Aug. 7, 1945. A. ZUKOR 2,381,478

AUTOMATIC AIRPLANE SAFETY RAISING AND GUIDING DEVICE

Filed Sept. 10, 1942 4 Sheets-Sheet 1

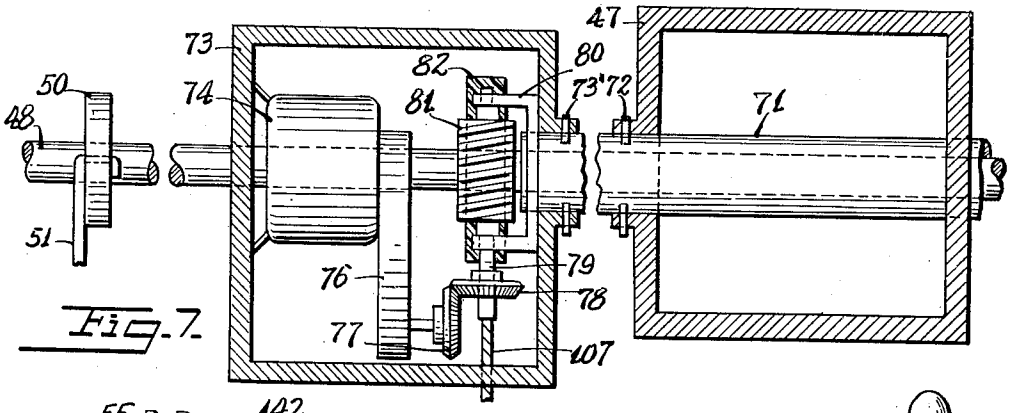


Fig. 7.

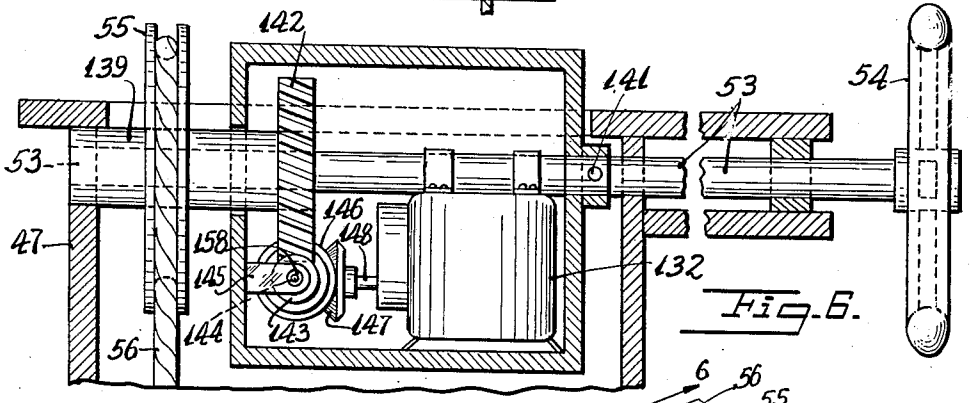


Fig. 6.

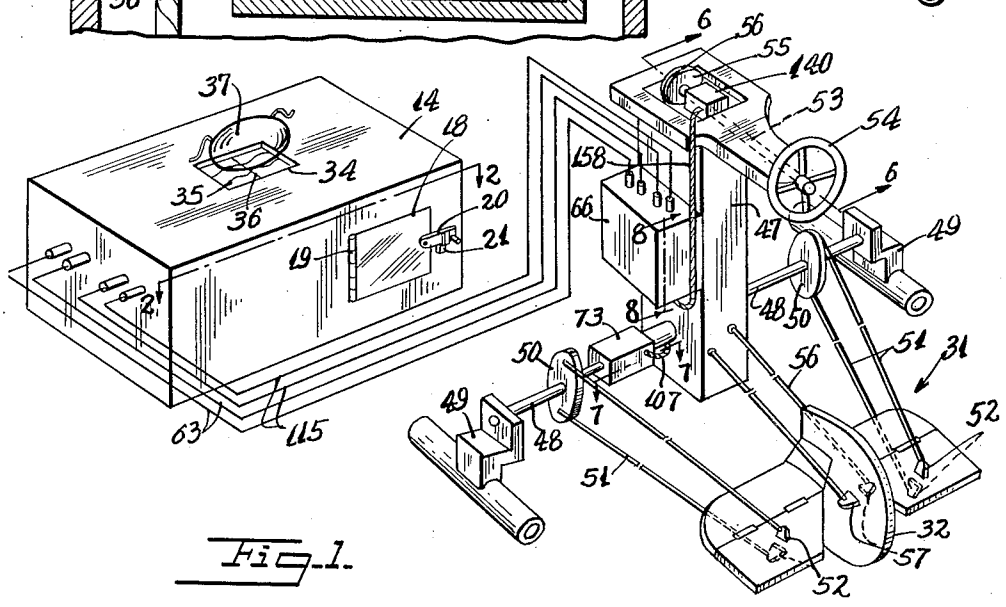


Fig. 1.

