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(71) Applicant: **Ni, Kanghan**
Nanning 530011 (CN)

(72) Inventor: **Ni, Kanghan**
Nanning 530011 (CN)

(74) Representative: **Leach, James et al**
Mewburn Ellis LLP
33 Gutter Lane
London EC2V 8AS (GB)

(54) LINKAGE DEVICE FOR REMOTE CONTROL MODEL HELICOPTER WITH COAXIAL AND COUNTER ROTATING DOUBLE-PROPELLER

(57) A linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller includes a servo steering engine operating system, a tail motor operating system and a receiver controlling device; the servo steering engine operating system includes a forward and backward servo steering engine operating unit and a leftward and rightward servo steering engine operating unit; the receiver controlling device is connected to both the servo steering engine operating system and the tail motor operating system and for controlling the forward and backward servo steering engine operating unit and the tail motor operating system to link simultaneously. Compared to a conventional three-channel or four-channel model helicopter, the model helicopter using the linkage device has better resistance to winds and meets requirements to fly fast against winds outdoors.

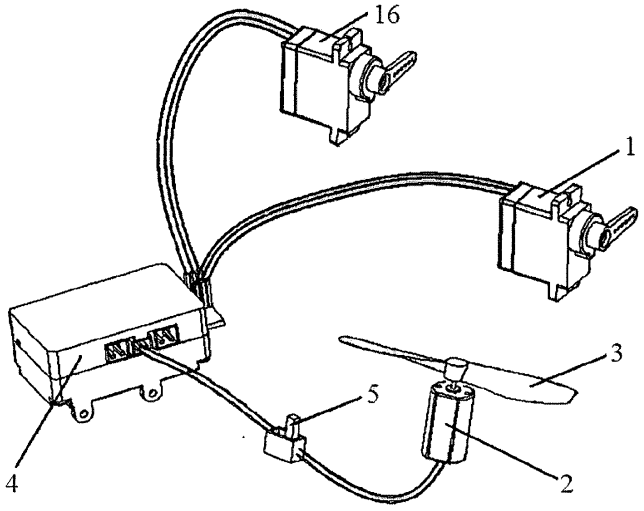

Fig. 1

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Description

Background of the Present Invention

Field of Invention

[0001] The present invention relates to a linkage device for a model helicopter, and more particularly to a linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller.

Description of Related Arts

[0002] The conventional remote control model helicopter with coaxial and counter rotating double-propeller mainly comprises a landing gear, a body, a receiver controlling device, a motor power transmitting device, a rotor lifting device, a flybar device and a forward and backward device.

[0003] The forward and backward device of a conventional four-channel model helicopter is embodied as an operating unit of a forward and backward servo steering engine in a servo steering engine controlling system which is realized by a manner that the servo steering engine drives a servo steering engine joystick; that the servo steering engine joystick further drives a swashplate to tilt; and that the swashplate further drives a rotor head via a rotor connecting rod to force a rotating plane of a lower rotor to tilt forwardly or backwardly. However, the forward and backward device thereof has a disadvantage that, when the rotating plane of the lower rotor tilts forwardly and the helicopter flies forwardly, under the action of a centrifugal force of the flybar, the upper rotor would produce an opposite equal force tilting backwardly to counteract with the force driving the helicopter to fly forwardly; and vice versa. Thus this type of helicopter has relatively weak forces of flying forwardly and backwardly and is vulnerable to airflows; a strong wind may stop the helicopter.

[0004] The forward and backward device of a conventional three-channel model helicopter is embodied as a tail motor operating system which is realized by a manner that a tail motor rotates positively and reversely to drive a screw propeller to rotate positively and reversely, so as to generate forces to lower or raise a head thereof. The conventional three-channel model helicopter also has the problem of the weak forces of flying forward and backward. Because the tail motor is related with power matching, an appearance and a center of gravity, a volume, a size and a weight thereof are strictly limited, and thus the tail motor has a small power and provides very small motive forces; moreover, under the action of the centrifugal forces of the flybar, the rotating plane of the upper rotor tilts opposite to a tilting direction of the body and a force of the tilting adequately counteracts with the force lowering or raising the head thereof generated by the positive and negative rotations of the tail motor, so that the body thereof is unable to effectively generate torque to lower or raise the head; and thus the conventional three-channel helicopter is unable to fly in outdoor winds.

