April 17, 1945. G. E. BARNHART 2,373,990

GUN CONTROL APPARATUS

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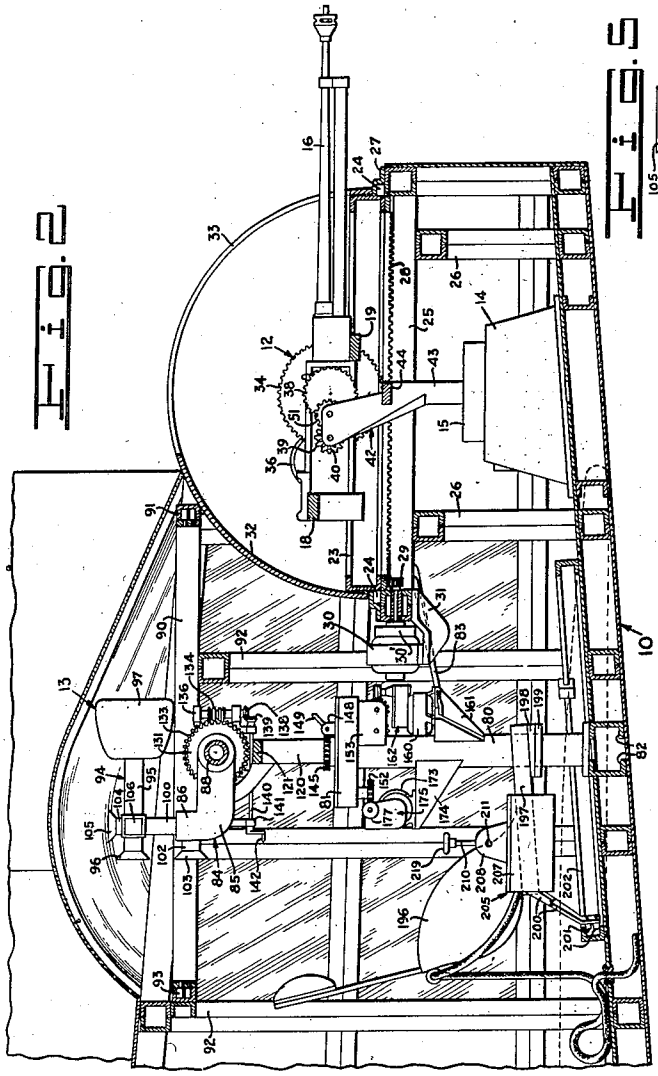

Fig. 2

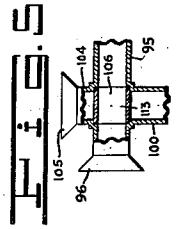

Fig. 5

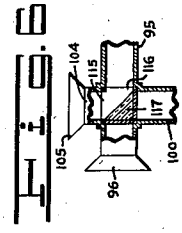

Fig. 6

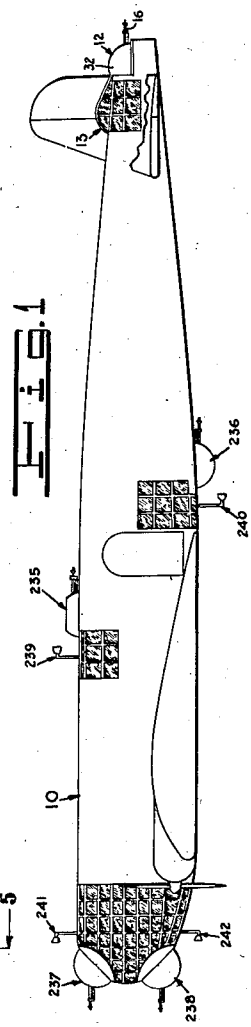

Fig. 1

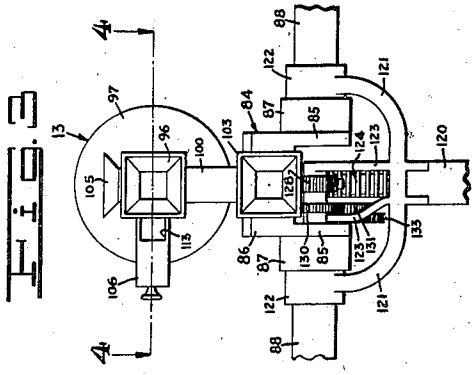

Fig. 3

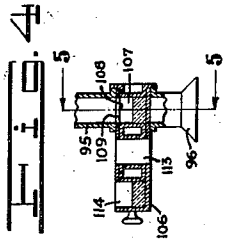

Fig. 4

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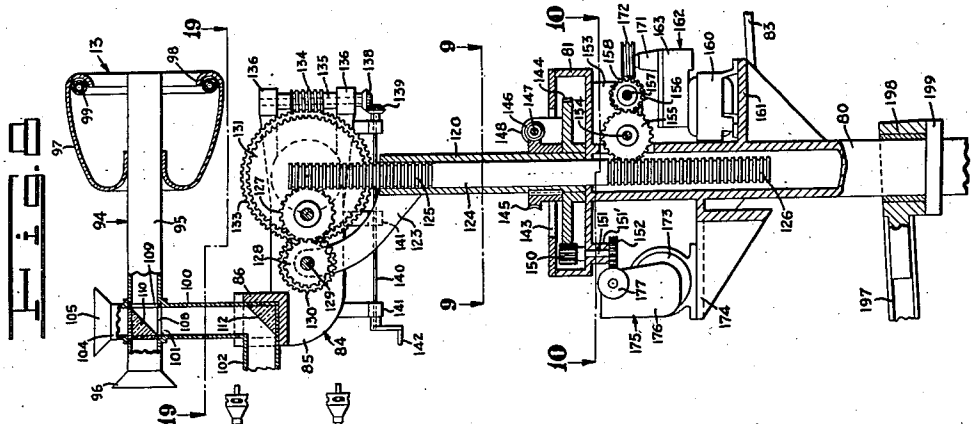