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AUTOMATIC AIRPLANE SAFETY RAISING AND GUIDING DEVICE

Filed Sept. 10, 1942 4 Sheets-Sheet 2

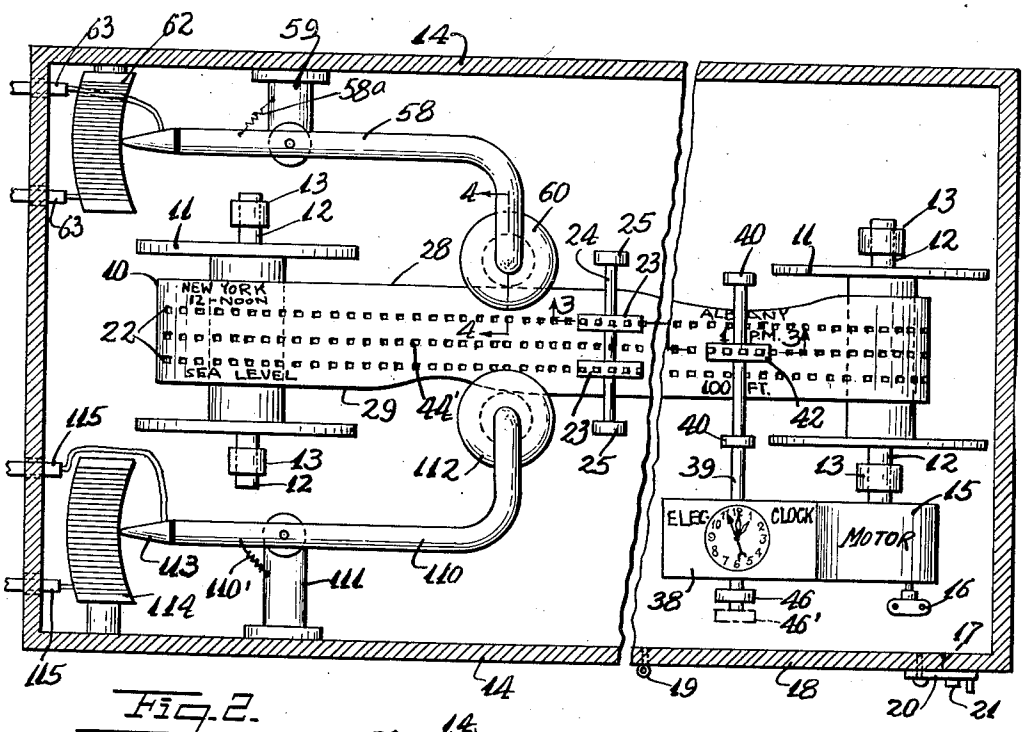


Fig. 2.

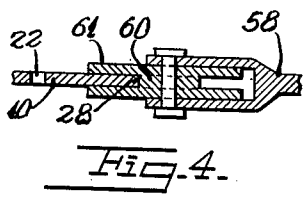


Fig. 4.

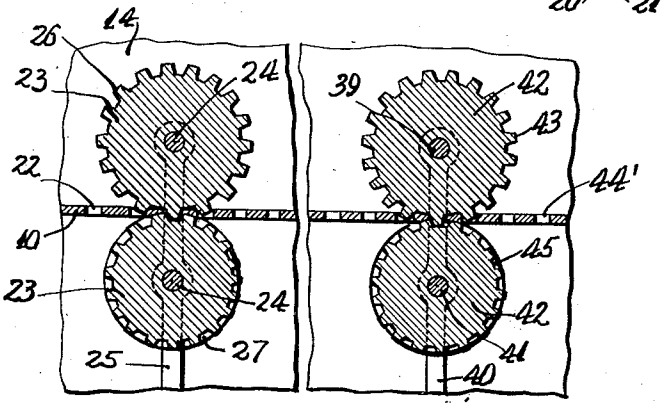


Fig. 3.

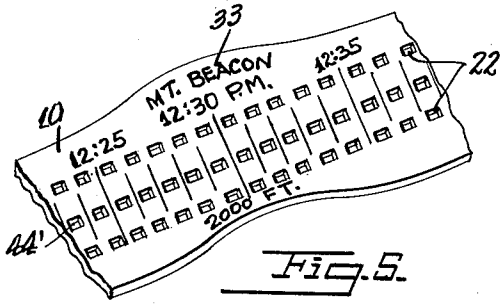


Fig. 5.

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AUTOMATIC AIRPLANE SAFETY RAISING AND GUIDING DEVICE

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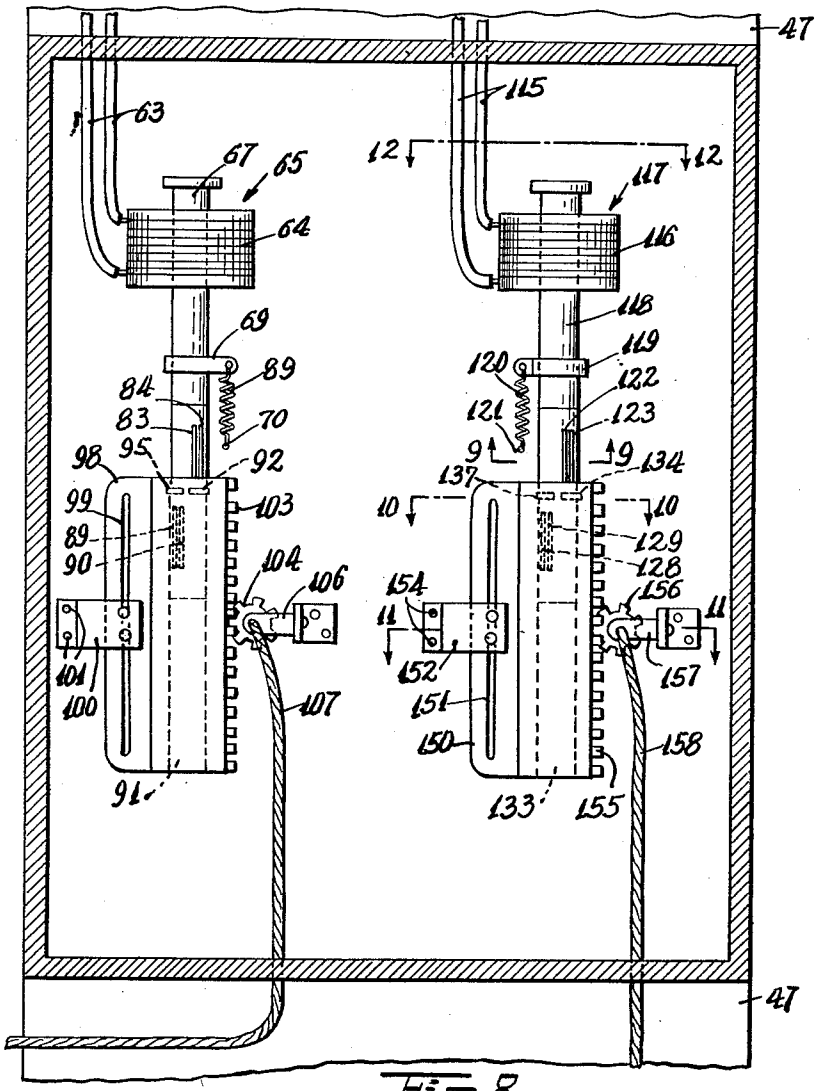