Summary of the Present Invention

[0005] An object of the present invention is to provide a linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller having a good resistance to winds, so as to satisfy requirement for the model helicopter to fly fast against winds outdoors.

[0006] In order to accomplish the above objects, the linkage device of the present invention adopts following technical solutions. The linkage device comprises a servo steering engine operating system, a tail motor operating system and a receiver controlling device. The servo steering engine operating system comprises a forward and backward servo steering engine operating unit and a leftward and rightward servo steering engine operating unit. The receiver controlling device is connected to both the servo steering engine operating system and the tail motor operating system and able to control the forward and backward servo steering engine operating unit and the tail motor operating system to link simultaneously.

[0007] The receiver controlling device is for controlling the forward and backward servo steering engine operating unit and the tail motor operating system to link simultaneously to control the forward and backward servo steering engine operating unit and the tail motor operating system to act simultaneously when the model helicopter flies forwardly and backwardly.

[0008] The forward and backward servo steering engine operating unit comprises a forward and backward servo steering engine, a servo steering engine joystick, a swashplate, a rotor head connecting rod, a rotor head and rotors. The forward and backward servo steering engine is installed on a body of the model helicopter; a first end of the servo steering engine joystick is installed on the forward and backward servo steering engine and a second end thereof is connected to the swashplate; a first end of the rotor end connecting rod is installed on the swashplate and a second end thereof is installed on the rotor head; the rotors are installed on the rotor head. The tail motor operating system comprises a tail motor frame, a tail motor, a screw propeller and tail motor fasteners. The tail motor frame is fixed on a back of the body; the tail motor is fixed on the tail motor frame via the tail motor fasteners; and the screw propeller is fixed on the tail motor.

[0009] The tail motor operating system further comprises a tail motor manual switch connected to the receiver controlling device.

[0010] The receiver controlling device comprises a radio frequency (RF) signal circuit, a micro controller unit (MCU) and a motor driving circuit, wherein the MCU is connected to the servo steering engine operating system; the motor driving circuit is connected to the tail motor operating system; after receiving a controlling instruction, the RF signal circuit is processed by the MCU and then sends controlling signals into the servo steering engine operating system and the motor driving circuit.

[0011] The present invention combines a conventional three-channel model helicopter with a conventional four-channel model helicopter via the receiver controlling device, and controls a lower rotor to tilt via the forward and backward servo steering engine operating unit of the servo steering engine operating system to counteract with reaction forces of an upper rotor; meanwhile, the tail motor operating system receives an instruction of the receiver controlling device that the tail motor drives the screw propeller to rotate positively or reversely to generate an upward force or a downward force without restrictions which acts on the body of the helicopter to form and keep a relatively big angle tilting forwardly or backwardly, when rotating planes of the upper rotor and the lower rotor also form and keep an identically big angle, in such a manner that the upper rotor and the lower rotor rotate to generate a relatively big force pushing forwardly or backwardly to provide a relatively strong forwardly or backwardly driving force for the helicopter to reach effects of a strong resistance to winds and a fast flying speed, so as to satisfy needs of flying against the winds outdoors.

[0012] These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

Brief Description of the Drawings

[0013]

Fig. 1 is a perspective view of a linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller according to a preferred embodiment of the present invention.

Fig. 2 is a block diagram of circuit principles of a receiver controlling device of Fig. 1.

Fig. 3 is a sketch view of installing the linkage device according to the preferred embodiment of the present invention.

[0014] In the drawings: 1-forward and backward servo steering engine; 2-tail motor; 3-screw propeller; 4-receiver controlling device; 5-tail motor manual switch; 6-RF signal circuit; 7-MCU; 8-motor driving circuit; 9-servo steering engine joystick; 10-swashplate; 11-rotor head connecting rod; 12-rotor head; 13-rotor; 14-tail motor frame; 15-tail motor fastener; 16-leftward and rightward servo steering engine.