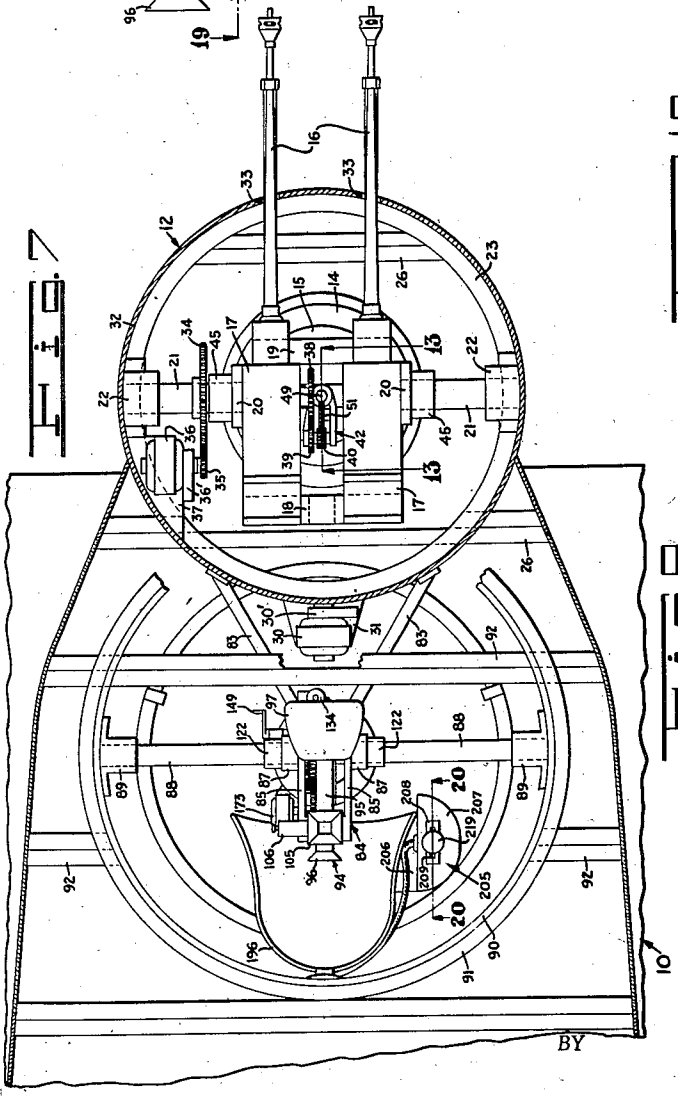

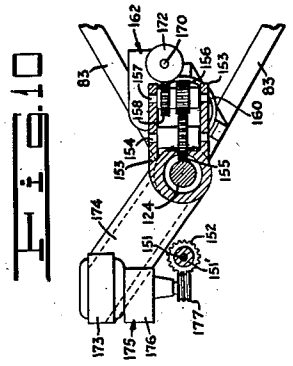

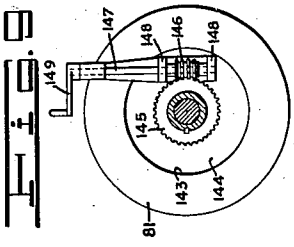

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FIG. 11

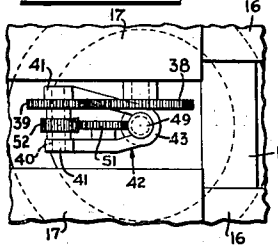


FIG. 12

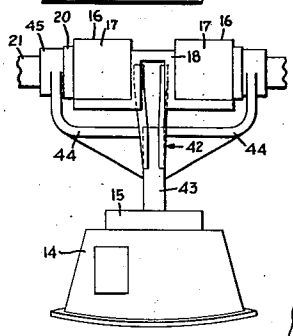


FIG. 13

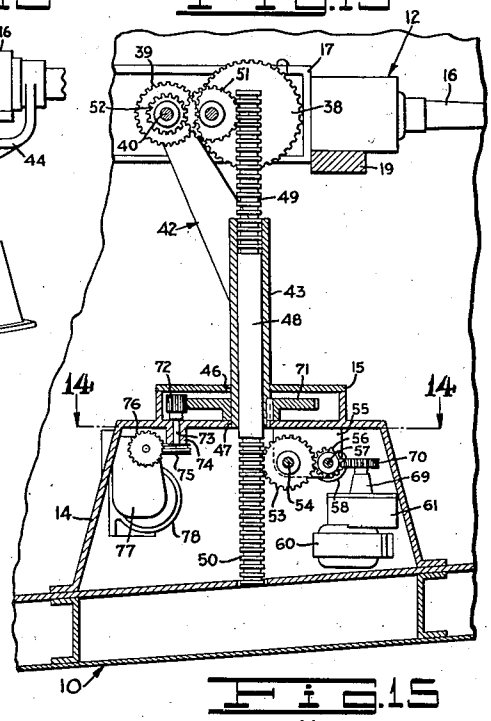


FIG. 14

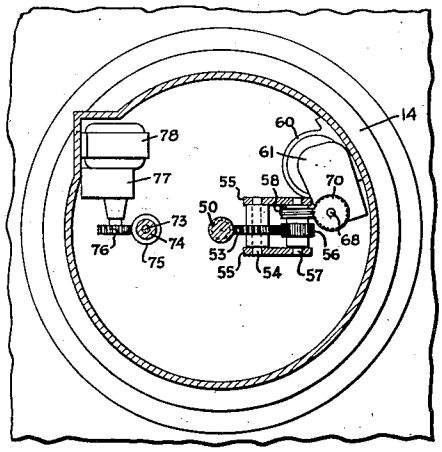


FIG. 15

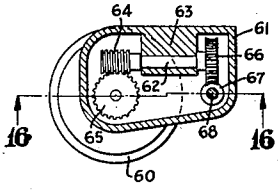


FIG. 19

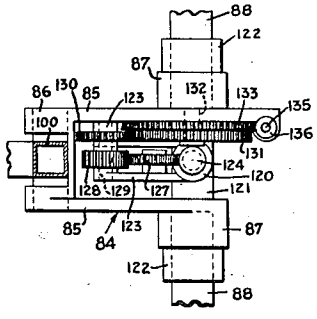


FIG. 17

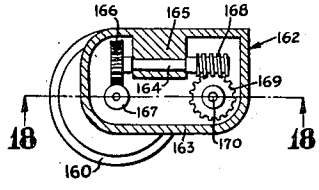


FIG. 16

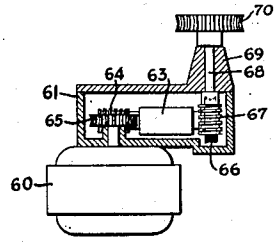
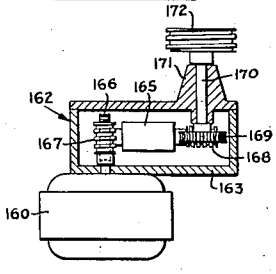


FIG. 18



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B. J. Craig.

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FIG. 20

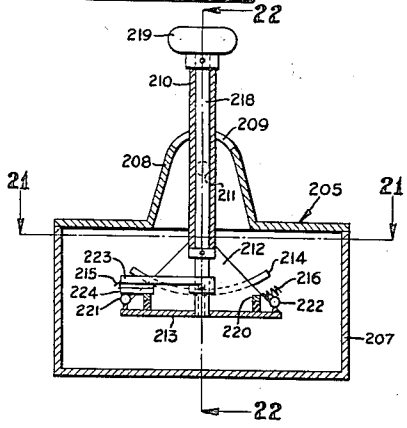


