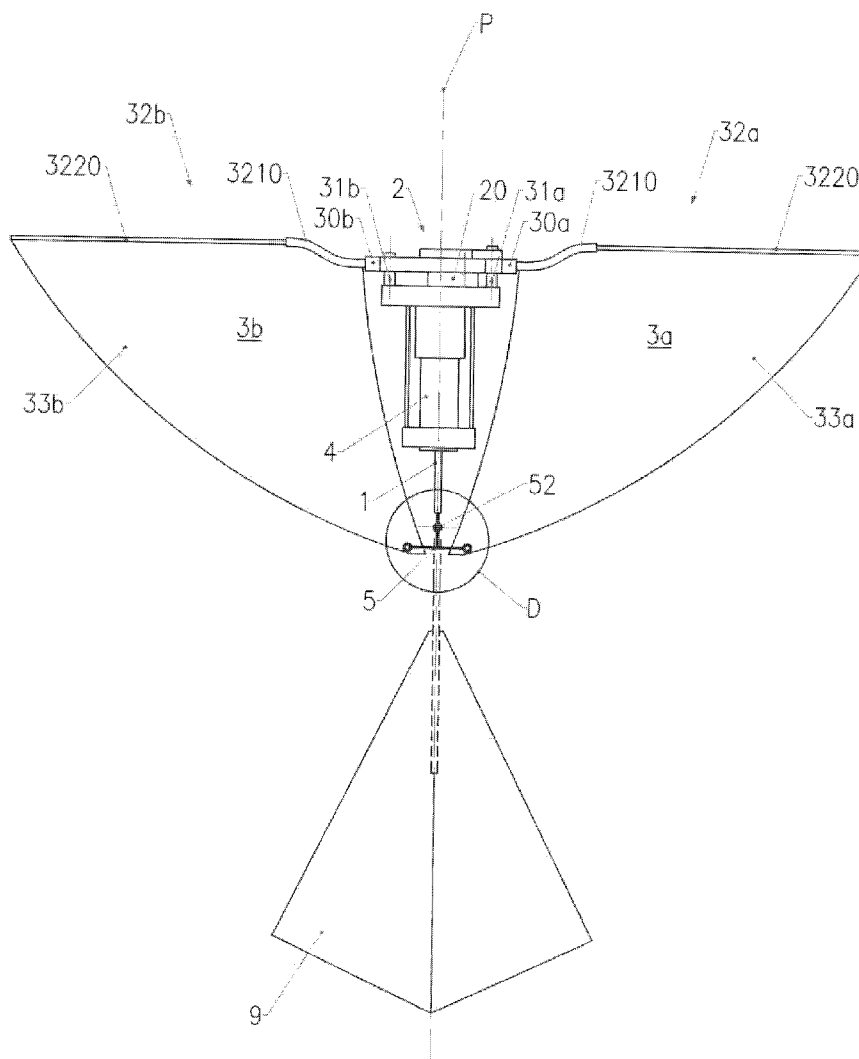




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(19) **United States**(12) **Patent Application Publication**
VAN RUYMBEKE(10) **Pub. No.: US 2014/0162524 A1**(43) **Pub. Date: Jun. 12, 2014**(54) **FLYING TOY CONFIGURED TO MOVE BY
WING FLAPPING****Publication Classification**(71) Applicant: **Edwin VAN RUYMBEKE**, Marseille
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(FR)(52) **U.S. Cl.**
CPC **A63H 27/008** (2013.01)
USPC **446/35**(21) Appl. No.: **13/902,790**(22) Filed: **May 25, 2013****Related U.S. Application Data**(63) Continuation-in-part of application No. 13/775,221,
filed on Feb. 24, 2013, which is a continuation-in-part
of application No. 12/830,402, filed on Jul. 5, 2010,
now Pat. No. 8,382,546.(57) **ABSTRACT**

A flying toy capable of moving by flapping of wings includes an actuation mechanism, for the wings, comprising a crank drive rotated by a means providing the driving force, two flexible wings arranged symmetrically with respect to the vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism. The wing bases are mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy. The toy includes a control means, that receives a control signal indicating a left turn, increases the tension on the right wing and reduces it on the left wing. For a right turn, the opposite action is performed.



