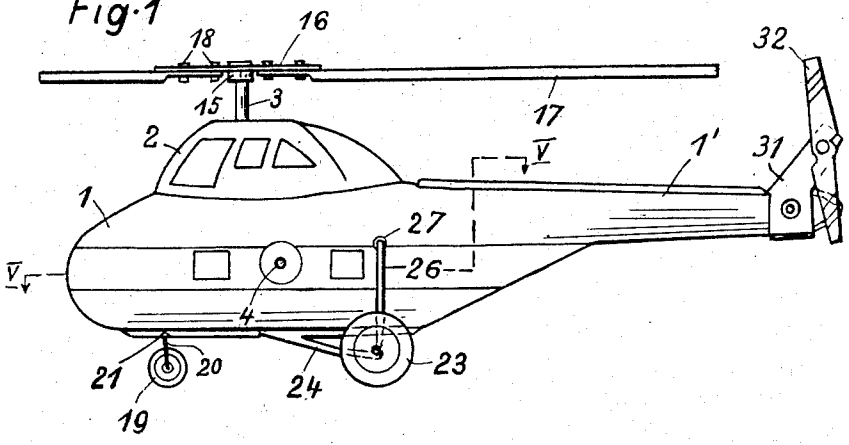
Aug. 6, 1957 M. ERNST 2,801,494

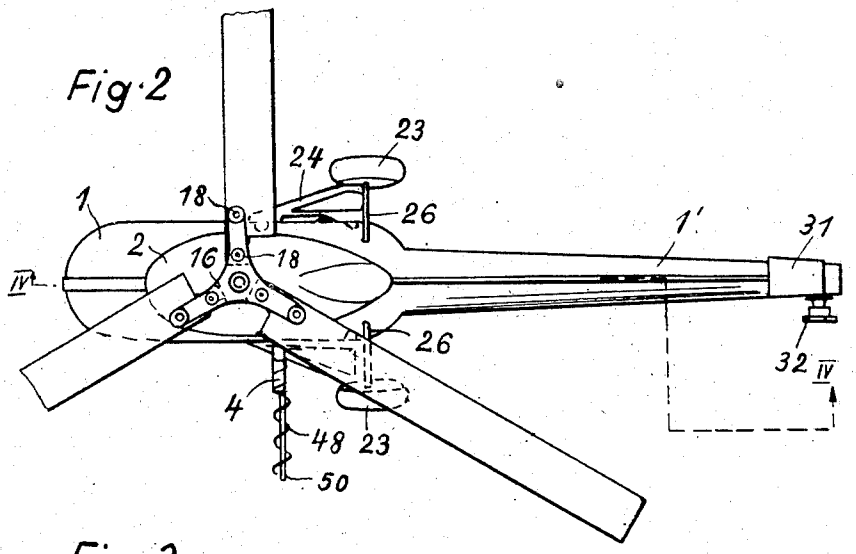
REMOTELY CONTROLLED TOY AIRCRAFT

Filed April 20, 1955 2 Sheets-Sheet 1

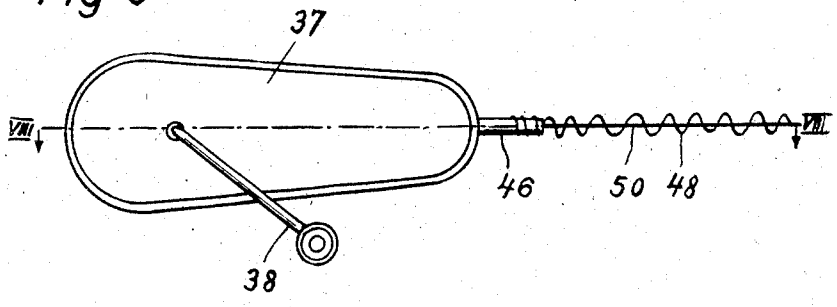
Fig·1



Fig·2



Fig·3



INVENTOR.
Max Ernst
By
Patent Agent

Aug. 6, 1957 M. ERNST 2,801,494

REMOTELY CONTROLLED TOY AIRCRAFT

Filed April 20, 1955 2 Sheets-Sheet 2

Fig. 4

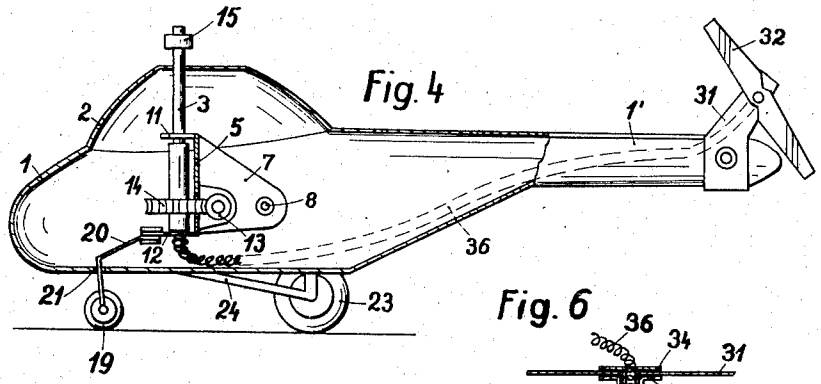


Fig. 6

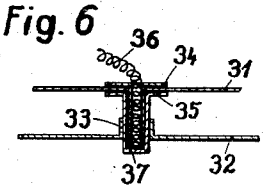


Fig. 5

Fig. 8

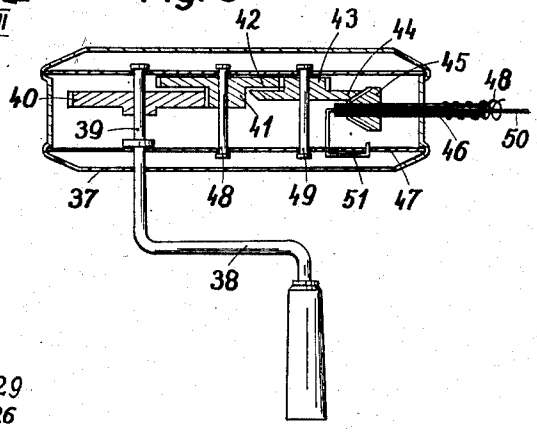
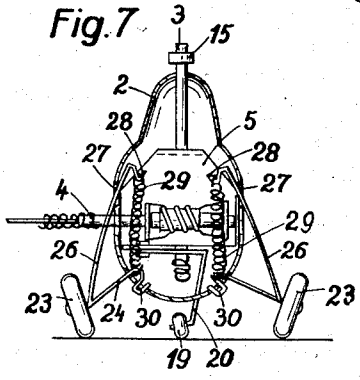


Fig. 7



INVENTOR:
Max Ernst
By Walter Becker
Patent Agent

United States Patent Office

2,801,494

Patented Aug. 6, 1957

2,801,494

REMOTELY CONTROLLED TOY AIRCRAFT

Max Ernst, Nurnberg, Germany

Application April 20, 1955, Serial No. 502,552

Claims priority, application Germany December 31, 1954

9 Claims. (Cl. 46—75)

The present invention relates to a top airplane adapted to be driven by a remote driving device.

It is the primary object of this invention to provide a toy airplane which will actually take off, fly and land and which has means adapted to convey not only driving but also controlling forces from the driving device to the toy airplane.

It is another object of this invention to provide a toy airplane of the type set forth above, in which the driving and the controlling forces are conveyed independently of each other from the driving device to the toy airplane.

It is still another object of this invention to provide a toy airplane which is remotely driven and is remotely controlled so that the airplane can selectively be caused to fly forwards and backwards.

It is also an object of the invention to provide a remote control toy airplane with a kind of shock absorbing arrangement for landing wheels below the fuselage.

These and other objects and advantages of the invention will appear more clearly from the specification in connection with the accompanying drawings, in which:

Fig. 1 diagrammatically illustrates a side view of a helicopter according to the invention.

