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LE ROY F. MAURER ET AL

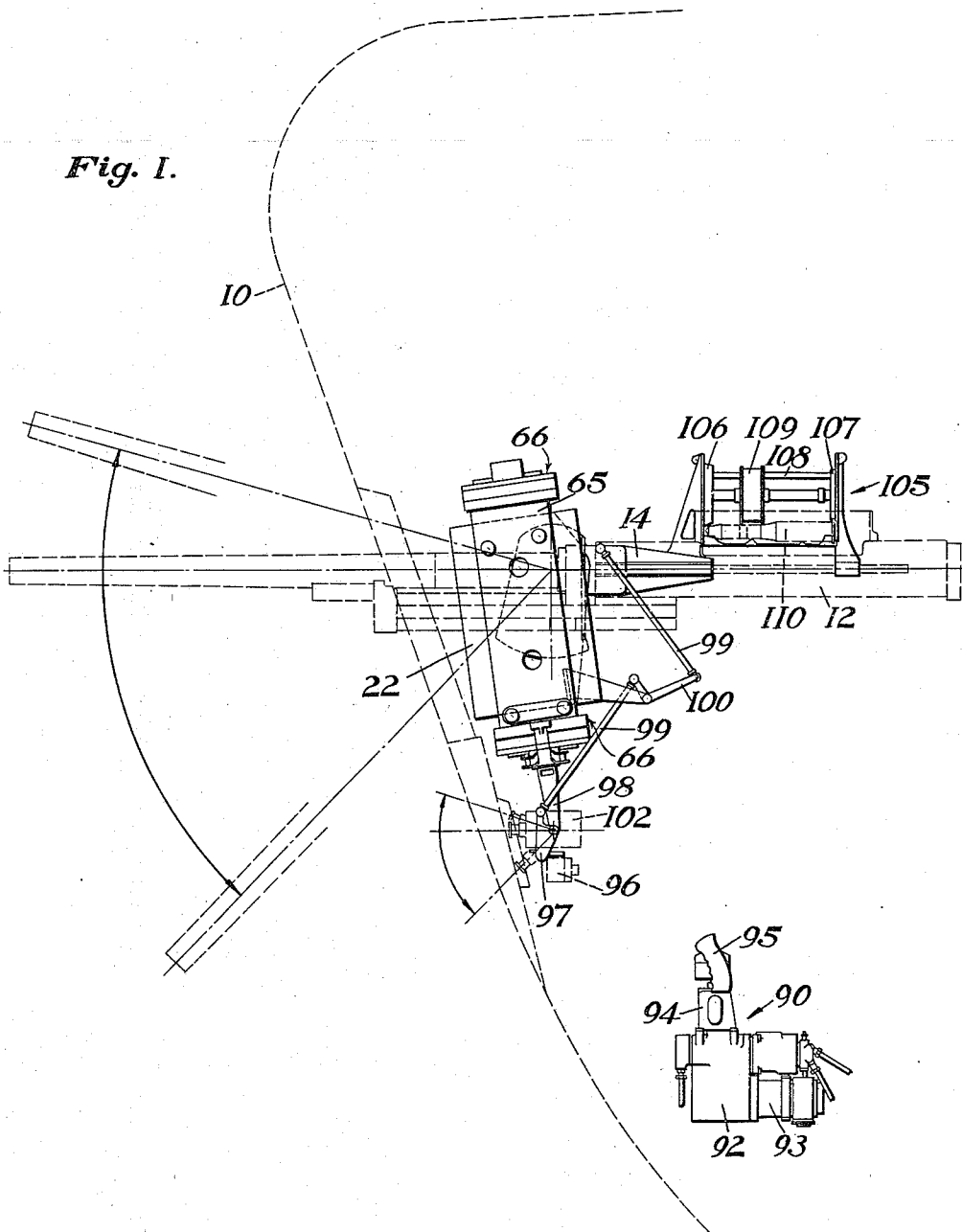
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Fig. 1.



INVENTORS

LeRoy F. Maurer, John C. Trotter

By Beau, Brooks, Buckley & Beau.

