

Nov. 7, 1950

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2,529,324

BOMBSIGHT

Filed Nov. 1, 1943

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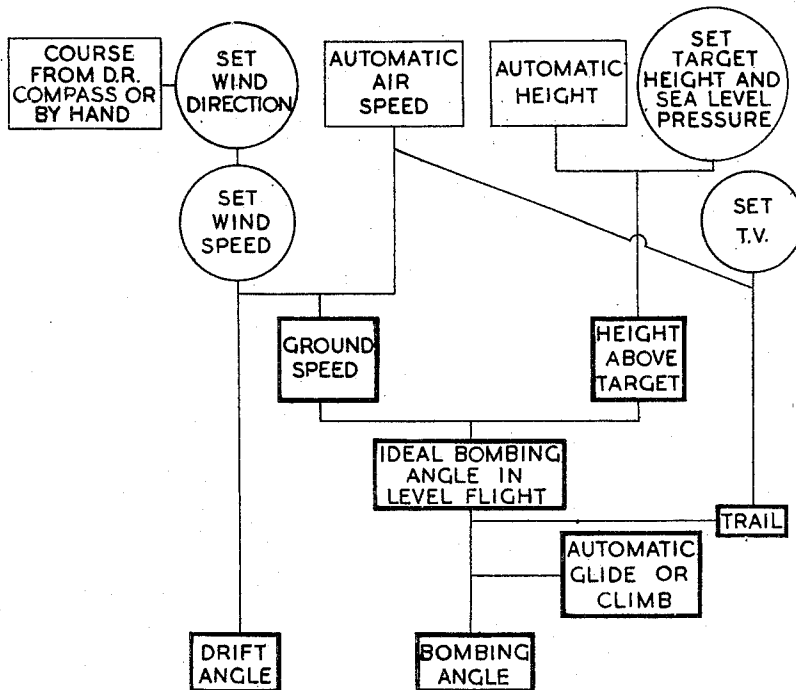
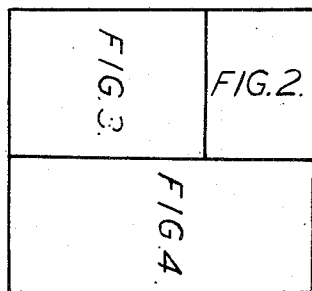


FIG. 1.

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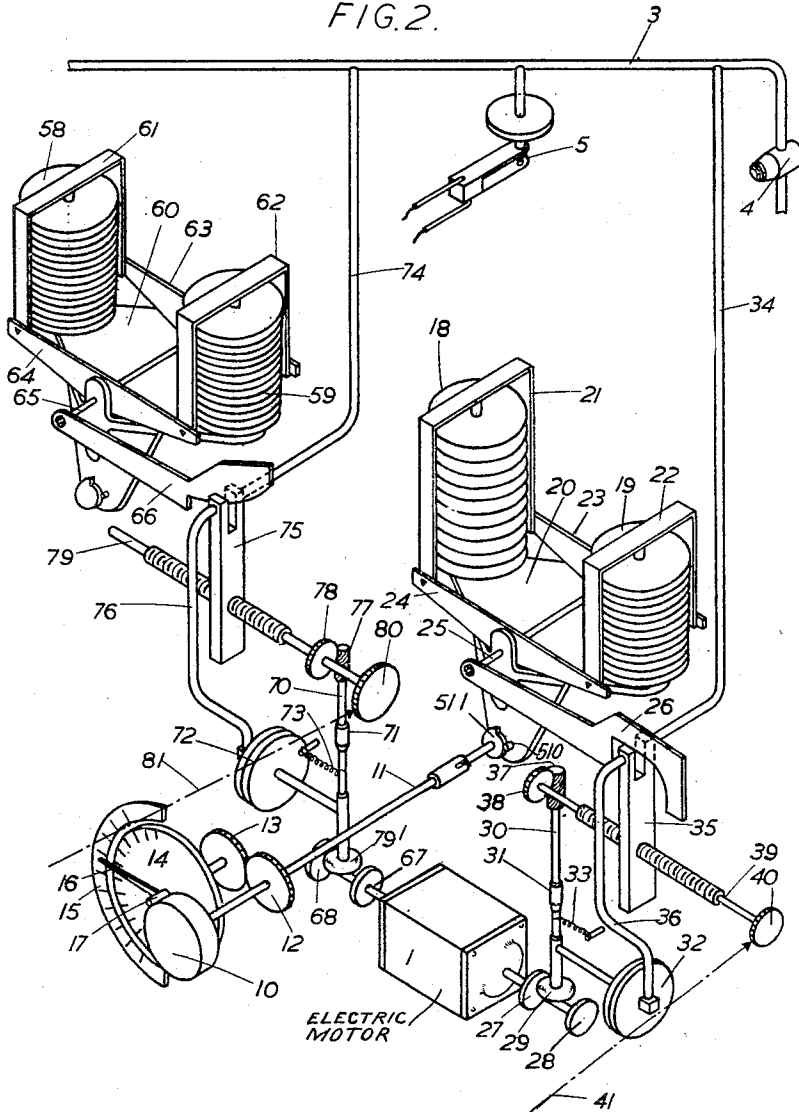
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BOMBSIGHT

Filed Nov. 1, 1943

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FIG. 2.