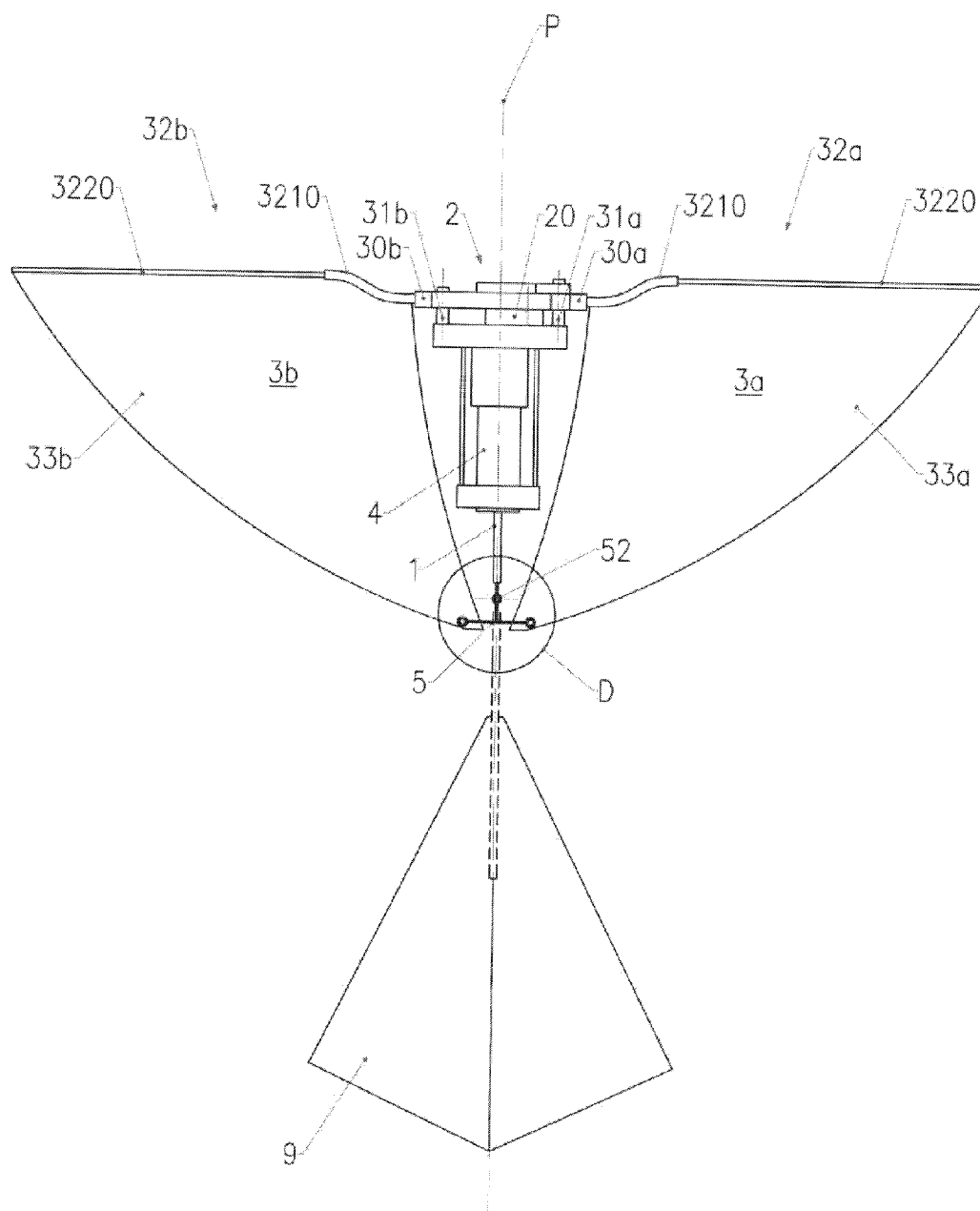


Figure 1

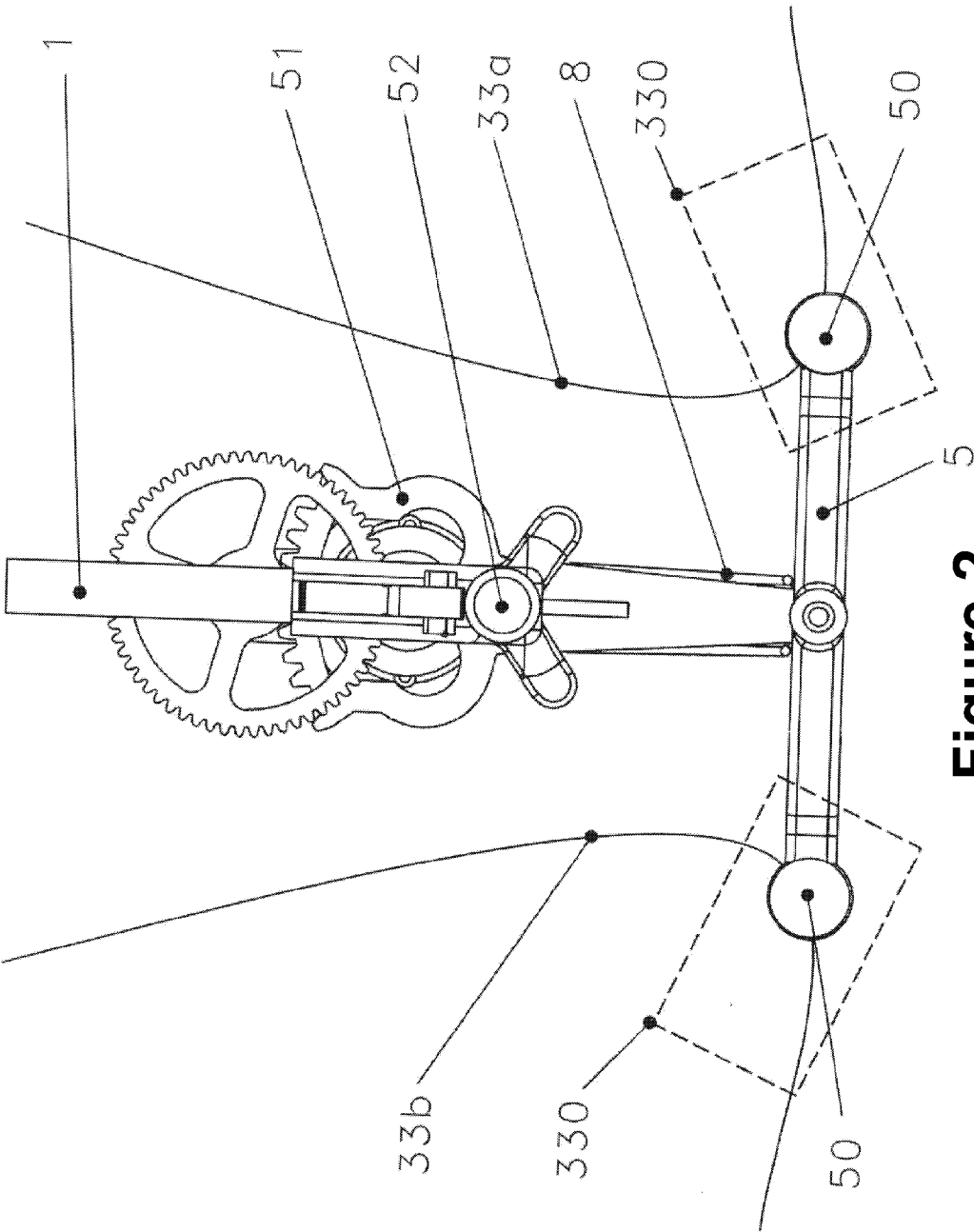


Figure 2

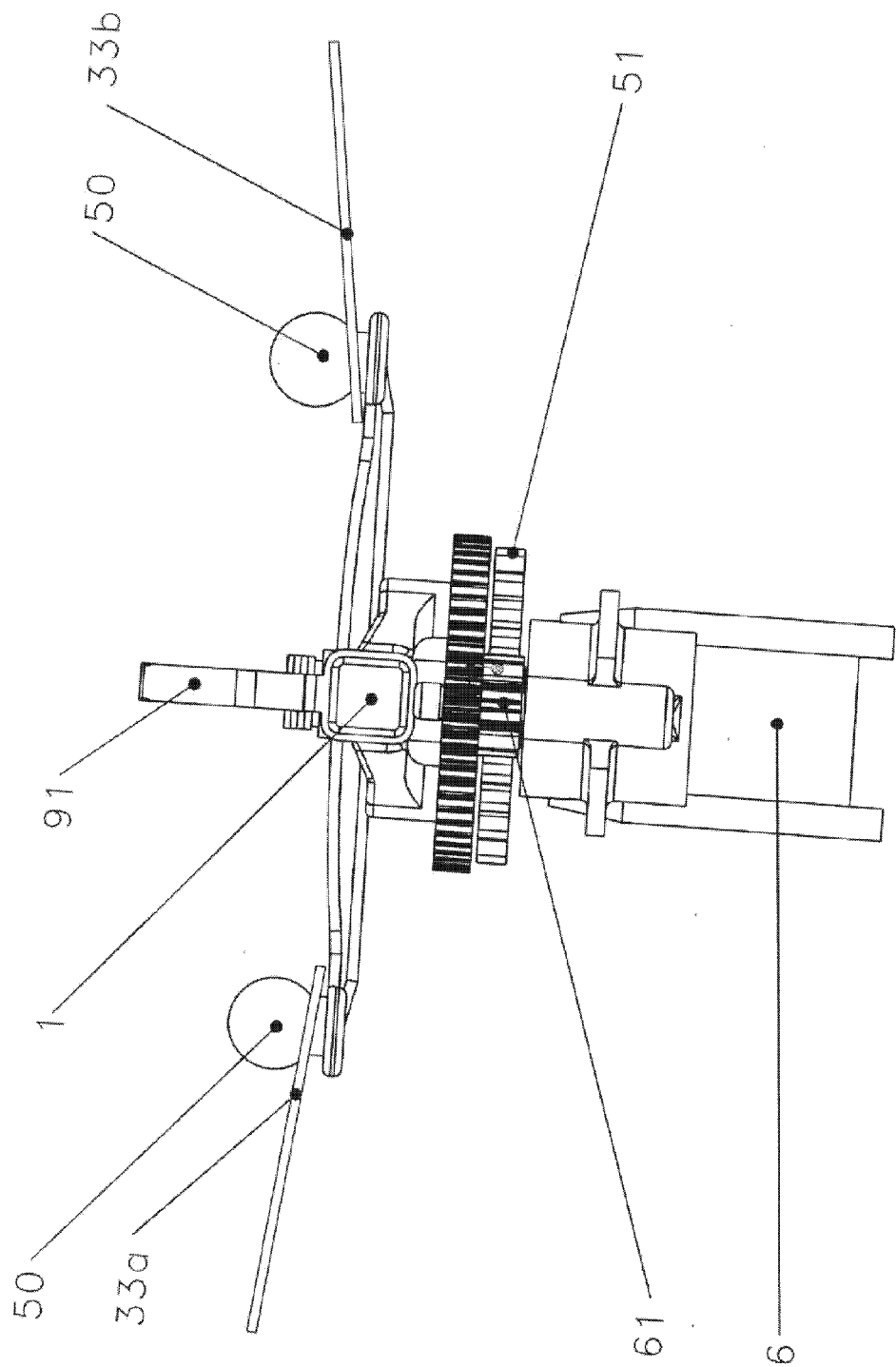


Figure 3

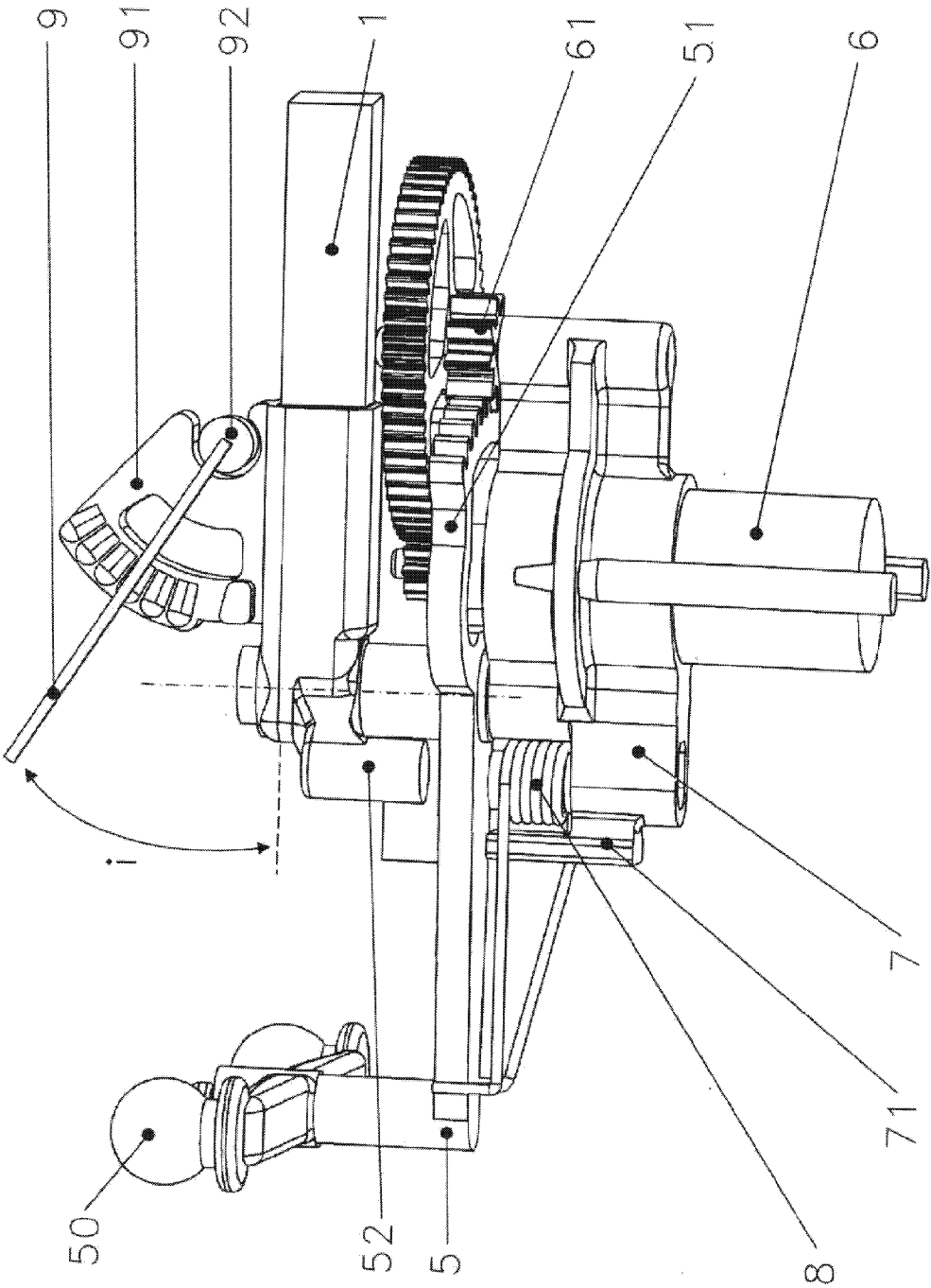


Figure 4

