

TITLE: FIRE INTERFERENCE DEVICE AND RELATED FIREARM.

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## DESCRIPTION

### Technical field

5           The present invention relates to a safety fire interference device for firearms.

          The present invention further relates to a firearm comprising the fire interference device according to the present invention.

### 10   Technical background

          Fire interference devices are known which are adapted to prevent a movement, e.g. an upward movement, of a safety element, such as a safety rod, of the breechblock of the firearm. Fire interference devices  
15   prevent the blowback mass from snapping if a fire button has not been pressed or the firearm has been inhibited or prevented from firing a piece of ammunition, e.g. a cannon within wooded field or misaligned.

          A known problem with fire interference devices is  
20   that they must prevent the safety element from moving in the above-mentioned cases and during the recoil of the recoiling mass while also allowing the same safety element to be quickly and reliably released when a fire button is actually pressed, if the firearm has been  
25   enabled to fire a piece of ammunition.

Implementing an actuator which is both reliable and reactive, as well as a kinematic chain for motion transmission from the actuator to the locking element of the safety element which is reliable, reactive, simple  
5 to manufacture and easy to maintain, is, in fact, a problem well known in the art.

In particular, this problem is apparent in light of the fact that the firing pin or blowback mass is positioned in the recoiling part of the firearm, so that  
10 also the safety element has to be arranged in the movable part of the firearm, while the control part of the fire interference device is located, for safety reasons, in the fixed part of the firearm, particularly in the cradle. It follows that it is a difficult task to design  
15 a motion transmission chain which is both stable and reliable.

#### **Summary of the invention**

The present invention aims at solving these and other technical problems suffered by the prior art by  
20 providing a reliable and safe fire interference device.

One aspect of the present invention relates to a fire interference device having the features set out in the appended claim 1.

A further aspect of the present invention relates to a firearm having the features set out in the appended claim 9.

Auxiliary features are set out in respective  
5 dependent claims.

The features and advantages of the device and firearm of the present invention will become more apparent in light of the following description of at least one exemplary, but non-limiting, embodiment  
10 thereof and of the annexed drawings as summarized below.

**Brief description of the drawings**

- Figure 1 shows a schematic perspective transparency view of a portion of a firearm that comprises a fire interference device according to the  
15 present invention;

- Figure 2 shows a perspective view of one possible embodiment of the fire interference device according to the present invention acting upon a safety element, and reloading levers of a blowback mass;

- 20 • Figure 3A shows a partly sectional side view of one possible embodiment of the fire interference device according to the present invention;

- Figure 3B shows a top view of a detail of one possible embodiment of a mechanical transmission  
25 connected to an electro-hydraulic actuator;

- Figure 4A shows a perspective view of one possible embodiment of an electro-hydraulic actuator comprised in the fire interference device;
- Figure 4B shows one possible embodiment of the  
5 electric and hydraulic circuit diagram of the electro-hydraulic actuator;
- Figure 5 shows a perspective view of one possible embodiment of the fire interference device acting upon the safety element, in a first operating  
10 configuration in which the electro-hydraulic actuator is off;
- Figure 6 shows a side view of a detail of the fire interference device of Figure 5, acting upon the safety element, in the first operating configuration in  
15 which the electro-hydraulic actuator is off;
- Figure 7 shows a perspective view of the fire interference device of Figure 5, in a second operating configuration in which the electro-hydraulic actuator is on;
- Figure 8 shows a side view of the fire  
20 interference device of Figure 7, acting upon the safety element, in the second operating configuration in which the electro-hydraulic actuator is on;
- Figure 9A shows a side view of a further detail  
25 of the fire interference device, illustrating the

interaction between the fixed portion and the movable portion thereof in the first operating configuration in which the electro-hydraulic actuator is off;

- Figure 9B shows a side view of the detail of the fire interference device of Figure 9A, illustrating the interaction between the fixed portion and the movable portion thereof in the second operating configuration in which the electro-hydraulic actuator is on.

#### **Detailed description of the invention**

With reference to the above-listed figures, reference numeral 3 designates as a whole the fire interference device as such; whereas reference numeral 1 designates as a whole the firearm as such.

Fire interference device 3 according to the present invention is particularly suitable to be comprised in a firearm 1 according to the present invention, e.g. mechanical-percussion firearms.