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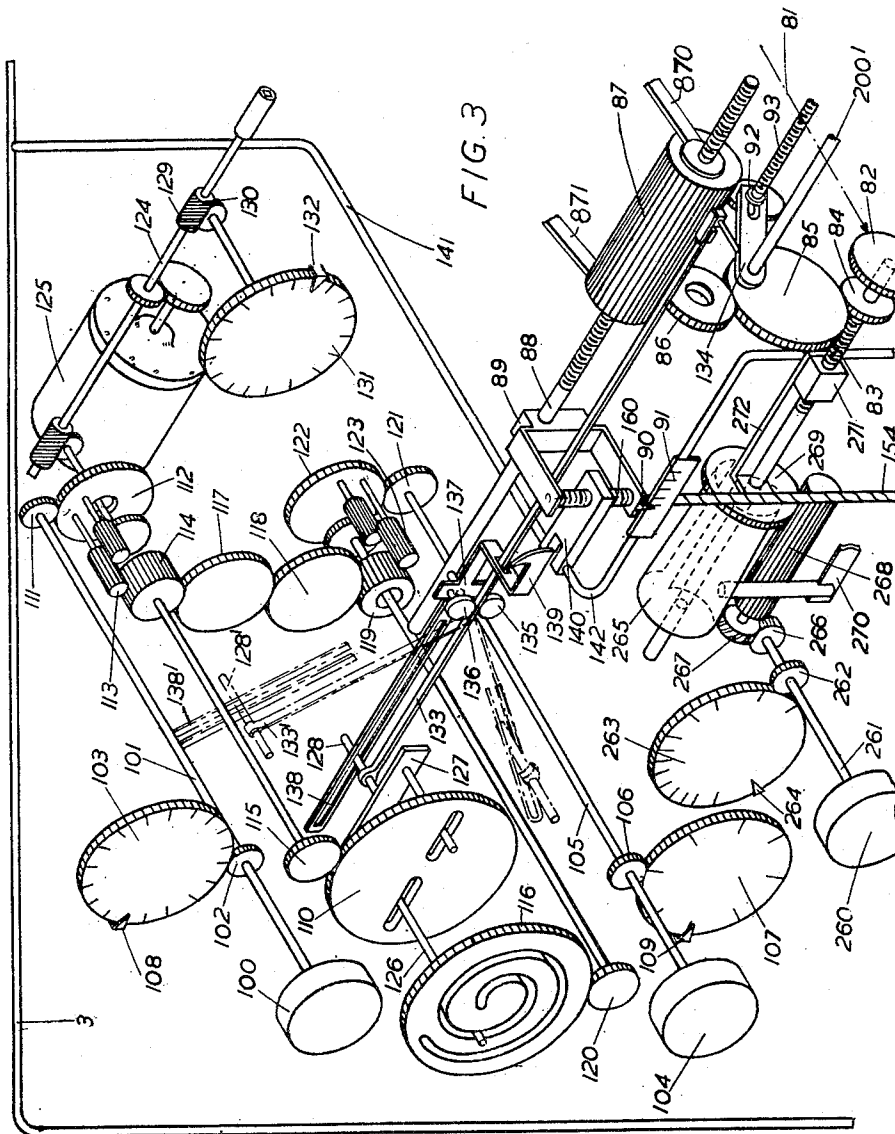
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Filed Nov. 1, 1943

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Filed Nov. 1, 1943

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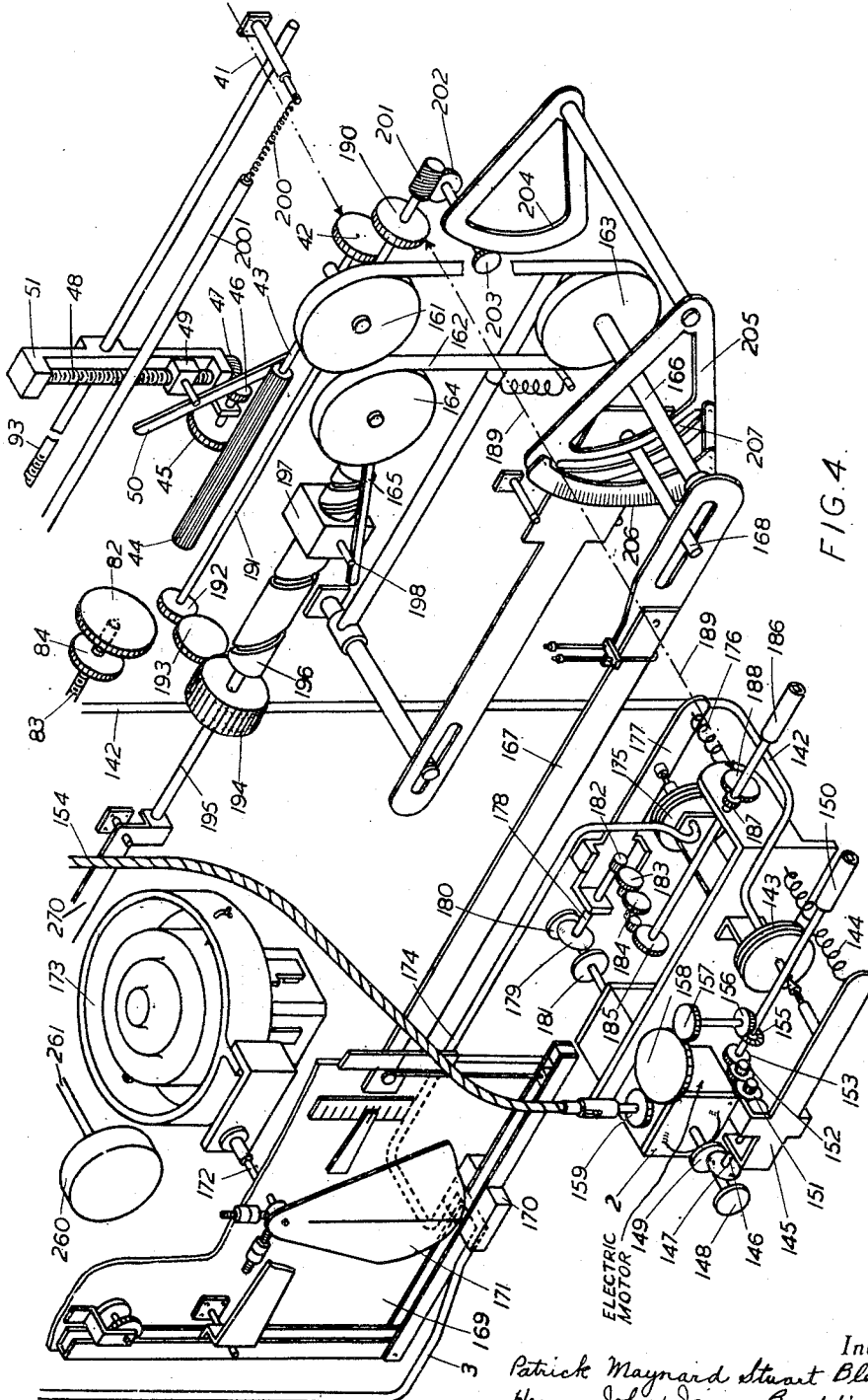