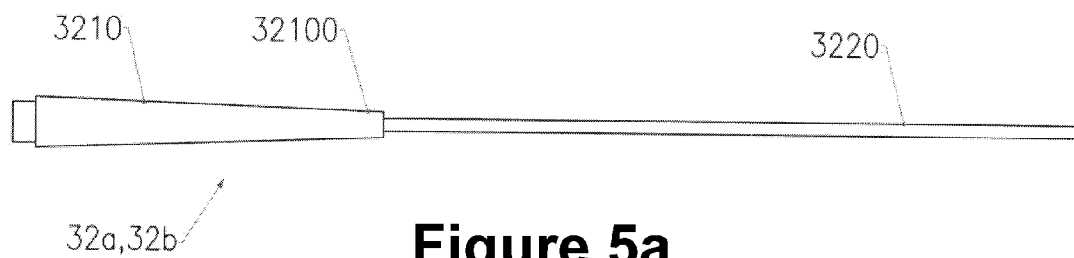


Figure 5a

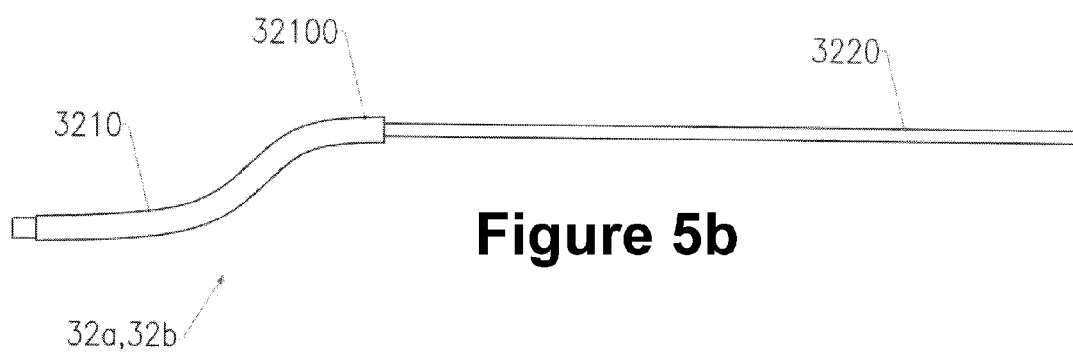


Figure 5b

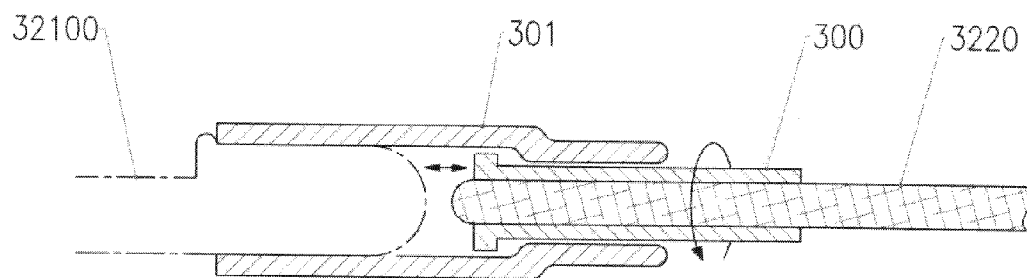


Figure 6

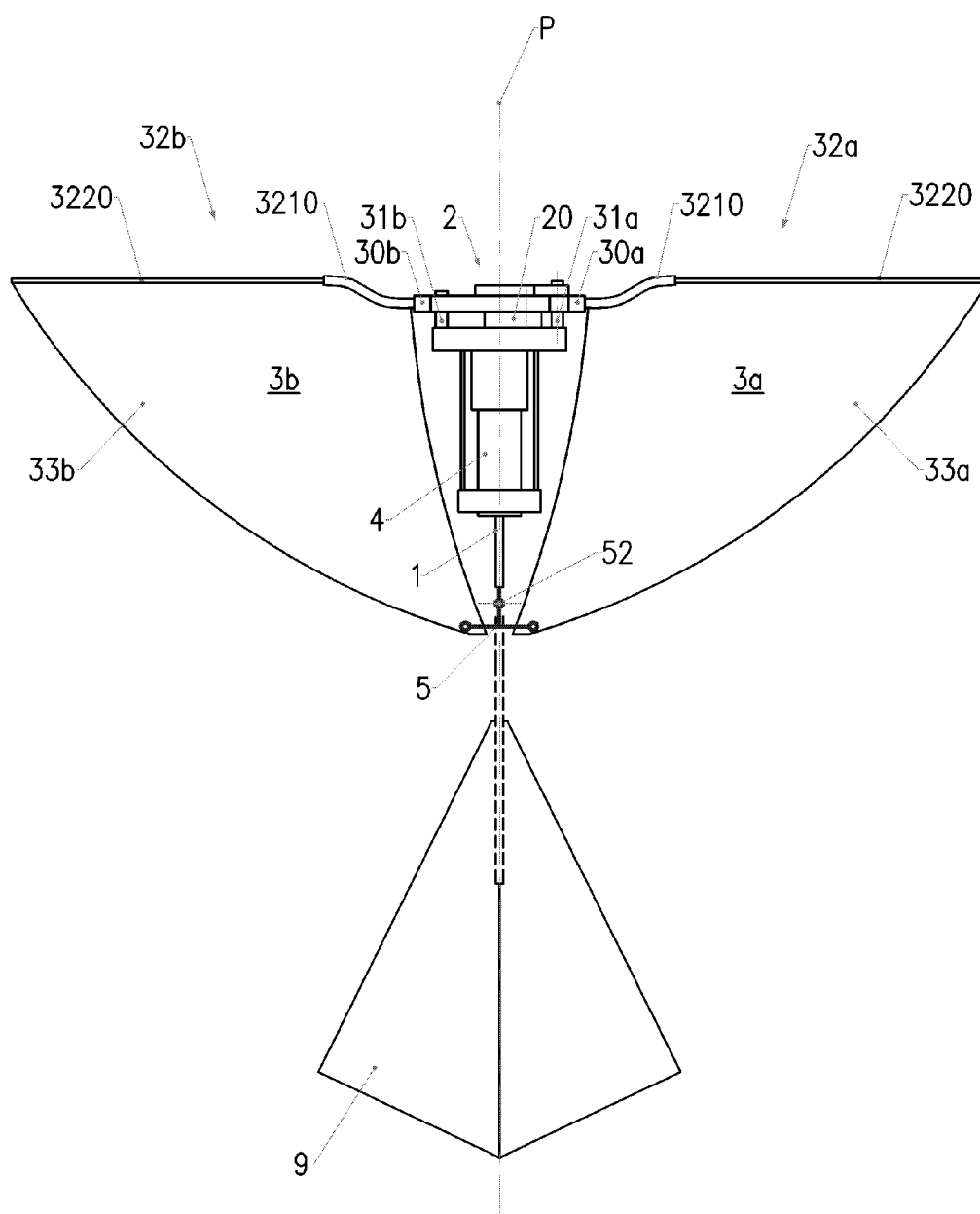


Figure 7

