This invention relates to improvements in arrangements for mounting machine guns within airplane wing structures, or the like.

One of the objects of the invention is to provide a simple gun mounting means adapted to support a machine gun in firmly mounted and quickly detachable relation for gun servicing operations in an improved manner. Another object of the invention is to provide an improved gun mounting means adapted to provide the above mentioned object and to support the gun within an airplane wing panel in such manner as to substantially avoid projection of gun mount parts externally of the ideal contour of the housing wing structure. Another object of the invention is to provide in an airplane an improved mount for automatic guns of the detachable barrel type whereby either the entire gun mechanism or only the gun barrel thereof may be selectively removed for servicing operations in accord with a simplified and improved procedure. Another object of the invention is to provide in an airplane wing gun mount improved means for minutely adjusting the training of the gun as a final step of the installation thereof. Another object of the invention is to provide, in conjunction with a machine gun mounted within an airplane wing or the like, an improved cartridge belt feeding and empty cartridge case and link discharging means. Other objects and advantages of the invention will appear from the specification hereinafter.

In the drawings:

Fig. 1 is a vertical transverse section through an airplane wing showing in elevation a machine gun mounted therewithin in accord with the invention;

Fig. 2 is a section along line II—II of Fig. 1 showing the gun and mount of Fig. 1 in plan view;

Fig. 3 is a section, on an enlarged scale, taken substantially along line III—III of Fig. 1, illustrating one portion of the bracket means of the gun mount;

Fig. 4 is a fragmentary top plan of the bracket means of Fig. 3;

Fig. 5 is a section, on an enlarged scale, taken substantially along line V—V of Fig. 1 and showing another portion of the bracket means of the gun mount;

Fig. 6 is a section taken substantially along line VI—VI of Fig. 5; and

Fig. 7 is a section, on an enlarged scale, taken substantially along line VII—VII of Fig. 1 through the ammunition feeding and empty cartridge case and clip conveying means of the invention.

The drawings illustrate the invention in connection with a machine gun comprising generally a main housing cover 10 and a barrel 12 extending therefrom; the gun unit being mounted within an airplane wing structure designated generally by the numeral 16. The invention includes a transversely disposed bulk heads 18 constituting portions of the wing framing structure. The gun is mounted by means of a pair of brackets designated generally by the numerals 20 and 40, respectively. The bracket 20 includes a sparer member 16 and transversely disposed bulk heads 18 constituting portions of the wing framing structure. The gun barrel 12 is enclosed by a conduit member 21 which is built in as an integral portion of the wing structure; the conduit 21 being open at its forward end 22 (Figs. 1 and 2) for discharge of the gun therethrough.

The bracket means 20 comprises a supporting lug 24 rigidly attached to the spar member 16 and provided with an extending body portion 26 which is vertically bored to support thereon a stub shaft 27. The stub shaft 27 is formed with an enlarged head 28 at its lower end so as to be adapted to mount thereon a collar 29 in freely rotatable relation; the shaft 27 being mounted at its upper end upon the bracket 24 by means of a screwed threaded nut 30.

The collar 29 is provided at its outer surface with a series of parallel keys 31 extending outwardly therefrom into bearing engagement with correspondingly key-wedyed portions of a yoke 32 in such manner that the yoke 32 is adapted to be suspended by the collar 29 from the bracket 24 in freely rotatable relation about the vertical axis of the shaft 27. As illustrated in Fig. 6, the keys 31 are broken away as at 33. Similarly, the yoke member 32 is broken away as at 34, intermittently about the perimeter of its inner bore so as to allow the keys 31 of the collar to disengage from supporting connection with respect to the yoke 32 whenever the collar 29 is rotated relative to the yoke 32. The keys 31 in registry with the broken away portions 34. A detent for normally maintaining the collar 29 against rotation relative to the bracket 24 is provided in the form of a ball member 35 mounted within the bracket portion 26 and backed up by a compression spring 36 so as to be at all times resiliently urged to bear against the adjacent surface of the collar 29 and into a recess 37 therein whenever the ball 35 and
recess 31 are in registry. Thus, the collar 29 is maintained against accidental rotation relative to the housing 24, but the detent device 39—46 is so provided that the collar 29 may be rotated manually against the action of the detent device for disengagement of the yoke 32 from the supporting bracket. The yoke member 32 carries at its lower end a trunnion pin 30 which pivotally engages opposed lug portions 35 of the gun cover structure. Thus, the gun is pivotable about the horizontal axis of the trunnion pin 38 and is also rotatable about the vertical axis of the supporting shaft 27.