ATTORNEYS

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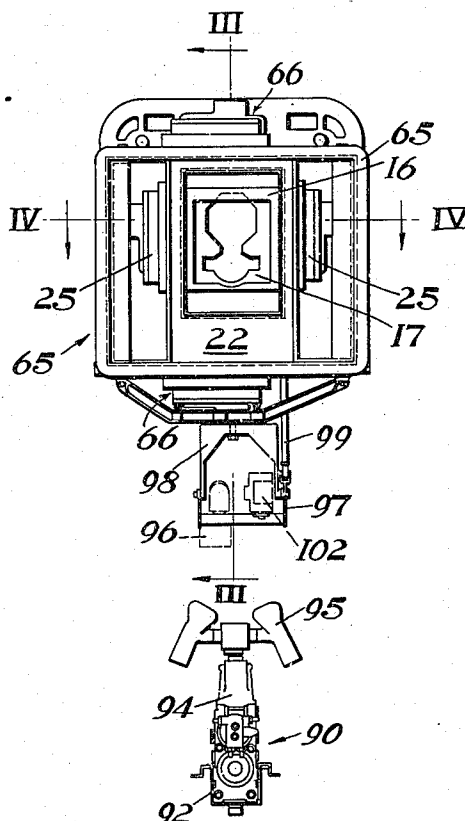
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Fig. 2.



INVENTORS

LeRoy F. Maurer, John C. Trotter

BY

Beau, Brooks, Buckley & Beau.

ATTORNEYS

Feb. 5, 1946.

