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FIREARM OF THE RECOILING TYPE

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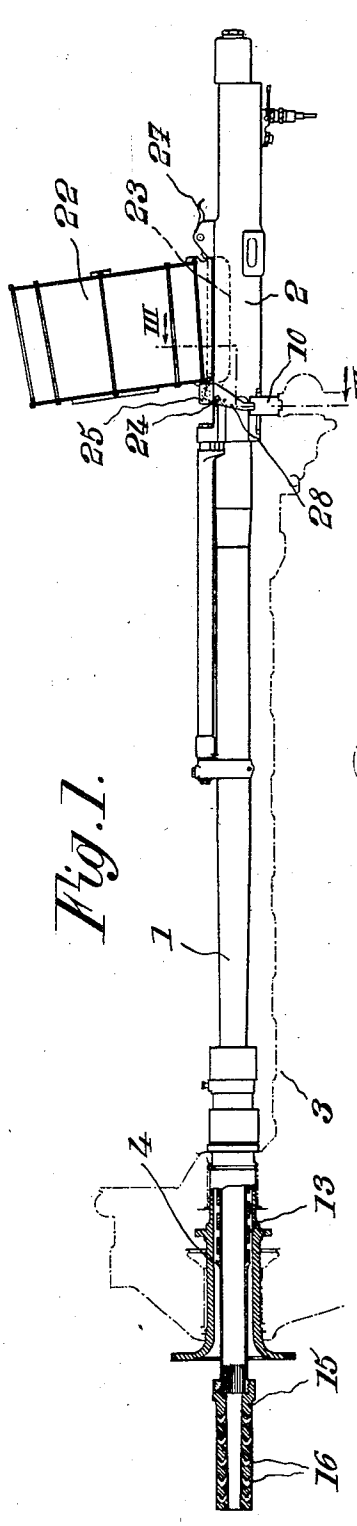


Fig. 1.

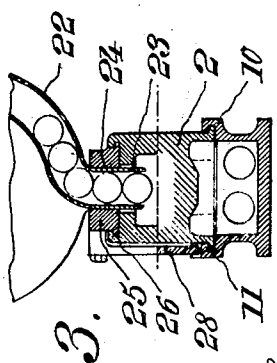


Fig. 3.

Fig. 2.

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FIREARM OF THE RECOILING TYPE

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5 Claims. (Cl. 89—37.5)

The present invention relates to firearms of the barrel recoiling type, that is to say at least the barrel of which is adapted to recoil, under the effect of the firing of a shot, with respect to the cradle or other support in which said barrel is mounted. The invention is more especially, although not exclusively, concerned with automatic firing guns of this type, and especially light cannons to be fitted on aircrafts.

The object of the present invention is to provide a firearm of the type above described which is better adapted to meet the requirements of practice than similar arms as made up to the present time.

According to an essential feature of the present invention, the gun includes, in addition with recoil absorbing means adapted to absorb a portion of the recoil energy of the movable parts, a muzzle brake fitted on the end of the gun barrel, the whole being preferably designed in such manner that the action of said muzzle brake is capable of balancing, at least approximately, the residual live force of said movable parts existing when the barrel is nearing the end of its recoil stroke.

According to another feature of the present invention, I further provide braking means, preferably of the pneumatic kind, for slowing down the movement of the barrel at the end of its return stroke toward the front position thereof.

According to still another feature of the present invention, relating more especially to automatic firearms of the type above described, in which the barrel oscillates longitudinally, under the effect of the recoil forces, at the rate of firing, I provide, for the feed of cartridges to the gun, a magazine which is mounted in stationary position with respect to the arm, so that it does not participate in the oscillating or reciprocating movement of the barrel, the cartridges being advantageously guided, for insertion into the chamber of the gun, by lips engaging into an elongated longitudinal slot provided in the breech case.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described, with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is an elevational view, with parts shown in section, of an automatic cannon mounted or incorporated in the power plant of an aircraft, the whole being made according to the present invention;

Fig. 2 shows, on an enlarged scale and in axial section, the front part of the gun in question;

Fig. 3 is a sectional view on the line III—III of Fig. 1.

