

Fire arm with improved salvo accuracy and device used to that end.

The invention concerns a fire arm with improved salvo accuracy.

- 5 In particular, the invention concerns a fire arm of the machine-gun type which can fire by bursts, whereby the fire arm comprises a barrel and a casing mounted on a supporting frame, whereby the frame comprises a cradle provided with a slide which can slide in a direction
10 which is mainly parallel to the axis of the barrel, whereby the casing is mounted on the slide of the cradle by means of a transversal hinge pin on the one hand, and on the frame by means of at least one shoe mounted in a sliding guide provided in the frame on the other hand.
- 15 The arm can be mounted with its frame on a tripod, on a remote-controlled turret or any other support whatsoever.

The casing and the barrel can move in the axial direction of the barrel, whereby the casing is supported by the
20 slide of the cradle and by the shoe which is held in the sliding guide of the frame which, in the case of the known arms, is parallel to the axis of the barrel.

In rest, the slide of the cradle is maintained in an intermediary position by means of a spring or several

springs.

While firing, the slide and the shoe allow for a guided recoil of the arm through the effect of the reactive
5 forces of the propulsion gases of the ammunition that is being fired, and the spring or springs, either or not assisted by one or several shock absorbers, make it possible to dampen the axial to-and-fro movement of the casing while firing by bursts, and to stabilize the
10 position of the casing around an average axial position.

The hinge pin of the casing on the frame allows the casing and the barrel to tilt.

When firing by bursts, the first shot is fired in the rest position of the arm, as when firing shot by shot,
15 and the arm recoils due to the impulse of the first shot.

Immediately after the first shot and during the following shots, the barrel puts itself in position as the mobile elements of the arm and the interface elements such as the shoe connect again, and it puts
20 itself in an average raised and diverted position around which the barrel oscillates through the effect of the successive shots.

Said oscillation of the barrel contributes to the dispersion of the firing impacts around an average point
25 of impact which forms the centre in which the impacts of the successive shots come together at the first salvo.

In the case of the known fire arms we observe a deviation between the initial point of impact of the first shot and the average point of impact of the successive shots, which is translated in a diminished shooting accuracy, as all
5 the salvos are taken into account, including the first shot.

The invention aims to remedy the above-mentioned and other disadvantages and to provide a fire arm with improved salvo accuracy, which makes it possible to
10 correct and compensate for the deviation between the initial point of impact of the first shot and the average point of impact of the successive shots.

This aim is reached according to the invention with a fire arm of the above-described type, but in which the sliding
15 guide of the shoe of the casing is not parallel to the axis of the barrel, but is inclined in relation to the direction of this axis when in rest.

When firing a salvo, the barrel and the casing recoil and they tend to redress themselves as the elements connect
20 again.

Since the shoe of the casing is guided by an inclined sliding guide, the recoil of the casing will make the casing swivel around the hinge pin so as to take the barrel back to its initial rest position, which is
25 translated in that the average point of impact of the shots fired after the first shot comes close to the initial point of impact of the first shot, and thus in a

salvo with improved accuracy.

According to a preferred embodiment, the fire arm comprises at least two sliding guides, each containing a casing shoe, whereby the dimensions of these sliding
5 guides are such that a recoil of the casing and the barrel on the frame is translated in an inclined swiveling of the barrel and the casing around its transversal hinge pin and by a lateral swiveling around an axis which is perpendicular or mainly
10 perpendicular to the transversal hinge pin and the axis of the barrel.

Thus, it is possible to compensate for the deviation between the initial point of impact of the first shot and the average point of impact of the following shots in two
15 perpendicular planes, for example the vertical plane and the horizontal plane, such that said deviation can be eliminated completely.

The invention also concerns a device to improve the salvo accuracy for a fire arm, whereby the device comprises a
20 fixing element for the fire arm which is mounted on a supporting frame which comprises a cradle provided with a slide which can slide in a longitudinal direction parallel to the axis of the barrel, whereby the fixing element is mounted on the slide of the cradle by means of
25 a transversal hinge pin on the one hand and on the frame by means of at least one shoe mounted in a sliding guide provided in the frame, whereby said sliding guide is inclined in relation to said longitudinal direction.