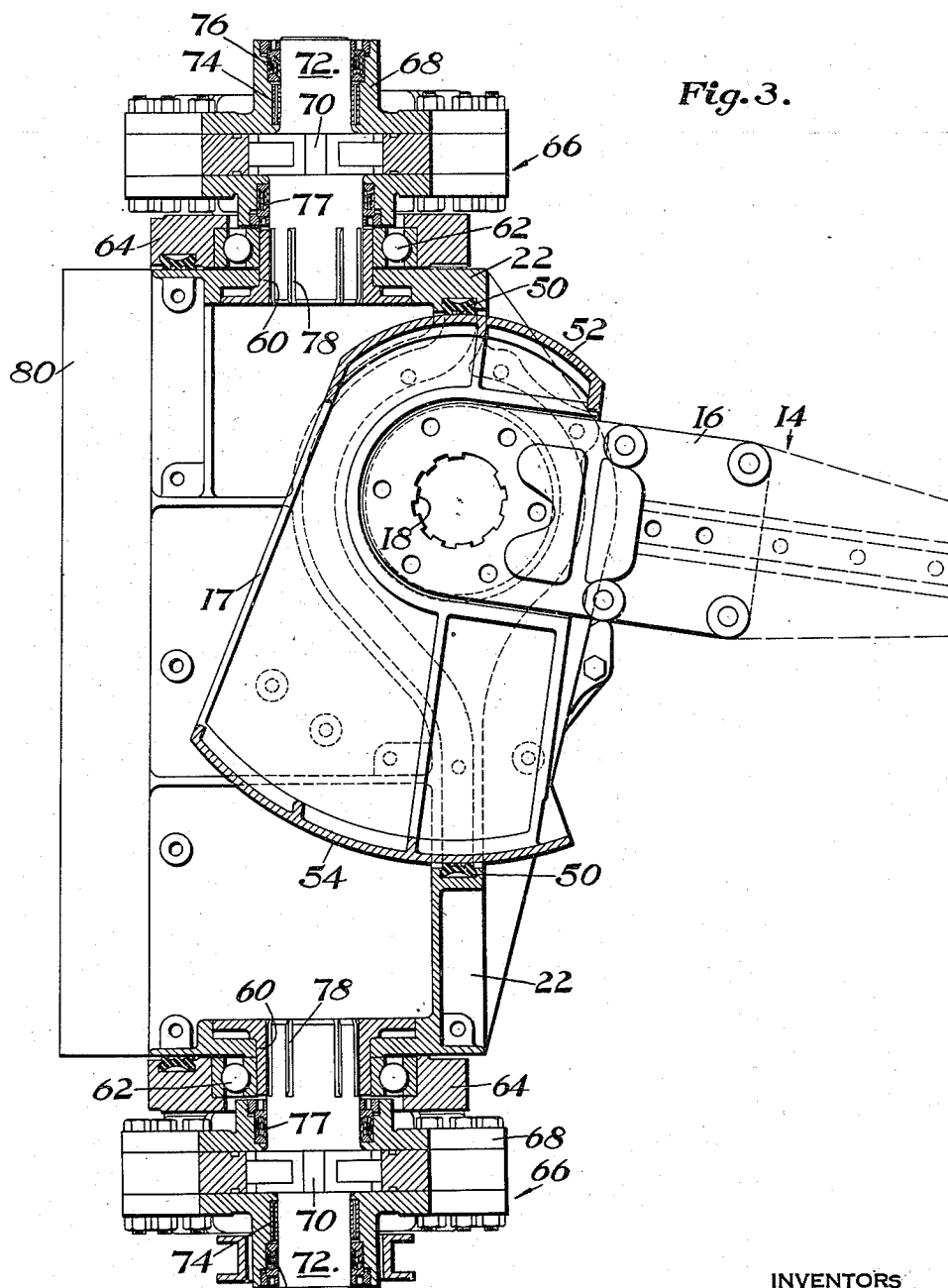
LE ROY F. MAURER ET AL

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INVENTORS

LeRoy F. Maurer, John C. Trotter

BY

Beau, Brooks, Buckley & Beau.
ATTORNEYS

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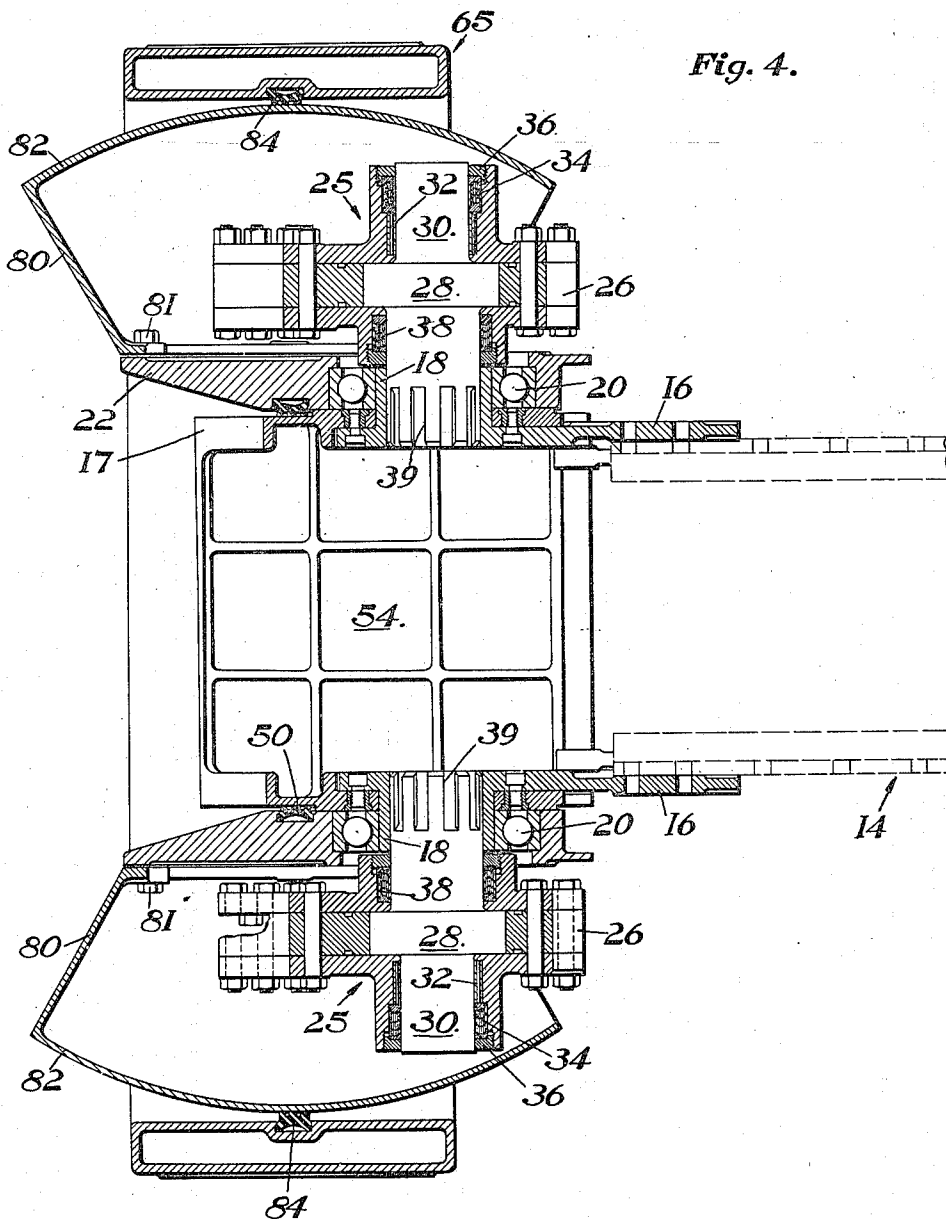
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INVENTORS