Fig. 2 is a top plan view of the helicopter of Fig. 1.

Fig. 3 is a side view of a driving device for driving the toy airplane.

Fig. 4 is a side view of and partial vertical section through the fuselage of the airplane of Fig. 1, said section being taken along the line IV—IV of Fig. 2.

Fig. 5 is a horizontal section of the fuselage taken along the line V—V of Fig. 1.

Fig. 6 shows on a larger scale than that of the preceding figures the journalling of the balance air screw.

Fig. 7 is a vertical section through the fuselage along the line VII—VII of Fig. 5.

Fig. 8 is a horizontal section through the remote driving device, said section being taken along the line VIII—VIII of Fig. 3.

The primary feature according to the present invention consists in the provision of a smooth wire, preferably steel wire, fixedly connecting a fixed element of the remote driving device with a fixed element of the airplane so that the driving device and the plane are fixedly coupled or connected to each other in such a manner that a tilting of the driving device brings about a positive and automatic tilting movement of the plane, thereby causing the plane to perform certain desired manoeuvres. The said control wire is surrounded by a wire coil fixedly connecting a rotatable element in the driving device with a rotatable element in the plane, while said last mentioned rotatable element is drivingly connected to the propeller of the plane, and the rotatable element of the driving device is operatively connected to the manually operable crank 38. The operation of the control wire is independent of the operation of the wire coil transmitting the driving power from the driving device to the propeller of the plane.

A further advantageous feature of the present invention consists in the provision of a double purpose transverse wall in the fuselage, which both serves as a stiffening member for preventing a compression of the fuselage, and also as a support or bearing for a drive shaft in the driving power transmitting train.

The plane according to the invention has its main landing wheels linked to the fuselage and connected through strut means with the upper end of spring means which together with the strut means form a kind of shock absorbing arrangement for the landing gear.

Referring now to the drawings in detail, the fuselage 1 consists primarily of two shell-like body sections connected to each other in any standard manner and provided with a cabin 2. The fuselage 1 and cabin 2 may be made of light metal, preferably thin aluminum parts in order to keep the weight of the helicopter as low as possible. According to Figs. 4, 5 and 7, the helicopter screw shaft 3 and the horizontal driving shaft 4 are journalled in a Z-shaped member or transverse wall member 5, 6, 7. The sides 6 and 7 of said Z-shaped member, which may also be U-shaped or have a different profile, are fixed to the fuselage by means of hollow pins or rivets 8. In this way, the fuselage is secured against lateral compression. The transverse wall 5 is provided with a number of projections or ears of which projections 9 and 10 are adapted to support the horizontal driving shaft 4, while the projections 11 and 12 serve as bearings for vertical helicopter screw shaft 3.

A multiple worm 13 is mounted on the driving shaft 4, and a suitable worm wheel 14 is fixed to the helicopter screw shaft 3. Said worm 13 meshes with the worm gear 14 through an opening in said transverse wall 5. This worm wheel transmission brings about a considerable step down between the driving shaft 4 and the helicopter screw shaft 3. According to the invention the step down ratio is selected as 4:1. Of course, if desired, any other suitable transmission, for instance a screw transmission or a transmission consisting of a pinion and a crown wheel may be selected. The upper end of the helicopter screw shaft 3 has an enlarged section 15 having the helicopter screw connected thereto, e. g. by riveting. Said helicopter screw comprises three blades 17 each of which is connected to the star shaped hub 16 by means of hollow rivets 18.

The helicopter screw has a momentum of inertia as low as possible so that minor accelerating forces only have to be transmitted thereto from the driving device. Therefore, the blades of the helicopter screw consist of thin only slightly arched foils, preferably made of plastic. The blades of the helicopter screw may be made of relatively elastic material since they are stretched during rotation by the centrifugal forces acting thereupon.

