Nov. 17, 1953 V. E. ERICSSON 2,659,275

AIMING DEVICE FOR GUNS

Filed Jan. 26, 1951 2 Sheets-Sheet 1

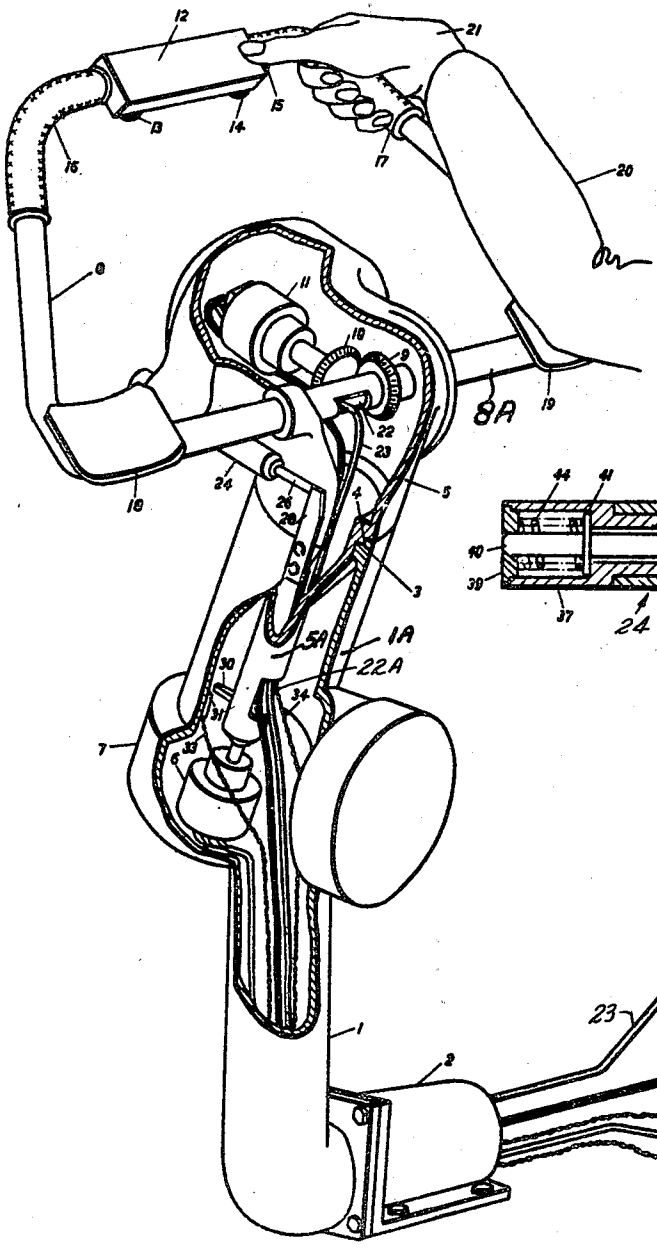
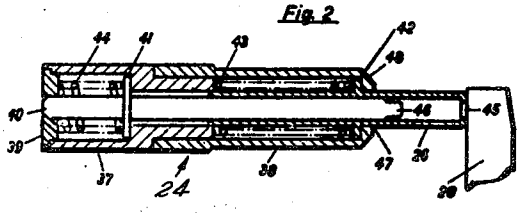