FIG. 21

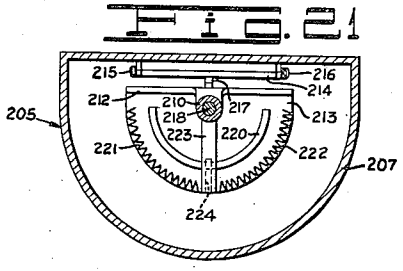


FIG. 22

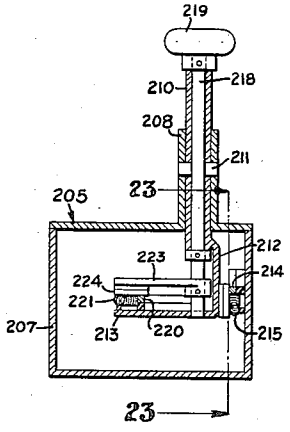


FIG. 23

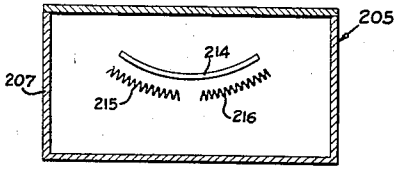


FIG. 24

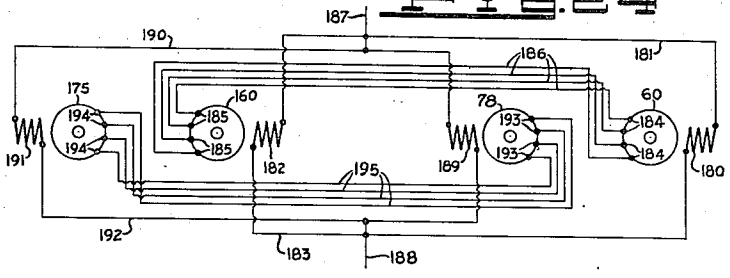
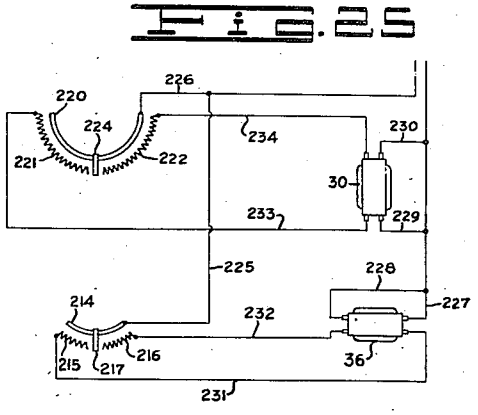


FIG. 25



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Patented Apr. 17, 1945 2,373,990

UNITED STATES PATENT OFFICE

2,373,990

GUN CONTROL APPARATUS

George E. Barnhart, Pasadena, Calif.

Application January 3, 1941, Serial No. 372,958

6 Claims. (Cl. 89—41)

This invention relates to gun control apparatus.

The general object of my invention is to provide an improved machine gun operating mechanism and sighting device.

A more specific object of the invention is to provide a novel gun mechanism and sight mechanism remote therefrom and synchronized therewith.