FIG. 4

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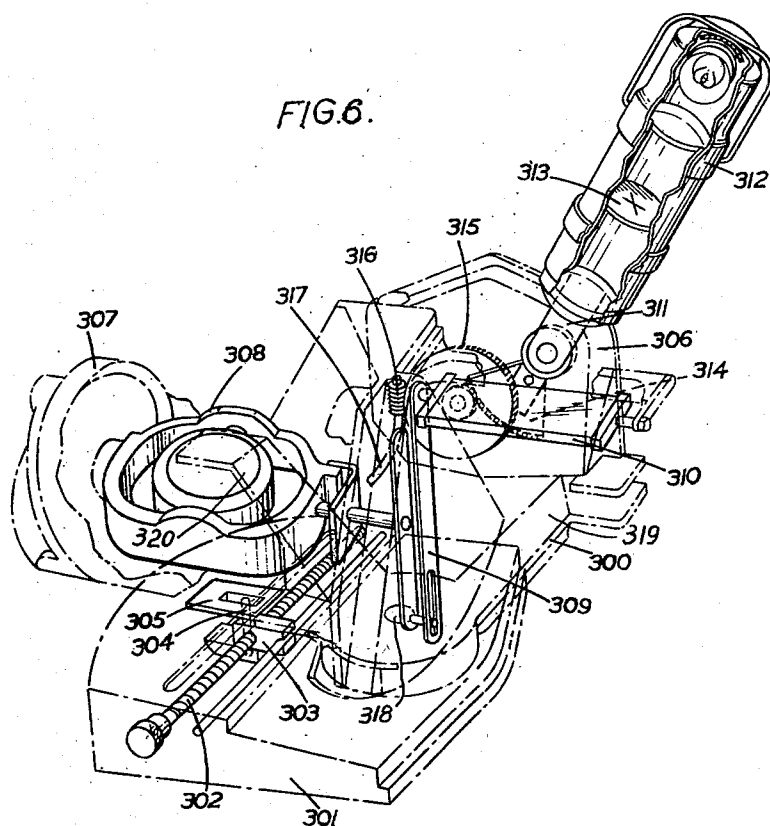
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Filed Nov. 1, 1943