In the following description, the invention will be described as applied to the case of an automatic firearm, such as a light cannon intended to be fitted on the power plant of a single-engined airplane, of the quick-firing type. Particularly, the invention concerns a recoiling, automatic firearm; that is, an automatic gun, the whole of which recoils after each shot.

Concerning the firearm proper, I make it in any suitable conventional manner. For instance, it includes, in the usual manner, a barrel 1, provided, at the rear end thereof, with a breech case 2.

This firearm is fitted in the frame 3 of the airplane engine, according to a known arrangement, so that it can fire through the propeller shaft 4, arranged, for this purpose, out of line with the engine crankshaft. The firearm is adapted to recoil in a direction parallel both to its axis and to the axis of said shaft, against the action of a recoil absorbing system capable of absorbing a portion of the recoil energy developed upon the firing of each shot. Thus the reaction exerted by the firearm on its support is reduced.

However, if this reaction were to be reduced to an acceptable value through the mere action of this recoil absorbing system, a relatively long recoil stroke would be necessary for barrel 1 and the breech casing attached thereto.

Such an arrangement would involve the serious drawback of imposing a heavy weight and requiring a considerable space for the recoil absorbing system and further for the breech casing 2, if the latter is to be fed through a stationary magazine such as will be hereinafter described. Furthermore, it would hardly permit firing at a high rate of fire, due to the considerable amplitude of the reciprocating movement due to the action of recoil forces.

According to the essential feature of the present invention, I obviate these drawbacks by providing the front end of barrel 1 with a muzzle brake capable of absorbing a portion of the total recoil energy of the firearm, and accordingly of reducing the reaction exerted by said arm on its supports and which is to be absorbed by the recoil absorbing means proper.

Now, such a muzzle brake starts acting when the projectile reaches the front end or muzzle of the barrel, that is to say when the whole of the recoiling parts of the firearm has already moved through a portion of its rearward stroke but still possesses a substantial live force.

Therefore, according to the present invention, the various characteristics of the whole, and in particular the length of the recoil stroke, the strength of the recoil absorbing system and the efficiency of the muzzle brake are chosen in such manner that this residual live force can be absorbed by said muzzle brake during the end of the recoil stroke.

In point of fact, the recoil absorbing device proper, in the system according to my invention, will absorb a certain portion of the residual live force in question during the end part of the recoil stroke of barrel 1, but this portion is very small as compared with that absorbed by the muzzle brake.

However, the energy supplied by the muzzle brake must not be too abundant because, if it were so, it would keep acting on the gun barrel after the latter has reached the end of its recoil stroke, and it would then accelerate the return movement of the barrel into firing position, which is rather to be avoided.

Consequently, for practical purposes, the above mentioned characteristics of the firearm should be determined in such manner that the amount of energy to be absorbed by the muzzle brake is slightly lower than the residual live force to be absorbed.

An automatic gun complying with the above conditions has a relatively small recoil stroke. Furthermore, the reactions of such a gun on its supports are considerably reduced. On the other hand, the recoil stroke will end practically without shock.

In the construction of such a gun, the means for slidably mounting the barrel in the engine frame 3 may be, for instance, made as follows:

At the muzzle end, the barrel 1 of the firearm is mounted in a bearing 5 provided at the rear end of a sleeve 6 the opposite end of which bears against a shoulder provided in a piece 7. This piece 7 is fixed to the casing 8 on the frame 3 which supports the propeller shaft 4. Sleeve 6 is kept applied against said shoulder by a ring 9 adapted to be screwed upon the end of this piece 7.

The firearm is supported, at the rear end thereof, by a kind of jaw 10, rigid with frame 3, and which constitutes a slideway for guiding a shoe 11 rigid with the breech casing 2.