The helicopter according to the invention is furthermore provided with a tricycle landing gear. The nose wheel 19 is movably arranged on a spring wire 20 projecting through an opening 21 into the inside of the fuselage and fixed to a projection 22 of the transverse wall 5. Consesuently, a major portion of the yieldable support for the nose wheel 19 is located inside the fuselage, thereby giving the toy airplane a more realistic appearance.

The two landing wheels 23 are supported by an arrangement acting like a shock absorbing arrangement. To this end, the wheels 23 are rotatably supported by frame members 24 which are linked to the fuselage 1 by means of bent pivots 25. Similarly, the elastic support for the two wheels 23 is likewise located inside the fuselage 1. As will be seen from the drawings, especially Fig. 7, struts 26 are connected to the ends of the frame members 24 and extend through openings 27 into the inside of the fuselage

1 where they are provided at their ends with hooks 28. Helical springs 29 inside the fuselage 1 have one of their ends hooked into the hooks 28, while the other ends are anchored at 30 in the bottom of the fuselage 1. The springs 29 continuously urge the wheels 23 into the position shown in Fig. 7. However, when the plane performs a landing operation and is setting down, the inertia of the fuselage causes the latter to move downwardly with regard to the wheels 23, which means that the axles will move from the inclined position of Fig. 4 into a more horizontal position. When this occurs, the struts 26 which are substantially stiff have their hook ends move upwardly along the substantial extension of the struts, thereby tensioning the spring 27. As soon as the above-mentioned inertia forces of the fuselage succumb, the tension of springs 29 moves the struts 26 again downwardly thereby causing the wheels 23 again to assume the position of Fig. 7.

The journalling of the drive for the balance air screw is also noteworthy. A sheet metal member 31 at the rear end 1' of the fuselage 1 carries a balance air screw 32 arranged on a horizontal pin. According to Fig. 6, said balance air screw 32 has a hub 33 frictionally engaging a driven hub. Said driven hub consists primarily of two hollow pins 34 and 35 engaging each other and provided with flanges. The hollow pin 34 is inserted from the inside of member 31 through an opening of said member 31 into the hollow pin 35 on the outside of the fuselage 1. In this way, the balance air screw 32 is carried by the end of a kind of overhanging shaft. A small wire coil 36 is guided into the inside of the hollow pin 34 which at 37 has its outer end soldered to the two hollow pins. Said thin wire coil 36 extends along the interior of the fuselage 1 to the lower end of the helicopter screw shaft 3, preferably designed as a hollow shaft, and is soldered to the inside of said hollow shaft. In this way, the driving of the balance air screw 32 is effected in a simple manner, while simultaneously damage to the driving shaft 36 will be avoided due to the friction fit of the balance air screw 32 on the pin. Therefore, it is impossible to damage the wire coil 36 by bumping against an object or by holding the balance air screw 32 stationary while the helicopter screw is rotating.

The helicopter may be driven by a driving device according to Figs. 3 and 8. Said driving device is composed of a rigid frame or casing 37 with a strong handle 38. The casing 37 may be held by one hand, while the other hand is turning the handle 38. A transmission gear system is located inside the driving device. The handle shaft 39 has fixed thereto a gear 40 meshing with a pinion 41. Pinion 41 is fixed to a gear 42, which meshes with a pinion 43. Said pinion 43 is secured to a bevel gear 44 meshing with a bevel gear 45. Gear 45 is fixed to one end of a hollow shaft 46 supported in the frame member 47 for the gear train 40—44. The hollow driving shaft 46 is connected, preferably soldered, to one end of a flexible shaft 48 designed as a pulled out wire coil or coil with spaced windings. The other end of the wire coil may be connected in the same manner with the driving shaft of the toy airplane. Gears 40—45 may be made of plastics, while the bearing shafts 39, 48 and 49 may be made of metal. In this way, the driving device is simple to manufacture and will have a long service life.