Another object of the invention is to provide a novel gun mechanism and sighting device which is remote therefrom and is operated by the movement of the gun.

A further object of the invention is to provide a remotely controlled gun mechanism and a sight device remote therefrom and operated by the movements of the gun mechanism.

Other objects and the advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side elevation of an airplane including the features of my invention.

Fig. 2 is an enlarged fragmentary longitudinal section through the tail portion of the airplane shown in Fig. 1, showing one of my devices.

Fig. 3 is a fragmentary rear view of the sight device shown in Fig. 2.

Fig. 4 is a fragmentary section taken on line 4—4 of Fig. 3.

Fig. 5 is a fragmentary section taken on line 5—5 of Fig. 4 showing the slide device moved to a straight through viewing position.

Fig. 6 is a view similar to Fig. 5 showing the slide device moved to a position to view through the top eye aperture.

Fig. 7 is a fragmentary top plan section through a portion of the airplane shown in Fig. 1 with portions thereof broken away.

Fig. 8 is a fragmentary longitudinal central section through the sight mechanism.

Fig. 9 is a section taken on line 9—9 of Fig. 8.

Fig. 10 is a section taken on line 10—10 of Fig. 8.

Fig. 11 is an enlarged fragmentary top plan view of the gun mechanism shown in Fig. 2.

Fig. 12 is a fragmentary rear view of the gun mechanism shown in Fig. 2.

Fig. 13 is an enlarged fragmentary section taken on line 13—13 of Fig. 7.

Fig. 14 is a section taken on line 14—14 of Fig. 13.

Fig. 15 is an enlarged top plane view of one of the machine gun "Selsyn" motors showing the gear housing in section.

Fig. 16 is a section taken on line 16—16 of Fig. 15.

Fig. 17 is a view similar to Fig. 15 of one of the "Selsyn" motors of the sight mechanism.

Fig. 18 is a section on line 18—18 of Fig. 17.

Fig. 19 is a fragmentary section taken on line 19—19 of Fig. 8.

Fig. 20 is an enlarged section taken on line 20—20 of Fig. 7.

Fig. 21 is a section taken on line 21—21 of Fig. 20.

Fig. 22 is a section taken on line 22—22 of Fig. 20.

Fig. 23 is a section taken on line 23—23 of Fig. 22.

Fig. 24 is a diagram showing the electrical connections between the "Selsyn" motors, and

Fig. 25 is a diagram showing the electrical connections between the drive motors and the controlling switch mechanism.

Referring to the drawings by reference characters, I have shown an airplane 10 having thereon a plurality of my improved gun mechanisms and sight devices therefor. In the accompanying drawings, I have shown the tail gun mechanism which is indicated generally at 12 and the accompanying sight mechanism which is indicated generally at 13.

The gun mechanism 12 includes a base housing member 14 having a chamber portion 15 on the top thereof.

Above the housing 14 I provide a pair of spaced guns 16 which adjacent the rear of the body portions thereof, are connected together by a stirrup member 18 (see Fig. 12) and adjacent the front of the body portion are connected by a bar 19 (Fig. 7). The outer sides of each of the gun bodies 17 has a boss 20 thereon in which a shaft member 21 is secured. The outer ends of each of the shafts 21 are pivotly mounted in bearing members 22 which are secured to a circular frame 23.

The frame 23 has a plurality of rollers 24 equally spaced therearound which are supported on a circular track 25 which is supported by suitable frame members 26. The rollers 24 are retained in engagement with the track 25 by a clasp ring 27 suitably secured to the track.

The circular frame 23 has a circular gear-toothed rack 28 on the under face thereof which is engaged by a gear 29, which is driven by an electric motor 30 through a built in gear reduction device 30'. The motor 30 is shown as mounted on a bracket 31 secured to the track 25.

Mounted on the frame 23 I provide a hemispherical metal shield 32 over the guns 16 which has a pair of slots 33 therein through which the

gun barrels project. When the motor 30 operates the gear 29 through the medium of the rack 28 rotates the frame 23 and thereby swings the guns 16 about a vertical axis.

Mounted on one of the shafts 21 I provide a gear 34 which meshes with a gear 35 which is driven by an electric motor 36 through a built in gear reduction drive 36'. The motor 36 is shown as mounted on a bracket 37 secured to the frame 23. When the motor 36 operates it, through the medium of the gears 34 and 35 rotates the shafts 21 and swings the guns 16 about a horizontal axis.

Between the gun bodies 17 one of the bodies has a gear 38 secured thereto which meshes with a reduced gear 39 on a shaft 40 which is rotatably mounted in spaced bearing portions 41 of a bracket member 42. The bracket member 42 includes a hollow vertical sleeve 43 having oppositely extending arms 44 (Fig. 12) thereon each of which includes a bearing portion 45 surrounding one of the shafts 21 to support the bracket. The sleeve portion 43 of the bracket extends into the base chamber 15 through an aperture 46 in the top thereof and is positioned in an aperture 47 in the top of the base housing 14.

Positioned in the sleeve 43 I provide a vertically reciprocating rod 48 which includes a circular geartoothed rack portion 49 adjacent the upper end and a similar geartoothed rack portion 50 adjacent the lower end. Rotatably mounted on the bracket 42 I provide an idler gear 51 which meshes with a gear 52 on the shaft 40.

Thus when the guns 16 are moved about their horizontal axis as previously described, the gear 38 rotates the gear 39 and the gear 39 rotates the shaft 40 which in turn rotates the gear 52 which rotates the idler gear 51 which in turn through the medium of the rack portion 49 moves the rod 48 vertically.