Fig. 1

Fig. 2



Inventor
VALTER ERLAND ERICSSON

By Ludwig E. Haas

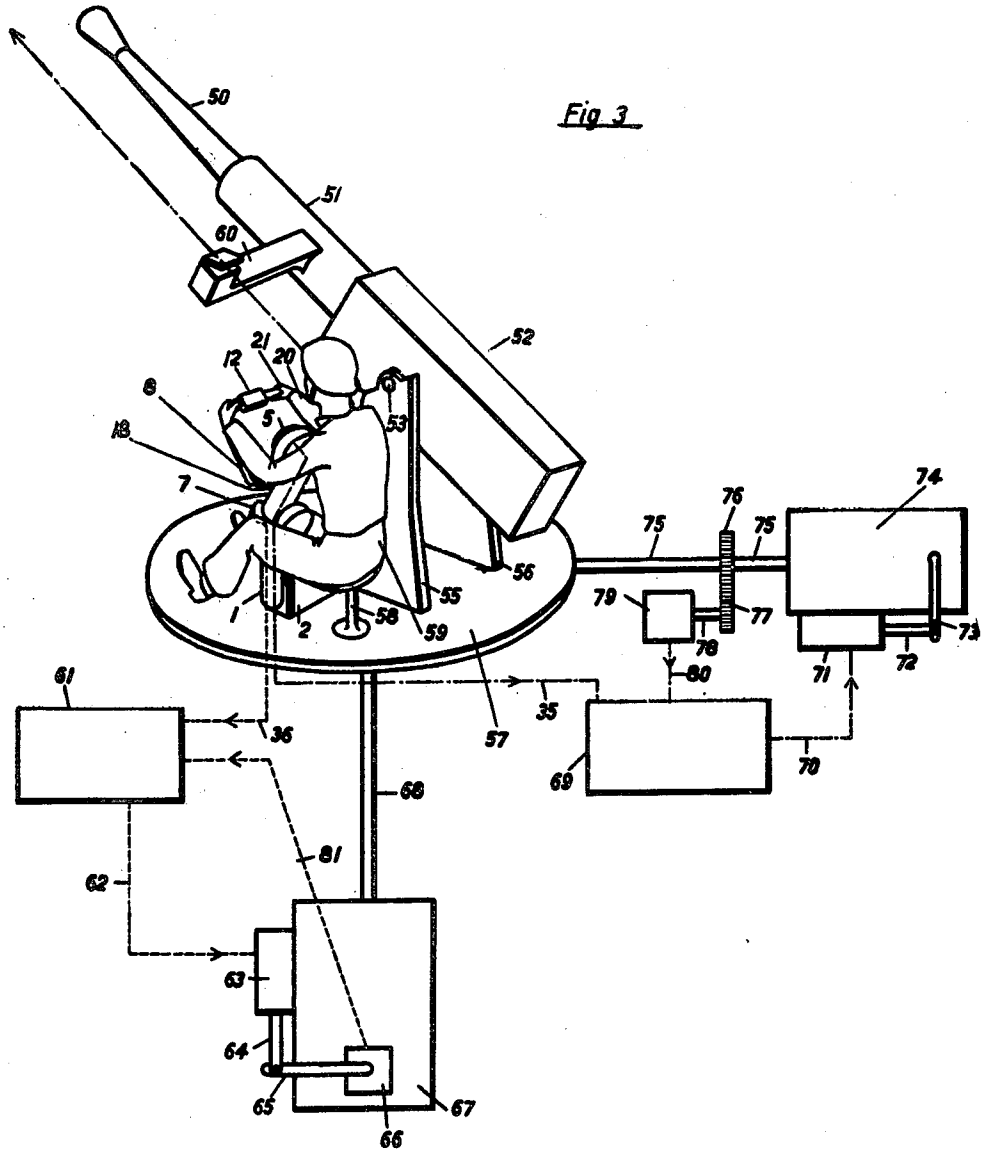
Attorney

Nov. 17, 1953 V. E. ERICSSON 2,659,275

AIMING DEVICE FOR GUNS

Filed Jan. 26, 1951 2 Sheets-Sheet 2

Fig 3



Inventor
VALTER ERLAND ERICSSON

By Frederick L. Hamm

Attorney

Patented Nov. 17, 1953

2,659,275

UNITED STATES PATENT OFFICE

2,659,275

AIMING DEVICE FOR GUNS

Valter Erland Ericsson, Karlskoga, Sweden, assignor to Aktiebolaget Bofors, Bofors, Sweden, a corporation of Sweden

Application January 26, 1951, Serial No. 207,969

14 Claims. (Cl. 89—41)

1

The present invention relates to an aiming device for guns and has its most immediate application in anti-aircraft artillery. Because a complete installation of a piece of ordnance involves the aiming and fire control mechanism in intimate cooperative association, the present invention will be described with reference to a complete installation.

