This invention relates to gun turrets for automatic guns of small caliber, such as 20 mm. especially for armored vehicles but also for use in fixed defense positions.

Among the more important features and considerations which must be taken into account in the development and design of such gun turrets are space, ventilation, vision, ammunition supply, weapon access, aiming system, sighting system, and external shape. It is the general object of this invention to provide such a turret in which these various features and factors are accounted for and accommodated in a manner such as to enhance most of these features while at least maintaining the advantages of others.

Accordingly, it is an object of this invention to provide a turret with a gun mounting of which the major part preferably is outside the turret, so that it does not compete with other essential equipment for space inside the turret, but which gives access to the gun and ammunition feed mechanism for arming, cocking and operational servicing of the gun from inside the turret, while avoiding venting of propel ling gas into the turret.

In accordance with these objects the invention generally comprises a gun turret including a rotatable cupula with a gun port in the cupula wall, a gun cradle mounted on trunnions about an elevation axis extending across the gun port, the major part of the gun cradle projecting outward from the gun port, a gun port mantlet movable with the cradle about the elevation axis to close the gun port at all firing angles of elevation, and a door at the rear end of the cradle accessible from inside the cupula to give access to a gun in the cradle. A suitable counterbalance is provided to balance the cradle, with a gun therein, about the elevation axis.

According to another feature of the invention, the cupula wall, or an ammunition store or magazine carried by or with the cupula, has an ammunition outlet port, and an ammunition chute arranged outside the cupula extends from the ammunition outlet port to the gun cradle, the ammunition chute being mounted to move the gun cradle in elevation and having a mantlet to close the ammunition outlet port at all firing angles of elevation. Conveniently and preferably, the ammunition outlet port is located alongside the gun port so that it is crossed by the elevation axis, the ammunition chute being pivoted about the elevation axis across the outlet port, and the inlet end of the ammunition chute is formed as a mantlet to close the outlet port at all firing angles of elevation.

In order to lead the ammunition smoothly from the outlet port to the gun, the ammunition chute conveniently is curved, substantially in the axial plane of the rounds of ammunition, and extends through about 90° from the outlet port to enter the gun cradle in front of the gun port. It is usual for the rounds of ammunition to be connected together, side by side, by spring metal links which make up a flexible belt of ammunition up to the feed mechanism of the gun by which the links are separated from the rounds and ejected.

In order to guide a linked ammunition belt in a flat curve, substantially in the axial plane of the rounds, the present invention provides a curved ammunition chute in which a series of sprockets are journaled on axes substantially radial to the curve of the chute and are located for the sprocket teeth to fit between the rounds and guide the belt round the curve by engaging the links between the rounds on the inside of the curve. This arrangement of guide sprockets provides for low-friction guiding of the ammunition belt and enables the noses and bases of the rounds to be kept out of contact with the sides of the ammunition chute.

Other objects, features and advantages of the invention will be apparent to those skilled in the art and armed with an understanding of the invention.

I have set forth with particularity in the appended claims those novel and improved features which I regard as characteristic of my invention, but the invention itself, its operation and advantages, will best be understood from the following description of a gun turret made in accordance with the invention and illustrated, by way of example, in the accompanying drawings, in which:

FIG. 1 is a sectional side elevation, showing a gun turret cupula in axial section and a gun cradle in side elevation, some parts being shown only in outline and others being omitted for clarity of illustration.

FIG. 2 is a front elevation of the gun turret.

FIG. 3 is a plan corresponding to FIG. 2 with part of the ammunition chute broken away to show the guide sprocket arrangement, with which is associated a series of fragmentary views 3A and 3B, of which 3A is taken generally on the line B—B of FIG. 3, and FIG. 4 is a fragmentary sectional view, on the line IV—IV of FIG. 3, showing the ammunition outlet port and the bent end of the ammunition chute.

As shown by the drawings, a gun turret armored cupula 1 is mounted to rotate in azimuth on a vehicle or other housing, indicated as 2, by a large diameter inner race ring 3 supported by ball bearings 4 in a fixed outer race ring 5 of which the inner periphery has gear teeth 6 to serve as a fixed training ring for training rotation in azimuth of the cupula by a pinion 7 on a motor 8 which is carried by the cupula and is under control of the gunner. The motor 8 may be combined with or replaced by a manual training gear. Such a rotatable mounting of the cupula is in accordance with known practice, and its details do not form part of the invention.

The cupula 1 is polygonal in plan (FIG. 3) with an inwardly sloping faceted wall in which are set thick glass block windows 9. The top of the cupula has a hatch closed by a hatch-cover in two parts 10 and 11 hinged at 12 and 13, respectively, to open wide, as indicated at 110 in FIG. 3, to admit a gunner who occupies the turret with his head and shoulders normally in the cupula.

