Sept. 2, 1924. 1,507,504

W. M. MORGAN

DIRECTION CONTROL MECHANISM FOR AEROPLANES

Filed March 22, 1921 2 Sheets-Sheet 1

Fig. 1

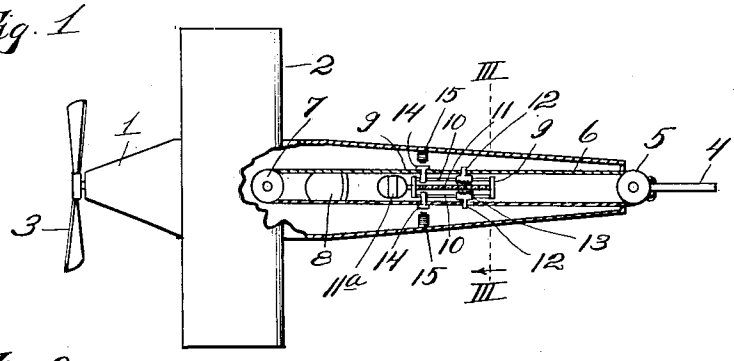
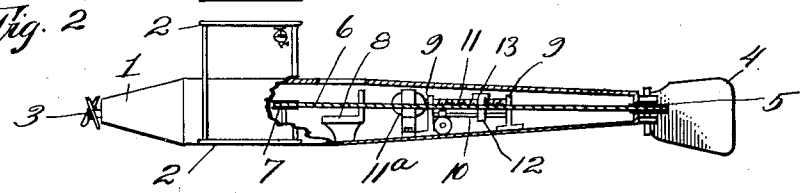


Fig. 2



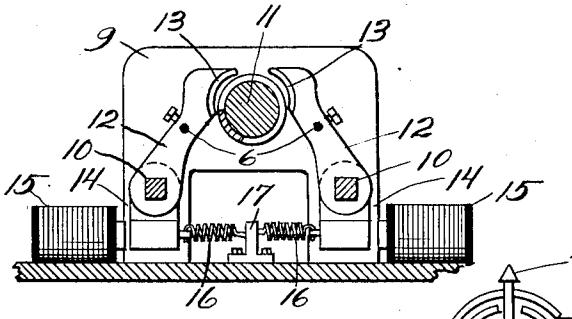
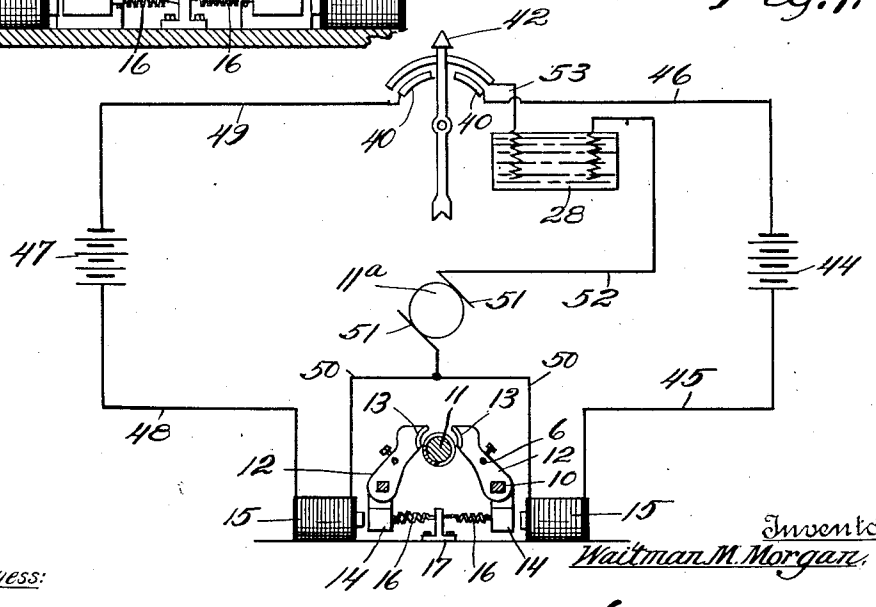


Fig. 3

Fig. 7.