LeRoy F. Maurer, John C. Trotter

BY

BY
Beau, Brooks, Buckley & Beau.

ATTORNEYS

UNITED STATES PATENT OFFICE

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ORDNANCE

Le Roy F. Maurer, Buffalo, and John C. Trotter,
 Williamsville, N. Y., assignors to Bell Aircraft
 Corporation, Buffalo, N. Y.

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8 Claims. (Cl. 89—37.5)

This invention relates to ordnance, and more particularly to improved gun mount means for mounting high velocity guns such as aerial cannon upon aircraft or the like, in such manner as to be readily adjustable in elevation and azimuth for target training purposes.

One of the objects of the invention is to provide an improved gun mount arrangement for the purpose described which is extremely compact and light in weight and otherwise particularly adapted to be used in mounting guns upon aircraft or the like. Another object of the invention is to provide an improved mount for aerial cannon and remote aim control arrangements therefor. Other objects and advantages of the invention will appear in the specification hereinafter.

In the drawings:

Fig. 1 is a side elevation of a gun mount and remote aim control arrangement of the invention, shown as being carried in the nose portion of an airplane and mounting a high velocity type cannon of the anti-tank variety thereon;

Fig. 2 is a front elevation of the gun mount and aim control mechanisms of Fig. 1;

Fig. 3 is a vertical section, on an enlarged scale, taken through the gun mount mechanism as along line III—III of Fig. 2; and

Fig. 4 is a horizontal section, on an enlarged scale, taken along line IV—IV of Fig. 2.

The invention is illustrated in the drawings as comprising an improved aim-adjustable gun carriage mounted in the nose portion 10 of a bomber type airplane. However, it will be understood that the gun mount device of the invention may be employed to advantage when mounting guns upon other types of vehicles, or the like. In Fig. 1 the mounted gun is designated 12 and is of the high velocity aerial cannon type for firing explosive shells in connection with anti-tank warfare, or the like. The barrel of the gun 12 is shown projecting through a suitably apertured portion of the mounting vehicle.

The gun carriage of the invention is illustrated as comprising a bracket designated generally at 14 which includes a pair of side plate portions adapted to embrace the casing of the mounted gun at opposite sides thereof so as to clamp the gun upon the bracket 14 while leaving the gun barrel mechanism to be free to reciprocate relative to the bracket 14 in response to recoil forces of the gun firing operation. As illustrated in detail in Figs. 3-4, the bracket 14 includes a pair of like side plate portions 16-16 which carry a weather shield as illustrated at 17 to encompass

the gun barrel in the region just ahead of the axis of elevational aim adjustment thereof. The side plate portions 16-16 are formed with oppositely extending and axially aligned collars 18-18. The collars 18-18 are rotatably mounted by means of corresponding ball bearing devices 20-20 upon a gimbal bracket 22 which encircles the gun carrying bracket 14 in such manner as to permit the gun to be rocked about the axis of the bearings 20-20 for elevational aim adjustment purposes.