In place of one of its plain facets, the front wall or facet of the cupula is formed with a gun port 14 at the sides of which a pair of checks 15 are strongly built into the cupula structure to carry a pair of trunnion stubs 16 on which a gun cradle 17 cast from a light alloy is journaled by ball bearings 18 about an elevation axis X—X (FIG. 2) just outside the front facet of the cupula.
In the cradle 17 there is mounted an automatic gun 19 of which the barrel 20 projects from the cradle. Remote controls (not shown, but conventional) are provided on, or connected to, the rear end of the cradle inside the cupola for arming or cocking and firing the gun.

A door 21 on the rear end of the cradle inside the cupola gives access to the gun breech and recoil mechanism and, if necessary, allows removal of part of the mechanism into the cupula for service by the gunner under cover during operational use of the turret. A side door 22 on the cradle 17 also allows access to the ammunition feed mechanism from outside the cupula but below the silhouette and within lateral protection of the cupula.

Where it passes through the gun port 14, the cradle 17 carries a cylindrical armed mantelet 23 which is strongly structurally united with the cradle and is coaxial with the elevation axis X-X so as to move in elevation with the cradle and close the gun port 14, except for the necessary small turning clearance, at all firing angles of elevation of the gun.

As can be seen from FIGS. 1 and 3, the rear of the cradle just protrudes into the cupula, and the major part of the cradle projects outwardly from the gun port 14 so that the major part of its weight lies forward of the elevation axis. To counterbalance the cradle and gun about the elevation axis, a combined spring and hydraulic cylinder 24 is carried by a supporting frame 25 depending from the cupula inside the turret, the piston rod 26 of the hydraulic cylinder being in tension and strongly pivoted to the rear end of the gun cradle 17 inside the cupula. The hydraulic cylinder also serves for laying the gun, a manually operated or motor-driven pump being provided to operate the hydraulic cylinder as a ram to move the gun cradle in elevation about the axis X-X.

To supply the gun with ammunition from a magazine inside the turret, the cupula has a projection 27, alongside the gun port (FIG. 3), to form an ammunition outlet port 28 (FIG. 4) to which a linked belt of ammunition from a box 29 in the turret is guided by a cowl 30 having a flared throat 31.

An ammunition chute 32 extends in a curved path from the outlet port 28 to a feed housing 33 on top of the gun cradle 17 (FIGS. 2 and 3) by which the chute 32 is carried so as to move in elevation with the cradle about the axis X-X. The rear end of the chute 32 within the ammunition outlet port 28 is of part-cylindrical shape so as to form a mantelet 34 which turns in the outlet port 28 and closes it at all firing angles of elevation.

It can be seen from FIGS. 2 and 3 that the elevation axis X-X crosses the outlet port 28 and from FIG. 4, where the axis is indicated as X, that the flared throat 31 and mantelet 34 are coaxial with the elevation axis. Thus, a linked ammunition belt of rounds 35 passing through the cowl 30 and chute 32 can follow the movement of the chute 32 in elevation with the gun cradle 17.

The curve of the ammunition chute extends substantially through 90° from the outlet port 28 to the feed housing 33, and also lies substantially in the axial plane of the rounds 35. To guide the ammunition belt smoothly through the chute 32, a series of guide sprockets 36 are journaled in the lower wall of the chute 32 about axes 37 substantially radial to the curve of the chute (FIG. 3). The teeth of the sprockets 36 fit between the rounds 35 and laterally engage the links 38 between the rounds on the inside of the curve. This is illustrated somewhat diagrammatically in FIGS. 3A and 3B which respectively show a sprocket 36 in plan and in elevation along an axis 37 thus guiding the ammunition belt by means of the links 38 and the noses and bases of the rounds 35 are kept out of contact with the sides of the chute 32.

It will be noted that the feed housing 33 is on top of the gun cradle, so that the ammunition rounds enter the feed mechanism from the top instead of from the side as usual in the belt feed of the automatic gun 19. To suit this arrangement, the gun 19 in the cradle 17 is simply turned about its own axis through an angle of 90° from its conventional position. This has the advantage that the spent cases of the ammunition rounds 35 are ejected along a lateral path, indicated by the lines C in FIGS. 2 and 3, instead of the usual downward ejection which has the objection that ejected spent cases would violently encounter and bounce off the turret housing 2. Because of the relatively large propellant charges of modern ammunition, and relatively high rates of fire of modern automatic weapons, an appreciable amount of gas is produced during heavy firing. With an internally mounted weapon the ejection of cartridge cases is always a problem to some degree, but especially causes a large amount of fumes to be discharged into the turret and the vehicle.