Arranged inside the flexible shaft 48 and the hollow shaft 46 is a strong steel wire 50 having an angularly bent portion 51 connected to the frame 47. The steel wire 50 extends through the hollow shaft 4 in the toy airplane and, as shown in Fig. 5, has at its end a bent portion 52 which extends through the two hollow pins 8 on the right wall of the fuselage whereby it is non-rotatably, i. e. fixedly connected thereto. Inasmuch as thus one end of the steel wire 50 is fixedly connected to the frame 47 connected to the casing 37, while the other end of the wire 50 is fixedly connected to the fuselage, a positive fixed connection exists between the casing 37 and the airplane, so that any tilting of the casing 37 automatically and positively brings about the tilting of the airplane.

The length of the wire 50 and of the coil 48 may be selected as desired, but it is suggested to select not too long a length, perhaps the length of around a yard, which length will assume a safe control for the helicopter.

The operation of the toy airplane according to the invention is effected as follows: normally the toy airplane rests with its landing gear on the ground. The driving device is grasped by one hand and is held so that the flexible shaft is straight or only slightly curved. The helicopter screw is driven by rotating the handle or crank 38 while the balance air screw 32 is driven at the same time. At a certain speed of rotation of the helicopter screw, the helicopter lifts itself off the ground. The control of the helicopter is effected by tilting the casing 37 about the axis of the driving shaft. By a left hand tilting movement, the helicopter moves forwards, and by the right hand tilting movement the helicopter will move backwards while being in flight. Moreover, it is possible to transmit other controlling forces to the helicopter by tilting the driving device about other axes. The helicopter can in this way be moved into numerous positions in the air and can thereby be caused to perform various manoeuvres including a smooth landing at any desired time.

I claim:

1. A captivated toy airplane capable of flying in any direction, which comprises in combination: a rotatable helicopter propeller arranged above said airplane, rotatable driving means drivingly connected to said propeller for driving the same, a driving device remote from said airplane for driving said driving means, a first rotatable flexible shaft in the form of a steel wire coil with spaced windings, said coil having one end drivingly connected to said driving means and having its other end drivingly connected to said driving device, and a second flexible shaft in the form of a thin steel wire having one end fixedly connected to a fixed element of said driving device and having its other end fixedly connected to a fixed element of said airplane for controlling the movements of said airplane in conformity with the respective inclinations of said driving device.

2. A captivated toy airplane capable of flying in any direction, which comprises in combination: propeller means supported by said airplane for driving the same, a driving device remote from said airplane for driving said propeller means, a rotatable flexible shaft in the form of a steel wire coil with spaced windings, a pair of tubular members respectively connected to the ends of said rotatable shaft, one of said tubular members being drivingly connected to said propeller means and the other one of said tubular members being drivingly connected to said driving device, and a thin flexible steel wire extending through said tubular members and said flexible shaft and having one of its ends fixedly connected to a fixed element of said driving device and having its other end fixedly connected to a fixed element of said airplane for controlling the movements of said airplane in conformity with desired and manually effected inclinations of said driving device.

3. In a toy airplane having a fuselage and being provided with propeller means for driving said airplane: a horizontal shaft located in said fuselage transverse to the longitudinal direction thereof and drivingly connected with said propeller means, a manually operable driving device adapted to be held by hand remote from said airplane for driving said propeller means, a steel wire coil with spaced windings having one end drivingly connected to said driving device and having its other end drivingly connected to said horizontal shaft, said coil passing into said airplane through one side of said fuselage, and a thin flexible steel wire extending through said coil and having one of its ends fixedly connected to a fixed

part of said driving device and having its other end fixedly connected to a fixed part of said airplane.

4. In a toy airplane having a fuselage and being provided with propeller means for driving said airplane: a rotatable shaft located in said fuselage transverse to the longitudinal direction thereof and drivingly connected with said propeller means, step-down transmission means interposed between and drivingly interconnecting said shaft and said propeller means, a manually operable driving device including a casing adapted to be held by hand remote from said airplane for driving said propeller means, a flexible steel wire coil having one end drivingly connected to said driving device and having its other end drivingly connected to said rotatable shaft, and a thin flexible steel wire extending through said coil and having one of its ends anchored in said airplane in a stationary manner with regard to said fuselage and having its other end anchored in said driving device in a stationary manner with regard to the casing of said driving device, thereby effecting a fixed but flexible connection between the fuselage of said airplane and the casing of said driving device.

