June 3, 1952 W. A. RHODES 2,599,484

STEERING CONTROL FOR MODEL AIRCRAFT

Filed Aug. 1, 1947

Fig. 1.

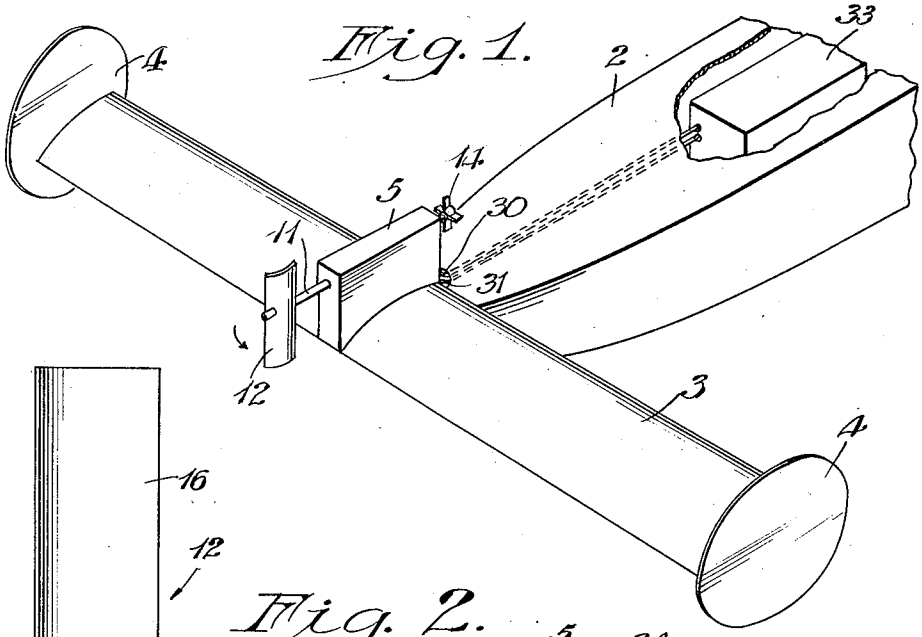



Fig. 2.

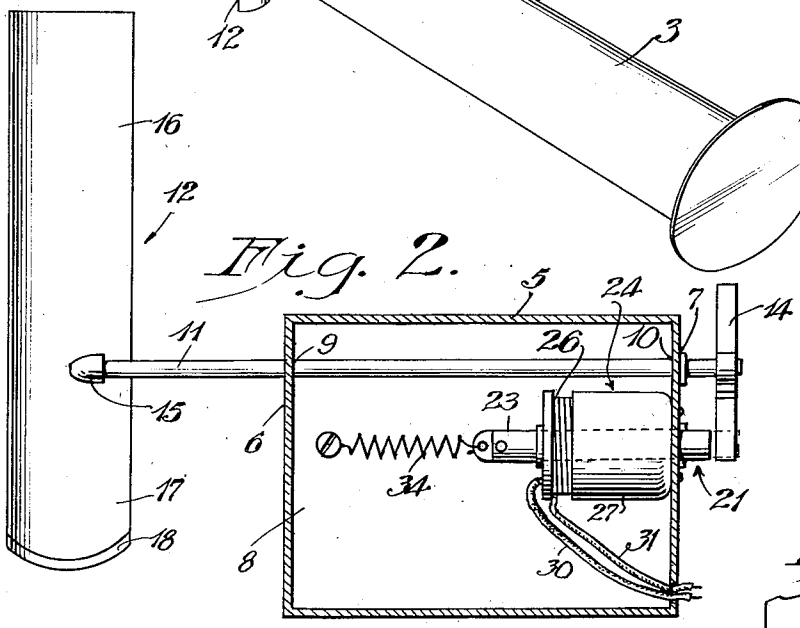



Fig. 3.

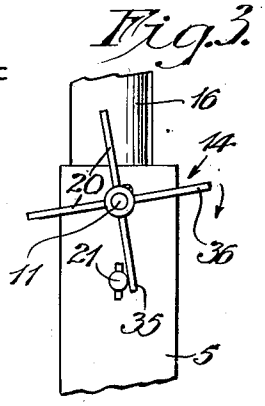



Fig. 5.

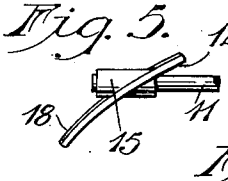



Fig. 4.