One known type of aiming device comprises a bar passing through a ball joint and provided with a handle to be grasped by the gun pointer. The other end of the bar acts upon two sets of controls, one set controlling a mechanism which traverses the gun in azimuth, the other set controlling a mechanism which traverses the gun in elevation, the motion of the bar which affects one set of controls being perpendicular to the motion of the bar affecting the other set. The gun pointer being required to tense his arm muscles to operate this type of device, the resulting fatigue decreases the sensitivity of his hands, an obvious disadvantage.

Another known aiming device comprises an elongated body comprising a shaft passing through a ball joint and slidable therein and turnable about a fixed axis. The shaft influences means controlling the movement of the gun barrel in one direction. A bar extends perpendicularly through the body adjacent the free end thereof, each end of the bar being provided with handles. Rotation of the bar on its axis influences means controlling the movement of the gun barrel in its other direction. While this device is superior to the first, the constant tension of the gun pointer's arm muscles produces similar disadvantages. Turning of the bar in this device has proved particularly fatiguing.

In still another known aiming device, an elongated rectangular frame is rotatably supported on vertical axis with its long sides parallel thereto, and has at its upper end a bar with a crank handle at each end. The gun pointer pushes these crank handles away from him or pulls them toward him to rotate the bar to actuate means controlling the elevation of the gun barrel. This is a very fatiguing motion, and involves sliding his arms back and forth in arm rests provided on the vertical sides of the frame. The frame must be revolved about its vertical axis to traverse the gun in azimuth, which is impractical both because the space for this movement is not conveniently available, and because the gun pointer must stand up and actuate this turning of the frame by walking. Thus the entire operation

2

produces fatigue quickly, interfering with accuracy of aiming.

The present invention overcomes the above difficulties by permitting the gun pointer to be seated and to relax his muscles by requiring only slight movement of the moving parts influencing the means controlling elevation and traversing in azimuth, these movements of the gun barrel being referred to hereafter as elevating and traversing respectively.

In accomplishing the objects of the present invention, a standard is provided on which a tubular housing is mounted, the lower portion of the housing being substantially vertical and the upper part being inclined toward the gun pointer. A head portion is rotatably mounted in the top portion of the housing and a parallel trapezoidal frame is mounted in the head for rotation about its longer parallel side portion which extends perpendicularly to the axis of rotation of the head. The long side is provided with elbow rests and the non parallel sides constitute rests for the forearms of the gun pointer, while the corners between the short parallel side and the non parallel sides underlie the hands of the pointer and constitute rests and grasp means.

The housing further has two arms projecting longitudinally upwardly therefrom on opposite sides thereof, and plungers slidably mounted in cylinders on the head and both facing rearwardly engage these arms and are urged toward them by springs. The springs thus resist rotation of the head in either direction and constantly tend to return the head to center position.

Other objects of this invention will in part be obvious and in part hereinafter be pointed out. The invention accordingly consists in the feature of construction, combinations of elements and arrangements of parts which will be exemplified in the constructions hereinafter described. In the accompanying drawing, in which is shown one of the various possible illustrative embodiments of this invention:

Figure 1 is a perspective view, partly in section, of the aiming device.

Figure 2 is an axial section of the centering device.

Figure 3 is a schematic view of an installation comprising the aiming device.

Referring now in detail to the drawings, the tubular housing 1 is adjustably mounted on the standard 2, the latter comprising lock means for locking the housing in any one of a plurality of positions, the illustrated position being that

in which the elongated lower portion of the housing is substantially vertical. The elongated upper portion 1A of the housing 1 forms an angle with the lower portion, being inclined rearwardly toward the gun pointer as shown in Figure 3.

The upper end 1A of housing 1 is formed with two concentric bores and a shoulder as at 3, thus providing radial and thrust bearing surfaces for the complementary surfaces 4 of the hollow, substantially L shaped head 5. Head 5 is thus mounted for rotation about the axis of the upper portion 1A of housing 1 in a flat plane of rotation. Antifriction bearings may of course be used for such mounting.

Head 5 further comprises the funnel portion 5A extending into the housing upper portion 1A and coaxially connected to the rotor shaft of a synchronizing device 6. Said device 6 which does not constitute part of this invention and is therefore not described in detail may be any one of a number of well known devices for generating a signal indicating the direction and amplitude of rotation of one element relative to another. For instance, the synchronizing device 6 may be a variable resistor or other means for modifying the characteristics of an electric current in a circuit in which it is connected, so that the rotation of the element whose rotation is to be measured will cause a progressively increased resistance when occurring in one direction and a progressively diminished resistance when occurring in the opposite direction. Device 6 is immovably mounted in the chamber 7 of housing 1.