Detailed Description of the Preferred Embodiment

[0015] Referring to Fig. 1 of the drawings, according to a preferred embodiment of the present invention, a linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller comprises a servo steering engine operating system (only a forward and backward servo steering engine 1 and a leftward and rightward servo steering engine 16 showed), a tail motor operating system (only a tail motor 2 and a screw propeller 3 showed) and a receiver controlling device 4. The receiver controlling device 4 is respectively connected to the forward and backward servo steering engine 1, the leftward and rightward servo steering engine 16 and the tail motor 2 via electric wires and able to control the forward and backward servo steering engine 1 and the tail motor 2 to link simultaneously to control the forward and backward servo steering engine operating unit and the tail motor operating system to act simultaneously when the helicopter flies forwardly and backwardly. The screw propeller 3 is installed on the tail motor 2. A tail motor manual switch 5 is installed on the electric wires connecting the tail motor 2 and the receiver controlling device 4 to control whether the tail motor operating system accepts and executes acting instructions from the receiver controlling device 4.

[0016] Fig. 2 shows circuit principles of the receiver controlling device 4 which comprises a RF signal circuit 6, an MCU 7 and a motor driving circuit 8, wherein the MCU 7 is connected to the forward and backward servo steering engine 1 and the leftward and rightward servo steering engine 16; and the motor driving circuit 8 is connected to the tail motor 2. After receiving a first controlling instruction of flying forwardly or backwardly, the RF signal circuit 6 is processed by the MCU 7 and sends two groups of controlling signals into the forward and backward servo steering engine 1 and the motor driving circuit 8; a first group comprises pulse position modulation (PPM) signals for controlling the forward and backward servo steering engine 1 to act according to the first controlling instruction of flying forwardly or backwardly; a second group comprises pulse width modulation (PWM) signals for synchronously controlling the motor driving circuit

8 to drive the tail motor 2 to act according to the first controlling instruction of flying forwardly or backwardly. Thereby it is realized that the forward and backward servo steering engine 1 and the tail motor 2 are linked simultaneously, so as to accomplish a purpose of improving performance in resisting winds. When the model helicopter flies indoors or without winds, the tail motor manual switch 5 can be turned off, when a signal route to reach the tail motor 2 is cut off and the tail motor 2 is idle, so as to satisfy needs of flying without winds. After receiving a second controlling instruction of flying leftwardly or rightwardly, the RF signal circuit 6 is processed by the MCU 7 and sends the first group of PPM signals into the leftward and rightward servo steering engine 16 to control the leftward and rightward servo steering engine 16 to act according to the second controlling instruction of flying leftwardly or rightwardly.

[0017] Fig. 3 shows an installing structure of the linkage device of the present invention. The servo steering engine operating system is installed on an upper part of a body, comprising the forward and backward servo steering engine operating unit and the leftward and rightward servo steering engine operating unit which is provided at backside and not showed, wherein the forward and backward servo steering engine operating unit comprises the forward and backward servo steering engine 1, a servo steering engine joystick 9, a swashplate 10, a rotor head connecting rod 11, a rotor head 12 and rotors 13. The forward and backward servo steering engine 1 is installed on the body; a first end of the servo steering engine joystick 9 is installed on the forward and backward servo steering engine 1 and a second end thereof is installed on the swashplate 10; a first end of the rotor end connecting rod 11 is installed on the swashplate 10 and a second end thereof is installed on the rotor head 12; the rotors 13 are installed on the rotor head 12. The tail motor operating system, provided on a tail part of the body, comprises a tail motor frame 14, a tail motor 2, a screw propeller 3 and tail motor fasteners 15. The tail motor frame 14 is fixed on a back part of the body; the tail motor 2 is fixed on the tail motor frame 14 via the tail motor fasteners 15; and the screw propeller 3 is fixed on the tail motor 2. The receiver controlling device 4 is provided in a front part of the body.

