United States Patent [19]

Chang

[11] **3,740,032**

[45] **June 19, 1973**

[54] **HELICOPTER TOY**

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[73] Assignee: **Mattel, Inc.**, Hawthorne, Calif.

[22] Filed: **Dec. 16, 1971**

[21] Appl. No.: **208,572**

[52] **U.S. Cl.** ..... **272/31 B**

[51] **Int. Cl.** **A63h 27/12**

[58] **Field of Search** ..... 272/31 B, 31 A, 30, 272/36, 24, 52.5, 53.1, 53.2, 54, 55

[56] **References Cited**

UNITED STATES PATENTS

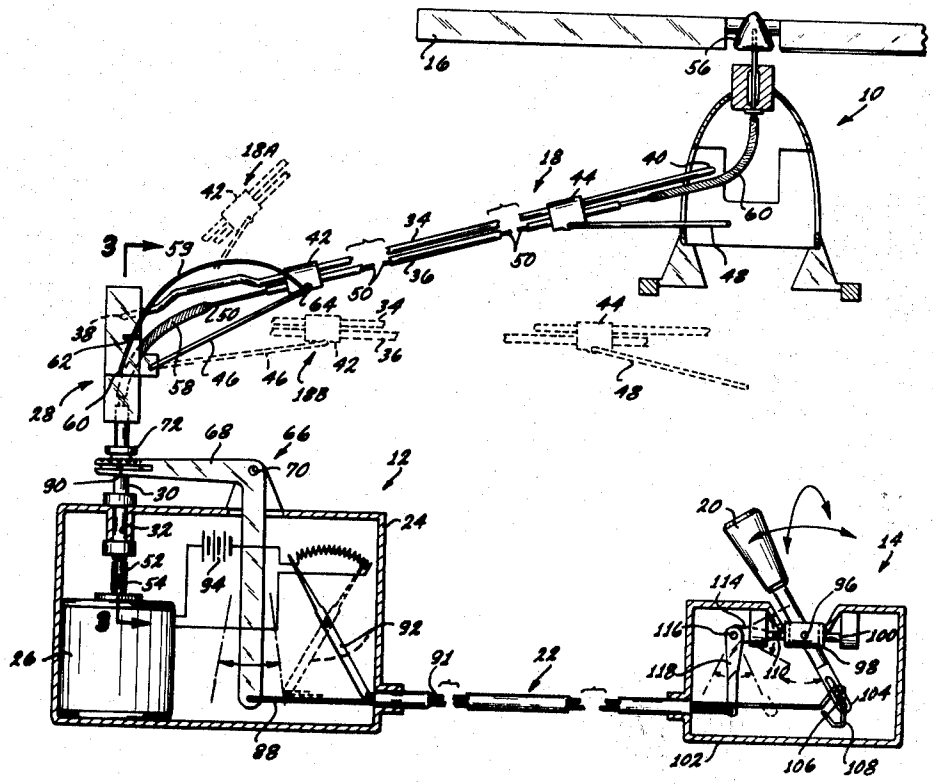
3,022,069	2/1962	Pettit	272/31 A
3,383,110	5/1968	Brown	272/31 B X
2,067,828	1/1937	Christiansen	272/31 A
2,300,649	11/1942	Christiansen	272/31 A
2,216,899	10/1940	Berger	272/31 A

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Assistant Examiner—Arnold W. Kramer
Attorney—Seymour A. Scholnick

[57] **ABSTRACT**

A toy helicopter system that can be produced at low cost, and which enables remote control of the flight of a toy helicopter by tilting it. The system includes a housing designed to rest on the ground, and a modified parallelogram boom connecting the housing to the helicopter to control it and to guide a flexible shaft that drives the helicopter rotor from a motor in the housing. A child can make the helicopter fly forward or backward by operating an actuator that twists the boom to alter the pitch orientation of the helicopter so its rotor pulls it forward or backward. One of the arms of the boom is hollow and serves as a guide for a flexible shaft that extends from the housing to the helicopter rotor to drive it. The hollow arm is shorter than the other arm, and opposite ends of the hollow arm are connected by pivotally mounted links to the housing and helicopter, respectively, and the hollow arm is connected by slide connectors to the other arm.