5. In combination: a toy airplane having a fuselage and being provided with propeller means for driving said airplane; a manually operable driving device adapted to be held by hand remote from said airplane for driving said propeller means, a steel wire coil having one end drivingly connected to said driving device and having its other end drivingly connected to said propeller means, a thin flexible steel wire extending through said coil and having one of its ends anchored in said airplane in a stationary manner with regard to said fuselage and having its other end connected to a fixed part of said driving device thereby establishing a fixed but flexible connection between said fuselage and said driving device, a balance air screw arranged at the rear end of said fuselage, and an additional wire coil arranged within said fuselage and drivingly connecting said first mentioned wire coil with said balance air screw.

6. A toy airplane having a fuselage and being provided with propeller means for driving said airplane, which comprises in combination: a rotatable shaft located in said fuselage transverse to the longitudinal direction thereof and drivingly connected with said propeller means, a combination stiffening and bearing member arranged in said fuselage transverse to the longitudinal direction thereof and connected thereto while supporting said rotatable shaft, a manually operable driving device including a casing adapted to be held by hand remote from said airplane for driving said propeller means, a flexible steel wire coil having one end drivingly connected to said driving device and having its other end drivingly connected to said rotatable shaft, and a thin flexible steel wire extending through said coil and having one of its ends anchored in said airplane in a stationary manner with regard to said fuselage and having its other end anchored in said driving device in a stationary manner with regard to the casing of said driving device thereby effecting a fixed but flexible connection between the fuselage of said airplane and the casing of said driving device.

7. A toy airplane having a fuselage and being provided with propeller means for driving said airplane, which comprises in combination: a manually operable driving device including a casing adapted to be held by hand remote from said airplane for driving said propeller means, a flexible wire coil having one end drivingly connected to said driving device and having its other end drivingly connected to said propeller means for conveying driving power from said driving device to said propeller means, a thin flexible steel wire fixedly interconnecting said fuselage and the casing of said driving device for tilting said fuselage by tilting said casing, a pair of wheel axles, a pair of landing wheels respectively supported by one end of said axles, the other ends of said axles being linked to said fuselage, strut means respectively extending from the inside of said fuselage through the latter to said axle means near said wheels and being connected to said axle means, and spring means arranged within said fuselage and connected to the inner ends of said strut means for continuously urging said axle means to assume an inclined position with regard to a horizontal plane.

8. A toy airplane having a fuselage and being provided with propeller means for driving said airplane, which comprises in combination; a manually operable driving device including a casing adapted to be held by hand remote from said airplane for driving said propeller means, a flexible wire coil having one end drivingly connected to said driving device and having its other end drivingly connected to said propeller means for conveying driving power from said driving device to said propeller means, a thin flexible steel wire fixedly interconnecting said fuselage and the casing of said driving device for tilting said fuselage by tilting said casing thereby controlling the movements of said airplane, landing wheels, supporting means for said landing wheels, and spring means arranged within said fuselage and yieldingly supporting said supporting means.

9. A toy airplane according to claim 8, in which said landing wheels include a nose wheel, a spring wire having one end anchored within said fuselage extending through said fuselage and carrying said nose wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,653,039	Dowd	Dec. 20, 1927
1,803,469	Gardner	May 5, 1931
1,852,340	Vlahov	Apr. 5, 1932
1,928,154	Hojnowski	Sept. 26, 1933
2,165,050	Harb	July 4, 1939
2,400,704	Moore	May 21, 1946
2,472,556	West	June 7, 1949
2,620,596	Abrahamson	Dec. 9, 1952
2,732,656	Cohn	Jan. 31, 1956

FOREIGN PATENTS

1,094,088	France	Dec. 1, 1954