The second gun supporting bracket device 40 is illustrated in detail in Figs. 3 and 4 as comprising generally an L-shaped arm 42 having a horizontally disposed end portion 43 extending transversely between the gun case at a position spaced rearwardly of the bracket device 28. The arm portion 43 is threaded through aperture lug portions 44 extending downwardly below the gun case 10 in free sliding relation therein so that the gun may be shifted axially upon the arm portion 43 so as to cause the gun to be rotated about the vertical axis of the shaft 27 for minor adjustments of the gun in azimuth during final installation thereof upon the gun mount means. For this purpose the arm end 63 is externally threaded at 45 to engage in screwthreaded relation with a threaded portion 48 of a collar 47 disposed between the gun lugs 44, and a slide fitting bushing 46 is fitted upon the reduced outer end portion 63 of the arm 62 and is maintained thereon by means of a threaded nut 49. Thus, the collar 47 may be rotated upon the arm 42 to provide end thrust forces against the gun lugs 44 so as to cause the gun to be shifted axially of the shaft portion 43 for the azimuth adjustments as hereinabove described. A set screw is provided as shown in the collar 47 for firing it in final adjusted position relative to the shaft 43. To assemble the bracket device, the collar 47 is first disposed between the lugs 44 and the arm portion 43 is then inserted through the lugs 44 and the collar 47 by rotation of the arm so as to thread it through the collar 47 into the position illustrated in Fig. 3, whereupon the bushing 46 is slid into position upon the arm and locked thereon by means of the nut 49.

The upper end of the arm 42 is formed with a vertically disposed stem portion 50 which is slotted and mounted within a hinge member 52. The stem portion 50 is externally threaded for engagement with oppositely disposed nuts 53 for adjustably positioning the arm 42 vertically upon the hinge member. Lock nuts 54 are provided to back up the nuts 53 so that the latter may be conveniently fixed in their respective adjusted positions in such manner as to leave the arm 42 free to rotate relative to the hinge member 52 about the vertical axis of the stem portion 50. The stem portion 50 is preferably flattened at a side portion thereof and calibrated as shown so as to fit the gun elevation socket of a convenient means for reading the vertical adjustment of the stem 50 relative to the hinge member 52, as indicated by the degree of emergence of the stem 50 from the lock nut 54. The hinge member 52 is supported by means of a pin 56 extending from a stationary portion of the airplane wing bulk head structure; the mounting of the hinge member 52 upon the lugs 55 being provided by means of a pin 56 extending through registering bored portions of the connecting members. The parts are so formed that the pin 56 is disposed vertically and the hinge member 52 is supported thereby in freely rotatable relation about the hinge member 52 and the pin 56.

Thus, the gun is mounted upon a pair of spaced bracket devices 20—40 to provide for an installation procedure as follows: Prior to installation of the gun in the win model structure, the arm 42 is mounted upon the lugs 44 of the gun with the collar 47 therebetween, as explained hereinabove. The yoke member 32 is then placed in operative position and clamped to the lugs 35 of the gun by means of the pin 38. The gun is then inserted within the wing structure to a position wherein the upper end of the yoke 32 comes into registry with the collar 29 which has been previously mounted in operative position upon the bracket 24 by means of the shaft 27. The collar 29 is then rotated against the action of the detent device 35 to a position wherein the cut away portions 36 of the yoke 29 register with the outwardly extending keys 31 of the collar 29, whereupon the yoke is raised into mounted position upon the collar 29. The collar 29 is then further rotated until the detent device 35 engages the corresponding key-wayed portion of the collar 29 to support thereby the adjacent portion of the gun against vertical or minor displacement from the position illustrated. However, it will be noted that at this stage of the installation proceeding the gun is freely pivotable about the horizontal axis of the pin 38 and also about the vertical axis of the shaft 27.

The second step of the installation procedure involves the mounting of the hinge member 52 upon the lugs 55; the hinge member 52 having been previously mounted upon the arm stem 50. The hinge member 52 is mounted between the fixed lugs 55 by means of the detachable pin 56. Thus, the gun is mounted generally in operative position within the wing structure of the airplane by means of the two bracket devices 20—40. Owing to inaccuracies of forming and assembling manufacturing operations, however, it has been found necessary to provide for certain adjustments of the gun upon its supporting brackets in order to obtain accurate training of the gun as may have been previously specified. To this end the invention provides improved means of bored portion 51 of a hinge member 52, the stem portion 50 of which is externally threaded for engagement with oppositely disposed nuts 53 for adjustably positioning the arm 42 vertically upon the hinge member. Lock nuts 54 are provided to back up the nuts 53 so that the latter may be conveniently fixed in their respective adjusted positions in such manner as to leave the arm 42 free to rotate relative to the hinge member 52 about the vertical axis of the stem portion 50. The stem portion 50 is preferably flattened at a side portion thereof and calibrated as shown so as to fit the gun elevation socket of a convenient means for reading the vertical adjustment of the stem 50 relative to the hinge member 52, as indicated by the degree of emergence of the stem 50 from the lock nut 54. The hinge member 52 is supported by means of a pin 56 extending from a stationary portion of the airplane wing bulk head structure; the mounting of the hinge member 52 upon the lugs 55 being provided by means of a pin 56 extending through registering bored portions of the connecting members. The parts are so formed that the pin 56 is disposed vertically and the hinge member 52 is supported thereby in freely rotatable relation about the hinge member 52 and the pin 56.