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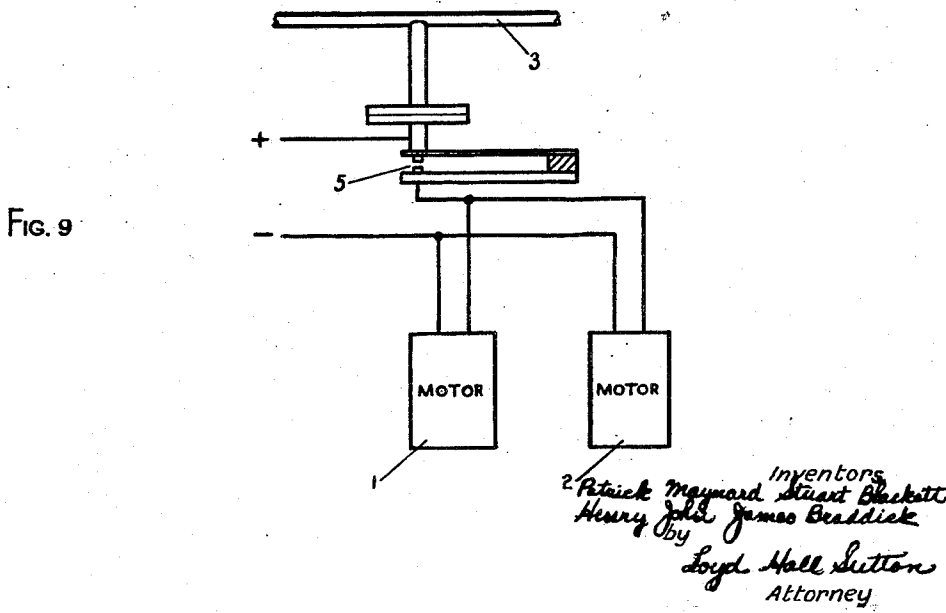
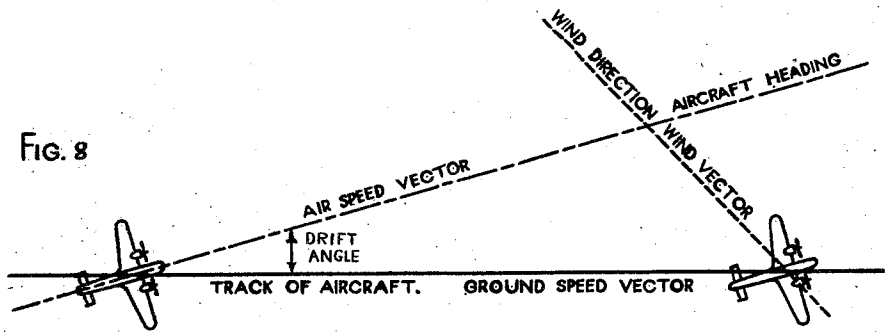
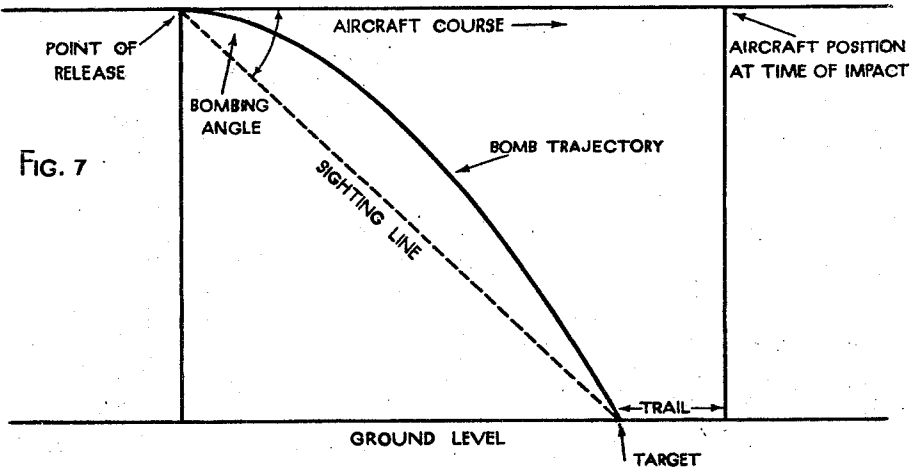
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BOMBSIGHT

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UNITED STATES PATENT OFFICE

2,529,324

BOMBSIGHT

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Application November 1, 1943, Serial No. 508,652
In Great Britain December 31, 1941

Section 1, Public Law 690, August 8, 1946
Patent expires December 31, 1961

4 Claims. (Cl. 33—46.5)

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The invention relates to bombsights for aircraft.

When a bomb or the like projectile is released from an aircraft, the initial forward velocity of the bomb relative to a fixed point is the same as that of the aircraft, and its downward velocity zero. If the bomb were falling in vacuo, its forward velocity would be constant and it would undergo downward acceleration due to gravity, and assuming that the height and ground speed of the aircraft were maintained constant, the trajectory of the bomb would be a curve of increasing steepness, being of such form that at any instant during its fall the bomb would be vertically below the position of the aircraft at that instant. A straight line drawn between the point of release of the projectile and the point of impact of the projectile, said line constituting the sighting line, would make an angle with the horizontal termed "ideal bombing angle," the value of which would depend on the height of the aircraft above the point of impact, and on the ground speed of the aircraft, i. e. the speed of the aircraft relative to the point of impact. In practice however the forward motion of the bomb is decelerated owing to wind resistance and the bomb lags behind the aircraft, the amount of such lag at the point of impact being designated "trail." The ideal bombing angle must therefore be corrected for trail to give an actual bombing angle, and the bombing angle is also subject to further correction if the aircraft is not flying level, i. e. for the pitch attitude of the aircraft, to obtain a sighting angle defining the sighting line in relation to a datum line in the aircraft.

If the aircraft is not flying directly up or down wind, the track of the aircraft will deviate from the heading of the aircraft, and the angle between aircraft heading and track is designated "drift angle." Since the bomb after release will travel in the same direction as the aircraft, the sighting line must be rotated through an angle the magnitude of which depends on the drift angle. The geometrical relation between the points referred to is illustrated in Figs. 7 and 8 of the accompanying drawings.

An object of the invention is to produce a bombsight comprising a mechanical computer from which the sighting and drift angles are continuously obtainable and a sighting arrangement defining a sighting line which is automatically adjusted by variations in the sighting angle and drift angle obtained from the computer.

In a computer for a bombsight in accordance

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with the invention, means are provided for computing drift angle and ground speed from the course of the aircraft, the direction and speed of the wind and the airspeed relative to the aircraft; means for computing an ideal bombing angle as hereinbefore defined from the ground speed value so obtained and the height of the aircraft above the target, means for applying a trail correction to said ideal bombing angle, said trail correction being computed for the airspeed and the ballistic properties of the projectile, and means for applying a further correction to said ideal bombing angle in response to changes in pitch attitude of the aircraft, whereby the value of the sighting angle is obtained. The values continuously obtained from such a computer are transferred continuously to a sighting arrangement which defines a sighting line, so as to move the sighting line in accordance with the indications of sighting angle and drift angle obtained from the computer. Since the bombing angle is defined in relation to the horizontal, while the sighting angle is related to a datum line in the aircraft, the bombsight or a part thereof must be stabilised in roll, so that the datum line is maintained steady in azimuth during banked turns or similar motion involving a change in roll attitude of the aircraft.