I provide means for preventing the whole of the firearm movable parts from turning about the axis of the barrel under the effect of the reaction torque due to the angular acceleration of the projectile in said barrel 1. For instance, for this purpose, jaw 10 and shoe 11 are given a T-shaped section, as shown by Fig. 3, the lateral bearings of said shoe being calculated in such manner that they can support the action of this torque without interfering with the sliding movement of the firearm.

Referring to the recoil absorbing system, I may use a hydraulic brake or, alternately, as shown by the drawing, I make use of a spring brake, consisting for instance of a spiral spring 13 mounted inside the propeller shaft 4 and around barrel 1, the front end of said spring bearing against a shoulder 14 provided on said barrel 1 and the rear end of said spring bearing against the rear end of sleeve 6, which is rigid with the engine frame 3.

The muzzle brake, as illustrated by the drawing is constituted by a sleeve 15, adapted to be fixed by screwing upon the end of barrel 1. In the walls of said sleeve I provide a plurality of nozzles 16 capable of deflecting the powder gases toward the rear after the projectile has moved past said nozzles.

These gases thus exert, during the time for which they flow through said nozzles 16, a reaction directed toward the front, and which tends to oppose the recoil displacement of the firearm.

I can then, for instance after having chosen the length of the recoil stroke of tube 1, and knowing the efficiency of the muzzle brake 15 (that is to say the value of the portion of the recoil energy that can be absorbed by said muzzle brake), determine the strength of spring 13 in such manner that this recoil stroke ends without shock.

As the return movement of the recoiling mass into firing position takes place under the action of spring 13, it is advisable to prevent this return movement from producing a shock of said recoiling mass against frame 3.

It is therefore now proposed to brake this return stroke of the gun barrel by means of a damping system. This damping is for instance made, as illustrated by the drawing, as follows:

Barrel 1 is provided with a piston 17, preferably fitted with a packing ring 18, said piston being rigidly fixed on said barrel.

This piston coacts with a cylinder 19 fixed on the rear end of sleeve 6. As illustrated, this cylinder 19 serves to maintain a prolonged part of bearing 5.

I provide, in the walls of this cylinder 19, vents 20 suitably distributed in such manner as to ensure a gradual damping of the return movement of the barrel into firing position. For instance, these vents are distributed in such manner that piston 17 has moved past the whole of them when the barrel is near the end of its return stroke, the air that remains imprisoned between said piston and the end of cylinder playing the part of a shock-absorbing cushion.

Finally, I provide a thrust ring 21, for instance made of fiber.

The working of the automatic gun above described is believed to result sufficiently clearly from the preceding indications for rendering unnecessary any further explanation concerning its operation and its advantages.

However, it should be noted that the chief of these advantages lies in the fact that the gun does not produce, when firing, exaggerate reactions on the engine frame 3 and on the whole of the structure of the airplane.

In some instances it might be desirable to arrange the feed magazine 22 of such a fire arm in such manner that it moves together with the barrel in the course of the recoil and return movement thereof.

However, I have found that it is preferable to arrange this magazine in such manner that it is stationary with respect to the frame of the firearm. This can be obtained the more easily as the combined actions of the muzzle brake and the spring brake reduce substantially the amplitude of the recoil strokes.

Such an arrangement is characterised by the following features:

The magazine 22, which is made of any suit

able structure, is prolonged by two lips 23 adapted to engage in an elongated slot 24 provided in the breech 2. This elongated slot permits the recoil displacements of the breech casing with respect to the magazine, and these lips serve to guide and to keep in suitable direction the cartridges as said cartridges are being introduced into the gun chamber.

On the other hand, said magazine is supported by a frame 25, which is arranged to be able to slide on the breech casing, for instance by providing it with longitudinal projections 26 which slide in longitudinal grooves on the breech casing. The magazine is mounted on said frame by a swinging movement, and a pawl or the like 27 is provided for keeping magazine 22 in firing position once the lips 23 are correctly engaged in the breech box.