The lower rack portion 50 of the rod 48 is engaged by a gear 53 on a shaft 54 which is rotatably supported in spaced flanges 55 integral with the housing 14. The gear 53 meshes with a gear 56 on a shaft 57 which is rotatably supported by the flanges 55 and has a worm pinion 58 thereon.

Within the housing 14 adjacent the flanges 55 I provide a "Selsyn" motor 60 having a gear reduction housing 61 thereon.

As shown in Figs. 15 and 16 within the housing 61 I provide a shaft 62 rotatably mounted in a bearing portion 63. Mounted on one end of the shaft 62 I provide a worm pinion 64 which meshes with a worm gear 65 on the armature shaft of the "Selsyn" motor 60. Mounted on the opposite end of the shaft 62 I provide a worm gear 66 which meshes with a worm pinion 67 on a shaft 68 which is rotatably mounted in a bearing portion 69. Exterior to the housing 61 the shaft has a worm gear 70 thereon which meshes with the worm pinion 58.

Thus when the rod 48 is moved vertically as previously described the gear train consisting of the gears 53, 56 and 58 rotate the gear 70 which in turn through the medium of the shaft 68 and the gear train consisting of the gears 64, 65, 66 and 67 rotates the "Selsyn" motor 60.

Mounted on the sleeve 43 within the chamber 15 I provide a gear 71 which meshes with a gear 72 on a vertical shaft 73 rotatably mounted in a bearing portion 74 of the housing. Within the housing the shaft 73 has a worm pinion 75 thereon which meshes with a worm gear 76 of a reduction gear mechanism 77 of a "Selsyn" motor 78. The reduction gear mechanism 77 of the "Selsyn" motor 78 is the same as the reduction gear mechanism previously described in connection with the "Selsyn" motor 60 and shown in Figs. 15 and 16.

Thus when the guns 16 are moved about a vertical axis, as previously described the bracket sleeve 43 rotates the gear 71 which through the gear train consisting of the gears 72, 75 and 76 and the gear reduction mechanism 77 rotates the "Selsyn" motor 78.

The sight mechanism 13 includes a hollow vertical standard 80 having a hollow housing portion 81 thereon adjacent the upper end. The standard 80 is shown as mounted on frame portion 82 of the airplane and is braced by arms 83 secured to the track 25. Above the housing I provide a bracket member 84 which includes spaced vertical flanges 85 connected adjacent one end by a transverse holding member 86. Each of the flanges 85 has a boss 87 (Fig. 19) thereon which has a shaft 88 secured thereto. Each of the shafts 88 is rotatably mounted in a bearing member 89 (Fig. 7) mounted on a ring 90. Surrounding the ring 90 I provide an aluminum channel iron track member 91 which is suitably mounted on frame portions 92 of the airplane. The ring 90 includes a plurality of equally spaced rollers 93 (Fig. 2) therearound which are positioned in the track 90.

Mounted on the holding member 86 of the bracket 85 I provide a sight member 94 which includes a main horizontal viewing tube 95 having an eye piece 96 at one end. Adjacent the opposite end I provide a reflector member 97 which surrounds the tube 95 and is mounted thereon. The outer edge of the reflector 97 is curved inward as at 98 and has a fluorescent or other light tube 99 supported in the portion 98.

When the light tube 99 is illuminated the portion 98 reflects the rays therefrom rearward against the main body of the reflector 97 which in turn reflects them outward.

Intermediate the eye piece 96 and the reflector 97 the sight member includes a downwardly extending vertical tube 100 which communicates through an aperture 101 in the tube 95 with the interior thereof. The lower portion of the tube 100 communicates with a horizontal tube 102 having an eye piece 103 thereon. In line with the tube 100 and extending above the tube 95 the sight device includes a tube 104 which opens into the tube 95 and has an eye piece 105 thereon.

At the juncture of the tubes 95, 100 and 104 I provide a slide member 106 which adjacent one end has a chamber 107 therein with an aperture 108 opening thereinto through the bottom wall and an aperture 109 opening thereinto through the front wall and has a prism 110 therein which when the slide 106 is in the position shown in Figs. 4 and 8 directs light rays from the tube 95 downward through the tube 100. At the juncture of the tubes 100 and 102 I provide a prism 112 which directs light rays reflected from the prism 110 through the tube 102 towards the eye piece 103.

Intermediate the length thereof the slide 106 has a horizontal aperture 113 therein which when the slide 106 is moved to align it with the tube 94 as shown in Fig. 5 allows an unrestricted view through the tube 94 from the eye piece 96. Adjacent the end of the slide 106 opposite the chamber 107 I provide a chamber 114 having an aperture 115 opening thereinto through the top wall and an aperture 116 opening thereinto through the front wall and has a prism 117 therein which when the slide is moved to align the aperture 116 with the tube 94 as shown in Fig. 6 directs light

rays from the tube 94 through the tube 104 towards the eye piece 105.

Coaxial with the standard 80 and thereabove I provide a hollow sleeve member 120 which includes outwardly extending arms 121 (Fig. 3) with each arm including a bearing portion 122 surrounding the adjacent shaft 88. Adjacent the top thereof the sleeve 120 further includes rearwardly and upwardly extending spaced bracket portions 123 (see Figs. 3, 8 and 19).

Positioned in the sleeve 120 and vertically reciprocal therein I provide a rod 124 which adjacent the upper end includes a circular geartoothed rack portion 125 and adjacent the lower end includes a similar rack portion 126.