The invention is illustrated by way of example in the accompanying drawings in which Fig. 1 is a diagram showing the various data supplied to and computed by the computer, Figs. 2-4 are schematic perspective views which together show a preferred form of computer, Fig. 5 is a key diagram showing on a reduced scale the manner in which Figs. 2-4 should be associated, Fig. 6 is a perspective view of the sighting head, Figs. 7 and 8 are vector diagrams illustrating the geometrical principles involved, and Fig. 9 is a circuit diagram.

Referring to Fig. 1, the data which in the preferred embodiment shown in Figs. 2-5 are supplied manually to the computer are enclosed in circles, those which are supplied automatically to the computer are enclosed in rectangles drawn in light lines, and those which are automatically computed by the computer are enclosed in rectangles drawn in heavy lines. The figure thus shows that the course, airspeed and height are automatically supplied to the computer, the air pressure at sea level, target height, wind direction, wind speed, and terminal velocity of the projectile (T. V. in the figure) are preset manually, and that from these data the drift angle, ground speed and height above target are computed auto-

matically and that from the height above target and ground speed so evaluated an ideal bombing angle is computed and corrected both for trail and for the pitch attitude of the aircraft.

Referring now to Figs. 2-5, power for the computer mechanism to be described in detail later, is derived from two electric motors 1 and 2. Pneumatic detector systems are also provided, and compressed air for these is obtained from a pipe line 3, equipped with a pressure reducing valve 4. A pressure-actuated switch 5 is also located in the motor supply circuit, so that the current supply to the motors 1 and 2 is interrupted if the pressure in the pipe line 3 falls below a predetermined lower limit. The circuit and switch are diagrammatically illustrated in Fig. 9.

For convenience in reading, further description of the computer is arranged under headings.

Manual settings

The target height is preset on the computer, by rotating the knob 10, secured to a shaft 11, which causes through gearing 12, 13, a dial 14 to rotate, the dial 14 being juxtaposed with a stationary dial 15 which is engraved with indications of barometric pressure for the sea level pressure at the location of the target. A pointer 16 is attached to a knob 17, enabling the value for the sea level barometric pressure at the location of the target to be preset by rotating the knob 17, after which the knob 10 is rotated until the value on the dial 14 opposite the pointer 16 corresponds with the known or estimated height above sea level of the target. Rotation of the knob 10 also adjusts the height mechanism to be described hereinafter.

Wind direction is set by rotation of the knob 100 fast with a shaft 101, carrying gearing 102, whereby rotation of the knob 100 causes an engraved dial 103 to rotate. Wind speed is set by rotation of a knob 104 fast with a shaft 105 carrying gearing 106 causing rotation of an engraved dial 107. Rotation of the knob 100 is continued until the appropriate reading on the dial 103 for the known or estimated wind direction is opposite a fixed pointer 108, and rotation of the knob 104 is continued until the reading on the dial 107 appropriate for the known or estimated wind speed is opposite a fixed pointer 109. Rotation of the knobs 100 and 104 also adjusts the wind mechanism to be described hereinafter.

The known value of the terminal velocity of the bomb or class of bomb which is to be dropped is preset on the mechanism by rotation of a knob 260, fast with a shaft 261 carrying gearing 262, causing a dial 263 to rotate, until the appropriate value engraved on the face thereof is located opposite a pointer 264. Rotation of the knob 260 also adjusts the trail mechanism to be described hereinafter. The terminal velocity of a bomb is that velocity at which the acceleration due to gravity just equals the retardation due to air resistance, i. e. the maximum downward velocity attainable when falling through air.

Height mechanism

The height mechanism of the computer comprises a bellows 18, the interior of which is connected to aeroplane static pressure, and a bellows 19 the interior of which is exhausted. The bellows 18 and 19 are mounted at one end on opposite ends of a base plate 20, and are attached at their other ends to frames 21 and 22 secured to a pair of rocking levers 23 and 24 fast on a spindle 25 pivoted in lugs on the base plate 20. Fast with

a spindle 21 is a blade 26. Increasing altitude with consequent fall in atmospheric pressure will cause the bellows 18 to collapse and the bellows 19 to expand thus rocking the links 23 and 24 and causing the free end of the blade 26 to rise while decreasing altitude will cause the free end of the blade 26 to fall. The blade 26 forms the detector of an electro-pneumatic servo system for which power is derived from the motor 1. Driven by the motor 1 is a shaft carrying two friction discs 27, 28, between which is located a friction ring 29 carried by a shaft 30 having a flexible coupling 31. The friction ring 29 is moved into contact with the disc 27 by expansion of a bellows 32 against the action of a spring 33, while when the bellows collapses the spring 33 moves the friction ring into contact with the disc 28. Air under pressure is supplied to the bellows 32 through a branch 34 from the pipe line 3, said branch terminating in a jet in a slotted block 35. Opposite the jet is the inlet of a pipe 36 connected to the bellows 32. The lower edge of the blade 26 moves in the slot of the block 35, and serves to control the passage of air from the pipe 34 to the pipe 36 and hence to the bellows. To the top of the shaft 30 is fixed a worm 37 driving a wheel 38 fast with a screwed shaft 39 on which is mounted the block 35. When the bellows 32 receives sufficient air to hold the friction ring 29 in contact with the disc 27 the shafts 30 and 39 are rotated and the block 35 is moved to the right until, owing to the curvature of the lower edge of the blade 26, the air supply to the bellows is insufficient to hold the friction ring 29 against the disc 27. If the air supply to the bellows 32 is so small that the friction ring 29 is held against the disc 28, the parts will move in the reverse direction until the bellows 32 expand against the action of the spring 33. Fast with the shaft 39 is a gear 40, which drives through the intermediary of gearing, not shown in detail but indicated by the chain line 41 (Fig. 4), a gear 42 fast with a shaft 43 rotation of which causes through gearing 44, 45, 46, 47, a height screw 48 to rotate in a carriage 51, and move a height nut 49, a projection of which abuts against a pivoted arm 50, the function of which will be described hereinafter. It will accordingly be appreciated that the position of the height nut 49 represents the height of the aircraft. A projection 510 on a depending portion of the base plate 20 engages with a cam 511 on the spindle 11, to which is secured the setting knob 10 previously described, so that rotation of the setting knob has the effect of varying a datum in the height mechanism by rocking the base plate 20 on which the bellows 18, 19 are mounted and hence moving the blade 26.