A round hollow tube bent to form a parallel trapezoidal bow or frame 8 has its longer parallel side 8A rotatably mounted in head 5 for rotation about an axis perpendicular to the axis of rotation of said head 5. A bevel gear 9 is concentrically mounted on side 8A and is in mesh with a bevel gear 10 mounted on the rotor shaft of a second synchronizing device 11 fixedly mounted in head 5. The device 11 also does not form part of the invention.

The shorter, outer parallel side portion of frame 8 mounts a switch housing 12 which contains manually operated contacts 13 and 14 and the switch 15. Contacts 13, 14 are connected to a cable 23 which enters the tubular conduit constituted by frame 8 through an opening 22 located inside head 5. Funnel portion 5A is provided with a similar opening 22A located inside portion 1A of housing 1.

The upper, outer corners of the frame 8, between the shorter parallel side portion and the non parallel side portions, are provided with coverings 16, 17 of rubber or other suitable material, these coverings being very convenient handles for grasping bow frame 8 and also constituting hand rests. Elbow rest pads 18, 19 are located at the inner lower corners of frame 8.

There are further provided centering means for returning control head 5 into a predetermined position relative to the standard or housing 1, namely into the zero or center position. These means are shown as yieldable means comprising a pair of cylinder assemblies generally designated by 24 and located on opposite sides of head 5. Each of the cylinder assemblies is secured to head 5 and coacts with a stop arm 28 fixedly secured to housing 1 and extending longitudinally upwardly therefrom. As can best be seen on Fig. 2, each cylinder assembly comprises an outer cylinder composed of cylinder sections 37 and 38 partly telescoped into each other so that section 37 forms shoulders within section 38. One end of cylinder section 38 is closed by an end wall 48 formed with a hole 47 therethrough. A plunger tube 26 is slidably extended into the cylinder through hole 47. The outer end of plunger 26 abuts against stop arm 28. The plunger is urged by a loaded spring 43 against tne stop arm and retained in the cylinder by a flange 42 abutting against end wall 48 of cylinder section 38. Each cylinder assembly further comprises a plunger bar 40 slidable within plunger tube 26. The bar is guided in an opening through an end plug 39 fitted in cylinder section 37 at the open end thereof adjacent to head 5 and is provided with a flange 41 coacting with one of the shoulders formed by cylinder section 37. A second loaded spring 44 stronger than spring 43 urges bar 40 into the position shown on Fig. 2 in which the spring abuts against flange 42 and a shoulder formed by the inner end of cylinder section 37. The end of bar 40 facing stop arm 28 is set off to form a nose 46 disposed to enter a guide hole 45 in the outer closed end of plunger 26. Each cylinder is attached to the control head for movement in unison therewith.

When now the control head 5 is rotated in counter clockwise direction (as seen on Fig. 1) each cylinder is moved toward the right as seen on Fig. 2. Consequently, the weaker spring 43 is first compressed, plunger 26 being retained by arm 28. Upon a substantially complete compression of spring 43, spring 44 is also compressed. In other words, cylinder sections 37 and 38 are first displaced relative to plunger 26 and bar 40 and then the cylinder sections and plunger 26 are displaced relative to bar 40, the space left between the inner end of plunger 26 and flange 41 permitting such movement. As will now be apparent, the strongly loaded cylinder assemblies urge the control head to return into its zero or center position.

Two electrical contacts 31 are located interiorly of housing 1, one not being visible in the drawing. These contacts are actuated by a nose 30 which is fixed on funnel 5A perpendicular to the parallel side portions of frame 8. With the head 5 in rest or zero position, the contacts 31 are equidistantly spaced from nose 30. Contact 31 is connected with a cable 33 and contact 32 with a cable 34. A cable 35 is connected to synchronizing device 11 and a cable 36 is connected to synchronizing device 6.