Witness:

R. C. Hamilton

Inventor

Waitman M. Morgan

By Thorpe & Girard

Attorneys

Sept. 2, 1924. 1,507,504

W. M. MORGAN

DIRECTION CONTROL MECHANISM FOR AEROPLANES

Filed March 22, 1921 2 Sheets-Sheet 2

Fig. 4

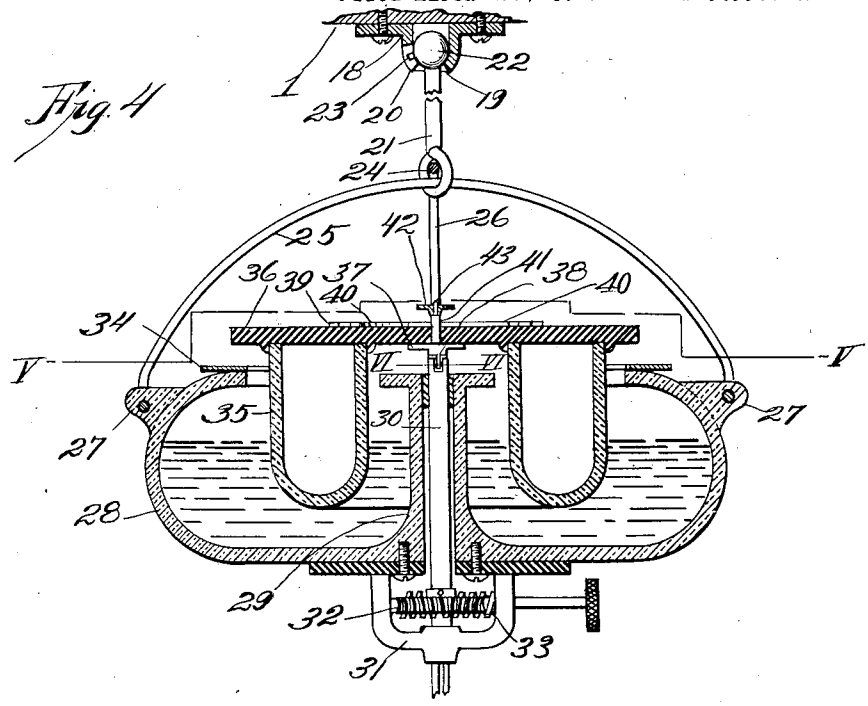


Fig. 5

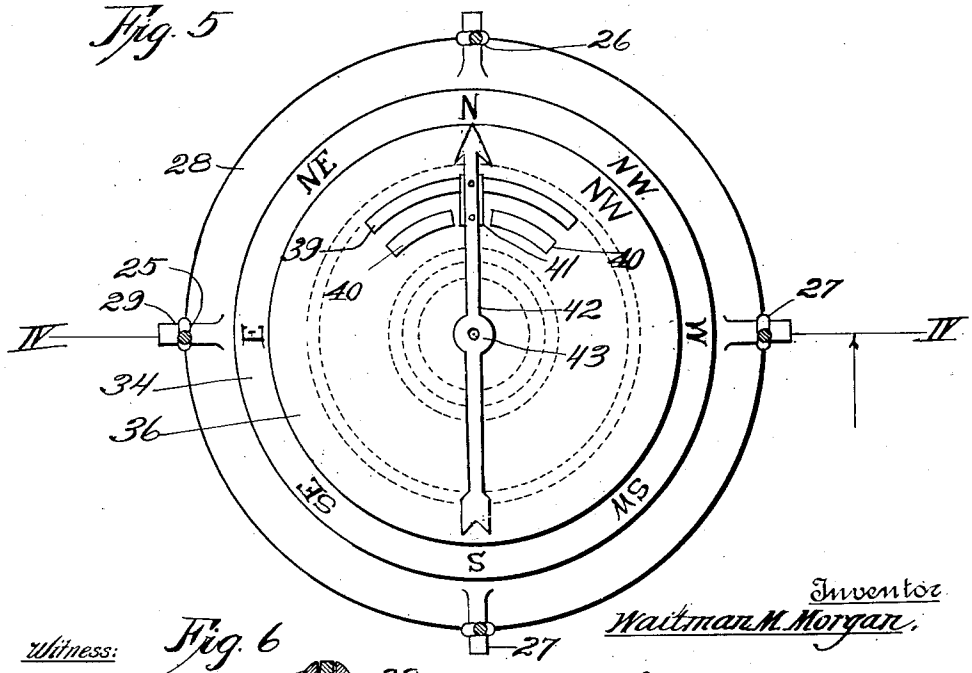


Fig. 6



Witness:

R. R. Hamilton

Inventor

Waitman M. Morgan.

By Thorpe & Grard

Attorneys

Patented Sept. 2, 1924. 1,507,504

UNITED STATES PATENT OFFICE.

WAITMAN M. MORGAN, OF KANSAS CITY, MISSOURI, ASSIGNOR OF TWO-THIRDS TO ALFRED PETERSON, OF INDEPENDENCE, MISSOURI.

DIRECTION-CONTROL MECHANISM FOR AEROPLANES.

Application filed March 22, 1921. Serial No. 454,543.

To all whom it may concern:

Be it known that I, WAITMAN M. MORGAN, a citizen of the United States, and resident of Kansas City, county of Jackson, State of Missouri, have invented a certain new and useful Improvement in Direction-Control Mechanism for Aeroplanes, of which the following is a complete specification.