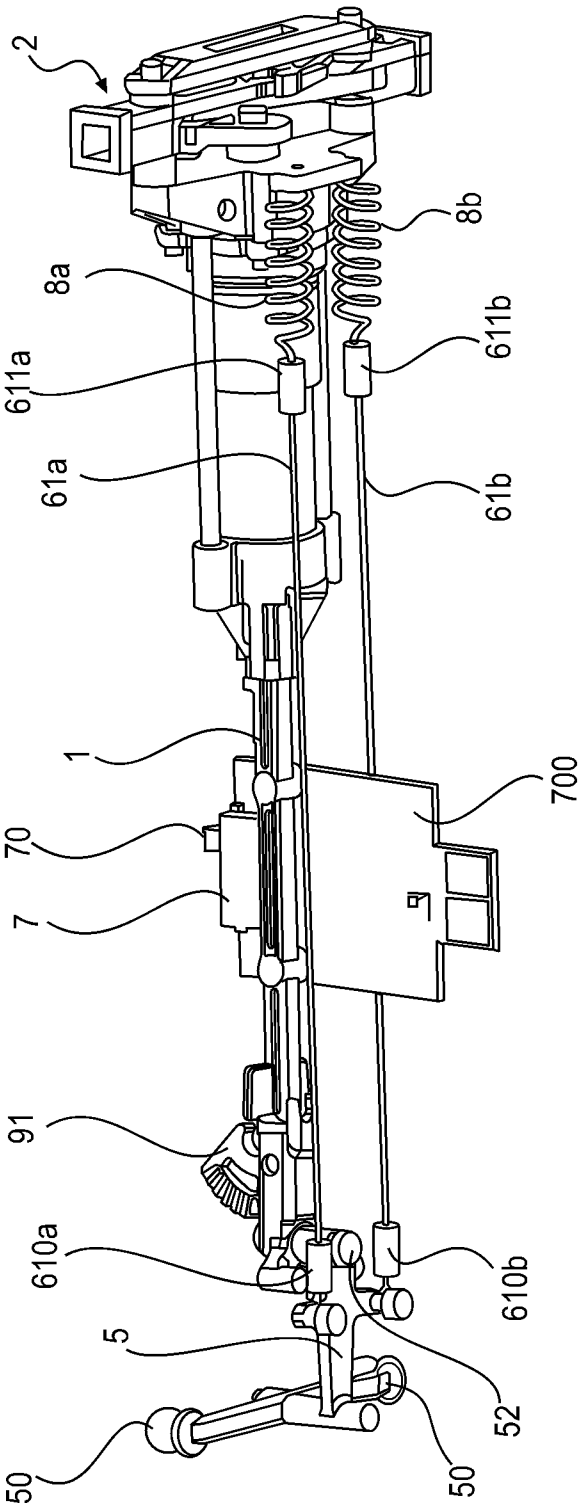
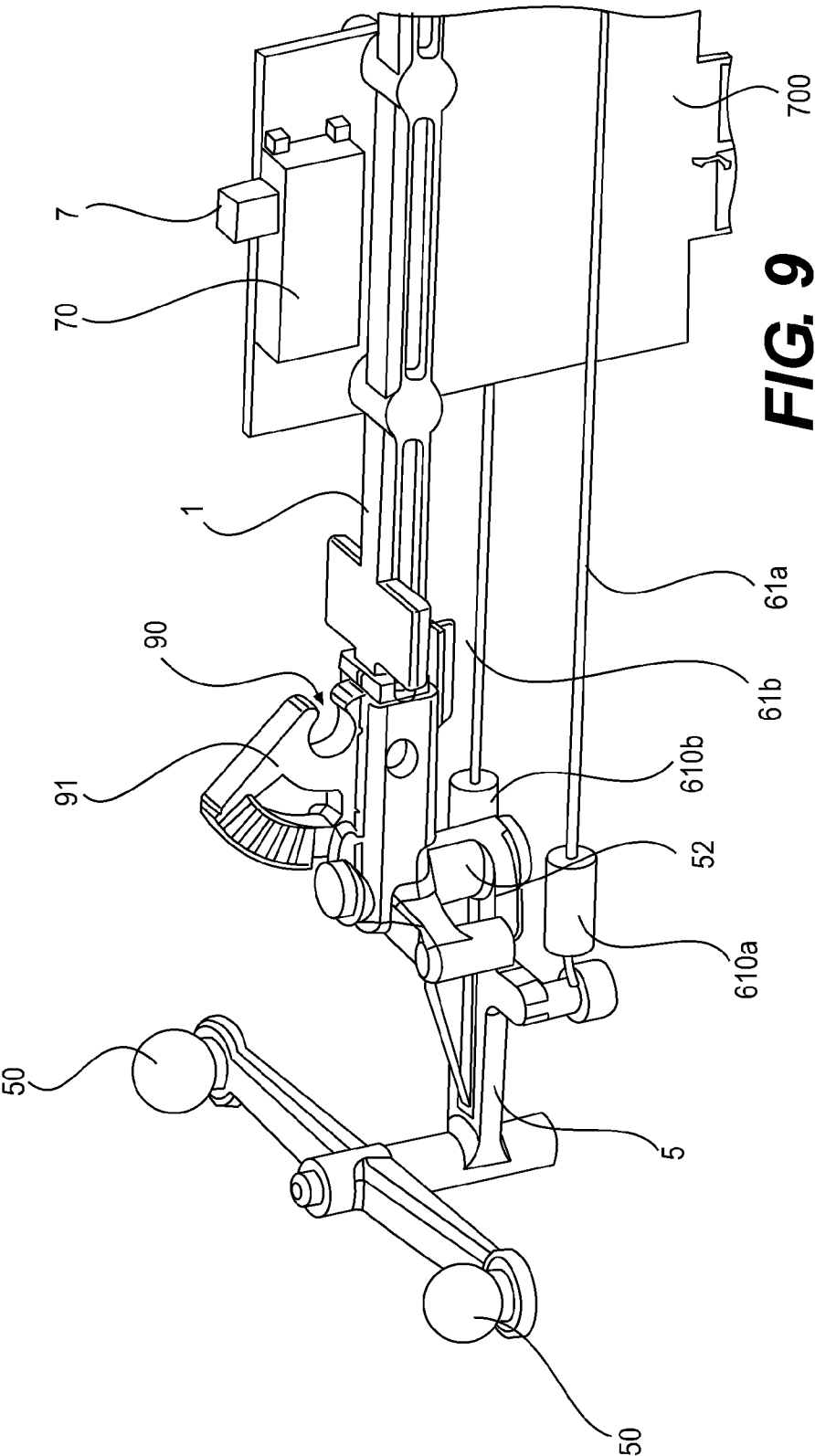


FIG. 8



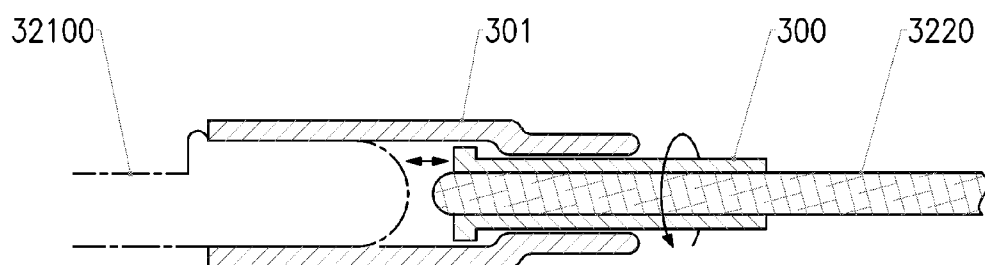
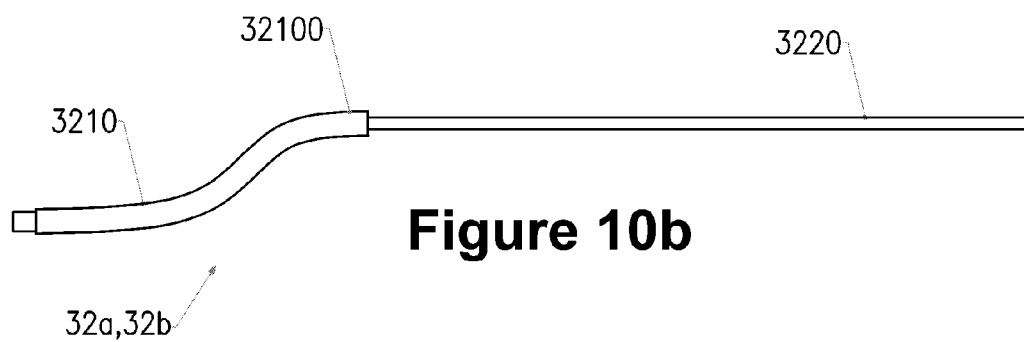
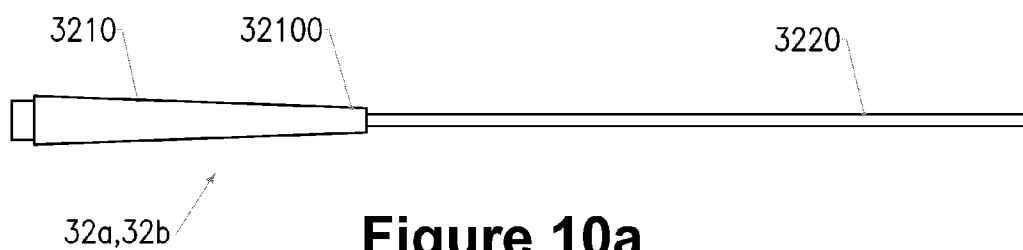