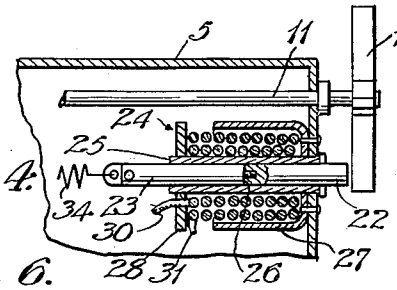
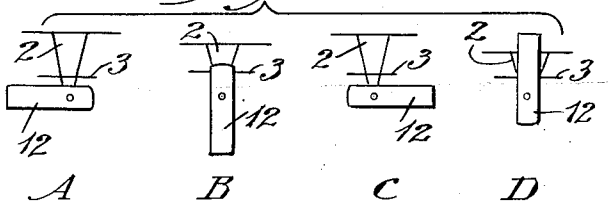



Fig. 6.




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## STEERING CONTROL FOR MODEL AIRCRAFT

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7 Claims. (Cl. 46—45)

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This invention relates to a steering control device for craft in fluid media, and pertains particularly to a control unit which will steer the vehicle in both a vertical and horizontal plane as it passes through the media, which may be either the air, a gas or a liquid such as water.

In the particular adaptation here illustrated, as for example, this control device is used for steering a self-propelled model airplane. Model airplanes of this type are well known to those familiar with the art and in keeping with the advance in the art it is commonly known that these planes are powered and propelled with small gasoline engines. Heretofore control of the flight of one of these models has been made by setting the elevators and rudders to a fixed position and then letting the plane fly until the fuel is exhausted. All of which was a haphazard method of operation and usually ended in a partial or complete destruction of the model. Accordingly, various persons have attempted to control the direction of flight of these planes by radio waves emanating from a transmitter on the ground received by a receiver in the machine in such a way that the signals were transmitted into a movement of the rudder and elevators of the plane. These devices made use of the conventional rudder, elevator and ailerons operated by motors positioned in the body of the craft and these, in turn, were controlled by time or escapement controls magnetically operated. These devices were found to be cumbersome, intricate and unnecessarily heavy, and the device hereinafter described has been produced with the general object of simplifying the construction of a directional control unit for such craft, and making it with the fewest number of parts, and with such simplified construction that failure of operation is reduced to a minimum.

It is further obvious that while radio signals are here mentioned as the means for transmission of signaling energy, it is entirely feasible to use signals transmitted from the control to the craft by means of sound waves, light waves or the like.

In view of the foregoing, the objects of the invention are to provide a steering control unit for vehicles operating in a fluid media which comprises a minimum number of parts and can be manufactured at a minimum cost and maintained with a minimum of adjustment:

A second object is to provide such a device in which the craft is directly controlled from the device and does not necessitate the use of independent motor or driving units to effect directive control.

A third object is to provide such a device in which there is a directive fin, freely turning in the fluid media all the time while the craft is moving, but which may be stopped at any position, and when stopped, the fin tends to move the portion of the vehicle on which it is mounted in a direction depending upon the position in which the fin has been stopped.

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Other objects will appear hereinafter.

I attain the foregoing objects by the device illustrated in the accompanying drawings, in which

Figure 1 is a semi-diagrammatic view of the device assembled and mounted on the tail portion of a model airplane;

Figure 2 is a vertical side elevation of the device with the containing case sectioned off to show the interior construction;

Figure 3 is a rear view of a fragmentary portion of the containing case showing particularly the escapement;

Figure 4 is a fragmentary view of the interior of the case with the operating solenoid shown in vertical section;

Figure 5 is a side elevational view of the control fin in horizontal position and rotated 90 degrees counterclockwise from the position shown in Figure 1 with its operative shaft in position relative to that in Figure 4 as a continuation thereof; and

Figure 6 is a diagrammatic illustration of the four control positions of the fin used to obtain both vertical and horizontal directional control.

Similar numerals refer to similar parts in the several views.

As shown in Figure 1, 2 indicates the rear portion of the fuselage of a model airplane; 3 is a horizontal stabilizer attached to the rear of the fuselage and 4 indicates the vertical stabilizing fins, in this instance attached to the ends of the horizontal stabilizer. A case 5 which forms a support for the control device is mounted at the middle of the horizontal stabilizer 3 and on and directly above the center of the rear of the fuselage 2.

Case 5 consists of a box of sheet aluminum or other light material wherein the narrow ends 6 and 7 are bent up at right angles to the side plate 8 so as to provide bearing holes at 9 and 10 for a shaft 11, which I term the rotating fin shaft.

A rotating control fin 12 is mounted at the outer rear end of this shaft and an escapement wheel 14 is at the front end. The rotating control fin consists in this instance of a thin strip of steel having an arcuate section and secured to shaft 11 by a thimble 15 so as to be angularly mounted relative to the axis of the shaft (see Figure 5). The thimble 15 is positioned with reference to the length of fin 12 so that there is a longer portion 16 on one side of the axis of the shaft and a shorter portion 17 on the opposite side. The weight of the longer portion 16 is counterbalanced by a small beaded rim of lead

or solder 18. When the plane is drawn through the air by its propeller, or otherwise, the air catches the fin 12 and rotates it. Since a greater portion of the fin blade is on the side indicated by 16, this portion will be acted on by the air more than the shorter portion 17, and the fin will turn in a counterclockwise direction as viewed particularly in Figure 1. The portion 17 of the fin tends to slow its turning movement down and is thus used to counteract its speed of revolution so that when it is stopped, as hereinafter described, there will be less strain put on the parts. The counterbalance 18 merely acts to balance the weight of the portion 16 relative to portion 17.

