

Improved device for the remote control of a fire arm.

The invention concerns an improved device for the remote control of a fire arm.

5 A device for the remote control of a fire arm generally consists of an all-directional turret head to be mounted for example on a vehicle or on a fixed or mobile carriage and which comprises a pintle carrying a frame which serves as a fixing support for the fire arm and which is suspended in an upward tilting manner in said pintle of
10 the turret head.

In order to point the fire arm in the direction of a target, the swiveling of the turret head is controlled by an azimuth motor and the inclination of the frame and thus of the fire arm is controlled by an
15 elevation motor.

For the remote control of the fire arm, the device is provided with a camera whose aiming axis is orientated in the direction of the barrel of the fire arm.

Said camera is mounted on the device in such a manner that
20 it follows the movements of the fire arm, controlled by the operator, which enables the operator to localize the target on a screen, via said controls, and to aim at the

target through a reticule visible on screen.

The screen and the remote control of the operator may be situated at a distance from the turret head, which makes it possible to control the fire arm from a distance.

- 5 The effect of gravity on a fired projectile results in that the projectile follows a curved ballistic trajectory, which makes it necessary to raise the axis of the fire arm in relation to the aiming axis.

Ballistic compensation as a function of the firing
10 distance is necessary to guarantee a good firing precision. Said ballistic compensation is also known as super elevation.

Devices whose camera is made in one piece with the frame are already known, which results in that the
15 movements of the camera are entirely synchronized with the movements of the fire arm supported by the frame. Thus, the camera and the fire arm are raised by one and the same motor.

A disadvantage of these devices is that, when the firing
20 angle is high, for example when the firing distance is long, the ballistic compensation may result in that the target is no longer visible on screen for the operator, which has for a result that firing becomes very imprecise, if not impossible.

25 Devices whereby the frame and thus the fire arm are

raised by a first motor, whereas the camera is directed by a second, independent motor are already known as well.

- 5 A device of this type is disadvantageous in that it is relatively complex, heavy and expensive, and in that its maintenance costs are relatively high.

10 The invention aims to remedy one or several of the above-mentioned disadvantages and to provide a device for the remote control of a fire arm which allows for a good firing precision and whose construction is relatively simple.

According to the invention, this aim is reached by an improved device for the remote control of a fire arm,
15 which comprises a turret head which can be pointed in all directions, controlled by an azimuth motor; a frame for fixing the fire arm which is suspended in an upward tilting manner in a pintle which is part of said turret head; a sighting camera connected to a screen displaying a
20 sighting reticule; a single elevation motor to control the elevation of the frame and the camera; a remote control to control the azimuth motor and the elevation motor; one or several sensors to determine the orientation of the frame and/or of the camera and a
25 ballistic calculator connected to said sensors to calculate and control the super elevation of the frame as a function of the information from the sensors and the distance of the target, characterized in that the camera is driven by the above-mentioned elevation motor and in

that the frame can be inclined in elevation in relation to the camera, whereby said frame is driven by the elevation motor via a super elevation jack placed between the frame and the motor, whereby the super
5 elevation of the frame is controlled by the elongation of said jack, calculated by the ballistic calculator.

10 The camera and the frame are thus driven simultaneously by one and the same elevation motor, whereas the super elevation of the frame is obtained by means of an elongation of the super elevation jack which is placed between the elevation motor and the frame and thus also between the camera and the frame, so as to obtain a shift between the elevation of the camera and the elevation of the frame.

15 In this manner, the raised position of the camera and the raised position of the frame are uncoupled so to say, which is advantageous in that the operator can always see the target on screen, whereas the ballistic calculator has the possibility to introduce the necessary super elevation of the frame as a function of the distance of the target.

20 Another advantage of a device according to the invention is the relative simplicity of the construction of the device and its components, which is advantageous as far as price and maintenance costs are concerned, without compromising the firing precision however.

25 According to a preferred embodiment of the invention, the elevation motor is situated on one side of the frame, whereas the camera is situated on the other side of the frame,

whereby the camera is coupled directly to the elevation motor by means of a mechanical coupling in the form of a bridge between the elevation motor and the camera, thus avoiding to disrupt the supply and ejection of the ammunition.

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Said mechanical bridge is preferably mounted under the frame so as to simplify the mounting of the fire arm on the frame, as well as its dismounting.

○ 10 For clarity's sake, the following examples of an embodiment of an improved device according to the invention for the remote control of a fire arm are described hereafter as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

15 figure 1 is a view in perspective of a device according to the invention for the remote control of a fire arm mounted in the device;

○ figure 2 is an exploded view of the part indicated by F2 in figure 1;

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figure 3 is a view similar to that in figure 1, but in which some parts have been omitted;

○ figure 4 represents the part indicated by F4 in
25 figure 3;

figure 5 is a view of the image on the sighting

screen;

figure 6 is a view similar to that in figure 5, but
for an inclined position of the device according to
5 the invention;

figures 7 and 8 show views similar to that in figure
6, but at different aiming stages.