In Figure 3 there are shown the elevating parts of a gun, consisting of a barrel 50, a recoil jacket 51 and a breach casing unit 52. The last mentioned unit is provided on opposite sides with two trunnions 53. Each trunnion rests in a bearing in the vertical plates 55 and 56, respectively. The two plates are firmly mounted on a round plate 57. On this plate there is a seat 58 for a gun pointer 59. The seat can also be provided with a back rest. In front of the said seat, the aiming device as shown in the Figure 1 is mounted in such a manner that the parallel parts of the frame are in rest position. At the recoil jacket there is an optical sight 60 with a reticule or the like. The synchronizing device 6 in the aiming device is connected by means of cable 36 to the input side of a unit 61 containing a detector with a frequency transmission network and an amplifier. The output side of the said unit is connected by means of a cable 62 with an electro-hydraulic control device 63. The said device has an arm 64 which is coupled together with a starting arm 65 of a traversing machinery 67. The said

last mentioned arm is also connected with a synchronizing device 66 which through a cable 81 is connected to the unit 61. A shaft 68 of the machinery 67 is connected with the plate 57 in such a way that a rotation of the shaft turns the plate around its axis perpendicular to its surface. The synchronizing device element 11 is connected via cable 35 to the input side of a unit 69 containing a detector with a frequency transmission network and an amplifier. From the output side of the unit a cable 70 leads to an electro-hydraulic control device 71, which has an arm 72 coupled with a starting arm 73 of an elevating mechanism 74 of the gun. The said mechanism comprises a shaft 75 the rotation of which influences the elevation of the elevation mechanism. The movement of the shaft 75 is transmitted via gear wheels 76 and 77 to a shaft 78 of a synchronizing device 79. The said device and the unit 69 are connected with each other through the cable 80. The contact 13 is connected to gyros in the optical sight 60 if any, and the contact 14 to a firing device not shown. The switch 15 is adjustable so that when necessary it can block the contact 14. The contacts 31 are connected through cables 33, and 34 to the traversing machinery 67 in such a way that when actuated they increase the speed of this mechanism.

When a gun pointer intends to operate the gun, he sits down on the seat 58, grasps coverings 16 and 17 of the bow frame 8 with both hands, and rests his arms on the supports 18 and 19. This position of the pointer's body is especially advantageous, as he does not need to strain the muscles. This means that he can sensitively operate the bow frame. For the vertical movement of the bow frame he has but to move the forearms around the elbow-joint and for the lateral movement of the bow frame he has but to turn his body a little. Furthermore he has to look through the optical sight 60. When the target which he wants to line up in the sight is located directly above the intersection of the reticule he moves the bow frame towards himself, and when it is situated below, away from himself. The movement the gun pointer makes is transmitted via the synchronizing device 11 and the cable 35 to the unit 69, which generates a control voltage for the device 71, which controls the elevating machinery, whereby the machinery 74 adjusts the barrel so that the intersection coincides with the target seen in the sight. When the target is situated straight to the left of the intersection he turns his body and rotates the bow frame to the right. In this connection it may be appropriate to mention that the housing 1 is bent in the middle. Because the resulting position of the gun pointer is more natural and produces the desired movement of head 5 with less exertion by the gun pointer. The turning movement the pointer makes with the bow is transmitted via the synchronizing device 6 and the cable 36 to the unit 61, which creates a control voltage for the control device 63 via the cable 62. The device controls the traversing machinery 67 so that it turns the barrel in such a way that in the sight the target coincides with the intersection. Both the machinery for traversing and the machinery for elevation are servo actuated. For the first mentioned machinery, this actuation is carried out by the position of the synchronizing device 66 being transmitted by the cable 81 to the unit 61, and for the other machinery by the position of the synchronizing device 79 being transmitted by the cable 80 to the unit 69.

The traversing mechanism and the elevating mechanism controlled by the aiming device according to the invention are more fully described in a co-pending application Ser. No. 207,950, filed on January 26, 1951, by Borje Ingvar Larsson and Kurt Martin Nordfors.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. An aiming device for a gun having a barrel moveable in elevational and azimuth directions, the said device comprising a stationarily mounted standard, a control head mounted on said standard for rotation about a substantially upright axis, a control frame having a base branch and two side branches extending from the ends of the base branch at approximately a right angle thereto, the base branch of the said frame being supported on said head rotatable about an axis transversely to the rotational axis of the control head, first control means operatively coupled with the control head for controlling the azimuth position of the barrel by the rotational position of the control head relative to said standard, and second control means operatively coupled with said frame for controlling the elevational position of the barrel by the angular position of the frame relative to the control head, the said base branch forming arm rests for a gun pointer operating the said aiming device and the said side branches of the frame forming hand rests for the gun pointer.