Fig. 8.

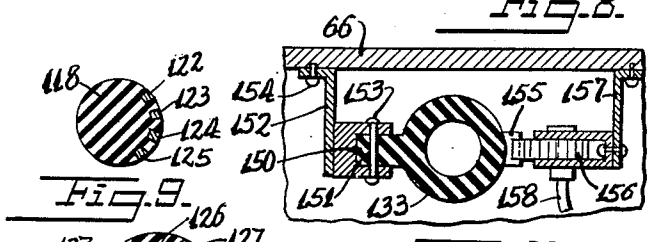


Fig. 9.

Fig. 11.

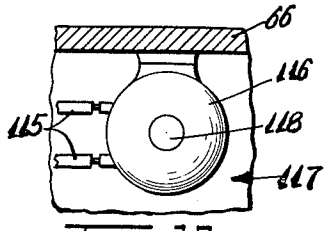


Fig. 12.

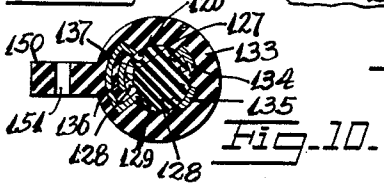


Fig. 10.

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AUTOMATIC AIRPLANE SAFETY RAISING AND GUIDING DEVICE

Filed Sept. 10, 1942 4 Sheets-Sheet 4

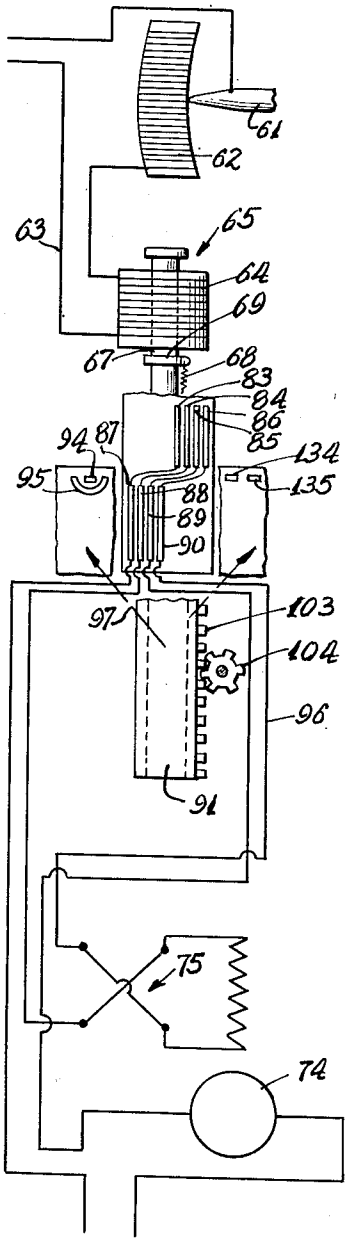


Fig. 13.

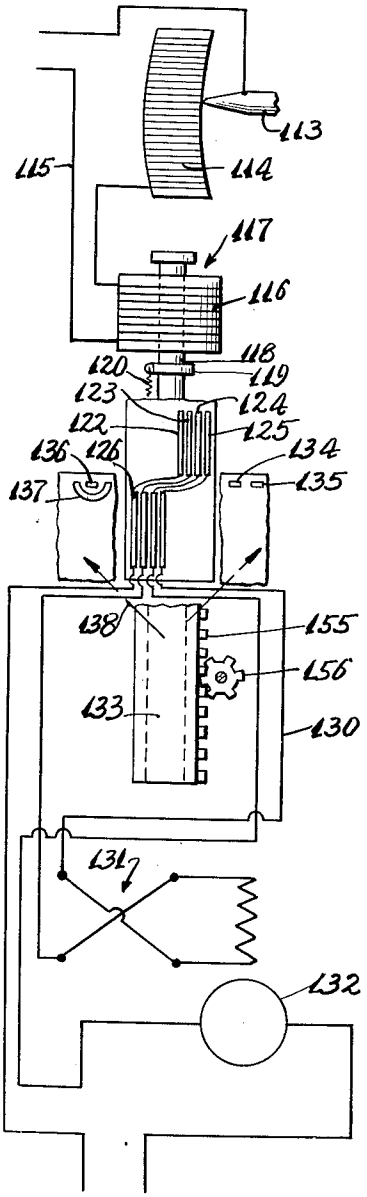


Fig. 14.

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Patented Aug. 7, 1945

2,381,478

UNITED STATES PATENT OFFICE

2,381,478

AUTOMATIC AIRPLANE SAFETY RAISING AND GUIDING DEVICE

Arnold Zukor, New York, N. Y.