Air speed mechanism

The air speed mechanism is similar in many respects to the height mechanism and comprises a bellows 58 connected to pitot pressure and a bellows 59 connected to static pressure, said bellows being mounted upon a base plate 60, and the tops of the bellows being connected to frames 61, 62, secured to pivoted links 63, 64, mounted on a spindle 65 to which is secured a blade 66, the free end of which moves in a slotted block 75, similar to the block 35 of the height mechanism, and which controls the air supply to a bellows 72 through pipes 74 and 76. As in the height mechanism, the bellows controls the position of a shaft 70, having a flexible coupling 71 and carrying a friction ring 79, which may engage with either of a pair of friction discs 67, 68 driven by the

motor 1. The shaft 70 drives through gearing 77, 78 a screwed shaft 79, along which the block 75 moves to adjust the air supply to the bellows 72.

With increase in the airspeed the bellows 58 will expand causing the blade 66 to move and the shaft 79 consequently to rotate, in a manner similar to that described for the height mechanism. A gear 80, secured to the shaft 79 drives through gearing, not shown in detail but indicated by the broken line 81, a gear wheel 82 fast with a shaft 83 which drives through gearing 84, 85, 86, a pinion 87 located between end stops 870, 871 and tapped to accommodate a screwed shaft 88. Rotation of the pinion 87 thus causes the shaft 88 to move endwise carrying with it a carriage 89 which may be termed the drift carriage and the function of which will be described hereinafter. Changes in airspeed are therefore represented by lateral displacement of the shaft 88 and drift carriage 89. To the drift carriage is attached a pointer 90, which moves over a scale 91 engraved to indicate airspeed values. At the same time rotation of the pinion 87 causes a pinion 92 to rotate, said pinion 92 being prevented by means not shown from lateral movement, and being tapped to receive a screwed shaft 93 to which is secured the carriage 51 carrying the height screw 48 previously referred to. Thus variation in airspeed causes lateral displacement of the shaft 93 and carriage 51, and consequent resetting of the pivoted arm 50. The movement of the shaft 93 is however also controlled by the wind mechanism, as described hereinafter, and its displacement represents not airspeed, but ground speed.

Wind mechanism

The wind mechanism comprises a radially slotted pinion 110 driven from the shaft 101 through differential gearing 111, 112, 113, 114, 115. A scroll pinion 116 is also provided coaxial with pinion 110 and driven from the shaft 101 through the gears 111, 112, 113, 114, 117, 118, 119 and 120. The shaft 105 also drives the scroll pinion 116 through a compensating differential gearing 121, 122, 123, 119 and 120. The course of the aircraft is also fed into the differential gearing 111, 112, 113, 114, 115, from the shaft 124, which may be rotated by a repeater motor 125 driven by a compass, or manually by a member of the crew. A pin 126 passes through both the slot and scroll of pinions 110 and 116 and carries a frame 127 and pin 128. Thus if both pinions are caused to rotate together, i. e. owing to rotation of knob 100 to preset a new wind direction, or to rotation of the shaft 124 due to change of course, the navigational bearing of the pin 126, relative to the axis of the pinions 110 and 116, will be varied, while rotation of the knob 100, to preset a new wind speed, will cause the pinion 116 only to rotate and will alter only the distance between the axis of the pinions 110 and 116 and the pin 126. Rotation of the course shaft 124 also drives gearing 129, 130, causing a dial 131 to rotate relative to a fixed pointer 132, the face of the dial being engraved to represent course.

The pin 128 is secured to a metal tape 133 attached at its other end to a carrier 134 in which is mounted the ground speed shaft 93. A spring 200 (Fig. 4) attached to the carrier 134 by rod 200' maintains tension in the tape 133. Thus rotation of the pinion 116 while pinion 110 is stationary causes the pin 126 to be moved along the slot in the latter and causes lateral displacement

of the pin 128; tape 133, carrier 134 and ground speed shaft 93. The tape 133 passes through rollers 135, 136 on a frame 137, pivoted to the shaft 88, having a slotted arm 138 in the slot of which the pin 128 is located. If the pinion 110 or both pinions 110 and 116 are rotated the pin 128 will undergo rotational or rotational and translational movement and may assume for example the position indicated by broken lines e. g. at 128', the tape 133 moving to the position shown at 133', and the slotted arm 138 moving to 138'. This will cause the tape 133 and ground speed shaft 93 to take up a new position, and the pivoted frame 137 to be rotated, the result produced by the latter movement being described under the heading "Drift Mechanism." The line joining the pin 128 and the single axis of pinion 110 will thus represent the wind vector in the diagram of Fig. 8, while the length of tape between the pin 128 and rollers 135 represents the ground speed vector.