[0018] After receiving a synchronous controlling instruction of flying forwardly or backwardly, the receiver controlling device 4 sends synchronous action signals into the forward and backward servo steering engine 1 and the tail motor 2, and then the forward and backward servo steering engine operating unit and the tail motor operating system act simultaneously. A specific process is as follows. The forward and backward servo steering engine 1 drives the servo steering engine joystick 9; the servo steering engine joystick 9 drives the swashplate 10 to tilt; and the swashplate 10 drives the rotor head 12 via a rotor head connecting rod 11 to force a rotating plane of a lower rotor 13 to tilt forwardly or backwardly. When the rotating plane of the lower rotor 13 tilts forwardly according to instructions, the tail motor 2 drives the screw propeller 3 to positively rotate synchronously to generate a downward force to lift the tail part of the helicopter and lower the head of the helicopter and instantly the helicopter gains force components tilting forwardly to fly forwardly; when the rotating plane of the lower rotor 13 tilts backwardly according to instructions, the tail motor 2 drives the screw propeller 3 to reversely rotate synchronously to generate an upward force to press the tail part of the helicopter downwardly and lift the head and instantly the helicopter gains force components tilting backwardly to fly backwardly. Thereby, even flying in a windy weather, the helicopter is protected from airflows. The tail motor manual switch 5 can be turned on and off according to practical needs to control whether the tail motor 2 is synchronously linked with the forward and backward servo steering engine 1. When the tail motor manual switch 5 is turned off, the forward and backward servo steering engine 1 drives the rotating plane of the lower rotor 13 to tilt forwardly or backwardly under instructions, but the tail motor 2 is idle, so as to suit for flying indoors or without winds. Similarly, a tail motor circuit can be turned off via wireless instructions to realize flying without winds when the tail motor operating system and the forward and backward servo steering engine operating unit are unable to link simultaneously, i.e., the tail motor operating system is idle and the forward and backward servo steering engine operating unit acts.

[0019] After receiving the synchronous controlling instruction of flying leftwardly or righwardly, the receiver controlling device 4 sends action signals to the leftward and rightward servo steering engine 16 and instantly the leftward and rightward servo steering engine operating unit acts to force the helicopter to fly leftwardly or rightwardly.

[0020] In order to prove superior performance of the linkage device of the present invention, a testing and comparison experiment about resistance to winds is held between identical helicopter types of each conventional model helicopter with coaxial and counter rotating double-propeller on the market and a model helicopter with coaxial and counter rotating double-propeller using the linkage device of the present invention. Table 1 shows results thereof.

Table 1

350 helicopter types	test frequency	flying tests of model helicopters against winds of each scale					conclusion
		scale 0	scale 1	scale 2	scale 3	scale 4	
		status of the flight speed	status of the flight speed	status of the flight speed	status of the flight speed	status of the flight speed	
350 two-channel helicopter	5	3 m/s stable & controllable	0 m/s going with winds & losing control	0 m/s going with winds & losing control	0 m/s unable to take off	0 m/s unable to take off	suitable for flying indoors
350 three-channel helicopter	5	6m/s stable & controllable	4 m/s stable & controllable	2 m/s bumpy & hardly controllable	0 m/s going with winds & losing control	0 m/s unable to take off	suitable for flying indoors or in outdoor breeze
350 four-channel helicopter	5	7 m/s stable & controllable	5 m/s stable & controllable	3 m/s bumpy & controllable	0 m/s going with winds & losing control	0 m/s unable to take off	suitable for flying indoors or in outdoor breeze
330 helicopter using the present invention	5	14 m/s stable & controllable	12 m/s stable & controllable	10 m/s stable & controllable	8 m/s stable & controllable	5 m/s bumpy & controllable	suitable for flying indoors or in outdoor winds below scale 4

[0021] The results show that, in a condition of no winds, the model helicopter using the linkage device of the present invention flies faster than the conventional model helicopter; in a condition of winds below scale 4, the model helicopter using the linkage device of the present invention flies faster than the conventional model helicopter and has better stability and controllability than the conventional model helicopter, especially in relatively strong winds of scale 3 to scale 4, the conventional model helicopter totally lose control while the model helicopter using the linkage device is still able to fly against winds.