In order to better explain the characteristics of the invention, an example of an embodiment of a known fire arm and of a fire arm according to the invention with improved salvo accuracy are given as an example only
5 without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 is a schematic side view of a known fire arm, a part of which is represented as a vertical
10 section;
figure 2 represents the part indicated by F2 in figure 1 to a larger scale;
figure 3 is a view similar to that in figure 1, but for a fire arm according to the invention;
15 figure 4 represents the part indicated by F4 in figure 3 to a larger scale;
figure 5 is a section according to line V-V in figure 2, to a larger scale;
figures 6 and 7 are views similar to those in figure
20 4, but for two different positions.

Figure 1 represents a known fire arm 1, in particular a machine-gun which can fire by bursts.

This known fire arm 1 comprises a barrel 2 and a casing 3 mounted on a supporting frame 4, whereby the frame
25 comprises an elastic cradle 5 provided with a slide 6 which can slide in the supporting frame 4 according to a direction which is mainly parallel to the geometric axis X-X' of the barrel 2 in rest.

The slide 6 is maintained in a free intermediary position by means of return spring 7 in such a manner that the slide can move towards the front as well as to the rear.

The frame 4 also comprises one or two shock absorbers 8 to dampen the movement of the slide 6 of the cradle 5.

The casing 3 is hinge-mounted between two parallel, spaced-apart ears 9 of the slide 6 of the cradle 5 by means of a transversal hinge pin 10 on the one hand.

On the other hand, the casing 3 is supported by the frame 4 by means of a shoe 11 mounted in a sliding guide 12 which is part of the frame and which is limited by two guiding walls 13 which are parallel to the axis X-X' of the barrel in rest.

In a general manner, there are two shoes 11 sliding in two sliding guides at a distance from the hinge pin 10 of the casing 4.

The working of the fire arm 1 is well known.

When a first salvo is fired, the barrel is situated in its rest position, with its axis directed according to axis X-X'.

The point of impact of the first shot, called the initial point of impact, is schematically represented by point 14 on the target 15 in figure 1.

When the following shots of the salvo are fired, the barrel 2 and the casing 3 recoil backwards due to the propulsion gases of the fired ammunition, while being supported by the slide 6 and by the shoes 11 which allow
5 for a movement in the direction of the axis of the barrel X-X' in rest.

During the firing, the barrel 2 and the casing 3 oscillate around an average recoiled position M, characterized by a movement A in relation to their rest
10 position, whereby this oscillating movement is either or not dampened and stabilized through the action of the return spring 7 or springs and the shock absorber or shock absorbers 8.

Simultaneously, the barrel 2 and the casing 3 redress
15 themselves through the action of the propulsion gases as the elements connect again, i.e. the mobile elements of the fire arm 1 and the interface elements such as the shoes 11 in the sliding guides 12.

The barrel 2 oscillates in a rotating manner around an
20 average direction Y-Y' which forms an angle B with the rest direction X-X'.

The dynamics of this firing by bursts explains why the impacts 16 of the successive shots at the first salvo come together in a zone 17 whose center is called the
25 average point of impact 18, which is situated at a distance C above an initial point of impact 14.

As the mobile elements of the fire arm 1 connect again, not only the barrel 2 redresses itself, but also the muzzle 2A of the barrel 2 is laterally shifted, which results in a shifting D of the average point of impact 18 in relation to the initial point of impact 14.

The divergence between the average point of impact 18 and the initial point of impact 14 is translated in a less accurate salvo.

Figures 3 to 7 show an improved fire arm 19 according to the invention which resembles the fire arm 1 of figure 1, but in which the shoes 11 of the casing 3 are mounted in sliding guides 12 which are such that a recoil of the casing 3 is translated in a swiveling of the casing 3 and the barrel 2 around the hinge pin 10 of the casing 3.