If, for example, it is determined that adjustments in azimuth are required, the collar 47 may be rotated to provide the necessary axial displacement of the gun relative to the rear supporting structure of the airplane by means of the bracket device 20. Particular attention is called to the fact that azimuth adjustments of the gun about the vertical axis of the shaft 27 as the center of rotation provides corresponding minor displacements of the lug portions 44—44 of the
gun from the positions illustrated; and it will be noted that such displacement movements have components directed both laterally of the gun and longitudinally thereof. Hence, the movement of the lugs 44—44 in plan view is in the path about the axis of the forward bracket 27 as its center. Therefore, azimuth adjustments of the rear end of the gun to either side of the position thereof illustrated in Fig. 4 causes the lugs of the lugs 44 to be displaced angularly from the line thereof illustrated in Fig. 4 which intersects the vertical center lines of the stem portion 50 and the pin 58. However, since the stem 50 is freely rotatable within the hinge member 52 and the hinge member 52 is freely rotatable upon the pin 56, the supporting arm 42 is at all times free to assume the angular attitude corresponding to changes in disposition of the lug members 44—44 in connection with the azimuth adjustments. Therefore, such adjustments can be freely made as required, and without imposition of secondary stresses upon the gun supporting brackets 44—44.

Also, it will be understood that vertical adjustment movements of the stem 50 within the hinge member 52 will be accompanied by minor longitudinal displacements of the rear end of the gun because of its mounting on 58, and that such movements are automatically compensated for by pivotal movements of the hinge member 52 about the vertical members 50 and 56, thus eliminating interferences with the desired adjustments and/or secondary stresses in the mounting device.

To remove the gun from mounted position upon the brackets 20—40, the collar 29 of the forward bracket is simply rotated so as to free the key connections to permit the forward end of the gun to be lowered out of engagement with the bracket. The rear bracket pin 56 is then removed and the rear end of the gun is then free to be lowered out of engagement with its rear supporting means. Thus, the gun is freed to be bodily withdrawn from the wing structure through openings provided therein by removal of a detachable cover plate 50 at the under surface of the wing proper. A second opening in the wing structure is provided for the same purpose by removal of a second detachable cover plate 52 in the upper surface of the adjacent wing flap 64. A third detachable cover plate 68 is provided in the upper surface portion of the wing flap 64 so that the flap 64 may be placed in its lowered position and the plate 68 removed and the gun barrel 12 removed rearwardly through the opening in the flap 64 so provided. A top cover plate 80 may be conveniently arranged in the upper wing contour to provide access into the gun compartment from above.

As illustrated in Figs. 1, 2 and 7, the gun 10 is provided with a cartridge belt feed inlet and empty case and link outlet mechanism. The cartridge belt inlet device comprises a chute 80 having its discharge port in registry with the belt feed pawl and cartridge receiving port 82 of the gun. The intake end of the chute 80 is flared as at 84 and disposed in registry with the cartridge belt outlet end 86 of an ammunition box 88 disposed within the wing structure adjacent the gun mount compartment. The chute 80 is mounted directly upon the gun case 10 by means of a bracket 82 extending into abutting relation with an adjacent side portion of the gun case and clamped thereto against by means of a bolt 91 extending through the gun case. At the opposite side of the gun case the bolt 91 engages a second bracket 92 extending from a cartridge belt clip chute 94 which is disposed so as to have its intake end 98 in registry with the clip ejecting port of the gun and its discharge end 96 directed downwardly toward an opening in the airplane wing covering so as to provide for discharge of disengaged belt clips therethrough.

An extending sheet metal portion of the chute 80 is rolled as at 97 to engage the usual belt holding pawl pin 90 of the machine gun; the pin 90 being inserted longitudinally through aligned lugs extending from the gun and the rolled portion 97 of the cartridge belt chute 88 so as to complete the mounting of the chute 88 upon the gun in a detachable but otherwise integral manner. Similarly, a rolled portion 90 of the chute 94 is provided to engage with the opposite gun pawl pin 90 to complete the mounting of the clip ejection chute 94 as an integral unit with the gun case 10. Thus, the cartridge belt feed chute 80 and the clip ejection chute 94 normally remain as integral elements of the gun unit for movement bodily therewith during gun installation and training adjustment movements and during withdrawal of the gun from the airplane wing for repair and/or servicing.