[0022] One skilled in the art will understand that the embodiment of the present invention as shown in the drawings and described above is exemplary only and not intended to be limiting.

[0023] It will thus be seen that the objects of the present invention have been fully and effectively accomplished. Its embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

Claims

1. A linkage device for a remote control model helicopter with coaxial and counter rotating double-propeller, **characterized in that** said linkage device comprises a servo steering engine operating system, a tail motor operating system and a receiver controlling device, wherein said servo steering engine operating system comprises a forward and backward servo steering engine operating unit and a leftward and rightward servo steering engine operating unit; said receiver controlling device is connected to both said servo steering engine operating system and said tail motor operating system and for controlling said forward and backward servo steering engine operating unit and said tail motor operating system to link simultaneously.

2. The linkage device, as recited in claim 1, **characterized in that** said receiver controlling device is for controlling said forward and backward servo steering engine operating unit and said tail motor operating system to link simultaneously to control said forward and backward servo steering engine operating unit and said tail motor operating

system to act simultaneously when the model helicopter flies forwardly or backwardly.

3. The linkage device, as recited in claim 1, **characterized in that** said forward and backward servo steering engine operating unit comprises a forward and backward servo steering engine, a servo steering engine joystick, a swashplate, a rotor head connecting rod, a rotor head and rotors, wherein said forward and backward servo steering engine is installed on a body of the model helicopter; a first end of said servo steering engine joystick is installed on said forward and backward servo steering engine and a second end thereof is installed on said swashplate; a first end of said rotor head connecting rod is installed on said swashplate and a second end thereof is installed on said rotor head said rotors are installed on said rotor head; and said tail motor operating system comprises a tail motor frame, a tail motor, a screw propeller and tail motor fasteners, wherein said tail motor frame is fixed on a back part of the body; said tail motor is fixed on said tail motor frame via said tail motor fasteners; and said screw propeller is fixed on said tail motor.

4. The linkage device, as recited in claim 3, **characterized in that** said tail motor controlling system further comprises a tail motor manual switch connected to said receiver controlling device.

5. The linkage device, as recited in any claim from 1 to 4, **characterized in that** said receiver controlling device comprises a RF signal circuit, an MCU and a motor driving circuit, wherein said MCU is connected to said servo steering engine operating system; said motor driving circuit is connected to said tail motor operating system; after receiving a controlling instruction, said RF signal circuit is processed by said MCU and sends controlling signals into said servo steering engine operating system and said motor driving circuit.