Application September 10, 1942, Serial No. 457,822

6 Claims. (Cl. 172—282)

This invention relates to an automatic airplane safety raising and guiding device.

Accidents in which airplanes fly into the sides of mountains occur quite frequently. They usually occur in fog or storm or on dark nights. This invention proposes an automatic device for raising an airplane as it approaches a mountain and lowering it after it has passed, so as to avoid the accidents specified. Furthermore, the automatic device will also guide the plane to avoid mountains and hills by flying around the same, if this is practical without straying too much from the course.

More specifically, the invention proposes characterizing the automatic device by a tape which is flexible longitudinally so that it may be wound and unwound on spools or rollers, and which is rigid transversely. It is proposed that this tape have the contour of one side shaped to correspond with the altitude flying requirements of a plane operating between certain points. It is further proposed that the other side of the tape be shaped to correspond with the theoretical ideal course between the points, which may or may not be in a straight line. It is proposed that the automatic safety raising and lowering and guiding be controlled by the edges of the tape.

The invention contemplates a time control means for driving said tape which will operate in conjunction with "seconds" indicating mechanism of an electric clock for controlling the flying schedule of the plane. For example, one inch of tape may represent one mile of flying. With this proportion a practical device may be constructed for covering long periods of flying time, such as generally used by transport planes.

The invention also proposes that the face of the tape be imprinted with various cities or towns or airfield beacons or stations along the route, so that the pilot may continuously check for position with the position of the tape. It is proposed that the pilot advance or retard the tape at points of checking whenever it is off. With this arrangement the pilot will know his position at any point along the route merely by looking at and reading the tape. It is proposed to provide the tape with additional data such as the altitude of the land being flown over at any particular time. Thus the pilot may check the altitude of the plane with the altitude on the tape to make certain that everything is functioning correctly.

In accordance with this invention a different tape is required for each route, in the same manner as different films are required for different motion picture screens. For example, if a plane travels from New York to Chicago, it is merely necessary for the pilot to place this particular roll of tape into his automatic safety and guiding device. On the trip back a return tape is required.

With this invention a plane will be as safe as a train on tracks in that the pilot will always know the location over which he is at any instant, just as a locomotive engineer knows his tracks, stations, and similar landmarks.

Still further the invention contemplates the provision of means for automatically controlling the elevators of the plane controlled by the altitude control side of the tape. It is proposed to so construct this means that it will not interfere with the manual control of the elevators, or the robot control thereof. Similarly, a means is proposed for automatically controlling the rudder or the compass of the plane controlled by the course side of the tape. This latter means is also to be constructed to work independently and not interfere with the manual or robot control of the rudder.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure—

Fig. 1 is a perspective schematic view of an automatic airplane safety raising and guiding device shown applied to the control stick, elevators and rudders of a plane, which is not illustrated on the drawings, as it forms no part of the invention.

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary vertical sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary horizontal sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary perspective view of a portion of the tape shown in Fig. 2.

Fig. 6 is a fragmentary vertical sectional view taken on the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary horizontal sectional view taken on the line 7—7 of Fig. 1.

Fig. 8 is a fragmentary vertical sectional view taken on the line 8—8 of Fig. 1.

Fig. 9 is a fragmentary horizontal sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary horizontal sectional view taken on the line 10—10 of Fig. 8.

Fig. 11 is a fragmentary horizontal sectional view taken on the line 11—11 of Fig. 8.

Fig. 12 is a fragmentary horizontal sectional view taken on the line 12—12 of Fig. 8.

Fig. 13 is a schematic wiring diagram of the mechanism which controls the rudders.

Fig. 14 is a schematic wiring diagram for the mechanism which controls the elevators.

The automatic airplane safety raising and guiding device, according to this invention, includes a tape 10 of aluminum or other similar material which is flexible longitudinally so that it may be wound and unwound on spaced spools 11 rotatively supported on shafts 12 having their ends fixedly supported in brackets 13 mounted within a casing 14 positioned in close proximity to the pilot of the plane. The right hand spool 11 has its shaft 12 connected with a spring motor 15 which continuously pulls on the tape 10 tending to unwind it from the left hand spool 11 and wind it on the right hand spool. The motor 15 is provided with a knob 16 by which the spring thereof may be rewound when desired. The knob 16 is arranged in position behind the opening 17 formed in one wall of the casing 14. This opening is adapted to be closed by means of a door 18 having one side supported upon hinges 19 and provided at its other side with a pivotally mounted keeper 20 engageable with a bolt 21 for holding the door closed. When the door 18 is opened one's hand may be inserted into the casing 14 for winding the motor 15 through the medium of the knob 16.

The tape 10 is formed with spaced rows of sprocket openings 22. Spaced sprocket wheels 23 engage the top and bottom faces of the tape 10 in alignment with the rows of openings 22. These sprocket wheels 23 are fixedly attached to shafts 24 which have their ends rotatively supported in brackets 25 mounted within the casing 14. The topmost sprocket wheels 23 are provided with projecting teeth 26 which are engageable with complementary openings 27 formed in the bottom sprocket wheels 23. To engage the teeth 26 with the openings 27 it is necessary that the teeth 26 pass through the spaced rows of sprocket openings 22 formed in the tape 10. Thus the sprocket wheels 23 act as guide rollers to maintain the tape moving in a constant position spaced laterally of the sides of the casing 14.

The tape 10 has the contour of its side 28 shaped to correspond with the altitude flying requirement of an airplane between certain points. The tape likewise has its other side 29 shaped to correspond with the theoretical ideal course between the two points being flown by the airplane and which course may or may not be in a straight line. As shown in Figs. 2 and 5, the side 28 may be formed with projected portions or recessed areas designed to control the elevators 30 of an airplane tail assembly 31 for causing the plane to be raised or lowered corresponding with the contour of the earth's surface. The side 29 is similarly formed with recessed or projected areas in a manner to control the rudder 32 of the tail assembly 31 in a manner to cause the plane to fly to the right or left of a given point.