The gimbal bracket 22 carries at opposite sides thereof a pair of like vane type hydraulic motors designated generally at 25-25. Each of the motors 25-25 comprises a housing 26 enclosing a vane type piston 28 which is mounted upon and geared to a cross shaft 30. The outer end portions of the shafts 30-30 are rotatably mounted upon the respective motor housings by bearings 32-32 and sealed by packing devices 34-34 which are held in position by ring nuts 36-36. The inner end portions of the shafts 30-30 are similarly sealed at 38 and are splined at 39 for geared engagement with similarly splined portions of the sleeves 18-18 of the gun carrying bracket. Thus, it will be understood that application of fluid pressure force differentials against opposite faces of the motor pistons will procure corresponding rocking movements of the gun carrying bracket 14 in vertical directions. A resilient packing strip of rubber or the like, as indicated at 50, is carried within a suitably grooved portion of the gimbal bracket 22 to extend therefrom into slide bearing contact against adjacent outer surface portions of the bracket 17 so as to weather-seal the junction therebetween without interfering with free elevational aim adjustments of the gun relative to the gimbal bracket 22. To facilitate effective sealing action at this point of the mechanism the upper and lower face portions of the shield 17 are arcuately shaped concentrically of the axis of the bearings 20-20, as indicated at 52-54.

As illustrated in detail in Fig. 3, the gimbal bracket 22 is provided with a pair of opposite vertically extending sleeve devices 60-60 at the upper and lower central portions of the bracket 22. The sleeves 60-60 carry thereon corresponding ball bearing devices 62-62 which are fitted within correspondingly bored portions 64-64 of a support frame designated generally at 65. As shown in Fig. 2, the frame 65 encircles the gimbal bracket 22 and thereby carries the latter to be freely pivotable thereon about the aligned vertical axes of the bearings 62-62 to permit for

azimuth aim adjustments of the mounted gun relative to the frame 65. Thus, it will be understood that the frame 65 is adapted to be detachably mounted upon any suitable fixed structure of the airplane or other vehicle to carry the gun, and that the gun will thereupon be universally adjustable for target training purposes.

A pair of hydraulic motor devices designated generally at 66—66 are fixedly mounted upon the frame 65 adjacent corresponding of the bearings 62—62. Each motor 66—66 comprises a segmental housing 63 enclosing a vane type piston 70 which is keyed to a cross shaft 72 having its outer end portion mounted upon a bearing 74 and sealed at 76. The inner end portion of each shaft 72 is sealed at 77 and splined as at 78 for geared connection with correspondingly splined portions of the sleeves 60—60 of the gimbal bracket 22. Thus, it will be understood that application of pressure force differentials at opposite sides of the motor pistons 70—70 will procure corresponding rotating movements of the gun carrying gimbal bracket 22 relative to the frame 65 about the axis of the bearings 62—62 for adjustments of the gun aim in azimuth.

A pair of like housings 80—80 are mounted by screws 81 to extend from opposite sides of the bracket 22 so as to substantially enclose the motor devices 25—25 to protect the latter from elements externally of the mounting aircraft, and the side face portions of the housings 80—80 are arcuately shaped as indicated at 82—82 concentrically of the vertical axis of rotation of the gimbal bracket 22. Resilient weather-seal devices of rubber or the like are mounted as indicated at 84 in suitably grooved portions of the frame 65 so as to extend therefrom in resilient slide bearing relation against the curved surface portions 82—82 of the housings, so as to weather-seal the junction between the housings 82—82 and the frame 65 without interfering with free rotation of the gimbal bracket and gun unit relative to the frame 65 for azimuth aim adjustment purposes.