Figure 1 represents an improved device 1 according
10 to the invention for the remote control of a fire arm 2,
which is a machine gun in the given example.

The device 1 comprises a turret head 3 which can be
pointed in all directions, provided with a bearing 4
for mounting the turret head 3 on a vehicle or any
15 other basis and which enables the turret head 3 to
rotate round an axis X-X', controlled by an azimuth motor
5.

The turret head 3 comprises a pintle 6 in which the
frame 7 is suspended in an upward tilting manner
20 round an axis Y-Y' by means of two hinge points 8.

As represented in figure 2, the frame 7 serves as a
support for fixing the fire arm 2 on the device 1 and in
this case comprises a cradle 9 which makes it possible to
stop and guide the movement of the fire arm 2 in the
25 axial direction in a known manner, since we know that the
fire arm 2 tends to recoil as a result of the reactive
forces of the propulsion gases of the fired ammunition.

The fire arm 2 is mounted with its receiver 10 on the frame 7 and is protected by means of two protection caps 11 and 12.

An elevation motor 13 is mounted on the turret head 3, preferably in an armored framework 14 situated on one side of the frame 7.

A sighting camera 15 is provided in an armored framework 16 on the other side of the frame 7, enabling the operator to visualize the target, whereby the camera 15 or the framework 16 is connected directly to the output shaft of the elevation motor 13 via a mechanical coupling 17, for example in the form of a mechanical bridge which, in the case of the figures, goes under the frame 7.

As a result, the elevated position of the camera 15 is directly controlled by the elevation motor 13.

The frame 7 on the other hand, is also directly controlled by the same elevation motor 13 as mentioned above, but indirectly by means of an electric super elevation jack 18 situated at right angles to the axis of the elevation motor 13 which coincides with the above-mentioned elevation axis Y-Y' and situated at a distance from said axis Y-Y'.

The sighting camera 15 is connected to a screen displaying the target 21 as well as a sighting reticule 22 via wiring 19 or via a wireless connection of the RF type

or any other type whatsoever.

The camera 15 can be situated on the turret head 3 or at a distance from the latter.

A remote control 23 is provided so as to enable
5 the operator to control the movements of the azimuth motor 5 and of the elevation motor 13 so as to direct the camera 15 and the frame 7 towards the target 21.

○ The remote control 23 may be a bidirectional control lever 24, for example, provided with a trigger 25 to
10 control the firing.

Said remote control 23 is connected directly or indirectly to the motors 5 and 13 by means of a controller and a ballistic calculator 26, and to the fire arm 2 by means of electric wiring 27 or via a wireless
15 connection.

○ The ballistic calculator 26 is coupled to one or several sensors to determine the orientation of the frame 7 and/or of the camera 15, including for example a sensor 28 to determine the azimuth of the turret head 3, a
20 sensor 29 to determine the elevation of the camera 15, a sensor 30 to determine the roll angle R of the turret head 3 and an encoder 31 to determine the elongation L of the super elevation jack 18, as well as a range finder 32 allowing to measure the distance between the device 1 and
25 the target 21.

The ballistic calculator 26 comprises software which makes it possible to calculate the super elevation to be provided to the frame 7 by means of the super elevation jack 18 as a function of the information
5 obtained from the sensors 28, 29 and 30, from the range finder 32 and the control information from the encoder 31.

The working of the device 1 is as follows.

When aiming, the camera 15 and the fire arm 2 are initially directed in the same direction, whereby the
10 super elevation jack is situated in a neutral position.

By means of the remote control 23, the operator controls the movement of the azimuth motor 5 and of the elevation motor 13 so as to position the sighting camera 15 in such a manner that the target 21 is displayed on
15 the screen 20 and so as to position the reticule 22 of the screen 20 on the target 21 as represented in figure 5, in which the reference mark * represents the position of the axis of the barrel 33 of the fire arm 2, whereby the position A is the position when aiming.

20 When the target 21 is being aimed at, the operator obtains the distance at which the target 21 is situated by activating the range finder 32.

The information regarding the distance is transmitted to the ballistic calculator 26 which calculates the super
25 elevation to be provided to the frame 7 in order to be able to hit the target 21, and which adjusts the

position of the fire arm 2 by a corresponding elongation of the super elevation jack 18 so as to obtain a position of the axis of the barrel 33 which corresponds to the position B in figure 5.

- 5 The case of figure 5 corresponds to a situation in which the axis of rotation X-X' of the turret head is vertical, which corresponds to a roll angle zero.

○ In reality, the bearing 4 of the turret head is not always horizontal, the axis X-X' forming a roll angle R with the
10 vertical line Z-Z'.