Figure 11

FLYING TOY CONFIGURED TO MOVE BY WING FLAPPING

[0001] This application is a continuation-in-part of pending U.S. patent application Ser. No. 13/775,221 of Edwin VAN RUYMBEKE filed 24 Feb. 2013, the contents of which are herein incorporated by reference; which is a continuation-in-part of U.S. patent application Ser. No. 12/830,402 of Edwin VAN RUYMBEKE filed 5 Jul. 2010, now U.S. Pat. No. 8,382,546, the contents of which are herein incorporated by reference.

TECHNICAL FIELD OF THE INVENTION

[0002] The invention relates to the general technical field of flying toys, and more particularly those imitating the flight of a bird which they may resemble.

DESCRIPTION OF RELATED ART

[0003] The patent documents FR 1,604,345 (G. VAN RUYMBEKE) and EP 0,449,922 (G. VAN RUYMBEKE) describe a flying toy of this type comprising:

[0004] a hollow body having an elongated shape and in the front which is housed an actuation mechanism driven by an elastic strap providing driving force;

[0005] two flexible wings attached, first, to the actuation on the one hand, the activation mechanism and second, on the body;

[0006] a winding system for twisting of the elastic strap motor.

[0007] In this type of flying toy, the actuation mechanism for the wings generally comprises two oscillating levers—or wing bases—connected or designed to be connected, each to a wing spanwise beam on which is attached the front edge of a flexible airfoil constituting the wings of the toy. In principle, the beating of wings suffices to ensure the levitation of the flying toy.

[0008] Several techniques enable turning of these flying toys. The patent documents GB 442,667 (HAENLE), GB 20145.AAD.1910 (EUSTACE), U.S. 2004/155145 (YOSHIIJI) or U.S. Pat. No. 1,450,480 (JAMES), teach for example changing the angle of incidence of the wings so that the toy turns right or left.

[0009] Known more particularly, from the patent document EP 1,958,681 (PROXYFLYER), is a flying toy that can turn in a desired direction, using a different drag on the wings. A control means, which receives a control signal indicating a left turn, increases the angle of incidence on the left wing and reduces it on the right wing. For a right turn, the opposite action is performed.

[0010] The wings of this toy have airfoil surfaces that have an increased drag when the angle of incidence increases. In practice, this technique does not enable turning of the toy with great precision.

[0011] Moreover, when the speed of the toy is too high, the controls can be inverted: the increase of the angle of incidence on the right wing (respectively left) drives a steering to the left (respectively right). The control of such a toy can be random.

[0012] Given this state of affairs, a principal objective of the invention is to work out a technique enabling more precise and more effective turning of a flying toy of the type known from the prior art.

SUMMARY OF THE INVENTION

[0013] To address the problem above, a flying toy capable of moving by flapping of wings and comprises a support structure, an actuation mechanism, for the wings, arranged on the support structure and comprising a crank drive rotated by a means providing the driving force, two flexible wings arranged symmetrically with respect to the vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism. The wing bases are mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy. The toy includes a control means, that receives a control signal indicating a left turn, increases the tension on the right wing and reduces it on the left wing, for a right turn, the opposite action is performed.

[0014] According to another aspect of the present invention, there is a method for controlling a flying toy capable of moving by flapping of wings, the toy comprising a support structure, an actuation mechanism, for the wings, arranged on the support structure and comprising a crank drive rotated by a means providing the driving force, two flexible wings arranged symmetrically with respect to the vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism, the wing bases being mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy. The method comprises increasing the tension on the right wing and reducing it on the left wing, to control a right turn, increasing the tension on the left wing and reducing it on the right wing, to control a left turn.

[0015] According to yet another aspect of the present invention, a flying toy capable of moving by flapping of wings, the flying toy comprising a support structure, an actuation mechanism arranged on the support structure and comprising a rotatable crank drive, two flexible wings each comprising a wing base, the two flexible wings being arranged symmetrically with respect to a vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism, the wing bases being mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy. The toy includes a control means that, responsive to receiving a control signal indicating a left turn, increases a tension on the right wing while reducing a tension on the left wing thereby effecting a left turn, and that, responsive to receiving a control signal indicating a right turn, increases the tension on the left wing while reducing the tension on the right wing thereby effecting a right turn, posterior edges of a main airfoil of the wings are attached on a rudder configured to pull laterally on the edges, in a plane of the wings, so as to change the tension of the wings: a lateral traction on the posterior edge of the right wing increases the tension on the right wing and decreases the tension on the left wing, a lateral traction on the posterior edge of the left wing increases the tension on the left wing and decreases the tension on the right wing, wherein the movement of the rudder is controlled by means of a memory shapes wires that, responsive to receiving an electric current, constricts.

[0016] According to yet another aspect of the present invention, there is a method for controlling a flying toy capable of moving by flapping of wings, the toy comprising a support structure, an actuation mechanism arranged on the support structure and comprising a rotatable crank drive, two flexible wings each comprising a wing base, the two flexible wings being arranged symmetrically with respect to a vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism, the wing bases being

mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy, each posterior edges of a main airfoil of the wings is coupled to a memory shape wire that, responsive to receiving an electric current, constricts. The method comprises receiving a control signal, responsive to the control signal indicating a right turn, constricting the memory shape wire coupled to the right wing to reduce the tension on the right wing, and responsive to the control signal indicating a left turn, constricting memory shape wire coupled to the left wing to reduce the tension on the left wing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Other advantages and features of the invention will become more apparent upon reading the description of preferred implementation modes which follows, with reference to the accompanying drawings, made by way of indicative and non limiting examples and wherein:

[0018] FIG. 1 is a schematic top view showing the layout of various components of a toy in accordance with an exemplary embodiment,

[0019] FIG. 2 is an enlarged view of detail D of FIG. 1, showing, from above, the tensioning device for the wings,

[0020] FIG. 3 is a front view of the tensioning device for the wings,

[0021] FIG. 4 is a perspective view of the tensioning device for the wings,

[0022] FIGS. 5a and 5b show respectively a front view and a top view of a second implementation mode for the spanwise wing beam,

[0023] FIG. 6 is a longitudinal section view showing an example of attachment of a rod to the end of a part of a spanwise wing beam,

[0024] FIG. 7 is a schematic top view showing the layout of various components of a toy in accordance with another exemplary embodiment,

[0025] FIG. 8 is a perspective view of the tensioning device for the wings,

[0026] FIG. 9 is an enlarged view of FIG. 8, showing the tensioning device for the wings,

[0027] FIGS. 10a and 10b show respectively a front view and a top view of another implementation mode for the spanwise wing beam,

[0028] FIG. 11 is a longitudinal section view showing an example of attachment of a rod to the end of a part of a spanwise wing beam.

[0029] The accompanying drawings which are incorporated in and which constitute a part of this specification, illustrate embodiments of the exemplary embodiment and, together with the description, explain the principles of the exemplary embodiment, and additional advantages thereof. Throughout the drawings, corresponding elements are labeled with corresponding reference numbers.

DETAILED DESCRIPTION OF FIRST EXEMPLARY EMBODIMENTS

[0030] The flying toy object of a first exemplary embodiment is typically a toy imitating the flight of a bird, whose appearance it has. It may be however any other type of flying toy that moves by flapping of wings, for example having the appearance of an insect or an imaginary winged character.

[0031] This toy is nonetheless remarkable in that a control means, that receives a control signal indicating a left turn, increases the tension on the right wing and reduces it on the

left wing, for a right turn, the opposite action being performed. A turn to the right or to the left is controlled by the tension of the opposite wing.

[0032] Referring to FIG. 1, the toy object of the exemplary embodiment comprises a support structure 1 on which are arranged the various components of the mechanism 2 of driving wings and steering rudder 5. A hollow body (not shown) having elongated shape, evoking the body of a bird, and typically made of plastic, will cover the support structure 1 in order to conceal the various components of the drive mechanism of the wings and rudder.