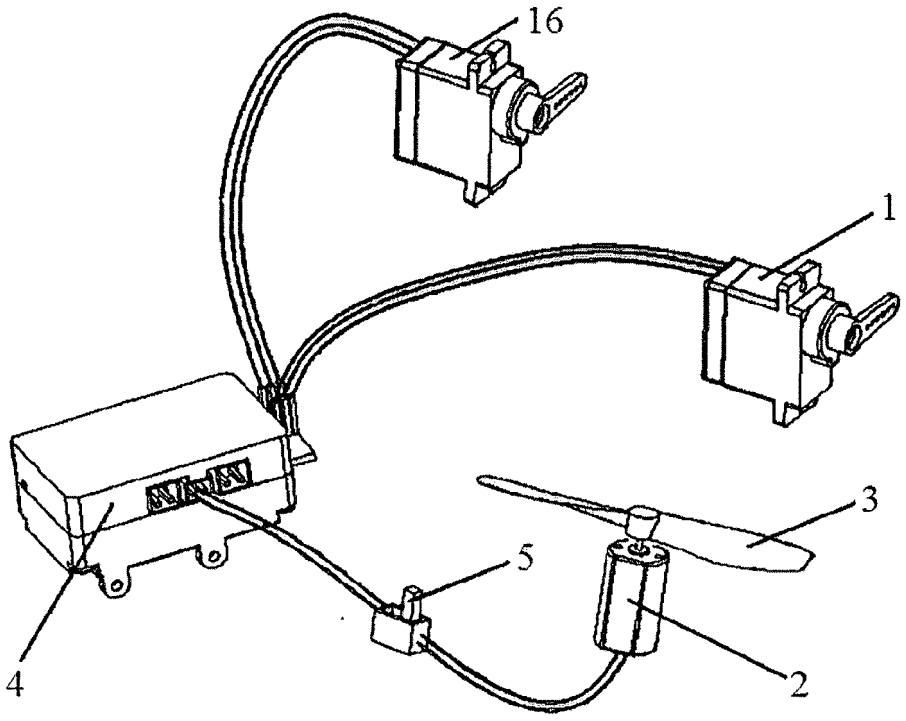

Fig. 1

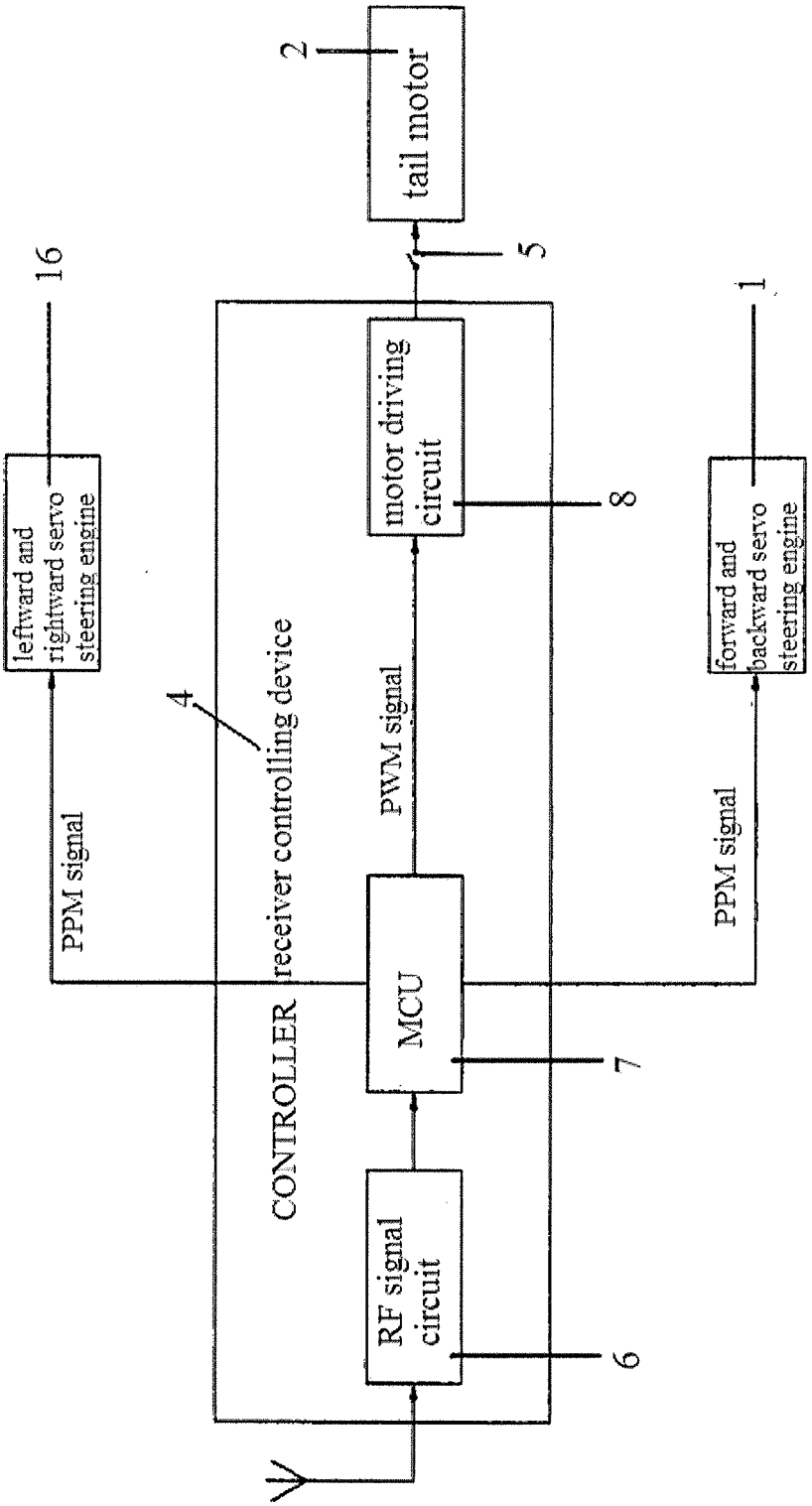
2
tail motor
5
16
1
leftward and rightward servo steering engine
motor driving circuit
8
4
receiver controlling device
PWM signal
forward and backward servo steering engine
PPM signal
PPM signal
CONTROLLER
MCU
7
RF signal circuit
6