The top face of the tape 10 is also imprinted with data 33 which will facilitate the continuous checking of the route of the plane giving the proper altitude, time schedule and other information which will be available to be checked by the pilot to determine whether or not the plane is meeting proper requirements to avoid accidents. The data 33 will be visible through an opening 34 formed in the top face of the casing 14. This opening is closed by a glass 35 having a hairline 36 which is adapted to be aligned with the data 33 in a proper relationship to the movement of the plane.

A magnifying glass 37 is mounted over the openings 34 and is provided for the purpose of enlarging the information aligned with the hairline 36 so as to be easily visible to the pilot.

An electric clock mechanism 38 is mounted within the casing 14 and has a rotative shaft 39 extended therefrom and above the tape 10 and rotatively supported in brackets 40. A similar shaft 41 is mounted beneath the tape 10 at a position directly below the shaft 39 and has its ends also rotatively supported in brackets 40. Sprocket wheels 42 are mounted upon the shafts 39 and 41. The topmost sprocket wheel 42 has projecting teeth 43 which pass through a central line of sprocket openings 44 formed in the tape 10 to engage recesses 45 formed in the periphery of the lowermost sprocket wheel 42. The line of openings 44 are formed at a point between the lines of openings 22. The clock control mechanism 38 is geared to feed the tape 10 at the rate of one inch for each mile flown. As the clock mechanism 38 feeds the tape 10 the spring motor 15 will wind it upon the left hand spool 11. The clock mechanism 38 has an extended knob 46 in alignment with the door 18. This knob 46 may be pulled out to the position indicated by the dot and dash lines 46' to declutch the clock mechanism 38 from the shaft 39 so that it may be rotated by hand through the medium of the knob 46, permitting the pilot to advance the tape or retract the tape in the event the plane is flying at a greater or lesser speed than the tape 10 is being advanced. Then the pilot must disregard the "time" inscription on the tape, during the remainder of the particular trip.

The movement of the tape relative to the movement of the airplane is determined by noting cities over which the plane is flying, and then checking with the tape to determine whether the same portion of the tape is aligned with the hairline 36. If this is not the case the position of the tape must be adjusted to align the proper portion of the tape with the area over which the plane is flying.

The interior of the airplane, which is not shown on the drawings, is provided with a stick 47 which extends vertically and is provided at its bottom end with an outwardly extending shaft 48 rotatively supported in brackets 49 fixedly mounted within the airplane. The shaft 48 carries plates 50 to which cables 51 are attached. More specifically, the cables at one of their ends are attached to the plates 50 and the other of their ends attached to lugs 52 mounted on the top and bottom faces of the elevators 30 for causing the elevators to be pivoted upwards or downwards as the stick 47 is pivoted forwards and rearwards. The top portion of the stick rotatively supports a shaft 53 which is provided at one end with a large handle 54 by which the shaft 53 may be manually turned. The inner end of the shaft 53 carries a pulley 55 over which the central portion of a cable 56 extends. The free ends of the cable 56 are attached to lugs 57 mounted on the sides of the rudder 32 for causing the rudder to be turned to the right or the left, depending upon the direction in which the handle 54 is turned.

Means is provided in connection with the altitude control side 28 of the tape 10 for moving the elevators 30 to control the altitude at which the

airplane will fly. This means comprises a lever 58 which is pivotally mounted intermediate of its ends upon a bracket 59 mounted within the casing 14. One end of the lever 58 rotatively supports a roller 60 which engages the altitude control supply side 28 of the tape 10 and pressed thereaginst by a spring 58a. The roller 60 is provided with large flanges 60a which engage the top and bottom faces of the tape 10 and assist in stiffening the tape transversely so that the contour of the side will cause the lever 58 to be pivoted as the tape 10 is drawn past the rollers 60. The rollers 60 will merely roll along the edge of the tape. The other end of the lever 58 is provided with a metallic tip 61 which is insulated from the remainder of the lever 58. This tip operates across a rheostat 62 mounted within the casing 14. The rheostat 62 is in a circuit 63 including a source of power not shown, and the winding 64 of an electro-magnet or solenoid 65. The electro-magnet or solenoid 65 is mounted within a casing 66 mounted on the side of the control stick 47. The solenoid 65 has a core 67 which is urged into the neutral position shown in Fig. 8 by means of a spring 68. The spring 68 operates between a collar 69 mounted on the core 67 and a fixed portion 70 of the casing 66.

The bottom of the end of the control stick 47 is fixedly attached to a tube 71 by means of pins 72. The shaft 48 carrying the plates 50 is extended through the tube 71. A casing 73 is fixedly attached on one end of the tube 71 by means of pins 73'. The interior of the casing 73 is provided with an electric motor 74 including a reversing switch 75. The reversing switch 75 is adapted to be manually closed in one direction so that the passage of current through the closed switch 75 in one direction or the other may be controlled by a master control switch to be hereinafter set forth. It is intended that the switch 75 be used merely for testing purposes for reversing the flow of current in the motor 74 only when the master control is closed. The electric motor 74 drives a transmission system 76 which ends in a bevel gear 77. The bevel gear 77 in turn meshes with a second bevel gear 78 mounted upon a shaft 79 rotatively supported in a bracket 80 fixed to one wall of the casing 73. The shaft 79 also carries a worm pinion 81 meshing with a large worm gear 82 fixedly mounted on a portion of the shaft 48. A master control is provided for controlling the flow of current through the normally closed reversing switch 75 to cause the motor 74 to be rotated in one direction or other to rotate the shaft 48 in one direction or the other independently of the tube 71 and control stick 47 for permitting the tape 10 to control movements of the elevators 30.