[0033] According to FIG. 1, the actuation mechanism 2 of wings 3a, 3b is arranged on the support structure 1 in the front part of the latter. This actuation mechanism 2 enables communication of identical oscillations to the wings 3a, 3b and more particularly the bases of wing 30a, 30b. This actuation mechanism 2 comprises a drive crank 20 rotated by means 4 providing the driving force. The means 4 providing the driving force to the crank 20 can be elastic. In this case, a winding device enabling twisting of the elastic will be provided. This type of elastic system providing power to the crank 20 is for example described in FIG. 5 of the document EP 0,449,922. However, the means 4 providing the driving force is preferably an electric motor 40 coupled to a reduction gear 41. The electric motor 40 is of the type known to the person of skill in the art, powered by battery or by cell and whose operation can be controlled by a remote control of the radio-control type. By actuating this dedicated control, the user will transmit a control signal causing the flapping of the wings to drive the flight of the toy or to the contrary stopping the beating during the landing and/or to simulate periods of gliding. The actuation mechanism 2 of wings 3a, 3b, however, is well known to the person of skill in the art and will therefore not be described here in more detail.

[0034] The two flexible wings 3a, 3b are arranged symmetrically with respect to the vertical plane of symmetry P of the toy and connected at the wing bases 30a, 30b, to the actuation mechanism 2. The bases of the wings are mounted oscillating in the two directions about axes 31a, 31b arranged symmetrically with respect to the plane P. In practice, the external part of the bases 30a, 30b is connected, or arranged to be couplable, for example by interlocking, to the spanwise wing beams 32a, 32b on which is coupled the front edge of the main airfoil 33a, 33b.

[0035] The spanwise wing beams 32a, 32b have a diameter of approximately 0.6 mm and are typically made of plastic or carbon. However, to further lighten the structure of the toy while retaining good rigidity, the spanwise wing beams 32a, 32b are made wholly or partially of liquid crystal polymer (LCP) combined with carbon fibers.

[0036] In the implementation modes shown in FIGS. 5a and 5b, the spanwise wing beams 32a, 32b are formed from a first part 3210 inserted into the wing bases 30a, 30b. This first part can have a tapered section at the end of which is attached a rod 3220 (FIG. 5a). In a second implementation mode (FIGS. 1 and 5b), the first part of 3210 has a "gooseneck" curvature type oriented toward the front of the toy enabling an esthetic closer to a bird, without losing efficiency. This configuration also enables displacement of the center position of the airfoil towards the front of the toy, which enables modification of the flight attitude without displacing the center of gravity.

[0037] Advantageously, the rods 3200 are mounted pivoting, along their longitudinal axis, in the first parts 3210. The rods 3220 may also be mounted sliding in the first parts 3210.

[0038] Referring to FIG. 6, the rods 3220 are tightly fitted and/or cemented in a sheath 300. The latter is made of a semi-rigid plastic. The sheath 300 covers the rods 3220 over a length of approximately 1 cm in order to consolidate their base and reduce the fragility in this area.

[0039] The sheath 300 is advantageously mounted mobile in rotation, and possibly sliding, in a sleeve 301 itself tightly fitted and/or cemented to the end 32100 of the first part 3210. During the flight of the toy, the rods 3220 can be subject to longitudinal axis torsional stresses. However, because the carbon rods have poor torsional rigidity, a non negligible risk of fracture exists. The degree of freedom of rotation of the sheath 300 cancels these torsional stresses and reduces the risks of fracture.

[0040] In practice, when they are manufactured and/or delivered, the rods 3220 are never perfectly straight but have a certain curvature. In these conditions, if the rods 3220 are rigidly connected to the first parts 3210, the curvatures of each wing 3a, 3b can not be symmetrical with respect to the plane P, which inevitably leads to an irregular, even random, flight. The degree of freedom of rotation of the sheath 300 enables natural restoration of the curvature of the rods 3220 toward the rear of toy, symmetrically with respect to the plane P.

[0041] The technique used in the exemplary embodiment and enabling rotation of the toys toward the right or toward the left will now be described in more detail with reference to FIGS. 1-4. In accordance with the exemplary embodiment, a control means 5, that receives a control signal indicating a left turn, increases the tension on the right wing 33a and reduces it on the left wing 33b. For a right turn, the control means 5 increases the tension on the left wing 33b and reduces it on the right wing 33a. A turn to the right or to the left is controlled by the tensioning of the opposite wing.

[0042] Referring to FIG. 1, the posterior edges of the main airfoil 33a, 33b of the wings are attached to a rudder 5 configured to pull laterally on the edges, in the plane of the wings (plane of FIG. 1 or 2 and perpendicular to the plane P), so as to change the tension of the wings:

[0043] a lateral traction on the posterior edge of the right wing 33a increases tension on the right wing and decreases the tension on the left wing 33b: the toy turns left,

[0044] a lateral traction on the posterior edge of the left wing 33b increases the tension on the left wing and decreases the tension on the right wing 33a: the toy turns right.

[0045] Referring to FIG. 2, the rudder 5 has the shape of a T of which the ends of the crossbar are attached to the posterior edges of the main airfoil 33a, 33b of the wings. The attachment can be made via a piece 330 more rigid than the airfoil and cemented on the airfoil and that comprises a hole that fits on a ball-shaped pin 50 (FIG. 3). The T-like longitudinal bar is terminated by a gear 51 meshing with a pinion 61 driven by an electric motor 6 (FIG. 4). The latter is of the type known to the person of skill in the art, powered by battery or by cell and whose operation is controlled by a remote control of the radio-control type. The direction of rotation of the motor 6 depends on the control signal that is sent to it. A reduction ratio device can be between the pinion gear 61 and the rotation shaft of the motor 6. The latter is secured to a base 7 attached to the support structure 1. The rudder 5 is pivotally

mounted around an axis 52 perpendicular to the plane of the wings 33a, 33b. In practice, the axis 52 is a vertically projecting element of the base 7, the T-like longitudinal bar forming the rudder 5 being mounted freely in rotation around this axis. In this configuration, when the engine 6 receives a control signal (to turn right or to left turn), the pinion 61 rotates, driving the gear 51. The rudder 5 then pivots either right or left by applying lateral tension on the posterior edges of the wings 33a, 33b. In reality, the ends 50 of the rudder 5 draw an arc whose center is the axis of rotation 52.

[0046] Referring to FIGS. 2 and 4, a return spring 8 enables automatic restoration of the rudder 5 in a neutral position where no tension is exerted on the posterior edges of the main airfoil 33a, 33b of the wings. In practice, a spiral spring 8 attached on the base 7 and from which the legs are arranged on both sides of the T-like longitudinal bar forming the rudder 5, is used. The spring 8 is pretensioned in the neutral position, the legs of the spring 8 being held apart by an element 71 of the base 7. At rest, the rudder 5 is in a neutral position, i.e. extending from the support structure 1. When the rudder 5 leaves this position, the legs of the spring 8 tend to return it into the neutral position. The spring 8 having a pre-tension and resting on the element 71, the rudder 5 is positively returned to the neutral, compensating for the residual friction of the reduction ratio device. This enables the flying toy to follow a straight path when the motor 6 is stopped.

[0047] In an implementation variation not shown, the rudder 5 is mounted mobile in translation in a direction parallel to the plane of the wings 3a, 3b, the displacement of the rudder causing a lateral tension on the posterior edges of the main airfoil 33a, 33b of the wings. In practice, a rudder 5 comprising a longitudinal control rod with ends to which are attached the posterior edges of the main airfoil 33a, 33b of the wings 3a, 3b, can be used. This control rod is engaged on a toothed pinion driven by the electric motor 6. The rotation of the toothed pinion drives the translation to the right or to the left of rudder 5 and alters de facto the tension of the wings 3a, 3b. A return spring similar to that described above will enable automatic restoration of the rudder 5 in a neutral position where no tension is exerted on the posterior edges of the main airfoil 33a, 33b of the wings.

[0048] Referring to FIGS. 1 and 4, the posterior part of the toy is provided with a tail airfoil 9 arranged symmetrically with respect to the vertical plane of symmetry P of the toy. This tail airfoil 9 can be orientable in a vertical plane so as to adjust the type of flight: when the tail is raised, a slow flight is obtained and when the tail is lowered, practically to the horizontal, a fast flight is obtained. The inclination of the tail 9 can be automatically controlled by means of a radio-controlled motor. However, the angle of inclination of the tail 9 can be manually adjusted. To do this, and referring to FIG. 4, the end of the tail 9 is pivotally mounted around a horizontal axis of rotation 90. A latching device 91 attached on the base 7 enables maintenance in position of the tail 9 corresponding to a desired angle of inclination "i".