The escapement, or stop 14, consists of a star-shaped wheel having four arms 20 equally spaced at right angles to each other. This wheel is positioned on shaft 11 at its front end so that the detent 21 may be made to engage any one of the arms 20, thus stopping the wheel from rotation. The detent 21 is composed of a forward rod part 22 of brass, aluminum or other non-magnetic metal threaded and joined to a rod of similar size 23 of magnetic material which constitutes the armature or movable core of the solenoid 24. Both the rods 22 and 23 operate smoothly within a brass sleeve 25 on which the windings 26 of the solenoid are wound. A cap 27 of magnetic material constitutes a closure for the forward end of the coil windings and shortens the magnetic field relative to the armature 23 and a disc 28 closes the rear end of the solenoid windings. These windings are brought out in two terminals 30 and 31 which are led by connecting wires to a relay, signal amplifier and radio signal receiver contained within a case 33 disposed within the body of the fuselage 2. When a signal is received it is amplified in the usual manner and made to operate a relay of conventional construction. This relay closes a circuit which includes a small dry cell and the windings 26 of the solenoid 24.

Closing of this circuit operates solenoid armature 23 so that it is drawn into the core of the solenoid and the detent rod 22 thrust forward sufficiently to engage one of the arms 20 of the escapement wheel 14. When the signal is discontinued, the spring 34 draws the armature from the core of the solenoid and the detent 21 is released from contact with escapement wheel 20.

In operation, the device is mounted as shown in Figure 1 and the plane is equipped with a receiver of a type well known to those familiar with the art and the receiver tuned to receive signals from a transmitter operated from the ground.

When the plane is set in motion, the control fin 12 spins or turns due to the deflection of the air against its surfaces, as above explained. This spinning motion continues throughout the flight of the plane until it is stopped by operation of the detent. The spinning motion of the fin has no effect upon the direction of the plane and since it can be made comparatively small, has very little drag or resistance.

It is assumed that the stabilizer 3 and the vertical fins 4 have been set to maintain the plane in a level straight flight. When it is desired to change the direction of the course of the plane a signal is sent from the transmitter on the ground to the receiver on the plane. This signal is in the form of a continuous radio electric impulse. The signal, upon being received by devices in the plane, closes the relay circuit and forces detent 21 to engage one of the arms of escapement wheel 14. This will change the course of the plane, depending on what particular arm is engaged. The four arms of the wheel are faced relative to shaft 11 so that when any one of them is engaged by the detent the fin will be held in either one of four positions indicated diagrammatically in Figure 6, as A, B, C, or D. Thus if the detent engages the arm indicated as 35, Figure 3, the fin will be stopped with the longer portion 16 in a vertical position, as indicated in Figure 2, and at D in Figure 6; the air striking the curved surface of portion 16 of the fin, will tend to force the tail of the plane to the left. Thus its direction will be changed to the right in a horizontal plane. If this is not the direction desired the signal is discontinued for an instant and again sent. This period of discontinuance may be very slight and sufficient only for escapement wheel 14 to move so that when a signal is again sent, the next succeeding arm 36, Figure 3, will be engaged. In this position the fin will be stopped in a horizontal position, as indicated at C, Figure 6, and the air striking portion 16 will tend to force the tail of the plane upward and cause the plane to nose down. Other arms of escapement wheel 14 may be similarly engaged and disengaged so that the fin may be stopped at positions B and A, as desired.

In position B, the tail of the plane will be forced to the right and its direction steered to the left in a horizontal plane. While in position A, the tail will be forced down and the plane nosed up.

I claim:

1. A steering control device for model aircraft, comprising, in combination, a directive control fin mounted on a shaft parallel with the direction of movement of the craft and set at an angle relative to said direction of movement to receive rotary motion from the air through which the craft travels and remotely controlled means for stopping said fin from rotating during the travel of the craft whereby wind pressure upon the fin causes it to act as a directional control air foil exerting force on the portion of the craft on which it is mounted according to the position in which it is stopped.

2. A steering control for model aircraft including in combination with a model aircraft a single bladed rotatable control fin airfoil mounted on a shaft on the craft, so as to freely rotate by the motion of the craft through the air, and remotely controlled mechanism for stopping the rotation of said fin while the craft is in motion at any one of a plurality of positions whereupon it becomes a directive airfoil.