The core 67 of the solenoid 65 is provided at its bottom end with a projected portion of insulation material upon which four contacts 83, 84, 85 and 86 are mounted at a given angular position above the bottom end thereof. A second set of four contacts 87, 88, 89 and 90 are mounted on the bottom portion of the insulated part of the core 67 at a different angular position from the first set of four contacts. These contacts form a portion of the master control for causing the reversing of the motor 74. The bottom end of the core 67 is projected into the top end of a tube 91. The tube 91 is also constructed of insulation material and is provided with a pair of spaced contacts 92 and 93. The contact 92 is adapted to engage against the contacts 83 and 84, and the contact 93 is adapted to engage across the contacts 85 and 86. These contacts 92 and 93 are normally positioned adjacent the bottom ends of the contacts 83, 84, 85 and 86 and will only engage these contacts when the core 67 moves downwards relative to the tube 91. At a different angular position the tube 91 is provided with contacts 94 and 95. The contact 94 is adapted to engage across the contacts 88 and 89, while the contact 95 is adapted to engage across the contacts 87 and 90. These contacts 94 and 95 are mounted above the contacts 87, 88, 89 and 90 and will engage these contacts only when the core 67 of the solenoid 65 moves upwards relative to the tube 91. It is to be understood that the contacts 83, 84, 85, 86, 87, 88, 89 and 90 are mounted in a circuit 96 including the reversing switch 75, the motor 74 and a source of power not shown, for causing the reversing switch 75 to be thrown to the right or left to reverse the movement of the electric currents through the motor 74 and cause it to rotate in one direction or the other.

In connection with the master control it is pointed out that in Fig. 13 the bottom end of the core 67 has been developed to clearly illustrate the two sets of four contacts each. Similarly, the top end of the tube 91 has been developed and separated, as illustrated by the dot and dash arrow lines 97, bringing the contacts 92, 93, 94 and 95 into clear view on opposite sides of the two sets of four contacts each. It is believed that this will serve to clearly illustrate that the contacts 92, 93, 94 and 95 are normally disposed between the adjacent ends of the two sets of four contacts each with the contacts 92 and 93 serving to close the top set of contacts, while the contacts 94 and 95 serve to close the bottom set of contacts with the contact 95 engaging on the contacts 87 and 90.

The tube 91 is slidably supported within the interior of the casing 66. More specifically, the tube 91 is formed at one side with a radially extending flange 98 formed with an elongated vertical slot 99. A bracket 100 is mounted within the casing 66 and attached to one wall thereof by means of pins 101. The free end of the bracket 100 is bifurcated and has its arms extending along the faces of the flange 98. Pins 102 are extended between the arms of the bifurcated end of the bracket 100 and pass through the vertical slot 99 permitting the tube 91 to be moved vertically upwards and downwards.

Means is provided for moving the tube 91 in the direction in which the core 67 of the solenoid 65 moves causing the contacts 92, 93, 94 and 95 to mimic the movements of the contacts 83 to 90. This means comprises rack teeth 103 formed on one side of the tube 91 and which are engaged by a small pinion 104 rotatably supported upon a shaft 105 supported in a bracket 106 attached to a wall of the casing 66. A flexible drive shaft 107 has one of its ends attached to the shaft 105. The free end of the flexible shaft 107 is projected from the casing 66 and into the casing 73 and is attached to the end of the shaft 79 which supports the double gear 78. Thus when the motor 74 rotates the worm pinion 81, to rotate the shaft 48, the flexible shaft 107 will transmit these rotations to the gear 104 to move the tube 91 either up or down, depending upon the direction in which the motor 74 is turning.

The operation of this device for raising the airplane is as follows:

As the tape 10 advances, if the altitude control side of the tape 28 has either a projection or recess it will cause the lever 58 to be pivoted in one direction or the other to move the metallic

tip across the rheostat 62. This movement of the tip 61 will cause more or less electrical current to be fed to the winding 64 of the solenoid 65. For the sake of this description, let us assume that the tip 61 moved downwards on the rheostat 62 in Fig. 13. This will cause the core 67 of the solenoid 65 to move upwards, causing the contacts 94 and 95 to engage the contacts 87, 88, 89 and 90 as hereinbefore described, to complete the circuit 96 and cause the current to pass through the reversing swtich 75 in one direction to rotate the motor 74 to turn the shaft 48 and move the elevators 30 upwards to raise the airplane. Simultaneously rotations of the motor 74 will be transmitted to the small gear 104 through the medium of the flexible shaft 107 and raise the tube 91 to a position in which the contacts 94 and 95 will disengage the contacts 87 to 90 causing the contacts 92, 93, 94 and 95 to assume a normal position between the contacts 83 to 86 and the contacts 87 to 90 in the raised position of the core 67.

As the roller 60 moves downwards along the other side of the projection which caused the tip 61 to move downwards on the rheostat, the lever 54 will pivot in the other direction and move upwards on the rheostat 62. This will supply a lesser quantity of electricity to the winding 64 of the solenoid 65. This will free the core 67 of the solenoid 65 to be pulled downwards by the spring 68. This downward movement will cause the contacts 83 to 86 to be engaged by the contacts 92 to 93, completing the circuit 96 and causing the current to move through the reversing switch 75 in the opposite direction and causing the motor 74 to rotate in the direction opposite to which it previously rotated and turn the shaft 48 back to its starting position and lower the elevators 30, causing the plane to level off at the new altitude. The new rotative motion of the motor 74 will influence the gear 104 through the medium of the flexible shaft 107 and move the tube 91 downwards, causing the contacts 92, 93, 94 and 95 to again assume a neutral position between the contacts 83 to 86 and 87 to 90, breaking the circuit and stopping the motor 97.