[0049] In summary, according to a preferred implementation mode, the posterior edges of the main airfoil of the wings are attached on a rudder configured to pull laterally on the edges, in the plane of the wings, so as to change the tension of the wings:

[0050] a lateral traction on the posterior edge of the right wing increases the tension on the right wing and decreases the tension on the left wing,

- [0051] a lateral traction on the posterior edge of the left wing increases the tension on the left wing and decreases the tension on the right wing.
- [0052] Advantageously, the rudder is mounted pivoting around an axis perpendicular to the plane of the wings, the pivoting of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.
- [0053] In an implementation variation, the rudder is mounted mobile in translation in a direction parallel to the plane of the wings, the displacement of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.
- [0054] The movement of the rudder preferably is controlled via a radio-controlled motor.
- [0055] To enable the flying toy to follow a straight path in the absence of stress on the wings, a return spring enables automatic restoration of the rudder into a neutral position where no tension is exerted on the posterior edges of the main airfoil of the wings.
- [0056] According to another advantageous feature of the exemplary embodiment:
- [0057] the radio-controlled motor is provided with a reduction ratio device,
- [0058] and wherein the spring is pretensioned in the neutral position, the legs of the spring being held apart by an element, the pre-tension enabling restoration of the rudder positively into the neutral position, compensating for the residual frictions of the reduction ratio device.
- [0059] Preferably, the wings comprise spanwise wing beams connected to the wing bases, the spanwise beams being formed from a first part inserted into the wing bases and at the end of which is attached a rod, the latter being pivotally mounted, about its longitudinal axis, in the first part.
- [0060] The rods can be tightly fitted and/or cemented in a sheath, the latter covering the rods so as to consolidate their base and decrease the fragility at this area.

DETAILED DESCRIPTION OF SECOND EXEMPLARY EMBODIMENTS

- [0061] Referring to FIG. 7, the toy object of a second exemplary embodiment comprises a support structure 1 on which are arranged the various components of the mechanism 2 of driving wings and steering rudder 5. A hollow body (not shown) having elongated shape, evoking the body of a bird, and typically made of plastic, will cover the support structure 1 in order to conceal the various components of the drive mechanism of the wings and rudder.
- [0062] According to FIG. 7, the actuation mechanism 2 of wings 3a, 3b is arranged on the support structure 1 in the front part of the latter. This actuation mechanism 2 enables communication of identical oscillations to the wings 3a, 3b and more particularly the bases of wing 30a, 30b. This actuation mechanism 2 comprises a drive crank 20 rotated by means 4 providing the driving force. The means 4 providing the driving force to the crank 20 can be elastic. In this case, a winding device enabling twisting of the elastic will be provided. This type of elastic system providing power to the crank 20 is for example described in FIG. 5 of the document EP 0,449,922. However, the means 4 providing the driving force is preferably an electric motor 40 coupled to a reduction gear 41. The electric motor 40 is of the type known to the person of skill in the art, powered by battery or by cell and whose operation can be controlled by a remote control of the radio-control type. By actuating this dedicated control, the user will transmit a con-

trol signal causing the flapping of the wings to drive the flight of the toy or to the contrary stopping the beating during the landing and/or to simulate periods of gliding.

- [0063] The two flexible wings 3a, 3b are arranged symmetrically with respect to the vertical plane of symmetry P of the toy and connected at the wing bases 30a, 30b, to the actuation mechanism 2. The bases of the wings are mounted oscillating in the two directions about axes 31a, 31b arranged symmetrically with respect to the plane P. In practice, the external part of the bases 30a, 30b is connected, or arranged to be couplable, for example by interlocking, to the spanwise wing beams 32a, 32b on which is coupled the front edge of the main airfoil 33a, 33b.

- [0064] The spanwise wing beams 32a, 32b have a diameter of approximately 0.6 mm and are typically made of plastic or carbon. However, to further lighten the structure of the toy while retaining good rigidity, the spanwise wing beams 32a, 32b are made wholly or partially of liquid crystal polymer combined with carbon fibers.

- [0065] In the implementation modes shown in FIGS. 10a and 10b, the spanwise wing beams 32a, 32b are formed from a first part 3210 inserted into the wing bases 30a, 30b. This first part can have a tapered section at the end of which is attached a rod 3220 (FIG. 10a). In another implementation mode (FIGS. 7 and 10b), the first part of 3210 has a "goose-neck" curvature type oriented toward the front of the toy enabling an esthetic closer to a bird, without losing efficiency. This configuration also enables displacement of the center position of the airfoil towards the front of the toy, which enables modification of the flight attitude without displacing the center of gravity.

- [0066] Advantageously, the rods 3200 are mounted pivoting, along their longitudinal axis, in the first parts 3210. The rods 3220 may also be mounted sliding in the first parts 3210.

- [0067] Referring to FIG. 11, the rods 3220 are tightly fitted and/or cemented in a sheath 300. The latter is made of a semi-rigid plastic. The sheath 300 covers the rods 3220 over a length of approximately 1 cm in order to consolidate their base and reduce the fragility in this area.

- [0068] The sheath 300 is advantageously mounted mobile in rotation, and possibly sliding, in a sleeve 301 itself tightly fitted and/or cemented to the end 32100 of the first part 3210.

- [0069] A technique used in the second exemplary embodiment and enabling rotation of the toys toward the right or toward the left will now be described in more detail with reference to FIGS. 7-9. A control means 5, that receives a control signal indicating a left turn, increases the tension on the right wing 33a and reduces it on the left wing 33b. For a right turn, the control means 5 increases the tension on the left wing 33b and reduces it on the right wing 33a. A turn to the right or to the left is controlled by the tensioning of the opposite wing.

- [0070] Referring to FIG. 7, the posterior edges of the main airfoil 33a, 33b of the wings are attached to a rudder 5 configured to pull laterally on the edges, in the plane of the wings (plane of FIG. 7 and perpendicular to the plane P), so as to change the tension of the wings:

- [0071] a lateral traction on the posterior edge of the right wing 33a increases tension on the right wing and decreases the tension on the left wing 33b: the toy turns left,

- [0072] a lateral traction on the posterior edge of the left wing 33b increases the tension on the left wing and decreases the tension on the right wing 33a: the toy turns right.

[0073] Referring to FIGS. 7, 8, and 9, the rudder 5 has the shape of a T of which the ends of the crossbar are attached to the posterior edges of the main airfoil 33a, 33b of the wings. The attachment can be made via a piece more rigid than the airfoil and cemented on the airfoil and that comprises a hole that fits on a ball-shaped pin 50 (FIGS. 8 and 9). The rudder 5 is pivotally mounted around an axis 52 perpendicular to the plane of the wings 33a, 33b. In practice, the axis 52 is a vertically projecting element of the support structure 1, the T-like longitudinal bar forming the rudder 5 being mounted freely in rotation around this axis.

[0074] Each side of the rudder 5 is attached to a memory shape wire 61a, 61b that, responsive to receiving an electric current, constricts. Memory shape wire 61a, 61b remembers its original cold-forged shape and returns to the pre-deformed shape when heated. Wires 61a, 61b are preferably copper-aluminium-nickel alloys or nickel-titanium (NiTi) alloys. Wires sold under the trademark FLEXINOL®, by the American firm Dynalloy®, are preferably used.

[0075] Each wire 61a, 61b has a first end 610a, 610b and a second end 611a, 611b. The first end 610a, 610b is attached on the rudder 5. The second end 611a, 611b is attached at the front of the toy, and more particularly on the actuation mechanism 2. To heat such wire, it is sufficient to apply an electric current to the wire.

[0076] First ends 610a, 610b are electrically connected to the bottom (for example positive bottom) of a battery 7, or a cell. Second ends 611a, 611b are also electrically connected to the bottom (for example negative bottom) of the battery 7, or cell. Accordingly, by connecting ends 610a-611a, respectively 610b-611b, to the bottom of the battery 7, the wire 61a, respectively 61b, electrical energy will be provided to such wire. Like a resistor, the wire 61a, 61b will heat, and therefore constrict.

[0077] Battery 7, or a cell, is preferably rechargeable and can have a voltage capacity of approximately 0.5 volts to 12 volts, and can be an alkaline battery, a lithium battery, a nickel-cadmium battery, or any other battery of like voltage capacity.

[0078] The switching power of each wire is controlled by a remote control 70 of the radio-control type. The remote control 70 is configured with the battery 7 such that when a wire 61a or 61b receives an electric current and constricts, the other wire 61b or 61a does not receive electric current and releases. Preferably battery 7, or cell, is provided with a switch means such that wires 61a and 61b may be selectively connected to the battery or cell. Remote control 70 controls such switch means. Referring to FIGS. 8 and 9, the remote control 70 and the battery 7 are mounted into a printed circuit board 700 positioned between the two wires 61a and 61b.