This invention relates to aeroplanes, and has for its object to produce automatic mechanism for steering the machine in a predetermined direction and to rectify its course of travel should it be driven by storm or drift from such course by cross or other adverse currents of air.

A further object is to produce an electrical steering mechanism of such character that the operative relation of its parts shall be maintained at all times regardless of tilting movements of the machine.

With these objects in view the invention consists in certain novel and useful features of construction and combinations of parts as hereinafter described and claimed; and in order that it may be fully understood reference is to be had to the accompanying drawings, in which:—

Figure 1 is a view partly in top plan and partly in horizontal section of a conventional type of aeroplane equipped with steering mechanism embodying the invention.

Figure 2 is a side elevation of the machine but showing it partly broken away to expose certain parts of the steering mechanism.

Figure 3 is an enlarged cross section taken on the line III—III of Figure 1.

Figure 4 is an enlarged central vertical section of part of the steering mechanism not disclosed by the preceding figures, the section being on the line IV—IV of Figure 5.

Figure 5 is a horizontal section taken on the line V—V of Figure 4.

Figure 6 is an enlarged horizontal section taken on the line VI—VI of Figure 4.

Figure 7 is a diagrammatic view showing the cooperative relation between the mechanism shown in Figures 1 to 3 inclusive, and 4 to 6 inclusive.

In the said drawings where like reference characters identify corresponding parts, 1 indicates the body or fuselage, 2 the planes, 3 the propeller, and 4 the vertical rudder of any approved type of aeroplane, and mounted upon the steering post of said rudder is a sheave 5, connected by a belt or cable 6, to a similar sheave 7 mounted in and near the front end of the fuselage, the strands of said belt or cable being disposed at opposite sides of the operator's seat 8.

Arranged within the fuselage rearward of the seat by preference, is a mechanism constructed as follows:

9 indicates a pair of standards connected by a pair of parallel rock bars 10 disposed at opposite sides of the longitudinal center of the machine, and arranged at equal distances from and parallel with said rock bars and journaled in said standards is a screw 11, driven by an electric motor 11^a when the latter is energized by the completion of a circuit, as will hereinafter appear. A pair of rock-arms 12 are secured to the respective strands of the belt or cable, and mounted slidingly on the rock bars 10, and provided with a pair of fragmental threaded portions or sleeves 13 for engagement at times with the screw 11, both threaded sleeves however never simultaneously engaging said screw. Secured rigidly on the rock bars and depending therefrom are armatures 14 for a pair of electro-magnets 15 secured on the bottom of the fuselage outward of their respective armatures, and the latter are connected by retractile springs 16 with a centrally located post or anchor 17, said springs being for the purpose of holding the armatures yieldingly away from the adjacent ends of the respective magnets except at such times as said magnets are energized.

Arranged within the fuselage at any convenient point, preferably forward of the seat and within convenient view of the operator at all times, is the following mechanism: 18 is a plate secured to the fuselage and provided with a rounded socket having a flaring mouth 19 at its lower side, and a radial slot 20. A pendulum 21 extends into said socket plate and is provided with a ball head 22 therein and capable of rocking so as to maintain the pendulum in a vertical position at all times regardless of whether the machine is tilted or not, and said ball head is provided with an outwardly projecting pin 23 loosely engaging

the slot 20 to guard against horizontal or axial rotation of the pendulum.

The pendulum is provided at its lower end with a loop or eye 24 receiving a pair of crossed bails 25 and 26 pivoted at their lower ends to lugs 27 projecting from a circular bowl or receptacle 28 of glass or equivalent insulating material, containing quick silver or the like. The bowl or receptacle is provided with a central tubular standard 29 through which extends a vertical shaft 30, suitably journaled near its upper end in the standard, and at its lower end in a bracket 31 secured to the bottom of the bowl, and within said bracket said shaft is equipped with a worm-wheel 32 engaged by a worm 33 adapted to be manually turned for the purpose of effecting rotary adjustment of said shaft, as hereinafter explained.

A ring 34 is secured to the bowl or receptacle at the upper end or mouth thereof concentrically of said shaft, and bears on its face symbols of the points of the compass, to wit: N. E.—S. and W., and the intermediate points, N. E.—S. E.—N. W. and S. W.

A circular float 35 depends into the bowl or receptacle concentrically of the axis thereof and is equipped at its upper side with a dial 36 of insulating material. Centrally the dial is provided at its lower side with a plate 38 resting upon and interlocked as shown most clearly by Figure 6, with the upper end of shaft 30, the arrangement being such that by turning the worm 33 said float and dial can be likewise turned. The dial is provided on its upper side with a contact 39 extending concentrically of shaft 30, and with a pair of contacts 40 disposed concentrically with respect to contact 39. A contact 41 for engagement with contact 39, and at times with either of the contacts 40, is secured to an index finger or needle 42 pivotally mounted as at 43 on the dial; said pointer or index finger being adapted to point at all times toward the magnetic pole.