7 Claims, 4 Drawing Figures



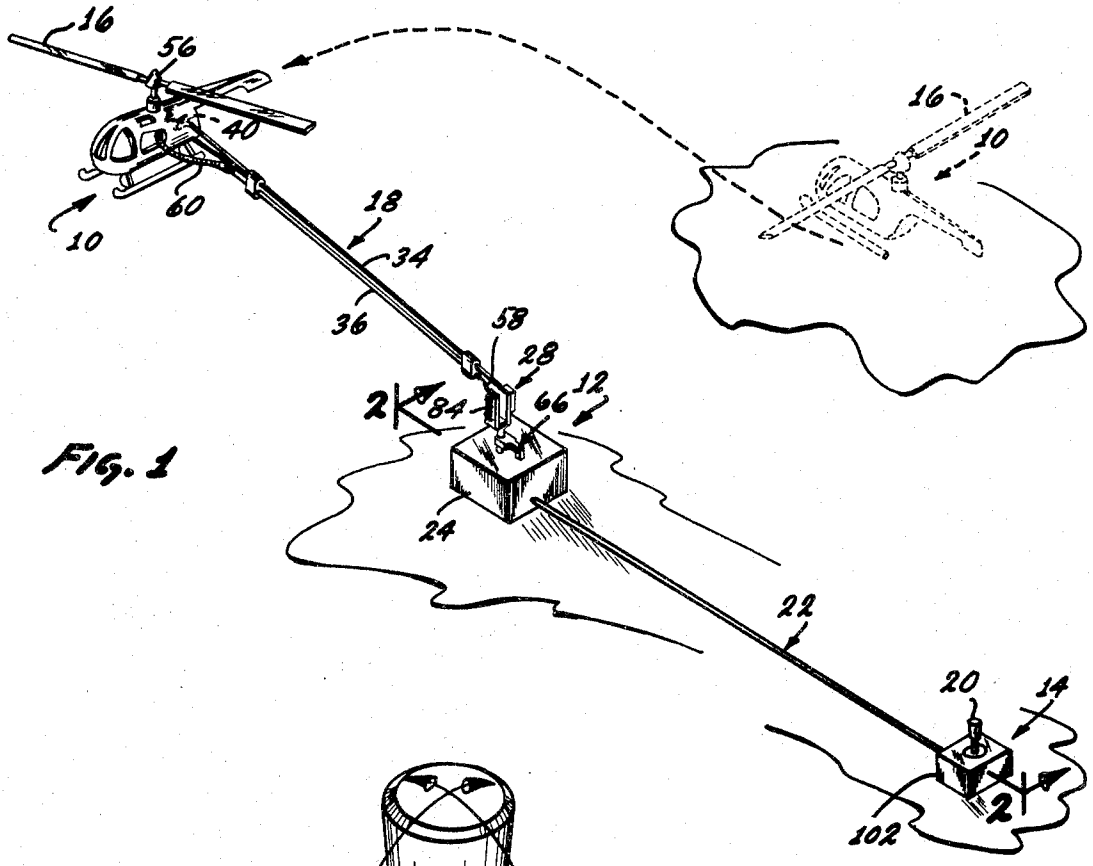

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FIG. 1

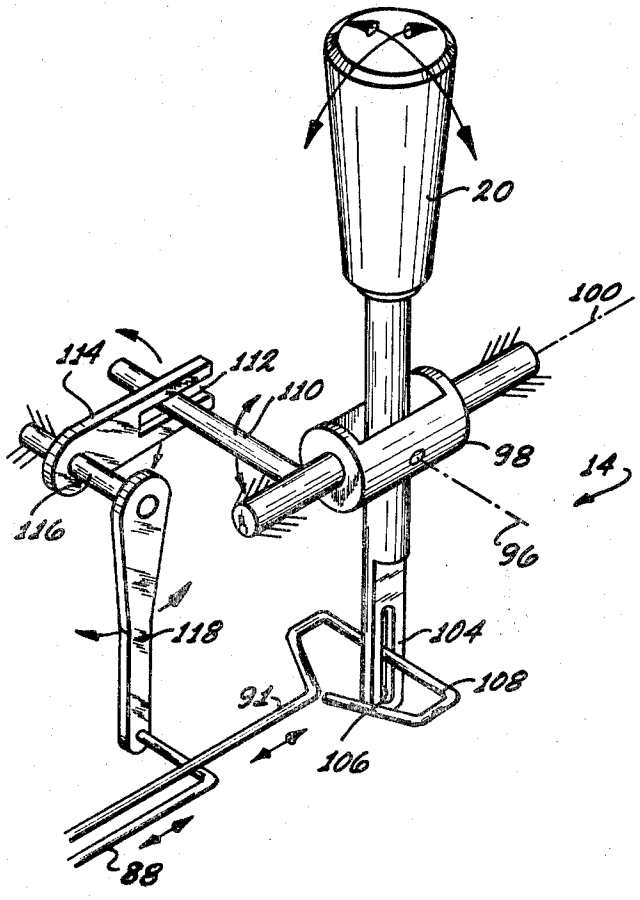

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FIG. 4

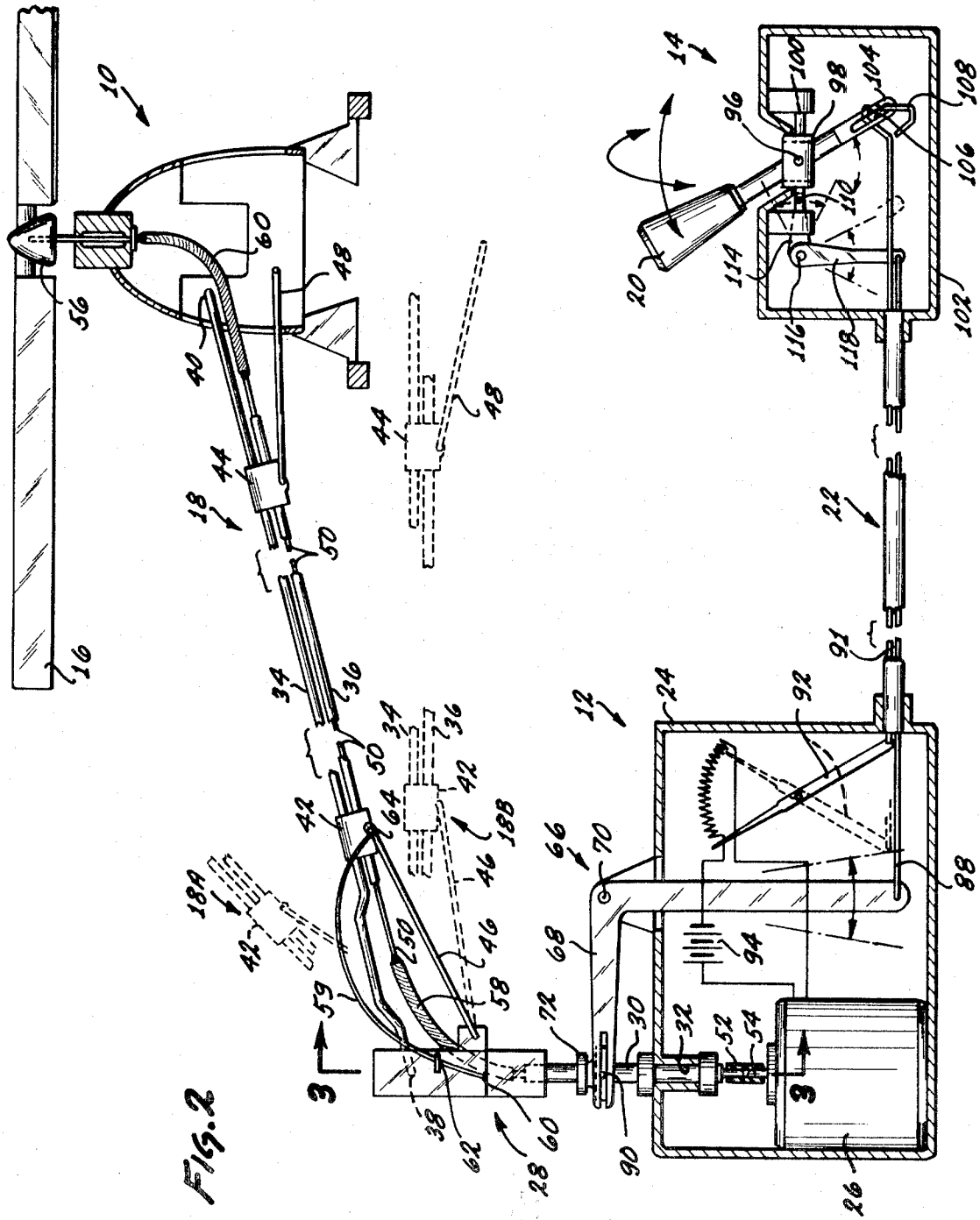

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FIG. 2

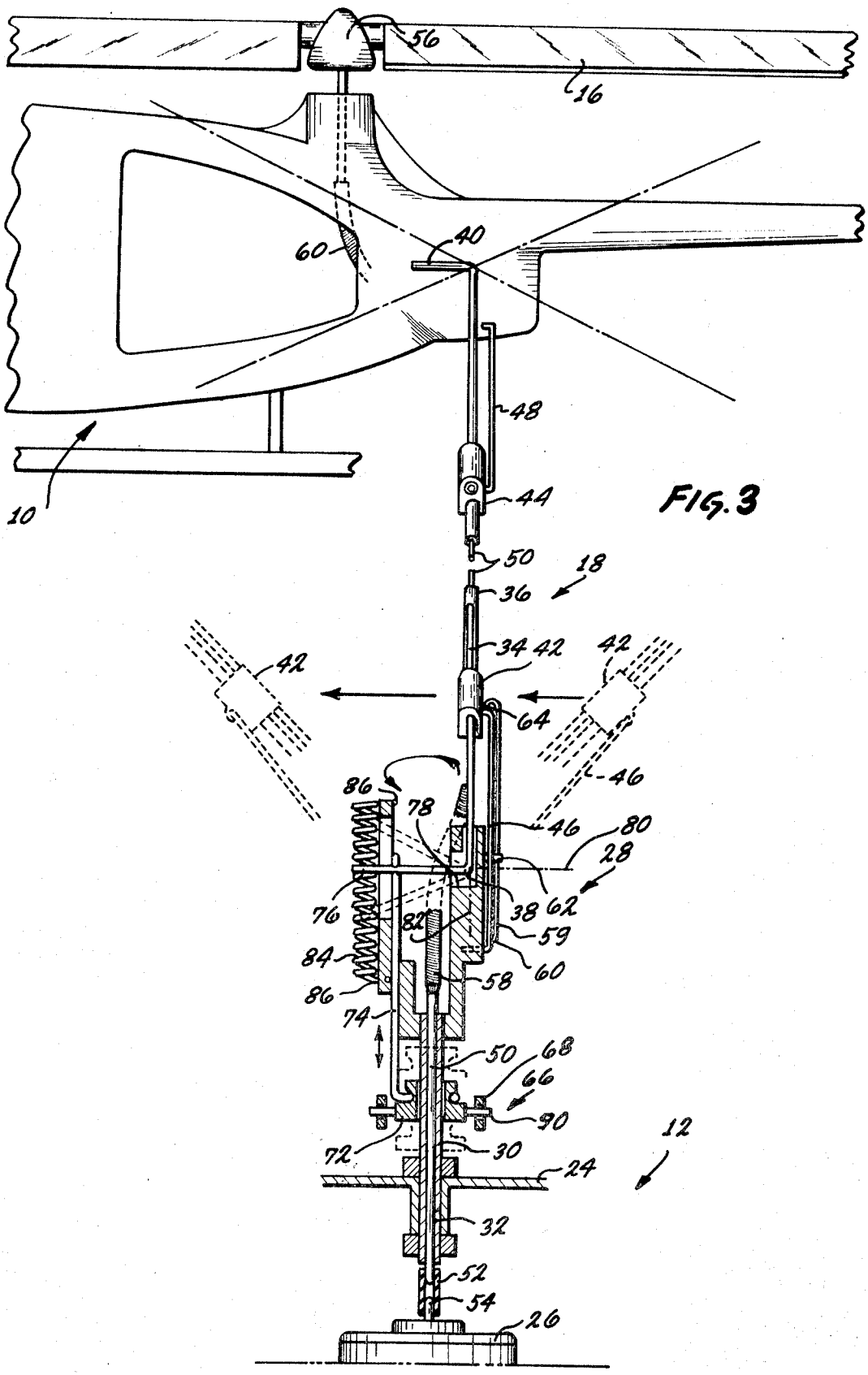

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FIG. 3

HELICOPTER TOY

BACKGROUND OF THE INVENTION

This invention relates to toys and more particularly to remotely operated vehicle toys.

One type of flying toy helicopter flies at the outer end of a boom, the boom having an inner end mounted on a housing that is supported on the ground or a tabletop. Inasmuch as as toy helicopters generally do not have a tail rotor or other means for aerodynamically stabilizing them against tipping, a relatively rigid boom is generally utilized to keep the helicopter upright. The helicopter can be made to fly in a circle by operating a motor or hand crank that slowly rotates the boom about the housing. However, this creates a somewhat artificial effect, inasmuch as real helicopters generally change their direction