As illustrated in Figs. 1 and 2, a remotely disposed aim control device for the mounted gun is designated generally at 90 to comprise a hydraulic pump 92 driven by a motor 93. The output control valve mechanism of the pump is designated 94, and the control valve actuating stem is keyed to a cross bar and hand grip device 95 which is adapted to be manually manipulated by the gun operator to regulate flow of pressured fluid from the pump 92 into the gun mount adjustment motors 25—66. It will be understood that the remote control valve and pump mechanism does not comprise subject matter of the present invention, and that any suitable type of hydraulic fluid supply and control means may be employed to cause the motor devices 25—66 to operate to adjust the gun mount for elevational and azimuth aim adjustment purposes. For example, the type of pump and control shown in detail in application Serial Number 474,106 of John C. Trotter filed January 30, 1943; or of the type shown in application Serial Number 438,400 of John C. Trotter and LeRoy F. Maurer filed April 10, 1942, may be employed. In any case it will be understood that suitable fluid conduits (not shown) will be connected to extend between the control pump mechanism and the gun mount motor devices 25—66 in accord with conventional hydraulic pressure transmission practice.

Thus, it will be understood that manual adjustment of the control bar 95 about the vertical axis of the stem of the valve 94 will actuate the valve

mechanism so as to enable the pump 92 to deliver pressured fluid to the azimuth control motors 66—66; whereby the entire gun and gimbal bracket unit will be caused to rotate relative to the frame 65 in such manner as to procure azimuth aim adjustments of the mounted gun in the direction of twisting of the control handle 95. Vertical twisting movements of the handle 95 about the horizontal axis of the cross bar portion thereof will actuate the valve mechanism 94 so as to cause the motor 92 to deliver pressured fluid to the motors 25—25 in such manner as to rock the gun carrying bracket 14 about the horizontal axes of the bearings 20—20; whereby to procure elevational aim adjustments of the mounted gun in the direction of twisting of the control handle 95.

A target sight device, as indicated at 96, is carried by a bracket 97 which pivots to a frame 98 suspended pivotally from the gun mount frame 65. A pair of links 99—99 connect through a bell crank 100 to cause the sight carrying bracket 97 to rock in consonance with vertical rocking movements of the gun mount bracket 14; whereby the sight 96 moves automatically in response to adjustments of the gun aim in synchronism therewith. A camera is mounted, as indicated at 102, upon the sight carrying bracket 97; whereby the camera 102 is carried to sight at all times in the direction of the gun aim to be adapted to record the effects of gun fire upon the target.

As indicated generally at 105 (Fig. 1) an ammunition magazine for the mounted gun is carried by the bracket 14, whereby the magazine will be disposed in feeding registry with the gun while being carried as an integral part of the gun mount mechanism. The magazine is illustrated for example to comprise a pair of spaced track devices 106—107 which are interconnected by cross bars 108 to provide a frame-like trackway upon which cartridges 110 may be disposed in side-by-side relation to be pulled around the trackway by a belt or the like carried in a channel 109, whereby the rounds will slide upon the trackway and be fed successively into the ammunition feedway port of the gun 12.

Thus, it will be understood that the gun mount arrangement of the invention provides an unusually compact and light weight gun carriage which provides for universal aim adjustments of the gun and positive control of the position and aim thereof under all conditions of gun aim adjustment. Because the elevation and azimuth aim control motor devices are mounted in paired alignment at opposite sides of the gun mount structure, the power output forces thereof are balanced at opposite sides of the mount brackets. The brackets are thereby free from twisting stresses such as would otherwise be transmitted thereto. Consequently, the bracket devices may be formed of minimum sectional dimensions and to lesser overall or bulk dimensions while being capable of firmly holding and rapidly moving the gun in connection with aim adjustments, whereby the necessary total bulk and weight of the gun battery installation is minimized.

Although only one form of the invention has been shown and described in detail, it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. A gun mount and aim adjustment device

for carrying a gun to fire from a gun battery device such as an airplane or the like, comprising in combination, a frame adapted to be fixed upon an apertured portion of said device, a gimbal bracket mounted interiorly of said frame by means of pivot connection devices having aligned vertical axes and mounting said bracket relative to said frame at upper and lower portions thereof, a gun mount bracket disposed interiorly of said gimbal bracket and pivotally mounted thereon by means of pivot connection devices having aligned horizontal axes whereby said gun mount bracket is mounted relative to said gimbal bracket at opposite side portions thereof, paired motor devices carried by said frame at upper and lower portions thereof and geared to said gimbal bracket for rotating the latter relative to said frame, paired motor devices carried by said gimbal bracket at opposite sides thereof and geared to said gun mount bracket for rotating the latter relative to said gimbal bracket, power supply means for energizing said motor devices to procure elevational and azimuth adjustments of the gun mount aim, a weather shield device carried by said gun mount bracket to closely fit upon and encompass the mounted gun and having outer side portions thereof curved concentrically of the axis of pivoting of said gun mount bracket relative to said gimbal bracket, and weather-seal means carried by said gimbal bracket to extend therefrom into slide-bearing weather-sealing relation against said curved surface portions of said shield.