[0079] The direction of rotation of the rudder 5 depends on the control signal that is sent to remote control 70. When the remote control 70 receives a control signal, one of the wire 61a or 61b receives an electric current and constricts. Responsive to a control signal indicating a right turn, memory shape wire 61a, coupled to the right wing 33a, is constricted (while no action is performed on the memory shape wire 61b coupled to the left wing 33b) to force the rudder 5 to rotate on the right side, which have to effect to reduce the tension on the right wing 33a and, at same time, increase the tension on the left wing 33b. For a left turn, memory shape wire 61b coupled to the left wing 33b is constricted (while no action is performed on the memory shape wire 61a coupled to the right wing 33a) to force the rudder 5 to rotate on the left side, which

have to effect to reduce the tension on the left wing 33b and, at same time, increase the tension on the right wing 33a.

[0080] The rudder 5 then pivots either right or left by applying lateral tension on the posterior edges of the wings 33a, 33b. In reality, the ends 50 of the rudder 5 draw an arc whose center is the axis of rotation 52.

[0081] Referring to FIG. 8, a return spring 8a, 8b enables automatic restoration of the rudder 5 in a neutral position where no tension is exerted on the posterior edges of the main airfoil 33a, 33b of the wings. In practice, a spiral spring 8a, 8b is attached on each the second end 611a, 611b of wires 61a, 61b and on the actuation mechanism 2. The spring 8a, 8b is pretensioned in the neutral position. At rest, the rudder 5 is in a neutral position, i.e. extending from the support structure 1. When the rudder 5 leaves this position, the spring 8a, 8b tends to return it into the neutral position. The spring 8a, 8b having a pre-tension, the rudder 5 is positively returned to the neutral position. This enables the flying toy to follow a straight path when the remote control 70 is stopped or when the battery 7 is not energized.

[0082] In an implementation variation not shown, the rudder 5 is mounted mobile in translation in a direction parallel to the plane of the wings 3a, 3b, the displacement of the rudder causing a lateral tension on the posterior edges of the main airfoil 33a, 33b of the wings. In practice, a rudder 5 comprising a longitudinal control rod with ends to which are attached the posterior edges of the main airfoil 33a, 33b of the wings 3a, 3b, can be used. This control rod is driven by the wires 61a, 61b which are attached on both sides of the rod. Constricting wires 61a, 61b drives the translation to the right or to the left of rudder 5 and alters de facto the tension of the wings 3a, 3b. A return spring similar to that described above will enable automatic restoration of the rudder 5 in a neutral position where no tension is exerted on the posterior edges of the main airfoil 33a, 33b of the wings.

[0083] Referring to FIGS. 7, 8, and 9, the posterior part of the toy is provided with a tail airfoil 9 arranged symmetrically with respect to the vertical plane of symmetry P of the toy. This tail airfoil 9 can be orientable in a vertical plane so as to adjust the type of flight: when the tail is raised, a slow flight is obtained and when the tail is lowered, practically to the horizontal, a fast flight is obtained. The inclination of the tail 9 can be automatically controlled by means of a radio-controlled motor. However, the angle of inclination of the tail 9 can be manually adjusted. To do this, the end of the tail 9 is pivotally mounted around a horizontal axis of rotation 90. A latching device 91 attached on the support structure 1 enables maintenance in position of the tail 9 corresponding to a desired angle of inclination.

[0084] In summary, according to the second exemplary embodiment, a flying toy comprises:

[0085] a support structure,

[0086] an actuation mechanism arranged on the support structure and comprising a rotatable crank drive,

[0087] two flexible wings each comprising a wing base, the two flexible wings being arranged symmetrically with respect to a vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism, the wing bases being mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy, and

[0088] a control means that, responsive to receiving a control signal indicating a left turn, increases a tension on the right wing while reducing a tension on the left wing thereby effecting a left turn, and that, responsive to receiving a control

signal indicating a right turn, increases the tension on the left wing while reducing the tension on the right left wing thereby effecting a right turn,

[0089] posterior edges of a main airfoil of the wings are attached on a rudder configured to pull laterally on the edges, in a plane of the wings, so as to change the tension of the wings:

[0090] a lateral traction on the posterior edge of the right wing increases the tension on the right wing and decreases the tension on the left wing,

[0091] a lateral traction on the posterior edge of the left wing increases the tension on the left wing and decreases the tension on the right wing,

[0092] wherein the movement of the rudder is controlled by means of a memory shapes wires that, responsive to receiving an electric current, constricts.

[0093] Accordingly to the second exemplary embodiment, control means that receives a control signal indicating a left turn constricts memory shape wire coupled to the left wing to reduce the tension on the left wing, the tension on the left wing being preferably increased at that time. For a right turn, the opposite action is performed.

[0094] Advantageously, the memory shapes wires are copper-aluminium-nickel alloys or nickel-titanium alloys.

[0095] The switching power of memory shapes wires is preferably controlled by a radio-control remote.

[0096] Advantageously, the rudder is mounted pivoting around an axis perpendicular to the plane of the wings, the pivoting of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.

[0097] In an implementation variation, the rudder is mounted mobile in translation in a direction parallel to the plane of the wings, the displacement of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.

[0098] To enable the flying toy to follow a straight path in the absence of stress on the wings, a return spring enables automatic restoration of the rudder into a neutral position where no tension is exerted on the posterior edges of the main airfoil of the wings.

[0099] Preferably, the wings comprise spanwise wing beams connected to the wing bases, the spanwise beams being formed from a first part inserted into the wing bases and at the end of which is attached a rod, the latter being pivotally mounted, about its longitudinal axis, in the first part.

[0100] The rods can be tightly fitted and/or cemented in a sheath, the latter covering the rods so as to consolidate their base and decrease the fragility at this area.

[0101] While preferred embodiments of the present exemplary embodiment have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present exemplary embodiment. The scope of the present exemplary embodiment, therefore, is to be determined solely by the following claims.

1-10. (canceled)

11. A flying toy configured to move by flapping of wings, the flying toy comprising:

a support structure,
an actuation mechanism arranged on the support structure and comprising a rotatable crank drive,

two flexible wings each comprising a wing base, the two flexible wings being arranged symmetrically with respect to a vertical plane of symmetry of the toy and

connected, at the wing bases, to the actuation mechanism, the wing bases being mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy,

a controller that, responsive to receiving a control signal indicating a left turn, increases a tension on the right wing while reducing a tension on the left wing thereby effecting a left turn, and that, responsive to receiving a control signal indicating a right turn, increases the tension on the left wing while reducing the tension on the right left wing thereby effecting a right turn,

posterior edges of a main airfoil of the wings are attached on a rudder configured to pull laterally on the edges, in a plane of the wings, so as to change the tension of the wings:

a lateral traction on the posterior edge of the right wing increases the tension on the right wing and decreases the tension on the left wing,

a lateral traction on the posterior edge of the left wing increases the tension on the left wing and decreases the tension on the right wing,

wherein the movement of the rudder is controlled by a memory shapes wires that, responsive to receiving an electric current, constricts.

12. A toy according to claim 11, wherein the memory shapes wires are copper-aluminium-nickel alloys.

13. A toy according to claim 11, wherein the memory shapes wires are nickel-titanium alloys.

14. A toy according to claim 11, wherein the switching power of memory shapes wires is controlled by a radio-control remote.

15. A toy according to claim 11, wherein the rudder is mounted pivoting around an axis perpendicular to the plane of the wings, the pivoting of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.

16. A toy according to claim 11, wherein the rudder is mounted movable in translation in a direction parallel to the plane of the wings, a displacement of the rudder causing a lateral traction on the posterior edges of the main airfoil of the wings.

17. A toy according to claim 11, wherein a return spring enables restoration of the rudder in a neutral position where no traction is exerted on the wings.

18. A toy according to claim 11, wherein the wings comprise spanwise wing beams connected to the wing bases, the spanwise beams being formed from a first part inserted into the wing bases and at the end of which is attached a rod, the latter being pivotally mounted, about its longitudinal axis, in the first part.

19. A toy according to claim 12, wherein the rods are tightly fitted and/or cemented in a sheath, the latter covering the rods so as to consolidate their base and decrease the fragility at this area.

20. A method for controlling a flying toy configured to move by flapping of wings, the toy comprising:

a support structure,
an actuation mechanism arranged on the support structure and comprising a rotatable crank drive,

two flexible wings each comprising a wing base, the two flexible wings being arranged symmetrically with respect to a vertical plane of symmetry of the toy and connected, at the wing bases, to the actuation mechanism,

nism, the wing bases being mounted oscillating about axes arranged on both sides of the vertical plane of symmetry of the toy,
each posterior edges of a main airfoil of the wings is coupled to a memory shape wire that, responsive to receiving an electric current, constricts,
the method comprising:
receiving a control signal,
responsive to the control signal indicating a right turn, constricting the memory shape wire coupled to the right wing to reduce the tension on the right wing,
responsive to the control signal indicating a left turn, constricting memory shape wire coupled to the left wing to reduce the tension on the left wing.

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