Rotatably mounted on one of the brackets 123 I provide a gear 127 which meshes with the rack portion 125 and with a gear 128 mounted on a shaft 129 which is rotatably supported by the brackets 123. Also mounted on the shaft 129 I provide a gear 130 which meshes with a gear 131 which is rotatably mounted on a stud shaft 132 secured to one of the bracket arms 85. (See Fig. 19.) Rotatably mounted on the stud shaft 132 and suitably secured to the gear 131 I provide an enlarged worm gear 133 which meshes with a vertically positioned worm pinion 134.

The worm pinion 134 is mounted on a shaft 135 which is rotatably supported in spaced bearing portions 136 integral with one of the bracket arms 85. The lower portion of the shaft 135 has a bevel gear 138 thereon which meshes with a bevel gear 139 on a horizontal shaft 140.

The shaft 140 extends rearwardly and is rotatably supported in a plurality of bearing portions 141 which are integral with one of the bracket arms 85. At the rear end thereof the shaft 140 has a hand crank 142 thereon for manually rotating it.

The lower portion of the sleeve 120 extends down into the housing 81 through an aperture 143 in the top thereof and within the housing it has a gear 144 rotatably mounted thereon. Above the gear 144 the sleeve has a worm gear 145 secured thereto which meshes with a worm pinion 146 mounted on a horizontal shaft 147 which is rotatably supported in bearing members 148 secured to the gear 144. The shaft 147 extends outwardly to one side of the device where it has a hand crank 149 thereon for manually operating it.

The gear 144 meshes with a reduced pinion gear 150 mounted on a vertical shaft 151 which is rotatably supported in a bearing portion 151' of the housing 81. Below the housing the shaft 151 has a worm gear 152 thereon. Opposite the bearing portion 151' the housing includes a pair of spaced depending flanges 153 which rotatably support a shaft 154 having a gear 155 thereon.

The gear 155 at one side meshes with the rack portion 126 of the rod 124 and at the opposite side it meshes with a gear 156 on a shaft 157 which is rotatably supported by the flanges 153'. Also mounted on the shaft 157 I provide a worm gear 158. For driving the gear 158 I provide a "Selsyn" motor 160 which is shown as mounted on a bracket portion 161 integral with the standard 80. The "Selsyn" motor 160 like the previously described "Selsyn" motor 60 includes a gear reduction mechanism 162 encased in a housing 163 and shown in detail in Figs. 17 and 18.

Within the housing 163 I provide a shaft 164 rotatably supported in a bearing portion 165 and at one end it has a worm gear 166 thereon which meshes with a worm pinion 167 on the armature shaft of the "Selsyn" motor 160. The opposite end of the shaft 164 has a worm pinion 168 thereon which meshes with a worm gear 169 on a shaft 170 which is rotatably supported in a bearing portion 171 of the housing 163. Exterior to the housing the shaft 170 has a worm pinion 172 thereon which meshes with the worm gear 152.

For driving the previously mentioned worm gear 152 I provide a "Selsyn" motor 173 which is mounted on a bracket 174 integral with the standard 80. The "Selsyn" motor 173 like the "Selsyn" motor 160 includes a gear reduction mechanism 175 encased in a housing 176 and which is similar in all respects to the previously described gear reduction mechanism 162 and includes a drive worm pinion 177 which meshes with the worm gear 152.

As shown in Fig. 24 one side of the field 180 of the "Selsyn" motor 60 is connected by a wire 181 to one side of the field 182 of the "Selsyn" motor 160 and the other sides of the fields are connected by a wire 183. The armature contacts 184 of the "Selsyn" motor 60 are connected to the armature contacts 185 of the "Selsyn" motor 160 by wires 186. Electrical power is supplied to the field wire 181 by a wire 187 from one side of a suitable source of electrical energy (not shown) and electric power from the other side of the source of power is supplied to the field wire 183 by a wire 188.

One side of the field 189 of the "Selsyn" motor 78 is connected by a wire 190 to one side of the field 191 of the "Selsyn" motor 175 and the other sides of the field are connected by a wire 192. Electrical power is supplied to the wire 190 by the wire 187 and electrical power is supplied to the wire 192 by the wire 188. The armature contacts 193 of the "Selsyn" motor 78 are connected to the armature contacts 194 of the "Selsyn" motor 175 by wires 195.

Thus it will be seen that when the "Selsyn" motor 60 is operated by movement about a horizontal axis of the guns 16 as previously described it will operate the "Selsyn" motor 160 of the sight mechanism and likewise when the "Selsyn" motor 78 is operated by movement about a horizontal axis of the guns 16 it will operate the "Selsyn" motor 175 of the sight device.

When the "Selsyn" motor 160 is operated the worm pinion 172 thereof drives the worm gear 158 which through the medium of the shaft 157, gear 156 and gear 155 through the medium of the rack 126 moves the rod 124 vertically.

As the rod 124 is thus moved it, through the medium of the rack 125, rotates the gear 127 which in turn rotates the gear 128 and through the shaft 129 rotates the gear 130. The gear 130 rotates the gear 131 and the worm gear 133 rotates therewith. As the worm gear 133 is thus rotated it, through engagement with the worm pinion, swings the bracket 84 vertically.

To compensate for the vertical parallax between the guns and the sight mechanism the operator may rotate the hand crank 142 to rotate the worm pinion 134 which when rotated will travel around the worm gear 133 to move the bracket 84 up or down depending on which way is necessary. To compensate for the horizontal parallax between the guns and the sight mechanism the operator may rotate the hand crank 149 to rotate the worm pinion 146 which when rotated will rotate the worm gear 145 and therethrough the sleeve 120.