To this end, the sliding guides 12 are inclined in relation to the direction X-X' of the axis of the barrel 2 in rest, in other words the guiding walls 13 of the sliding guides 12 form an angle E with the axis X-X' as represented in figure 4, in such a manner that the guiding direction Z-Z' of the sliding guides 12 is situated in a plane which is perpendicular to the hinge pin 10 of the casing 3.

According to a preferred embodiment, the ears 9 supporting the transversal hinge pin 10 are fixed to a non-represented supporting element, which is part of the slide 6 of the cradle 5, whereby this supporting element can swivel laterally around a pivot whose axis U-U' is

perpendicular or mainly perpendicular to the transversal hinge pin 10 and the axis of the barrel X-X', as represented in figures 3 and 4.

5 In the given example, two shoes 11 are interconnected by a rod 20 so as to form a single integrated piece 21, as illustrated in figure 5, whereby this piece is mounted between the guiding walls 13 of the sliding guides 12 and between two vertical guiding planes 22 which are inclined
10 at an angle F in relation to the axis X-X' of the barrel 2 so as to realize an additional sliding guide 23 serving as a guide for the shoes 11 in the lateral direction W-W'.

The effect of the sliding guide 23 is that a recoil of the
15 casing 3 results in a lateral shift of the muzzle of the barrel 2 while making the casing 3 and the barrel 2 swivel around the axis U-U' of the pivot of the supporting element of the hinge pin 10.

In the example of figure 5, the lateral surfaces 23 of the
20 shoes 11 make contact with the guiding planes 22 and they have a bulged shape.

The working of the fire arm 19 according to the invention differs from the working of the known fire arm
25 1 in that the recoil of the casing 3 and of the barrel 2 after the first salvo is translated in an inclination of the barrel 2, for example towards the bottom, and a lateral shift of the muzzle 2A of the barrel 2, for example to the right, due to the inclination of the

sliding guides 12 and 23 in relation to the axis of the barrel X-X' in rest.

The inclination of the barrel 2 through the action of the propulsion gases is illustrated in figures 4, 6 and 7.

5 Figure 4 corresponds to the situation in rest, whereas figures 6 and 7 respectively correspond to the position of the mobile elements after the first shot and the average position of the elements during a salvo.

10 Figures 6 and 7 clearly show that the recoil of the casing 3 makes the shoes 11 rise in the sliding guides 12, which results in an inclination of the barrel 2 towards the bottom.

15 The inclination angles E and F of the sliding guides 12 and 23 respectively in relation to the axis X-X' are selected such that the average point of impact 18 is reduced to the initial point of impact 14, whereby the vertical deviation C and the lateral deviation D are eliminated, as illustrated in figure 3.

20 In this manner, the accuracy of the salvo is considerably improved, as all the impacts are better gathered, including the initial impact 14 of the first shot and the impacts 16 of the successive shots of the salvo.

25 The invention is not limited to machine-guns, but it can also be applied to other automatic or semi-automatic fire arms

that can fire by bursts.

It is clear that, instead of using shoes 11 which are integrated in a single piece 21, one can also use separate shoes to correct the salvo, for example in a
5 vertical and a lateral direction.

It is not excluded to provide a firing correction exclusively in the vertical direction or exclusively in the lateral direction, depending on the type of fire arm.

10 The correction must not necessarily be situated in the vertical or horizontal plane.

It is also clear that, instead of the shoes 11, one can also use other guiding means, such as carriages, balls, etc.

15 As an option, one can provide an adjusting system to adjust the inclination of the sliding guides 12 and 23 in relation to the axis X-X' of the barrel 2 so as to be able to correct the accuracy when firing by bursts and to reduce the average point of impact 18 to the
20 point of impact 14.

It is not excluded that the fire arm 1 is not mounted directly on the frame, but through the intermediary of a fixing element.

In that case, the frame and said fixing element together
25 form a device on which a fire arm can be mounted so as to

improve the accuracy when firing by bursts with this fire arm.

The invention is by no means restricted to the above-described example; on the contrary, many modifications can
5 be made to the above-described fire arm while still remaining within the scope of the invention as defined in the following claims.

Claims.