2. An aiming device for a gun having a barrel moveable in elevational and azimuth directions, the said device comprising a hollow stationarily mounted standard, a control head pivotally supported on said standard for rotation about an approximately vertical axis, a control member in form of a trapezoidal frame, one of the parallel side portions of said frame being pivotally mounted in said control head transversely to the rotational axis of the head, first control means disposed within the standard and operatively coupled with the control head for controlling the azimuth position of the barrel by the rotational position of the control head relative to the standard, and second control means disposed within the control head and operatively coupled with the frame for controlling the elevational position of the barrel by the angular position of the frame relative to the control head, the said portion of the frame pivoted to the control head forming arm rests for a gun pointer operating the said aiming device and the non-parallel side portions of the frame forming hand rests for the gun pointer.

3. An aiming device according to claim 2, the mounting of said frame in said head being by means of the longer parallel side portion of said frame being journaled therein.

4. An aiming device according to claim 3, the non parallel side portions of said frame being substantially equal in length to a human forearm, said frame further comprising elbow rest pads located adjacent the inner ends of said non-parallel side portions, and the corner portions of said non parallel side portions with the shorter

parallel side portion constituting convenient hand grip means.

5. In an aiming device according to claim 2, wherein a switch is located on the shorter parallel side portion of said frame.

6. In an aiming device according to claim 5, said frame being constructed of hollow tubular material, and lead wires for said switch being located within the tubular conduit constituted by said frame.

7. In an aiming device according to claim 6, said lead wires further extending out of a portion of said frame located interiorly of said head, said lead wires further extending thence through a portion of said head and extending out of a portion of said head located inside said standard.

8. In an aiming device according to claim 2, said standard comprising a substantially tubular portion and said head being rotatable about the axis of said tubular portion.

9. In an aiming device according to claim 2, said standard comprising two elongated portions, said portions extending at an acute angle one to the other.

10. An aiming device according to claim 2 and further comprising switch means adapted to control a firing circuit and supported on said frame outside the control head and adjacent to said hand rests.

11. An aiming device according to claim 2, wherein said operative coupling means between the control means for controlling the elevational position of the barrel and the frame comprise gear means supported by a frame portion situated within the control head and gear means supported by the said control means, the said two gear means being in mesh one with the other whereby a pivotal movement of the frame effects a proportional adjustment of the elevational control means.

12. An aiming device according to claim 2, in combination with yieldable means between the control head and the standard biased continuously to urge the control head into a predetermined rotational position relative to the standard.

13. An aiming device according to claim 12, wherein the said yieldable means comprise cylinder means attached to the control head, plunger means slidably extending into the cylinder means and abutting against a stationary portion of said standard, and spring means within said cylinder means and coacting with the plunger means, the said spring means being loaded by a relative movement of the cylinder means and the plunger means in response to a rotation of the control head whereby the said yieldable means bias the control head toward the said predetermined rotational position relative to the standard.

14. An aiming device according to claim 13, wherein the said plunger means comprise an outer tube-shaped plunger slidable relative to the cylinder means and an inner plunger disposed within the outer plunger slidable relative thereto and relative to the cylinder means, and wherein the said spring means comprise a first loaded spring disposed between the cylinder means and the outer plunger and a second spring stronger than the first one disposed between the cylinder means and the inner plunger whereby upon rotation of the control head relative to the standard the said first spring is compressed prior to the second one.

VALTER ERLAND ERICSSON.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,409,406	Trotter	Oct. 15, 1946
2,448,450	Maxson et al.	Aug. 31, 1948
2,454,071	Lidral et al.	Nov. 16, 1948

FOREIGN PATENTS

Number	Country	Date
578,118	Great Britain	June 17, 1946
578,657	Great Britain	July 8, 1946