An empty cartridge case chute 100 of open end form is disposed immediately below the empty case ejecting port of the gun for conveyance of empty cartridge cases therefrom and into the airstream below the wing. The case chute 100 is formed as an integral portion of the wing structure and terminates at its upper end in such manner as to provide ample clearance with respect to the gun case 10 to avoid interference with the recoil and other vibrational movements of the gun when firing. Thus, it will be understood that the cartridge belt feed chute 80 and the discharge link chute 94 are normally mounted upon the gun case 10 as integral portions thereof by means of the bolt 91 and the pins 90. However, they may be readily removed from the gun case 10 simply by removal of the bolt and pin means for servicing purposes. It will also be understood that the chutes 80 and 94 terminate at their ends remote from the gun case 10 in such manner as to provide ample clearances with respect to stationary portions of the airplane structure so as to avoid interferences with the recoil or other vibrational movements of the gun when firing. An ammunition rounds counter 102 is mounted upon the chute 80 in operative association therewith so as to register the passage of rounds therethrough. For this purpose any suitable type of counter mechanism may be employed but it will be understood that by reason of this chute and counter arrangement changes of the magazine 88 and other servicing operations upon the gun and magazine devices do not disturb the counter device and the latter is protected from damage during servicing operations and the installation is capable of being serviced in place with an improved procedure providing benefits of increased convenience for the servicing crew.

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 herein without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In combination, a base support, a gun, a gun mount comprising a pair of gun suspension devices carried by said base support and spaced...
longitudinally of the gun, one of said suspension devices comprising means for mounting said gun to be pivotable relative to said support about vertical and horizontal axes, the other of said devices comprising means for adjustably holding said gun in various pivoted positions relative to said axes and including a link having a pair of pivot devices thereon defining spaced parallel pivot axes, one of said link pivot devices being connected to said base support against axial movement relative thereto, a mount arm having pivotal engagement at one of its ends with the other of said pivot devices, screw thread means carried by said mount arm for axially adjusting and retaining said mount arm in pivotal mounted relation with respect to said link, said mount arm having a second end portion extending at right angles to the first mentioned other end thereof and having pivotal connection with the gun, and screw thread means carried by said mount arm for adjusting and retaining the latter axially with respect to said gun.

2. In combination, a support, a gun, a gun mount device comprising a pair of gun connectors coupled to said support and spaced longitudinally of the gun, one of said connectors comprising means mounting said gun relative to said support to be universally pivotable thereon, the other of said connectors comprising a link, a hinge device mounting said link upon said support against movement relative thereto axially of said hinge connection so as to be pivotable thereon about a first axis, a gun mount arm having a portion thereof connected to said link to be pivotable thereon about a second axis substantially parallel to said first axis, means on said mount arm for positionally adjusting said gun mount arm with respect to said link, said arm having a second portion thereof pivotally connected to said gun, and means carried by said arm second portion for positionally adjusting the latter with respect to said gun.

3. In combination, a support, a gun, a gun mount comprising a pair of gun suspension devices carried by said support and spaced longitudinally of the gun, one of said suspension devices comprising means mounting said gun to be universally pivotable relative to said support, the other of said devices comprising link means, a hinge device mounting said link upon said support to be pivotable thereon about a vertical axis, a gun mount arm carried by said link and pivotable thereon about a second axis parallel to said vertical axis, means on said mount arm for vertically adjusting and retaining said mount arm with respect to said link, said mount arm having a portion thereof extending horizontally and in pivotal connection with the gun, and means for horizontally adjusting said mount arm with respect to said gun.

4. In combination, a base, a gun, a gun mount comprising a pair of gun connectors carried by said base and spaced longitudinally of the gun, one of said connectors comprising means mounting said gun relative to said base for pivoting thereon about vertical and horizontal axes, the other of said connectors comprising a link, a pivotal connection device mounting said link relative to said base so as to be fixed thereon against vertical movement relative thereto, a gun mount arm carried by said link for pivoting relative thereto about an axis parallel to the axis of said pivotal connection device, means carried by said mount arm for vertically adjusting and retaining said mount arm with respect to said link, said mount arm being connected to said gun for pivoting relative thereto about a horizontal axis, and means for adjusting and retaining said mount arm horizontally with respect to said gun.

EDWARD M. BERTRAN.
MAX SOKOL.