Drift mechanism

Rotational movement of the pivoted frame 137 causes movement of a blade 139 secured thereto in a slotted block 140, which blade variably obstructs the passage of compressed air from a pipe 141 communicating with the pipe 3, to a pipe 142 feeding a bellows 143 (Fig. 4). Expansion of the bellows 143 against the action of a return spring 144 causes movement of a frame 145, carrying a shaft 146 having a friction ring 147 which may engage with either of two friction discs 148, 149 driven by the motor 2.

Rotation of the shaft 146 causes a shaft 150 to rotate through gearing 151, 152, 153, the shaft 150 constituting the drift angle drive which is to be connected to the sighting arrangement. The blade 139 thus constitutes the detector of an electro-pneumatic servo system similar in general character to those in the height and airspeed mechanisms. The follow-up mechanism comprises a flexible shaft 154 driven from the shaft 150 through gearing 155, 156, 157, 158, 159, to the end of which is secured a screw 160 fixed to the drift carriage 89 and on which is mounted the slotted block 140.

Bombing angle mechanism

The carriage 51 (Fig. 4), described under the heading "Height Mechanism," is secured to the shaft 93 and its lateral displacement therefore corresponds to changes in ground speed, while the height of the nut 49 represents the height of the aircraft above the target. The arm 50 is secured to a pulley 161 to which is secured one end of a tape 162 which is always maintained taut; consequently the arm 50 is always in contact with the projection on the nut 49 and the position of the arm always represents a value for the ideal bombing angle as hereinbefore defined. The tape 162 passes round a floating pulley 163 and is secured at its other end to a third pulley 164, which carries a second arm 165, the function of which will be described subsequently. To the pulley 163 is secured a shaft 166 carrying one end of a variable fulcrum lever 167, whose fulcrum is a pin 168. To the other end of the lever 167 is secured a framework 169 on which is mounted a slotted block 170; working in the slot in the block is a blade 171 secured to a shaft 172 which is attached to the gimbal of a pitch gyro 173.

The blade 171 variably obstructs the passage of air under pressure from the pipe 3 to a pipe 174

to inflate a bellows 175, against the action of a return spring 176, and constitutes part of a further electro-pneumatic servo mechanism similar to such mechanisms already described. The bellows controls the position of a frame 177 in which is mounted a shaft 178 having a friction ring 179, which can make contact with either of two friction discs, 180, 181 driven by the motor 2. Movement of the blade 171 in response to a change in the pitch attitude of the aircraft, or of the block 170, due to movement of the floating pulley 163 and lever 167, is thus transmitted to the shaft 178, movement of which in turn is transmitted through gearing 182, 183, 184, 185 to a shaft 186 from which the sighting angle is transmitted to the sighting head. The follow-up mechanism comprises a pinion 187 on the shaft 186 engaging with a further pinion 188 whence the drive is taken through gearing not shown in detail but indicated by the broken line 189, to a pinion 190 on a shaft 191 and thence through gearing 192, 193, 194, to shaft 195 to which is secured a variable pitch screw 196 forming a cam groove and on which is mounted a nut 197 having a projection 198 engaging the arm 165 fixed to the pulley 164. Thus movement of the shaft 186 is transmitted to the pulley 164, causing the tape 162 to be moved and to move the floating pulley 163 and lever 167 to move the blade 171 and block 170 into their equilibrium positions in which the air passing through block 170 from the pipe 3 to the pipe 174 maintains the bellows 175 at such inflation that the friction ring 179 is held out of contact with the friction discs 180, 181. Movement of the shaft 191 is also transmitted through gearing 201, 202, 203 to a quadrant 204, carrying a cam plate 205 having a scale 206 engraved with values for the sighting angle, said scale being moved past a stationary pointer. The cam plate also has a cam shaped guide slot 207 embracing the fulcrum pin 168 for the lever 167.

The change in sighting angle with varying pitch attitude of the aircraft is not only dependent on the value of glide or climb but also on the actual value of the sighting angle, and the mechanism, just described provides a suitable means for correlating these values.

Trail mechanism

The trail mechanism includes a three dimensional cam 265 (Fig. 3) which is rotated from the shaft 261 through gearing 266, 267, 268, 269, to actuate a pivoted follower 270 causing lateral displacement of the shaft 195 (Fig. 4), variable pitch screw 196, nut 197, arm 165 and thence through the pulley and tape mechanism already described to the sighting angle shaft 186. The cam is mounted to slide on the shaft 83 driven by the gear 82 in the air speed mechanism. Also mounted on the shaft 83 is a nut 271 which is prevented from rotating so that when the shaft 83 is caused to rotate the nut 271 moves along it. Secured to the nut 271 is a frame 272 terminating in a fork embracing the gear 269 to which the cam 265 is fixed, so that the cam is moved endwise by rotation of the shaft 83. Thus movement of the cam follower 270 is governed both by air speed and by the terminal velocity of the bomb. Tables are available giving the relationship between trail distance and airspeed for bombs of differing terminal velocities dropped from varying operating heights. Thus the variation in effective radius of the cam as it is rotated corresponds with the known effect of varying the terminal velocity of the bomb while the

taper of the cam in the longitudinal direction corresponds with the known effect of varying the airspeed on bombs of the same terminal velocity.

Sighting head

A convenient form of sighting head is illustrated in Fig. 6, in which an inverted tripod 300 indicated in broken lines is pivotally mounted at 318 on a base plate 301. Two legs 319, 320 of the tripod 300 are shown in the drawing. A worm 302 carried by the base plate 301 is driven by a flexible shaft from the drift angle shaft 150, see Fig. 4, and engages a nut 303 having a pin 304 which passes through a slotted lug 305 fast with the tripod 300. Mounted on the tripod 300 is a casing 307 for a roll gyroscope whose outer gimbal 308 is connected through a 2:1 reduction linkage 309 to a half-reflecting screen 310, which consequently, when the roll attitude of the aircraft changes, moves through half the angle through which the aircraft rolls.