of flight by tilting the entire helicopter so that the rotor tends to pull the craft in a desired direction as well as lifting it. If the direction of movement of a toy helicopter could be controlled by such tilting while assuring stable operation, the realism and entertainment value of the toy could be appreciably enhanced.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, a toy apparatus is provided with can be mass produced at relatively low cost and which enables remote control of a flying toy helicopter in a realistic manner. The apparatus includes a helicopter with a rotor, a remote houming that can be supported on the ground or a tabletop, and a boom connecting the housing to the helicopter. A motor mounted in the housing is connected by a flexible shaft extending along the boom to the helicopter rotor to rotate it, so that the spinning rotor supports much of the weight of the helicopter. A bracket is rotatably mounted on the hosuing, and an inner end of the boom is mounted on the bracket so that the helicopter can fly in circles about the housing. A child can control the flight of the helicopter to make it move forward or backward around the circle or hover, by operating an actuator that twists the boom to thereby tilt the helicopter so its spinning rotor urges it forward or backward. The boom is a largely parallelogram type so that it maintains the helicopter upright against banking to the left or right while enabling the helicopter to rise or fall to different levels above the ground.

In order to simplify the apparatus, one of the arms of the boom is hollow, and the flexible shaft that connects the motor in the housing to the helicopter rotor extends through the hollow arm. The sharpness of bending of the flexible shaft, at any position of boom as it pivots up and down, is minimized by making the hollow arm of the boom shorter than its other arm, and utilizing a pair of links to connect opposite ends of the hollow arm to the bracket and helicopter.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a toy aircraft system constructed in accordance with the invention;

FIG. 2 is a view taken on the line 2—2 of FIG. 1;

FIG. 3 is a view taken on the line 3—3 of FIG. 2; and

FIG. 4 is a partial perspective view of the joystick control mechanism of the system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a toy helicopter system which includes a helicopter **10**, a pylon control box **12** which the helicopter can fly around, and a remote control box **14**. The helicopter **10** has an airscrew member or rotor **16** that is rotated to support the helicopter at varying heights above the ground, and which also can drive the helicopter forward or backward in a circle about the pylon housing **12**. A boom **18** extending from the pylon housing **12** to the helicopter serves to maintain the helicopter substantially upright, while also serving to produce a controllable forward or rearward tilt to the helicopter to make it move forward or backward. The boom **18** alse serves to transmit power from a motor in the pylon housing **12** to the rotor **16** to drive it. The remote control box **14** has a joystick **20** that can be pivoted by a child to control the speed of the motor that drives the helicopter rotor to thereby cause the helicopter to rise or fall, and which also controls movement of the boom **18** that causes the helicopter to fly forward or backward. A coupling **22** connects the box **14** to the pylon **12**, so that a child can control the helicopter from a position outside its circle of flight.