Assuming that the machine is pointed due north, it will be seen that the index finger is pointing toward the symbol N, and that the contact 41 is in engagement with the contact 39 but out of contact with the contacts 40, and by reference to Figure 7 it will be seen that the motor is deenergized. Referring to said figure; 44 is an electric battery shown conventionally and adapted to be secured at any suitable point in the fuselage, and connected by wire 45 with one of the electro-magnets 15, a second wire 46 leading from the opposite pole of the said battery to one of the contacts 40. A similar battery 47 is connected by a wire 48 to the other electro-magnet and by a wire 49 to the other contact 40. The two electro-magnets are connected by wires 50 to one of the brushes 51 of the motor, and the other brush 51 of the motor is connected by a wire 52 with the mercury in the bowl 28, and a wire 53 leads from the mercury in the bowl to the contact 39. It will be understood that with the needle set as shown, neither of the circuits from the batteries 44 or 47 is completed and that consequently the motor and the magnets 15 are deenergized, and that the threaded sleeves 13 are both held out of engagement with the screw 11 by means of the springs 16; the rudder 4 therefore standing in longitudinal alinement with the machine, and adapted to guide the machine due north. Should the course of the machine be changed to the right or left of the direction indicated by the needle, the left or right hand contact 41 respectively will engage the contact 40 and complete a circuit through the battery 47 or 44, and thus effect energization of the connected electro-magnet and the attraction of its armature and the consequent engagement of the associated threaded sleeve with the screw driven by the motor, this engagement effecting forward travel of the sleeve and the engaged strand of the cable, to cause the rudder to steer the machine in the reverse direction back to its proper course and as this result is attained the circuit is broken, it being understood that as one sleeve is forced forward by the screw the opposite strand of the cable effects corresponding rearward movement of the other sleeve.

If it be desired to cause the machine to travel to the northeast, the machine is pointed in that direction, this being indicated when the N. E. symbol is brought under the point of the needle, and as long as this course of travel is properly maintained, the needle and symbol maintain the relative positions mentioned, the circuits remain broken, the sleeves are held out of engagement with the screw by springs 16, and the rudder is stationary in line with the major axis of the machine.

It will thus be seen that to guide the machine in any desired direction all that is necessary is to initially point it in such direction, as by so doing the symbol identifying such direction is brought under the point of the needle and the latter maintains the circuits in broken condition unless the course of the machine changes, in which event the proper circuit is completed to cause the rudder to restore the machine to its proper course of travel.

It will of course be understood, that there is no necessity of initially physically setting the ship in the direction it is to follow, as circumstances may be such that it is necessary to start it in a different direction. In this event all that is necessary is for the operator depending on the automatic guiding mechanism, to see before or after he makes

his ascent, that the symbol indicative of the direction in which he is to travel, is below the point of the needle, and this he accomplishes by adjusting the dial until the space between contacts 40 is in radial alinement with the proper symbol on ring 34, this action setting the rudder to change the course of the machine until the said symbol and space occupy the same radial plane as the needle.

From the foregoing it will be understood that I have produced a steering attachment for aeroplanes, embodying the features set forth as desirable in the statement of the object of the invention, and while I have shown and described the preferred embodiment thereof, it will be apparent that it is susceptible of changes within the principle of construction and mode of operation involved.

I claim:

1. The combination with an aeroplane, of motor-actuated steering mechanism, a bowl containing a fluid conductor, suspended from the aeroplane to assume a horizontal position regardless of tilting movements of the machine, a fluid conductor in said bowl, two electro-circuits for energizing the motor alternately, said circuits including spaced contacts; and a magnetic needle and a contact in circuit with said fluid conductor and movable with said needle adapted through change in the course of travel of the machine, to engage one or the other of the said spaced contacts, to complete the respective circuit and energize the motor to set the rudder for the return of the machine to its predetermined course.

2. The combination with an aeroplane, of electric motor-actuated steering mechanism, including a bowl suspended to assume a horizontal position regardless of tilting movements of the machine, a fluid conductor in said bowl, a pair of spaced contacts electrically connected to said motor, a source of electric energy in circuit with said contacts; the motor being electrically connected to the conductor in the bowl, a third contact electrically connected to the conductor in the bowl, a magnetic needle, and a contact movable with said needle and engaging said third contact and adapted for also engaging either of said pair of contacts for completing a circuit through the motor.

In witness whereof I hereunto affix my signature.

WAITMAN M. MORGAN.