Pivoted to the bracket 306 is an arm 311 carrying a collimator 312, containing a graticule 313 whose image appears projected on the target when the latter is viewed through the screen 310. Secured to the arm 311 is a toothed quadrant 314, engaging with a gearwheel 315 driven by a worm 316 and flexible shaft 317 from the sighting angle shaft 186, see Fig. 4.

Thus the sighting head is rotated in azimuth in response to changes in drift angle evaluated by the computer and transmitted through the shaft 150, while the collimator 312 is tilted relatively to the screen 310 in accordance with changes in sighting angle evaluated by the computer and transmitted through the shaft 186. Accordingly, if the manual settings on the computer are correctly made and the computer is functioning correctly, a projectile released at any moment will strike the point viewed through the screen 310 upon which the image of the graticule appears to be superposed at the instant of release.

We claim:

1. An aircraft bombsight comprising the combination of a computer including means for continuously computing the drift angle and means for continuously computing the ideal bombing angle and for applying a trail correction to said bombing angle and a further correction in response to changes in pitch attitude of the aircraft to obtain continuously the value of the sighting angle, said last named means comprising a rotatable pulley, means for angularly positioning said pulley in accordance with changes in aircraft height and ground speed to represent an ideal bombing angle, a flexible element anchored at one end to said pulley, an adjustable anchorage for the other end of said flexible element, a movable member and means for adjusting the position of said member in accordance with the length of said flexible element between said pulley and anchorage, a movable element whose position is to represent the actual sighting angle, a coupling between said movable member and movable element, and means for adjusting said anchorage in accordance with the ballistic properties of the selected projectile, the aircraft air speed and the position of the movable element; an adjustable optical sighting means for defining a sighting line; and transmission means between said computer and said sighting means for continuously transmitting the drift and sighting angle values so obtained to the sighting means so as to move the sighting line accordingly, whereby the point

sighted at any moment is the point of impact of a bomb released at that moment.

2. An aircraft bombsight comprising the combination of a computer including means for continuously computing the drift angle and means for continuously computing the ideal bombing angle and for applying a trail correction to said bombing angle and a further correction in response to changes in pitch attitude of the aircraft to obtain continuously the value of the sighting angle, said last named means comprising a pulley, means for rotating said pulley to a position representing an ideal bombing angle, a second pulley, a flexible element having its ends anchored to said pulleys, a member movable in response to changes in the length of the flexible element between said pulleys, a lever movable by said member, a pitch gyroscope, a movable element whose position represents the actual sighting angle, a servo mechanism controlled by said lever and pitch gyroscope for adjusting the position of said element, and means for angularly positioning the second pulley in accordance with the ballistic properties of the selected projectile, the aircraft air speed and the position of the said element; an adjustable optical sighting means for defining a sighting line; and transmission means between said computer and said sighting means for continuously transmitting the drift and sighting angle values so obtained to the sighting means so as to move the sighting line accordingly, whereby the point sighted at any moment is the point of impact of a bomb released at that moment.

3. An aircraft bombsight comprising the combination of a computer including means for continuously computing the drift angle and means for continuously computing the ideal bombing angle and for applying a trail correction to said bombing angle and a further correction in response to changes in pitch attitude of the aircraft to obtain continuously the value of the sighting angle, said last named means comprising a pulley, means for rotating said pulley to a position representing an ideal bombing angle, a second pulley, a flexible element having its ends anchored to said pulleys, a member movable in response to changes in length of the flexible element between said pulleys, a lever movable by said member, a pitch gyroscope, a movable element whose position represents the actual sighting angle, a servo mechanism controlled by said lever and pitch gyroscope for adjusting the position of said element, means for angularly positioning the second pulley in accordance with the ballistic properties of the selected projectile, the aircraft air speed and the position of said element, said lever including a variable fulcrum, and means for adjusting said fulcrum in response to changes in the value of the sighting angle; an adjustable optical sighting means for defining a sighting line; and transmission means between

said computer and said sighting means for continuously transmitting the drift and sighting angle values so obtained to the sighting means so as to move the sighting line accordingly, whereby the point sighted at any moment is the point of impact of a bomb released at that moment.

4. An aircraft bombsight comprising the combination of a computer including means for continuously computing the drift angle and means for continuously computing the ideal bombing angle and for applying a trail correction to said bombing angle and a further correction in response to changes in pitch attitude of the aircraft to obtain continuously the value of the sighting angle, said last named means comprising a rotatable pulley, means for angularly positioning said pulley in accordance with changes in aircraft height and ground speed to represent an ideal bombing angle, a flexible element anchored at one end to said pulley, an adjustable anchorage for the other end of said flexible element, a movable member and means for adjusting the position of said member in accordance with the length of the said flexible element between said pulley and anchorage, a movable element whose position represents the actual sighting angle, a coupling between said movable member and movable element, and mechanism for positioning said movable element including a three-dimensional cam, manual means for moving the cam in one direction in accordance with the ballistic properties of the selected projectile, means for automatically moving said cam in another direction in response to changes in air speed and a follower on said cam for adjusting the position of said anchorage, thereby including a trail correction in the position of said movable element; an adjustable optical sighting means for defining a sighting line; and transmission means between said computer and said sighting means for continuously transmitting the drift and sighting angle values so obtained to the sighting means so as to move the sighting line accordingly, whereby the point sighted at any moment is the point of impact of a bomb released at that moment.

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