Referring also to FIGS. **2–4**, the pylon **12** includes a housing **24**, a motor **26** mounted within the housing and a bracket **28** pivotally mounted on the housing. The bracket **28** has a tubular lower portion **30** which extends through a bearing hole **32** in the housing, so that the bracket rotates about an axis that is vertical when the housing **24** is upright. The boom **18** has two arms **34, 36** that extend parallel to one another. The first arm **34** has an inner end pivotally mounJed at **38** on the bracket **28**, and an outer end pivotally mounted at **40** on the helicopter on a fore-and-aft axis. The second arm **36** is tubular and is shorter than the first arm so that it does not extend completely between the bracket and helicopter. A pair of guides or arm connectors **42** and **44** hold the two arms **34, 36** parallel to one another, each arm connector being fixed to the second arm **36** and slideably engaged with the first arm **34**. A single tube can be employed instead of using two separate arm connectors. The arm connectors **42, 44** also serve to connect the second arm **36** to the bracket and helicopter, by means of a pair of links **46, 48**. Each link **46, 48** has one end pivotally connected to one of the arm connectors **42, 44** and an opposite end pivotally connected to the bracket **28** or the helicopter **10**. This arrangement of arms, arm connectors, and links, serves largely as a parallelogram coupling that serves to maintain the helicopter **10** substantially upright, particularly against banking to the left or right, so that the helicopter always appears substantially upright, regardless of elevation changes.

The motor **26** in the pylon housing is connected to the rotor **16** by a flexible shaft **50**. The flexible shaft **50** has an inner end connected by a connector bushing **52** to the motor shaft **54**, and has an outer end connected to the rotor by means of a nose **56** of the rotor. The shaft **50** extends through the tubular arm **36** of the boom, and also extends through flexible sheaths **58, 60** respectively positioned at the bracket **28** and helicopter **10**. The flexible shaft **50** also extends through the

tubular portion **30** of the bracket. The motor **26** is positioned so that the axis of its shaft **54** is coincident with the axis of the bracket portion **30.**

The construction of the system with the shaft **50** extending through the axis of rotation of the bracket **28,** enables unrestricted flying of the helicopter in circles about the pylon **12.** The use of a short, hollow arm **36** in the boom enables the flexible shaft **50** to rotate without obstruction or sharp bending even when the boom is pivoted to a large angle as indicated at **18A** or to a small angle as indicated at **18B.** In addition, the tubular arm **36** of the boom is made to serve two purposes, as the arm of a modified parallelogram boom and as a sheath for the flexible shaft, thereby minimizing the cost of the toy. The unique arrangement of links and guides allows the use of the short arm that provides a large region for bending of the flexible shaft, while also making the boom arrangement function much like a parallelogram linkage to keep the helicopter substantially upright at all positions.

The mounting of the motor **26** remote from the helicopter reduces the weight of the helicopter and therefore the required rotor speed. To further decrease the required speed of the rotor, a spring wire **59** is employed that has an inner end captured at two points **60, 62** on the bracket and an opposite end held at **64** on the arm connector **42.** The spring **59** provides a lifting force to the boom that counteracts much of the weight of the helicopter. Accordingly, the helicopter rises off the ground for even a low rotor speed. The spring **59** provides a decreasing lifting force as the boom is lifted so that the helicopter does not continuously climb at a constant rotor speed, but tends to maintain a particular elevation which is increased or decreased as motor speed is increased or decreased.

The boom **18** is mounted so that it can be twisted about an axis extending long its length, to tilt the helicopter in pitch, that is to tilt it so that the rotor axis extends with a forward or rearward directional component instead of precisely vertically. The purpose of the tilting is to allow the rotor to pull the helicopter forward or rearwardly, so that the helicopter can be made to fly in a desired direction around the plyon **12,** or can be made to hover. Twisting or turning of the boom about its length, is accomplished by an actuator **66.** The actuator includes a bell crank **68** pivotally mounted at **70** on the pylon housing **24.** It also includes a bushing **72** that can be made to slide up and down along the tubular portion **30** of the bracket **28,** and a rod **74** (FIG. 3) that couples the bushing **72** to an end of the first arm **34** of the boom.