Frame 25 is provided with a finger or the like 28 capable of fixing it with respect to frame 3, for instance by engaging into a notch provided in jaw 10. This frame 25, which bears, through the sliding assembly 26, on the breech box 2, is thus maintained in a stationary position when said breech box moves toward the rear together with the whole of the firearm.

An arrangement such as that just above described has the advantage of rendering the magazine 22 independent of the sliding displacements of the barrel and the breech.

Of course, instead of being mounted on the power plant of an aircraft, an automatic firearm such as above described might quite as well be fitted, in a similar manner, on another part of said aircraft, for instance the wings, the fuselage, or any other suitable element.

Also, it is clear that the construction above described might be aplied, at least partly, to a land gun, or a naval gun, either of the automatic firing type or not.

In a general manner, while I have, in the above description disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. In combination with a support, an automatic firearm comprising a breech casing having a slide guide thereon and provided with an elongated slot, a frame which rests in said slide guide on said breech casing, means slidably mounting said breech casing on said support, means fixing said frame with respect to said support, said frame having a slot therethrough registering with the slot in said breech casing, and a loading device mounted on said frame, said loading device including lips projecting through the slot in said frame and into the elongated slot in said breech casing for guiding cartridges as they pass from the loading device into said breech casing.

2. In combination with a recoiling automatic firearm having a loading device and a barrel unit including a barrel and a breech box rigidly affixed to the barrel, of a relatively fixed support having a surface for supporting one side of said barrel unit, guide means for limiting the barrel unit to relative fore-and-aft displacements on said surface, said breech box having a slot therein elongated in fore-and-aft direction, said loading device communicating with said slot, a frame element slidably mounted on said breech box, means connecting said frame element and said support for preventing relative fore-and-aft movement therebetween, and means mounting said leading device on said frame element for holding said loading device fixed with respect to the fore-and-aft displacements of said barrel unit.

3. In combination with a recoiling automatic firearm having a loading device and a barrel unit including a barrel and a breech box rigidly affixed to the barrel, of a relatively fixed support having a surface for supporting one side of said barrel unit, guide means for limiting the barrel unit to relative fore-and-aft displacements on said surface, recoil absorbing means interposed between said barrel unit and said support, said breech box having a slot therein elongated in fore-and-aft direction, said loading device communicating with said slot, a frame element slidably mounted on said breech box, means connecting said frame element and said support for preventing relative fore-and-aft movement therebetween, and means mounting said loading device on said frame element for holding said loading device fixed with respect to the fore-and-aft displacements of said barrel unit.

4. In combination with a support, a recoiling automatic firearm having a magazine and a barrel unit including a barrel and a breech box rigidly affixed thereto, bearing means slidably supporting one side of said barrel unit on said support for relative fore-and-aft displacements, said breech box having a slot therein elongated in fore-and-aft direction, said magazine having a feed chamber communicating with said slot, a frame element, means slidably mounting said frame element on said breech box, means connecting said frame element and said bearing means for preventing relative fore-and-aft movement therebetween, and means mounting said magazine on said frame element for holding said magazine fixed with respect to the fore-and-aft displacements of said barrel unit.

5. In a recoiling automatic firearm, including a barrel and breech casing rigidly affixed thereto, a mounting comprising a bearing element substantially U-shaped in cross section and having a pair of opposed, elongated, parallel grooves extending forwardly and rearwardly in the inner wall thereof, a pair of outwardly extending flanges on the lower sides respectively of said breech casing slidably engaging in said grooves, means on the top of said breech casing forming a second pair of inwardly opening, elongated grooves extending forwardly and rearwardly, a frame element of substantially inverted T shape in cross section having the arms thereof slidably engaging in the last-mentioned grooves for supporting a magazine, said bearing element having a notch in the upper portion of one side thereof, and a downwardly extending finger rigidly affixed to one side of said frame element engaging in said notch.

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