2. A gun mount and aim adjustment device for carrying a gun to fire from an airplane or the like, comprising in combination, a frame adapted to be fixed upon an apertured portion of the airplane or the like, a gimbal bracket mounted interiorly of said frame and mounting said bracket relative to said frame at upper and lower portions thereof, a gun mount bracket disposed interiorly of said gimbal bracket and pivotally mounted thereon whereby said gun mount bracket is mounted relative to said gimbal bracket at opposite side portions thereof, a motor device carried by said frame and geared to said gimbal bracket for rotating the latter relative to said frame, a motor device carried by said gimbal bracket and geared to said gun mount bracket for rotating the latter relative to said gimbal bracket, power supply means for energizing said motor devices to procure elevational and azimuth adjustments of the gun mount aim, and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun and one of said motor devices and having outer side portions thereof curved concentrically of the axis of movement thereof.

3. A gun mount and aim adjustment device comprising in combination, a rectangular frame disposed to stand substantially vertically, a gimbal bracket mounted interiorly of said frame by means of paired first pivot connection devices having vertically aligned axes and mounting said gimbal bracket relative to said frame at upper and lower end portions thereof, a gun mount bracket disposed interiorly of said gimbal bracket and pivotally mounted thereon by means of paired second pivot connection devices having horizontally aligned axes whereby said gun mount bracket is mounted relative to said gimbal bracket at opposite side portions thereof, said gimbal bracket having splined sleeve devices extending integrally from its upper and lower end portions

concentrically of said first pivot connection devices, a pair of motor devices carried by said frame respectively at upper and lower portions thereof, each of said motors having a corresponding splined drive shaft portion thereof slip-fitted into and geared to a corresponding said gimbal bracket sleeve device for rotating said gimbal bracket relative to said frame, said gun mount bracket having splined sleeve devices extending integrally from its opposite side portions concentrically of said second pivot connection devices, a second pair of motor devices carried by said gimbal bracket respectively at opposite sides thereof, each of said second pair of motors having a corresponding splined drive shaft portion slip-fitted into and geared to a corresponding said gun mount bracket sleeve device for rotating said gun mount bracket relative to said gimbal bracket, and controlled power supply means for selectively energizing said pairs of motor devices and simultaneously energizing the motors of each pair thereof to procure elevational and azimuth adjustments of the gun mount aim.

4. A gun mount and aim adjustment device comprising in combination, a frame, a gimbal bracket mounted upon said frame by means of paired first pivot connection devices having vertically aligned axes and mounting said gimbal bracket relative to said frame at upper and lower end portions thereof, a gun mount bracket disposed interiorly of said gimbal bracket and pivotally mounted thereon by means of paired second pivot connection devices having horizontally aligned axes whereby said gun mount bracket is mounted relative to said gimbal bracket at opposite side portions thereof, said gimbal bracket having spline connection devices extending integrally from its upper and lower end portions concentrically of said first pivot connection devices, a pair of motor devices carried by said frame respectively at upper and lower portions thereof, each of said motor devices having a corresponding drive portion spline connected to a corresponding said gimbal bracket spline connection device for rotating said gimbal bracket relative to said frame, said gun mount bracket having spline connection devices extending integrally from its opposite side portions concentrically of said second pivot connection devices, a second pair of motor devices carried by said gimbal bracket respectively at opposite sides thereof, each of said second pair of motor devices having a corresponding drive portion spline connected to a corresponding said gun mount bracket spline connection device for rotating said gun mount bracket relative to said gimbal bracket, controlled power supply means for selectively energizing said pairs of motor devices and simultaneously energizing the motors of each pair thereof to procure elevational and azimuth adjustments of the gun mount aim, and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun and one of said motor devices and having outer side portions thereof curved concentrically of the axis of movement thereof.