The plane will now be at its new elevation and it is to be understood that the operation of the altitude control mechanism is identical for lowering the airplane, except for the fact that the tape will be formed with a recess engaged by the roller 60 instead of the projection previously described.

Means is also provided for automatically controlling the rudder 32 of the plane controlled by the course side 29 of the tape 10. This mechanism is schematically illustrated in Fig. 14.

The course controlling means includes a lever 110 pivotally supported on a bracket 111 mounted within the casing 14. One end of the lever 110 is provided with a roller 112 having large flanges which engage the top and bottom faces of the course side 29 of the tape 10 and pressed thereagainst by a spring 110a. The opposite end of the lever 110 is provided with an insulated metallic tip 113 which operates across a rheostat 114 fixedly mounted within the casing 14. This rheostat 114 is mounted in a circuit 115, including a source of power, not shown on the drawings, and the windings 116 of a solenoid 117. The solenoid 117 is also mounted within the casing 60 mounted on the side of the control stick 47. The solenoid 117 has a metallic core 118 provided with a collar 119. A contraction spring 120 operates between the collar 119 at a fixed point 121 of the casing 16 to pull the core 118 downwards relative to the winding 115.

The bottom end of the core 118 continues into a bottom portion of insulation material provided with four contacts 122, 123, 124 and 125 at a different angular position and beneath the contacts 122 to 125 the bottom insulated portion is formed with a set of contacts 126, 127, 128 and 129. These contacts 122 to 129 comprise a master control mounted in a circuit 130 for controlling the reversing switch 131 of an electric motor 132. In Fig. 14 the bottom end of the insulation portion of the core 118 of the solenoid 117 is developed to clearly illustrate the relationship between the contacts 122 to 129.

A tube 133 of insulation material engages the bottom end of the insulation portion of the core 118 of the solenoid 117. The top portion of the tube 133 is formed with spaced contacts 134 and 135. These contacts 134 and 135 are adapted to engage the contacts 122 to 125. More specifically, when the core 118 is moved downwards as will be hereinafter described, the contact 134 will engage the contacts 122 and 123, while the contact 135 will engage the contacts 124 and 125. This will cause the reversing switch 131 to be closed to cause the electric current to move through the field of the motor 132 in one direction. The opposite side of the top portion of the tube 133 is formed with contacts 136 and 137. The contacts 136 and 137 are adapted to engage the contacts 126 to 129 when the core 118 moves upwards. More specifically, the contacts 136 will engage the contacts 127 and 128 and the contact 137 will engage the contacts 126 and 129. This will cause the reversing switch 131 to be closed in the opposite direction, causing the current to move through the field of the motor 132 in the opposite direction, reversing the rotation of the motor.

In Fig. 14 the top end of the tube 133 has been developed and split into two parts which are shown on opposite sides of the developed bottom end of the core 118, as illustrated by the dot and dash arrows 138. This is done merely for illustrative purposes, and it is believed that it will assist in clearly illustrating which contacts engage the contacts 122 to 125 and which contacts engage the contacts 126 to 129.

The pulley wheel 55 over which the cable 56 extends is mounted fixedly upon a tube 139 which rotatively engages the free end of the shaft 53 which carries the handle 54. A casing 140 is fixedly mounted on the shaft 53 by means of a pin 141 and rotatively engages about the inner end of the tube 139. The inner end of the tube 139 within the casing 140 is provided with a worm gear 142 engaged by a worm pinion 143, fixedly attached to a shaft 144 rotatively supported in a bracket 145 mounted on the wall of the casing 140. One end of the shaft 144 carries a bevel gear 146. This bevel gear 146 meshes with a second bevel gear 147 mounted on a shaft 148. This shaft 148 extends from a transmission system 149 adapted to be rotated by the motor 132. The motor 132 is fixedly attached between a portion of the shaft 53 and the casing 140 within the casing 140.

The worm gears 142 and 143 serve to lock the tubular shaft 139 to the shaft 53 so that when the handle 54 is rotated to turn the shaft 53, the tube 139 will move therewith and pull on the cable 56 to turn the rudder 32 of the tail

assembly 31 to the right or the left, depending upon the direction in which the handle 54 is turned. This will influence the course of the airplane causing it to turn either to the left or the right. By the same token, when the motor 132 is energized and caused to rotate in one direction or the other, the worm pinion 146 will turn the worm gear 142 and turn the tubular shaft 139 relative to the shaft 53, which will remain stationary. Movement of the tube 139 will rotate the pulley wheel 55 and also pull on the cable 56, turning the rudder 32 either to the right or the left.

One side of the tube 133 is provided with a radially extended flange 150 formed with a vertically elongated slot 151. A bracket 152 is attached to one wall of the casing 66 and has a bifurated end with its arms engaging opposite faces of the flange 150. Pins 153 pass through the arms of the bifurcated end of the bracket 152 and through the slot 151 for slidably supporting the tube 133 to move vertically. The bracket is attached to the wall of the casing 66 by means of pins 154.

Means is provided for moving the tube 133 to mimic the movements core 118 of the solenoid 117 and break the circuit 130 to the motor 132 after the rudder 32 has been moved the desired distance to change the course of the plane. This means is characterized by rack teeth 155 formed on a side of the tube 133 opposed to the flange 150. These rack teeth 155 are engaged by a small pinion 156 which is fixedly attached to a shaft mounted in a bracket 157. A flexible shaft 158 extends from the shaft supporting the pinion 156 and connects with the shaft 144 supporting the worm pinion 146. Thus as the motor 132 rotates in one direction or the other the flexible shaft 158 will be similarly rotated to raise and lower the tube 153 as the solenoid 18 is raised and lowered to cause the contacts 134, 135, 136 and 137 to assume a position between the adjacent ends of the two sets of four contacts each.