Fig. 2

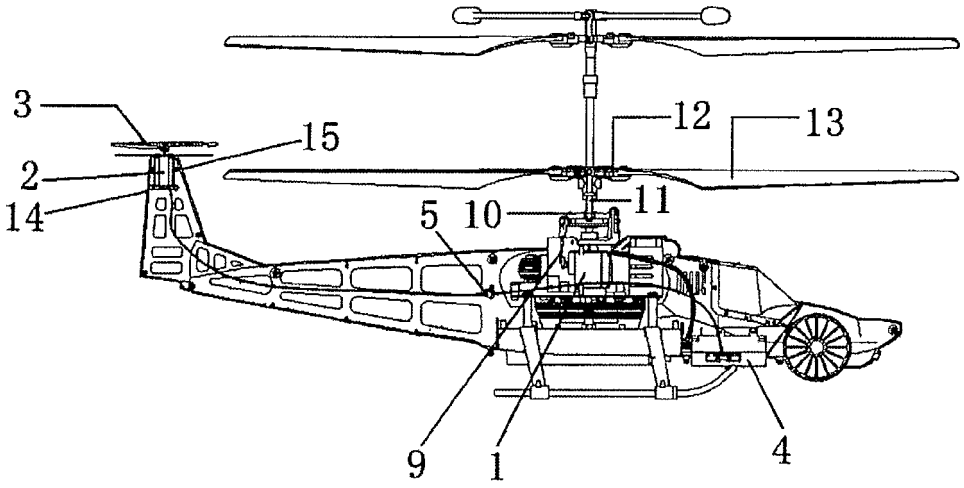

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/002183

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A63H27/- A63H29/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Data base: EPODOC, WPI, CNPAT, CNKI

Search terms: coaxial double two wing propeller vane tail trail motor wind linkage copter helicopter channel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN101912688A (NI, Kanghan) 15 Dec. 2010 (15.12.2010) Description paragraphs [0016]-[0022], claims 1-5, and figures 1-3	1-5
A	CN2761235Y (XING, Ying) 01 Mar. 2006 (01.03.2006) Description page 2, line 26 to page 4, line 4, and figures 1-3	1-5
A	CN2790551Y (LUO, Zhihong) 28 Jun. 2006 (28.06.2006) the whole document	1-5
A	CN201410297Y (NI, Kanghan) 24 Feb. 2010 (24.02.2010) the whole document	1-5
A	JP2005193905A (HIROBO KK) 21 Jul. 2005(21.07.2005) the whole document	1-5
A	WO2007052246A1 (ZIMET NACHMAN et al.) 10 May 2007 (10.05.2007) the whole document	1-5

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 May 2011 (06.05.2011)	**26 May 2011 (26.05.2011)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer LI, Hong Telephone No. (86-10)62084858

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2010/002183

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		ES2345839T3	04.10.2010
		CA2544980C	10.03.2009

Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2010/002183

CLASSIFICATION OF SUBJECT MATTER

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A63H27/24 (2006.01) i

Form PCT/ISA /210 (extra sheet) (July 2009)