The inner end portion of the arm **34** of the boom is bent at a right angle, so that an arm portion **76** extends substantially perpendicular to the rest of the arm. The bracket **28** has a bearing aperture **78** at the pivotal mounting point **38,** that receives the arm at its bent portion. The aperture **78** is formed to pivotally mount the arm so that it can pivot about the horizontal axis **80** for raising and lowering the boom and about a perpendicular axis **82** extending along the length of the arm. The rod **74** is pivotally connected to the arm portion **76,** so that when the rod pulls or pushes on the portion **76,** it causes the arm to twist about the axis **82,** and yet the arm can freely pivot about the axis **80** as the helicopter rises and falls. A spring **84** is provided whose end portions **86** are fixed to the bracket **28** and whose center portion engages the arm portion **76** to urge the arm **34** toward the position wherein the helicopter is oriented with its rotor axis, vertical, while allowing resilient twisting of the boom to urge the helicopter to fly forward or rearwardly.

Operation of the actuator **66** is controlled by a link **88** (FIG. 2) which can pull or push on an end of the bell crank **68** to pivot it. The bell crank engages pins **90** on the bushings **72** to raise and lower it so as to move the rod **74** up and down to pivot the boom arm **76** and thereby twist the boom arm **34.** Movement of the link **88** is controlled by the joystick **20** in the remote control box **14,** as will be described below. The speed of the motor **26** can be controlled by another link **91** that extends along the coupling **22** and is operated by the joystick **20,** as also will be described below. The link **91** moves a wiper arm **92** of a potentiometer that is connected in series with a battery **94** in the plyon and with the motor **26,** to vary the electrical power supplied to the motor and therefore its speed.

The joystick **20** moves the two links **88** and **91** that respectively control direction of helicopter movement and speed of its rotor. As best shown in FIG. **4,** the joystick is pivotally mounted about an axis **96** on a joystick bracket **98,** the joystick bracket **98** being pivotally mounted about an axis **100** on a housing **102** of the control box. A lower end portion **104** of the joystick has a slot **106** which engages an end portion **108** of the speed control link **91.** When the joystick **20** is pivoted about the axis **96** the end portion **104** thereof pulls or pushes the link **91** to move the wiper arm of the rheostat in the pylon and change the motor speed. The end portion **108** of the speed control link extends perpendicular to about the other axis of pivoting **100** of the joystick, so that any pivoting of the joystick about the axis **100** does not affect the position of the link **91** and therefore does not change the motor speed. The joystick bracket **98** has an arm **110** fixed thereto and extending substantially radially therefrom with respect to the axis of pivoting **100** of the joystick bracket. The arm **110** is received in a slot **112** of a lever **114.** The lever **114** is fixed to a shaft **116** that is pivotally mounted on the control box housing. Another lever **118** is fixed to the shaft **116** and has an end fixed to the direction control link **88** that controls tilting of the helicopter for forward and rearward movement. When the joystick **20** is pivoted about the axis **100,** the bracket **98** pivots, causing the levers **114** and **118** to pivot and causing the link **88** to be pulled or pushed. Pivoting of the joystick **20** about the axis **96** does not cause pivoting of the bracket **98,** and therefore should have no effect on the direction of helicopter movement. It may be noted, however, that when more power is supplied to the motor, more torque is also supplied through the flexible shaft to the helicopter, and this can cause twisting of the boom. The joystick construction can be modified so that movements that adjust motor power also cause corrective twisting of the boom.