5. A gun mount and aim adjustment device comprising in combination, a frame, a gimbal bracket mounted upon said frame by means of a first pivot means, a gun mount bracket, a second pivot means mounting said gun mount bracket upon said gimbal bracket, said gimbal bracket having a splined sleeve device extending integrally from an end portion thereof concentrically

of said first pivot means, a first motor device carried by said frame and having a splined drive shaft portion slip-fitted into geared connection to said gimbal bracket sleeve device for rotating said gimbal bracket relative to said frame, said gun mount bracket having a splined sleeve device extending integrally therefrom concentrically of said second pivot means, a second motor device carried by said gimbal bracket and having a corresponding splined drive shaft portion slip-fitted into geared connection to said gun mount bracket sleeve device for rotating said gun mount bracket relative to said gimbal bracket, controlled power supply means for selectively energizing said motor devices to procure elevational and azimuth adjustments of the gun mount aim and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun and said first motor device and having outer side portions thereof curved concentrically of the axis of movement thereof.

6. A gun mount and aim adjustment device comprising in combination, a rectangular frame disposed to stand substantially vertically, a rectangular gimbal bracket mounted interiorly of said frame by means of paired first pivot connection devices having vertically aligned axes and mounting said gimbal bracket relative to said frame at upper and lower end portions thereof, a gun mount bracket disposed interiorly of said gimbal bracket and pivotally mounted thereon by means of paired second pivot connection devices having horizontally aligned axes whereby said gun mount bracket is mounted relative to said gimbal bracket at opposite side portions thereof, said gimbal bracket having spline connection devices extending from its upper and lower end portions concentrically of said first pivot connection devices, paired vane type hydraulic motor devices carried by said frame at upper and lower portions thereof and disposed flatwise thereagainst and having corresponding splined drive shaft portions slip-fitted into geared connections to said gimbal bracket sleeve devices for rotating said gimbal bracket relative to said frame, said gun mount bracket having splined sleeve devices extending from its opposite side portions concentrically of said second pivot connection devices, paired vane type hydraulic motor devices carried by said gimbal bracket at opposite sides thereof and disposed flatwise thereagainst and having corresponding splined drive shaft portions slip-fitted into geared connections to said gun mount bracket sleeve de-

5 vices for rotating said gun mount bracket relative to said gimbal bracket, controlled power supply means for selectively energizing said pairs of motor devices and simultaneously energizing the motors of each pair thereof to procure elevational and azimuth adjustments of the gun mount aim, and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun and one of said motor devices and having outer side portions thereof curved concentrically of the axis of movement thereof.

7. A gun mount and aim adjustment device comprising in combination, a frame, a gun mount bracket, pivot means mounting said gun mount bracket upon said frame, said bracket having a splined sleeve device extending from an end portion thereof concentrically of said pivot means, a motor carried by said frame and having a drive shaft portion thereof splined and slip-fitted into geared connection to said bracket sleeve device for rotating said bracket relative to said frame, said motor comprising a pressured fluid supply casing of flat sector form and a vane type piston oscillatable within said casing, means for controlling flow of pressured fluid to said motor to procure adjustments of the gun mount aim, and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun to said motor device and having outer side portions thereof curved concentrically of the axis of movement thereof.

8. A gun mount and aim adjustment device comprising in combination, a frame, a gun mount bracket, pivot means mounting said gun mount bracket upon said frame, said bracket having a splined connector extending from an end portion thereof concentrically of said pivot means, a fluid pressure motor comprising a casing of flat sector form and a vane type piston oscillatable within said casing and a splined shaft integral with said piston and extending therefrom into slip-fitted geared connection with said bracket splined connector, means for controlling flow of pressured fluid to opposite sides of said motor piston to procure adjustments of the gun mount aim, and weather shield devices carried by said gun mount bracket and said gimbal bracket to closely fit upon and encompass respectively the mounted gun to said motor device and having outer side portions thereof curved concentrically of the axis of movement thereof.

LE ROY F. MAURER.
JOHN C. TROTTER.