Fire interference device 3 according to the present invention is adapted to prevent movements of a safety element 22 comprised in a breechblock 2 of a firearm 1. In particular, said safety element 22 is adapted to prevent the release of a blowback mass 21, particularly when a fire button has not been pressed or said firearm 1 has been inhibited from firing, e.g. a cannon within wooded field or misaligned.

Preferably, fire interference device 3 according to the present invention operates hydraulically, and is electrically controlled by a fire control logic of firearm 1.

5        Said fire interference device 3 comprises: a fixed portion 31, adapted to be fixedly ceiling-mounted on a cradle 12 of firearm 1; and a movable portion 34, adapted to be mounted on a breech ring 13 of firearm 1.

For the purposes of the present description,  
10    "fixedly ceiling-mounted" means that the upper part of fixed portion 31 is connected to a ceiling or top wall of the housing where fixed portion 31 of fire interference device 3 is at least partly housed.

Said fixed portion 31 in turn comprises: an electro-  
15    hydraulic actuator 32, adapted to be connected to a hydraulic circuit 19 comprised in firearm 1; a control unit 30, adapted to electrically control said electro-hydraulic actuator 32; and a cylindrical cam 33, whereupon said electro-hydraulic actuator 32 acts in  
20    order to operate it.

Said cylindrical cam 33 is adapted to assume a first configuration, or raised configuration, and a second configuration, or lowered configuration.

Said movable portion 34 in turn comprises: a first  
25    lever 35 and a retaining lever 36.

Said first lever 35 in turn comprises a plurality of arms; in particular, it comprises: a first arm or horizontal arm 351, whereupon said cylindrical cam 33 is adapted to act; and a second arm or vertical arm 352, adapted to engage said safety element 22.

Said retaining lever 36 is adapted to lock said first lever 35 during the counter-recoil of a recoiling mass 14 of firearm 1.

Said retaining lever 36 is adapted to cause first lever 35 to be able to release safety element 22 and allow it to snap, e.g. upwards, only when first arm or horizontal arm 351 of first lever 35 is engaged by cylindrical cam 33 in said second configuration or lowered configuration; for example, when the system is out of wooded field and properly aligned and the fire button has been pressed. In particular, said cylindrical cam 33 turns about its own axis 330.

More generally, said cylindrical cam 33, while switching from said first configuration or raised configuration to said second configuration or lowered configuration, acts upon said retaining lever 36, clearing it from said first arm or horizontal arm 351, before the same cylindrical cam 33 starts acting upon first arm or horizontal arm 351 of first lever 35. In fact, said retaining lever 36 is moved away from

cylindrical cam 33 before cylindrical cam 33 hits first arm or horizontal arm 351 of said first lever 35, thereby engaging it, during the counter-recoil of recoiling mass 14.

5           Fire interference device 3 according to the present invention prevents safety element 22 from being moved if a fire button has not been pressed or the firearm has been inhibited from firing a piece of ammunition, but at the same time it allows said safety element 22 to be  
10 quickly and reliably released when a fire button has been actually pressed and firearm 1 has been enabled to fire a piece of ammunition. Fire interference device 3 according to the present invention has proven to be reliable and reactive thanks to the type of actuator  
15 employed. Likewise, motion transmission from electro-hydraulic actuator 32 to first lever 35 is reliable, reactive, simple to manufacture and easy to maintain. Furthermore, fire interference device 3 operates reliably even though fixed portion 31 is fixed to cradle  
20 12 and movable portion 34 is fixed to breech ring 13.

          In a preferred embodiment of fire interference device 3 according to the present invention, said electro-hydraulic actuator 32 is advantageously enclosed in a sealed box 320 and comprises: a hydraulic piston  
25 321, in turn comprising a chamber 321A and a rod 321B;

and a solenoid valve 322. Said solenoid valve 322 is adapted to control said hydraulic piston 321 as a function of the power supply applied to said solenoid valve 322 by said control unit 30, e.g. a direct voltage, e.g. 28VDC. Said solenoid valve 322 is electrically  
5 powered by means of a power cable, preferably a dedicated one, connected to said control unit 30.

In particular, said solenoid valve 322 is adapted to suitably control a flow of oil circulating under  
10 pressure in said hydraulic circuit 19 towards said chamber 321A of hydraulic piston 321, thereby moving rod 321B in or out of hydraulic piston 321. Preferably, said electro-hydraulic actuator 32 is a hydraulic piston 321 controlled by solenoid valve 322. In the configuration  
15 in which said solenoid valve 322 is supplied, for example, with 28V direct voltage, it permits the pressurized oil to flow into chamber 321A of hydraulic piston 321, thereby causing rod 321B to return into hydraulic piston 321. In a preferred embodiment, said  
20 solenoid valve 322 comprises an inlet 322A, through which oil can flow in; an outlet 322B, through which oil can flow out, and a shut-off valve 3221.