Thus, the invention provides a toy aircraft system particularly useful in the case of a helicopter, which provides a relatively constant orientation of the helicopter while enabling controlled tilting in pitch so as to make the helicopter move forward or backward. This is accomplished by the use of a parallelogram type boom and an actuator for controlled twisting of the boom. The rotor of the helicopter is driven by a motor located in a housing that rests on the ground, and is coupled thereto by a flexible shaft. The boom is con-

structed to allow the flexible shaft to bend in a wide area as the boom moves up and down so as to avoid a sharp bend in the shaft, by utilizing a modified parallelogram boom arrangement. In this arrangement, one of the arms of the parallelogram is shortened and is hollow so that it forms a sheath for the flexible shaft. Separate links are employed for substantially pivotally connecting opposite ends of the shortened arm to a bracket on the pylon housing and to the helicopter.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. A toy helicopter system comprising:

a helicopter having a rotor;

a housing which can be supported upright independently of said helicopter;

a bracket mounted on said housing for rotation about a substantially vertical first axis when said housing is upright;

an elongated boom having upper and lower elongated arms extending substantially parallel to each other and being relatively movable in the direction of their length;

coupling means pivotally coupling opposite ends of said arms to said bracket and helicopter at vertically spaced points on each, to limit banking of the helicopter;

motor means coupled to said helicopter rotor to drive it;

one of said arms being pivoted to said helicopter on a fore-and-aft axis only; and

operable means on said housing for twisting said one arm about an axis extending along its length, whereby to tilt said helicopter in pitch so its rotor has a selected forward or rearward inclination to fly said helicopter in a chosen direction about said housing.

2. The toy helicopter system described in claim **1** wherein:

said coupling means includes a pair of arm connectors mounted at opposite end portions of said boom, each arm connector slideably engaged with one of said arms and fixed to the other arm, means pivotally connecting opposite ends of said one arm respectively to said bracket and helicopter, and a pair of link means, each link means having one end pivotally connected to a different one of said connectors and an opposite end respectively pivotally connected to said bracket and helicopter.

3. The toy helicopter described in claim **2** wherein:

said other arm of said boom is hollow; and

said motor means includes a motor mounted on said housing and a flexible shaft extending through said hollow arm and having opposite ends coupled to said motor and rotor.

4. The toy helicopter system described in claim **3** wherein:

said bracket has means defining a bearing engaged with a first end of said one arm for enabling twisting of said end about a first axis extending along the length of the arm as well as pivoting about an axis which is substantially horizontal and angled from said first axis; and

said means for twisting said arm includes an acitvator mounted for up and down movement and connected to a location on said first arm laterally spaced from the location thereon which is pivotally mounted on said bracket, for twisting said first arm about its length.

5. The toy helicopter system described in claim **1** wherein:

said operable means includes a bushing mounted on said bracket coaxial with said first axis to enable up and down sliding of said bushing on said bracket, linking means coupling said bushing to said one arm to twist it in accordance with the sliding movement of said bushing, and a manually controlled member mounted on said housing and coupled to said bushing to slide it up and down.

6. A toy aircraft system comprising:

an aircraft with a rotably mounted airscrew member for driving it through the air;

a housing for support independently of said aircraft;

an elongated first arm having first and second end portions, said first end portion pivotally coupled to said aircraft;

means pivotally coupling said second end portion of said first arm to said housing;

a second elongated arm extending parallel to said first arm, said second arm being tubular;

arm connector means fixed to one of said arms and slideably engaged with the other arm;

first and second links, each having a first end coupled to said arm connector means;

means coupling a second end of said first link to said housing;

means coupling a second end of said second link to said aircraft;

a motor mounted on said housing; and

elongated flexible shaft means extending through said tubular second arm and having opposite ends respectively connected to said motor and airscrew member.

7. The toy aircraft system descibed in claim **6** wherein:

said means pivotally coupling said second end portion of said first arm to said housing includes a bracket mounted on said housing for rotation thereon about a substantially vertical axis when said housing is supported on a level surface, said bracket having a bearing that supports said end portion of said first arm for pivoting about a horizontal axis and twisting about an axis parallel to its length;

said means coupling said second end of said first link to said housing includes means on said bracket pivotally supporting said second end of said first link; and including

an actuator having manually operable means coupled to said second end portion of said first arm for twisting it, whereby to control tilt of said aircraft in pitch.

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