When the "Selsyn" motor 175 is operated the worm pinion 177 thereof drives the worm gear 152 which through the medium of the shaft 151

drives the pinion gear 150 which in turn rotates the gear 144. When the gear 144 is rotated it through the medium of the worm pinion 146 mounted thereon moves the worm gear 145 with it which in turn rotates the sleeve 120 about the axis of the rod 124. As the sleeve 120 is thus rotated it through the medium of the arms 121 swings the shafts 88 and therethrough rotates the bracket 86 horizontally about the axis of the rod 124.

Adjacent the standard 80 I provide an operator's seat 196 mounted on an arm 197 which includes a bearing portion 198 surrounding the standard 80 and supported on a flange 199 integral with the standard. Opposite the arm 197 the seat 196 includes a pair of spaced legs 200 each having upper and lower rollers 201 thereon which are positioned in a channel iron track 202.

For operating the electric drive motors 30 and 36 I provide a switch mechanism which is indicated generally at 205 and shown as mounted on a bracket 206 (see Fig. 7) secured to the seat 196. As shown the switch mechanism 205 (Figs. 20–23) includes an enclosed housing 207 having an upwardly projecting hollow neck 208 having a slot 209 therein. Positioned in the slot 209 I provide a hollow sleeve 210 which is pivotly secured to the neck 208 as at 211. Extending downwardly from the sleeve 210 I provide an arm portion 212 which terminates in a right angularly bent flange portion 213. Mounted on the wall of the housing adjacent the arm 212 and suitably insulated therefrom I provide an electrical arcuate contact track 214 and adjacent the track 214 I provide a pair of spaced rheostat coils 215 and 216.

On the arm 212 and suitably insulated therefrom I provide a contact bar 217 which is adapted to bridge between the contact track 214 and either of the rheostat coils 215 and 216. Positioned in the sleeve 210 and rotatable therein I provide a shaft 218 having an operating handle 219 thereon above the sleeve.

Mounted on the flange 213 and suitably insulated therefrom I provide an arcuate electrical contact track 220 and adjacent the track I provide a pair of spaced rheostat coils 221 and 222. Mounted on the shaft 218 within the housing 207 I provide an arm 223 having an electrical contact bar 224 thereon and suitably insulated therefrom. The contact bar 224 is adapted to bridge between the contact track 220 and either of the rheostat coils 221 and 222.

As shown in the diagram in Fig. 25 the contact track 214 is connected by a wire 225 to one side of a suitable source of electrical energy (not shown) and the contact track 220 is connected by a wire 226 to the wire 225.

The other side of the source of electrical energy is connected by a wire to one side of one field of the reversible motor 36 by a wire 227 and to one side of the other field by a wire 228. One side of one field of the reversible motor 30 is connected by a wire 229 to the wire 227 and one side of the other field is connected by a wire 230 to the wire 227. One end of the rheostat coil 215 is connected by a wire 231 to one terminal of the motor 36 and one end of the rheostat coil 216 is connected by a wire 232 to the opposite terminal of the motor 36.

When the contact bar 217 is moved to bridge between the contact track 214 and the rheostat coil 216 current is directed to the motor 36 to operate it to move the guns 16 upward and when the contact bar 217 is moved to bridge between the contact track 214 and the rheostat coil 215 current is directed to the motor 36 to operate it to move the guns 16 downward.

The contact bar 217 is moved into engagement with the rheostat coils 215 and 214 by the operator rocking the sleeve 210 about the axis of the pivot 211 which in turn swings the arm 212 on which the contact bar 217 is mounted.

One end of the rheostat coil 221 is connected by a wire 233 to one terminal of the motor 30 and one end of the rheostat coil 222 is connected by a wire 234 to the opposite terminal of the motor 30.

When the contact bar 224 is moved to bridge between the contact track 220 and the rheostat coil 221 current is directed to the motor 30 to operate it to swing the guns 16 to the right and when the contact bar 224 is moved to bridge between the contact track 220 and the rheostat coil 222 electrical current is directed to the motor 30 to operate it to swing the guns 16 to the left.

The contact bar 224 is moved into engagement with the rheostat coils 221 and 222 by the operator rotating the operating handle 219 in the direction in which he wants the guns to swing.

In operation when the guns 16 are in a horizontal position and directed directly rearward as shown in Fig. 2, and the operator desires to swing the guns upward he grasps the operating handle 219 of the switch mechanism 205 and swings it rearwardly thereby causing current to be directed to the motor 36 which then operates to swing the guns 16 upwards as previously described. To stop upward travel of the guns the operator swings the operating handle to a straight vertical position.

As the guns 16 swing upward the "Selsyn" motor 61 of the gun mechanism is operated as previously described and operates the "Selsyn" motor 173 of the sight mechanism to vertically move the sight device 94 as previously described in unison with the guns 16.

To swing the guns 16 downward the operator swings the operating handle 219 forwardly thereby directing current to the motor 36 to operate it to swing the guns 16 downward as previously described.

To stop the downward movement of the guns the operator swings the operating handle 219 to a straight vertical position.

As the guns move vertically upward and move the sight device 94 the operator first peers through the eye piece 103 and as the guns continue to move upward the operator moves the slide member 106 to align the aperture 113 with the tube 95 and then peers through the eye piece 96. Upon movement of the guns to a vertical position the operator moves the slide member 106 to align the chamber 114 with the tube 95 and then peers through the eye piece 105.

When the operator desires to swing the guns 16 horizontally to the right or left he rotates the operating handle 219 in the direction in which he wants the guns to swing thereby causing the motor 30 to operate to swing the guns as previously described. To stop the horizontal movement of the guns the operator rotates the operating handle 219 to a neutral position wherein the contact bar 224 does not engage either of the rheostat coils 221 or 222.