In this case, the adjustment of the elevation of the frame 7 by means of the super elevation is translated by a movement of the axis of the barrel 33 in a non-vertical plane, leading to a position C as represented in figure 6,
15 which results in a lateral deviation error of azimuth D in relation to the actual position of the target 21.

○ For this reason, the ballistic calculator 26 is provided with azimuth adjusting means making it possible to adjust the azimuth of the turret head 3 in the opposite sense so as to
20 compensate for the deviation of the azimuth and to align the axis of the barrel 33 to the position E in the vertical plane Z-Z' of the target 21, taking into account the value of the roll angle R as measured by the sensor 30.

As the camera 15 follows the azimuth adjusting movement of the
25 turret head 3, the display of the target 21 moves on the screen 20 and recedes over a distance F from the position of

the reticule 22 in which the target 21 was aligned before the azimuth adjustment took place.

The operator then sees a display as illustrated in figure 7.

5 In order to be able to adjust the divergence F between the display of the target 21 and the position of the reticule 22, the device 1 preferably comprises azimuth adjustment means for the reticule 21 on screen 20, opposed to the azimuth adjustment of the turret head 3 so as to restore the position of the reticule on the target 21 as illustrated in figure 8.

10 It is clear that the azimuth adjustment of the turret head 3 and the adjustment of the position of the reticule 22 can be synchronized so as to always maintain the position of the reticule 22 on the target 21.

15 It is also clear that the super elevation jack 18 can be replaced by other means allowing for an upward swivel divergence of the frame 7 in relation to the camera 15.

20 The invention is by no means limited to the above-described examples; on the contrary, many modifications can be made to the improved device for the remote control of a fire arm while still remaining within the scope of the invention as defined in the following claims.

Claims.

1.- Improved device for the remote control of a fire arm, which comprises a turret head (3) which can be pointed
5 in all directions, controlled by an azimuth motor (5);
a frame (7) for fixing the fire arm (2) which is
suspended in an upward tilting manner in a pintle (6)
which is part of said turret head (3); a sighting camera
(15) connected to a screen (20) displaying a sighting
10 reticule (22); a single elevation motor (13) to control
the elevation of the frame (7) and the camera (15); a
remote control (23) to control the azimuth motor (5) and
the elevation motor (13); one or several sensors
(28,29,30) to determine the orientation of the frame (7)
15 and/or of the camera (15) and a ballistic calculator
(26) connected to said sensors (28,29,30) to calculate
and control the super elevation of the frame (7) as a
function of the information from the sensors and the
distance of the target (21), characterized in that the
20 camera (15) is driven by the above-mentioned elevation
motor (13) and in that the frame (7) can be inclined in
elevation in relation to the camera (15), whereby said
frame (7) is driven by the elevation motor (13) via a
super elevation jack (18) placed between the frame (7)
25 and the elevation motor (13), whereby the super elevation
of the frame (7) is controlled by the elongation of said
jack (18), calculated by the ballistic calculator (26).

2.- Device according to claim 1, characterized in that the
super elevation jack (18) is situated at right angles to

the axis (Y-Y') of the elevation motor (13) and at a distance from said axis (Y-Y').

3.- Device according to claim 1 or 2, characterized in that the elevation motor (13) is directly coupled to the
5 camera (15) by means of a mechanical coupling (17).

4.- Device according to claim 3, characterized in that the elevation motor (13) is situated on one side of the frame (7), whereas the camera (15) is situated on the other side of the frame (7) and in that the mechanical
10 coupling (17) is formed of a bridge between the elevation motor (13) and the camera (15).

5.- Device according to claim 4, characterized in that the super elevation jack (18) is mounted between the mechanical bridge (17) and the frame (7).

15 6.- Device according to claim 4 or 5, characterized in that the mechanical bridge (17) goes under the frame (7).

7.- Device according to any one of the preceding claims, characterized in that it is provided with a sensor to
20 determine the roll angle (R) of the turret head (3) and with azimuth adjusting means making it possible to adjust the azimuth of the turret head (3) so as to compensate for the azimuth deviation (D) of the frame (7) resulting from the super elevation of the frame (7)
25 when the roll angle (R) of the turret head (3) is not zero.

8.- Device according to claim 7, characterized in that it comprises azimuth adjusting means for the reticule (22) on the screen (20) opposed to the azimuth adjustment of the turret head (3) so as to compensate for the azimuth adjusting movement of the turret head (3) in order to maintain the position of the reticule (22) on the target (21).

9.- Device according to any one of the preceding claims, characterized in that it is provided with a range finder (32) to measure the distance at which the target (21) is situated and which is connected to the ballistic calculator (26) to calculate the super elevation.

10.- Device according to any one of the preceding claims, characterized in that the super elevation jack (18) is provided with an encoder (31) which is connected to the ballistic calculator (26) to transmit the information regarding the elongation of the jack (18).

11.- Device according to any one of the preceding claims, characterized in that the super elevation jack (18) is part of a stabilization system of the fire arm (2).