In one possible embodiment of fire interference device 3 according to the present invention, said  
25 electro-hydraulic actuator 32 acts, through a movable

part thereof, in particular said rod 321B, upon said cylindrical cam 33 via a mechanical transmission 324.

In one possible embodiment of fire interference device 3 according to the present invention, said  
5 mechanical transmission 324 comprises: a fork-shaped lever 324A; and an external lever 324B.

Said fork-shaped lever 324A is connected, at one end thereof, in particular at the bifurcate end thereof, to the movable part of electro-hydraulic actuator 32, in  
10 particular to rod 321B, while at the opposite end it is hinged to said external lever 324B.

Said external lever 324B is hinged, at a first end thereof, to said fork-shaped lever 324A, while at the opposite end it is hinged to said cylindrical cam 33. In  
15 particular, said external lever 324B is hinged to cylindrical cam 33 by means of a pin 331.

In one possible embodiment, said external lever 324B is adapted to rotate about an axis about which said cylindrical cam 33 also rotates. Said cylindrical cam 33  
20 is adapted to rotate about an axis 330, which is parallel to the axis along which movable portion 34 of fire interference device 3 moves during the recoil and counter-recoil of recoiling mass 14. In particular, the profile of said cylindrical cam 33 is such as to allow  
25 movable portion 34 of fire interference device 3 to slide

without interfering with its motion when the same cylindrical cam 33 is in the first configuration or raised configuration.

Said cylindrical cam 33 comprises a return spring 332, designed to hold said cylindrical cam 33 in said first configuration or raised configuration. In a preferred embodiment, said return spring 332 acts upon pin 331 that constrains cylindrical cam 33 to external lever 324B of mechanical transmission 324.

10 In a preferred embodiment of fire interference device 3 according to the present invention, said first lever 35 is an angle lever. In particular, said angle lever 35 comprises three arms, wherein: said first arm or horizontal arm 351 is adapted to be actuated by cylindrical cam 33; said second arm or vertical arm 352 15 is adapted to engage safety element 22, e.g. a safety rod; and a third arm or counterweight arm 353 is adapted to act as a balance counterweight.

In the first configuration or raised configuration 20 of the cylindrical cam, said first arm or horizontal arm 351 of angle lever 35 weighs upon said retaining lever 36.

Preferably, said third arm or counterweight arm 353 is adapted to activate a "released firing pin" consent. 25 For example, such consent is provided by a proximity

sensor 355. Said proximity sensor 355 is adapted to sense the position of said third arm or counterweight arm 353. When said third arm or counterweight arm 353 changes its position, e.g. due to a rotation of angle lever 35 about an axis 350, said proximity sensor 355 will sense the variation that has occurred in the position of said third arm or counterweight arm 353 and will emit an electric/electronic signal to activate the "released firing pin" consent.

10 For the purposes of the present description, "released firing pin" indicates that the firing pin of firearm 1, and particularly blowback mass 21, has been released for firing a piece of ammunition through firearm 1.

15 More generally, said first lever or angle lever 35 is adapted to be constrained to breech ring 13, particularly in such a way as to be able to rotate about said axis 350. Preferably, said axis 350 about which said first lever 35 rotates is perpendicular to axis 330 about which said cylindrical cam 33 rotates.

20 Preferably, movable portion 34 of fire interference device 3, and particularly said first lever 35, comprises a return spring 354 adapted to cause said first lever or angle lever 35 to position itself in such a way that said second arm or vertical arm 352 can engage said

safety element 22 and said first arm or horizontal arm 351 is engaged by said retaining lever 36. Preferably, said return spring 354 is adapted to cause said first lever 35 to rotate counterclockwise if a clockwise  
5 rotation of said first lever 35 has occurred.

In one possible embodiment, said retaining lever 36 is adapted to rotate about its own axis 360. Preferably, said retaining lever 36 is so shaped that it can, by rotating about said axis 360, moved away from said  
10 cylindrical cam 33 during the switching of said cylindrical cam 33 from the first configuration or raised configuration to said second configuration or lowered configuration, before said cylindrical cam 33 acts upon said first arm or horizontal arm 351 of said first lever  
15 or angle lever 35.