The operation of the course guiding mechanism is as follows:

As the tape 10 advances the roller 112 will roll along the edge thereof and cause the lever 110 to be pivoted as the roller engages projections and recesses on the course guiding side 29 of the tape 10. Movement of the lever 110 will cause the metallic tip 113 to move across the rheostat 114 and advance the circuit 115, energizing the winding 116 of the solenoid 117 in direct relation to the movement of the tip relative to the rheostat. This will raise or lower the solenoid 118 similar to the solenoid 67 in the altitude controlling mechanism in Fig. 13, to cause the contacts 134, 135, 136 and 137 to engage the respective sets of contacts, depending upon the direction in which the core 118 moves. This will control the passage of the electric current through the reversing switch 131 and cause the motor 132 to rotate in one direction or the other to rotate the pulley 55 and pull upon the cable 56 to turn the rudder 32 either to the right or the left independently of the handle 54. As the motor 132 rotates in one direction or the other the flexible shaft 158 will be similarly rotated, rotating the pinion 156, raising or lowering the tube, depending on the direction in which the motor 132 is rotating. However, if the core 118 moves upwards the tube 133 will also move upwards, and vice versa. This will cause the contacts 134, 135, 136 and 137 to be similarly moved and assume their positions between the sets of contacts 122 to 125 and 126 to 129. This will break the circuit 130 and stop the motor 132.

The rudder will remain as directed until the roller 112 moves over its respective projection or out of its respective recess, causing the metallic tip 113 to be moved back to its normal position and again moving the solenoid 118 in a direction opposite to the direction in which it previously moved to again close the circuit 130 and cause the current to move in the opposite direction through the reversing switch 131 and rotate the motor 132 in the opposite direction and bring the rudder 32 back to its normal rearwardly extended position.

It will be noted that the control stick 47 or the handle 54 may be manually operated independently of the automatic control mechanism and similarly, the automatic control mechanism may function independently of any manual operation to cause the elevators 30 and rudder 32 to be pivoted as controlled by the sides of the tape 10 to influence the course of the airplane and prevent accidents which sometimes occur during blind flying.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and the right is reserved to all changes and modifications coming within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points and the contour of its other side shaped to correspond with the theoretically ideal course between the two points which may or may not be in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said first means, comprising a pivotally mounted lever having a roller at one end engaging the altitude control side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat to move across said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's elevators, a solenoid for throwing said control switch in one direction or the other for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and move said elevators up or down, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch.

2. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points

and the contour of its other side shaped to correspond with the theoretically ideal course between the two points which may or may not be in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said first means, comprising a pivotally mounted lever having a roller at one end engaging the altitude control side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat to move across said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's elevators, a solenoid for throwing said control switch in one direction or the other for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and move said elevators up or down, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch, said master control circuit comprising said master control switch, said motor and a source of power connected together in series.

3. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points and the contour of its other side shaped to correspond with the theoretically ideal course between the two points which may or may not be in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said first means, comprising a pivotally mounted lever having a roller at one end engaging the altitude control side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat to move across said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's elevators, a solenoid for throwing said control switch in one direction or the other for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and move said elevators up or down, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch, said master control circuit, comprising said master control switch, said motor and a source of power connected together in series, and a manually controllable reversing switch connected in said master control circuit and normally closed in one direction to be used when desired to manually control the flow of current through said motor independent of said master control switch for testing purposes.

4. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points and the contour of its other side shaped to correspond with the theoretically ideal course between the two points which may or may not be in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said latter means, comprising a pivotally mounted lever having a roller at one end engaging the course side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's rudder, a solenoid for throwing said control switch in one direction or the other for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and turn said rudder to the left or right, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch.

5. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points and the contour of its other side shaped to correspond with the theoretically ideal course between two points which may or may not be in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said latter means, comprising a pivotally mounted lever having a roller at one end engaging the course side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's rudder, a solenoid for throwing said control switch in one direction or the other and for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and turn said rudder to the left or right, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch, said master control circuit, comprising said master control switch, said motor and a source of power connected together in series.

6. An automatic airplane raising and guiding device having a tape which flexes so that it may be wound and unwound from spools and which is rigid transversely with the contour of one side shaped to correspond with the altitude flying requirements of a plane between certain points and the contour of its other side shaped to correspond with the theoretically ideal course between the two points which may or may not be

in a straight line, time controlled means for driving the tape in proportion to the flying schedule of the airplane, means for automatically controlling the elevators of said airplane from the altitude control side of said tape, and means for automatically controlling the rudder of said airplane from the course side of said tape, said latter means, comprising a pivotally mounted lever having a roller at one end engaging the course side of said tape, a rheostat, a metallic tip formed on the other end of said lever and engaging said rheostat as said arm is pivoted in one direction or the other by said tape, a master control circuit including a master control switch of an electric motor connected with the plane's rudder, a solenoid for throwing said control switch in one direction or the other for reversing the flow of current through the electric motor to rotate said motor in one direction or the other and turn said rudder to the left or right, and an electric circuit including said tip, rheostat, solenoid and source of power for energizing or de-energizing said solenoid to influence the movements of said master control switch, said master control circuit, comprising said master control switch, said motor and a source of power connected together in series, and a manually controllable reversing switch connected in said master control circuit and normally closed in one direction to be used when desired to manually control the flow of current through said motor independently of said master control switch for testing purposes.

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