To satisfactorily ventilate such fumes requires a large quantity of air flow, and under A.B.C. warfare conditions this air must be filtered for crew use. With the externally mounted weapon of this invention, both problems are avoided. The spent links 38 are ejected in a downward path, indicated by the lines L in FIGS. 1 and 2, but they are small and light and do not cause any harm by hitting the ground that they strike.

As mentioned above, the cupula 1 has glass block windows 9 and, to preserve all-round visibility, despite the obstruction caused by the ammunition chute 32, a periscope 39 is provided above the cupula projection 27.

For aiming the gun, the cupula is provided with three sights. A direct sight 40 is provided above the cradle for use by the gunner with the cupula hatch open, A periscope sight 42 is provided for use from within the closed cupula.

Within the feed housing 33 there is preferably provided a resiliently-mounted sprocket mechanism, for ensuring correct alignment of the ammunition rounds as they enter the gun feed mechanism, as described in United Kingdom Patent No. 832,708 (U.S. 2,920,535).

Instead of ammunition being supplied to the gun from inside the turret, an armored external store or magazine could be provided on or with the cupula, so as to rotate therewith, and the ammunition outlet port would then be provided in such store or magazine but still located on the elevation axis to serve the gun in the same way as described above.

It will be apparent to those skilled in the art that the particular embodiment described and illustrated herein is susceptible of various modifications without departing from the scope and spirit of the invention. Accordingly, it should be understood that the foregoing embodiment is merely exemplary of the invention, and that the scope of the invention is limited only by the subjoined claims interpreted in the light of the foregoing specification and drawings.

Having thus described my invention in the manner required by the patent statutes, I claim:

1. A gun turret comprising a rotatable cupula, a gun port formed in the cupula wall below the uppermost profile of the cupula, a gun cradle for mounting a supporting gun and mounted on trunnions affixed to the cupula about an elevation axis extending across the gun port so as to have the cradle extend from the inside of the cupula through the gun port with the major part of the gun cradle projecting outwardly from the gun port, a gun port mantelet movable with said cradle about said elevation axis with said gun port at close side of turret, the gun port traversing the angles of elevation, a door at the rear end of said cradle accessible from inside said cupula at all angles of elevation of said cradle to give access at all times to a gun in said cradle, and counterbalance means for balancing said cradle about said elevation axis.
A gun turret comprising a rotatable cupola, a gun port formed in the cupola wall, a gun cradle for mountably supporting a gun and mounted on trunnions about an elevation axis extending across the gun port so as to have the major part of the gun cradle project outwardly from the gun port, a gun port manetle movable with said cradle about said elevation axis to close said gun port at different firing angles of elevation, door means at the rear end of said cradle accessible from inside said cupola through a side opening for discharging spent ammunition cases therefrom in a substantially horizontal direction.

A gun turret comprising a rotatable cupola, a gun port formed in the cupola wall, a gun cradle for mountably supporting a gun and mounted on trunnions about an elevation axis extending across the gun port so as to have the major part of the gun cradle project outwardly from the gun port, a gun port manetle movable with said cradle about said elevation axis to close said gun port at different firing angles of elevation, door means at the rear end of said cradle accessible from inside said cupola through a side opening for discharging spent ammunition cases therefrom in a substantially horizontal direction.

Apparatus as set forth in claim 2 wherein said means mounting said ammunition chute comprises a manetle connected to said ammunition chute and pivotally disposed about said ammunition outlet port for pivotal movement thereabout upon corresponding movement of said gun cradle about said elevation axis.

Apparatus as set forth in claim 3 wherein said ammunition outlet port is located alongside said gun port and substantially in alignment with said elevation axis, and the pivotal axis of said manetle connected to said ammunition chute is substantially in alignment with said elevation axis.

Apparatus as set forth in claim 4 wherein said ammunition chute is curved through an angle of substantially 90° considered in a substantially horizontal plane between said ammunition outlet port and said ammunition feed housing so as to progressively move the longitudinal axes of rounds passing through said chute through angles of substantially 90° from said outlet port into alignment with the longitudinal axis of said cradle at said ammunition feed housing.

Apparatus as set forth in claim 5 further comprising a series of sprockets in said ammunition chute journaled on axes substantially radial to the curve of said ammunition chute, the sprockets having teeth for fitting between the rounds of a linked ammunition belt and guiding the belt around the curve of the chute by engaging the links between the rounds on the inside of the curve.

Apparatus as set forth in claim 6 wherein said gun cradle has formed therein outside of said cupola an opening for discharging spent ammunition links therefrom and a side opening for discharging spent ammunition cases therefrom in a substantially horizontal direction.

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