- 1.- Fire arm with improved salvo accuracy, comprising a barrel (2) and a casing (3) mounted on a supporting frame (4), whereby the frame comprises a cradle (5) provided
5 with a slide (6) which can slide in a direction which is mainly parallel to the axis of the barrel (X-X'), whereby the casing (3) is mounted on the slide (6) of the cradle (5) by means of a transversal hinge pin (10) on the one hand, and on the frame (4) by means
10 of at least one shoe (11) mounted in a sliding guide (12-23) provided in the frame (4) on the other hand, characterized in that said sliding guide (12-23) is inclined in relation to the direction of the axis of the barrel (X-X') in rest.
- 15 2.- Fire arm according to claim 1, characterized in that the sliding guide (12) is situated at a distance from the hinge pin (10) of the casing (3).
- 3.- Fire arm according to claim 1 or 2, characterized in that the sliding guide (12) is such that a recoil of the
20 casing (3) and of the barrel (2) on the frame (4) is translated in an inclined swiveling of the barrel (2) and of the casing (3) around its hinge pin (10).
- 4.- Fire arm according to claim 3, characterized in that the guiding direction (Z-Z') of the sliding guide (12) is
25 situated in a plane which is mainly perpendicular to the

hinge pin (10) of the casing (3).

5 5.- Fire arm according to claim 1 or 2, characterized in that the transversal hinge pin (10) is mounted in a supporting element which is part of the slide (6) of the cradle (5) and which can laterally swivel around a pivot whose axis (U-U') is perpendicular or mainly perpendicular to the transversal hinge pin (10) and to the axis of the barrel (X-X').

10 6.- Fire arm according to claim 5, characterized in that the sliding guide (23) is such that a recoil of the casing (3) and of the barrel (2) on the frame (4) is translated in a lateral swiveling of the casing and of the barrel around the axis (U-U') of the pivot of the supporting element of the hinge pin (10).

15 7.- Fire arm according to claim 6, characterized in that the guiding direction (W-W) of the sliding guide (23) is situated in a plane which is mainly perpendicular to the above-mentioned pivot.

20 8.- Fire arm according to claim 5, characterized in that it comprises at least two sliding guides (12-23), each containing a shoe (11) which supports the casing (3), whereby the dimensions of these sliding guides (12-23) are such that a recoil of the casing (3) and of the barrel (2) on the frame (4) is translated in an inclined
25 swiveling of the barrel (2) around the hinge pin (10) of the casing (3) and in a lateral swiveling around the axis (U-U') of the pivot of the supporting element of

the hinge pin (10).

9.- Fire arm according to claim 8, characterized in that the guiding direction (Z-Z') of the first sliding guide
5 (12) is situated in a plane which is mainly perpendicular to the hinge pin (10) of the casing (3), whereas the guiding direction (W-W') of the second sliding guide (23) is situated in a plane which is mainly perpendicular to the above-mentioned pivot.

10 10.- Fire arm according to claim 8, characterized in that the shoe (11) which is mounted in the first sliding guide (12) and the shoe (11) which is mounted in the second sliding guide (23) are integrated into a single piece (21).

15 11.- Fire arm according to claim 8, characterized in that the two sliding guides (12 and 23) are integrated into a single piece (21).

12.- Fire arm according to any one of the preceding claims, characterized in that the shoe (11) comprises a
20 lateral surface (24) with a bulged shape.

13.- Fire arm according to any of the preceding claims, characterized in that it comprises adjusting means to adjust the inclination angle of the sliding guides (12-23) in relation to the axis of the barrel (X-X') in rest.

25 14.- Device to improve the salvo accuracy for a fire arm, whereby the device comprises a fixing element for the fire

arm which is mounted on a supporting frame (4) which comprises a cradle (5) provided with a slide (6) which can slide in a longitudinal direction parallel to the axis of the barrel (X-X'), whereby the fixing element
5 is mounted on the slide (6) of the cradle (5) by means of a transversal hinge pin (10) on the one hand and on the frame (4) by means of at least one shoe (11) mounted in a sliding guide (12-23) in the frame (4), whereby said sliding guide (12-23) is inclined in relation to said
10 longitudinal direction.