At night the fluorescent tube 99 in the reflector 97 is illuminated and as the night device 94 moves in unison with the guns 16 a beam of light is directed onto the target at which the guns are pointed.

As shown in Fig. 1 other gun stations such as is indicated at 235, 236, 237 and 238 and their associated sight stations such as indicated at 239, 240, 241 and 242 respectively may be located at various positions on the airplane.

From the foregoing description it will be apparent that I have provided a novel remotely controlled gun mechanism and a remote sight device therefor which is simple in construction and highly efficient in use.

I claim:

1. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, a member mounted to rotate with the gun in its movement about its vertical axis, a rack member having a pair of rack portions thereon and mounted to reciprocate and to rotate upon said member, said rack portions having circular teeth, gear means connecting said gun and one of said rack portions and driven by movement of the gun about its horizontal axis and constructed and arranged to transmit a drive from the gun to the one rack portion, a generator unit, means connecting the other rack portion to said generator unit and constructed and arranged to transmit a drive from said other rack portion to said generator unit, a second generator unit, gear means connecting said member to said second generator unit and constructed and arranged to transmit a drive from said member to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

2. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, a member mounted to rotate with the gun in its movement about its vertical axis, a gear rotatable with the gun about its horizontal axis, a rack member having upper and lower racks thereon and mounted to reciprocate and to rotate in said member about the vertical axis of said gun mount, said racks each having circular teeth, another gear engaging the upper rack, means connecting said gears and constructed and arranged to transmit a drive from the first gear to the other gear, a generator unit, means connecting said lower rack to said generator unit and constructed and arranged to transmit a drive from said lower rack to said generator unit, a gear fixed on said member, a second generator unit, means connecting said member gear to said second generator unit and constructed and arranged to transmit a drive from said member to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

3. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, a sleeve mounted to rotate with the gun in its movement about its vertical axis, a gear rotatable with the gun about its horizontal axis, a rack member having upper and lower racks thereon and mounted to reciprocate and to rotate in said sleeve, said racks each having circular teeth, another gear engaging the upper rack, means connecting said gears and constructed and arranged to transmit a drive from the first gear to the other gear, a generator unit, means connecting said lower rack to said generator unit and constructed and arranged to transmit a drive from said lower rack to said generator unit, a gear fixed on said sleeve, a second generator unit, means connecting said sleeve gear to said second generator unit and constructed and arranged to transmit a drive from said sleeve to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

4. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, an arm mounted to rotate with the gun in its movement about its vertical axis, a vertical sleeve mounted to move with said arm about the vertical axis of rotation of the gun, a gear rotatable with the gun about its horizontal axis, a second gear driven by said first gear, a rod mounted to reciprocate and to rotate in said sleeve, said rod having upper and lower racks thereon, said racks each having circular teeth, a third gear engaging the upper rack, a fourth gear mounted coaxial with and for rotation with the second gear and engaging said third gear, a generator unit, means connecting said lower rack to said generator unit and constructed and arranged to transmit a drive from said lower rack to said generator unit, a fifth gear fixed on said sleeve, a second generator unit, means connecting said fifth gear to said second generator unit and constructed and arranged to transmit a drive from said fifth gear to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

5. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, a pair of arms mounted to rotate with the gun in its movement about its vertical axis, a vertical sleeve mounted to move with said arms about the vertical axis of rotation of the gun, a gear rotatable with the gun about its horizontal axis, a second gear mounted to engage said first gear, a cylindrical rod mounted to reciprocate and to rotate in said sleeve, said rod having racks at the upper and lower ends thereof, said racks each having circular teeth, a third gear rotatably mounted adjacent to the upper rack and engaging the upper rack, a fourth

gear mounted coaxial with and for rotation with the second gear and engaging said third gear, a generator unit, means connecting said lower rack to said generator unit and constructed and arranged to transmit a drive from said lower rack to said generator unit, a fifth gear fixed on said sleeve, a second generator unit, means connecting said fifth gear to said second generator unit and constructed and arranged to transmit a drive from said fifth gear to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

6. A gun and sight synchronizing device including a gun mounted for rotation about vertical and horizontal axes, a pair of arms extending below the gun and mounted to rotate with the gun in its movement about its vertical axis, a bracket fixed on said arms, a vertical sleeve fixed on said bracket, the axis of said vertical sleeve coinciding with the vertical axis of rotation of the gun, a gear rotatable with the gun about its horizontal axis, a shaft on said bracket and spaced from the horizontal axis of rotation of said gun, a second gear fixed on said shaft and engaging said first gear, a cylindrical rod mounted to reciprocate and to rotate in said sleeve, said rod having racks at the upper and lower ends thereof, said racks each having circular teeth, a third gear rotatably mounted on said bracket and engaging the upper rack, a fourth gear fixed on said shaft and engaging said third gear, a generator unit, means connecting said lower rack to said generator unit and constructed and arranged to transmit a drive from said lower rack to said generator unit, a fifth gear fixed on said sleeve, a second generator unit, means connecting said fifth gear to said second generator unit and constructed and arranged to transmit a drive from said fifth gear to said second generator unit, a sighting device including a viewing member mounted for rotation about vertical and horizontal axes, a first receiver unit for controlling movement of the sighting device about its horizontal axis, a second receiver unit for controlling movement of the sighting device about its vertical axis, means operatively connecting said first generator unit and said first receiver unit and means operatively connecting said second generator unit and said second receiver unit.

GEORGE E. BARNHART.