3. Steering mechanism for model air craft including, in combination with a craft having a fuselage provided with a tail, a single bladed air-foil mounted on a rotatable shaft supported on the tail of said fuselage so that its axis substantially coincides with the direction of movement of said craft, said air foil being adapted to freely rotate with said shaft when said craft is in motion, together with remotely controlled mechanism for stopping the rotation of said air foil at ony one of a plurality of positions attained throughout its rotation, so that it will control the direction of movement of said aircraft.

4. In a model aircraft having a fuselage, vertical and horizontal stabilizing surfaces mounted on the tail end of said fuselage, and radio-elec-

tric signal receiving apparatus carried in said fuselage, the combination therewith of mechanism for steering said aircraft by radio signals transmitted to said signal receiving apparatus including an air foil fin angularly mounted near one of its ends on a fin shaft so as to rotate said shaft, a fin shaft journalled on the tail end of said fuselage, and normally free to rotate and extending parallel with the direction of flight of said craft, an escapement wheel having a plurality of radially extending arms mounted on said shaft, a detent, mounted on the armature of an electric solenoid, arranged to engage any one of the arms of said escapement wheel and stop rotation of said shaft, an electric solenoid, an electrical connection from said radio electric signal receiving apparatus to said solenoid arranged to energize said solenoid when signals are received by said apparatus so that rotation of said fin is stopped and it acts as a steering rudder.

5. In a model aircraft having a fuselage, vertical and horizontal stabilizing surfaces mounted on the tail end of said fuselage, and radio-electric signal receiving apparatus carried in said fuselage, the combination therewith of mechanism for steering said aircraft including a fin shaft extending in the direction of flight of said aircraft, journalled on the tail end of said fuselage and normally free to rotate, an air foil fin mounted on the periphery of said fin shaft and extending radially therefrom and set at an angle of incidence relative to the axis of said shaft so as to rotate said shaft when said craft is moving through the air and act as a directive tail surface when said shaft is detained from rotation, and means for detaining rotation of said fin shaft at annular positions responsive to signals received by said radio electric signal receiving apparatus including an electrically operated detent electrically connected to said signal receiving apparatus and an escapement wheel having radially extending arms on said fin shaft, positioned to be engaged and stopped by said detent.

6. In a model aircraft having a fuselage, vertical and horizontal stabilizing surfaces mounted on the tail end of said fuselage, and radio-electric signal receiving apparatus carried in said fuselage, the combination therewith of mechanism for steering said aircraft including a fin shaft extending in the direction of flight of said aircraft, journalled on the tail end of said fuselage and normally free to rotate, an air foil fin mounted radially on the periphery of said fin shaft at an angle of incidence relative to the axis of said shaft so as to rotate said shaft when said craft is moving through the air and act as a directive tail surface when said shaft is detained from rotation, and means for detaining rotation of said fin shaft at annular positions responsive to signals received by said radio electric signal receiving apparatus, including a star shaped escapement wheel having a plurality of radial arms mounted on said fin shaft, a solenoid having



a winding electrically connected to said radio electric signal receiving apparatus so as to be energized whenever a signal is received thereby, an armature operative in said solenoid having a rod adapted to project into engagement with any one of the arms of said escapement wheel when said solenoid winding is energized, and a spring operative on said armature normally holding it in disengaged position relative to said escapement wheel.

7. In a model aircraft having a fuselage, vertical and horizontal stabilizing surfaces mounted on the rear end portion of said fuselage, radio electric signal receiving apparatus carried in said fuselage, the combination therewith of mechanism for steering said aircraft by radio signals transmitted to said radio signal receiving apparatus, including, a shaft journalled on the rear of said fuselage with its axis parallel with the direction of flight of said aircraft and extending rearward of the stabilizing surfaces mounted on said craft fuselage; an air foil fin mounted on the rear portion of said shaft extending radially substantially on one side of said shaft with its air foil surfaces disposed at an angle to the axis of said shaft, to impart rotation to it and said shaft when said aircraft is moved forward thru the air; said shaft and fin being normally free to rotate; a star shaped escapement wheel having a plurality of radially extending arms, mounted on the forward end of said shaft; and an electrically operated solenoid, having an armature connected to a slidably operating detent, mounted on said aircraft so that it will engage between any two of the arms of said escapement wheel when said solenoid is energized; a spring normally holding said detent in a retracted position not engaging said escapement wheel; electric wiring connecting said solenoid with said radio signal receiving apparatus arranged so that said solenoid is energized to draw its armature and said detent into position to engage and stop the rotation of said escapement wheel whenever a signal is transmitted to said receiving apparatus; said fin acting as a directive rudder for said craft when its rotation is stopped by said detent.

WILLIAM A. RHODES.

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