Preferably, said retaining lever 36 is adapted to rotate about an axis 360, wherein said axis 360 is, advantageously, parallel to axis 330 about which cylindrical cam 33 rotates and perpendicular to axis 350  
20 about which said first lever 35 rotates. This perpendicular configuration of such two axes (350, 360) makes it possible to improve the safety of fire interference device 3, because an external force will not be able to act upon both retaining lever 36 and first

lever 35, so that, de facto, safety element 22 cannot be accidentally released.

Preferably, said retaining lever 36 comprises a contact portion 363, whereupon said cylindrical cam 33  
5 acts in order to clear retaining lever 36. Moreover, said retaining lever 36 is so shaped as to prevent first lever 35 from rotating about axis 350, particularly by holding said first arm or horizontal arm 351, thereby preventing a clockwise or downward rotation of said first  
10 lever 35.

Preferably, said retaining lever 36 comprises an abutment portion 362, whereon said first arm or horizontal arm 351 of said first lever 35 abuts, thus being prevented from moving, in particular being  
15 prevented for making a clockwise rotation about said axis 350.

Preferably, said retaining lever 36 comprises a return element 361, e.g. a spring. Said return element 361 is adapted to hold retaining lever 36 in the position  
20 in which it locks said first lever 35, particularly said first arm or horizontal arm 351.

Preferably, fire interference device 3 according to the present invention is so designed that, in an operating configuration wherein said electro-hydraulic  
25 actuator 32 is in an idle or non-powered or non-activated

configuration, said cylindrical cam 33 is in said first configuration or raised configuration. In particular, in the first configuration or raised configuration, said cylindrical cam 33 does not act upon said retaining lever  
5 36, the latter keeping said first lever 35 in a configuration in which it locks said safety element 22.

Preferably, fire interference device 3 according to the present invention is also so designed that, in an operating configuration wherein said electro-hydraulic  
10 actuator 32 is in an actuation, powered or activated configuration, said electro-hydraulic actuator 32 retracts a movable part thereof, particularly rod 321B of hydraulic piston 321, which causes, preferably by actuating said mechanical transmission 324, said  
15 cylindrical cam 33 to switch. This results in said cylindrical cam 33 switching from said first configuration or raised configuration to said second configuration or lowered configuration. In particular, during the switching of said cylindrical cam 33, the  
20 latter releases said first arm or horizontal arm 351 of first lever 35 from said retaining lever 36, and subsequently lowers said first arm or horizontal arm 351, in particular by rotating said first lever or angle lever 35 about axis 350. In particular, such displacement  
25 of cylindrical cam 33 allows said cylindrical cam 33 to

act upon said retaining lever 36, causing it to rotate about axis 360 and moving it away. Furthermore, such displacement of cylindrical cam 33 results in said first arm or horizontal arm 351 of first lever 35 going down  
5 as first lever 35 rotates, e.g. clockwise. The rotation of first lever or angle lever 35 about said axis 350 results in the following: disengagement of safety element 22; snapping, e.g. upwards, of safety element 22; rotation of a shaft 25 whereon an external reloading  
10 lever 23 and an internal reloading lever 24 of firearm 1 are mounted, causing them to be released; and release of blowback mass 21.

Said reloading levers (23, 24) are mounted on said shaft 25, about which they can rotate in order to either  
15 arm or release blowback mass 21. Safety element 22 acts upon said shaft 25 in order to keep said blowback mass 21 in the armed condition. In particular, said safety element 22 is designed in a manner such that, when said second arm or vertical arm 352 is engaged with said  
20 safety element 22, safety element 22 prevents any rotation of said shaft 25, thus allowing said internal reloading lever 24 to act upon blowback mass 21 to lock it and prevent it from snapping to fire a piece of ammunition. In a preferred embodiment, said internal  
25 reloading lever 24 is an angle lever.

Said internal reloading lever 24 is also acted upon by a latch 26, which is adapted to translate when blowback mass 21 is released. For example, said latch 26 comprises a cylindrical rod with a recess in which one end of internal reloading lever 24 works, in particular the end thereof opposite the one that retains said blowback mass 21. On the head of latch 26 a cam is formed which, by engaging into its housing on breechblock 2, prevents latch 26 from rotating and causes it to translate when it is in the position corresponding to a relief of an internal lever for opening and closing breechblock 2 (not shown), so as to release blowback mass 21. The other end of latch 26, i.e. the tip thereof, is so shaped that it can be operated by the lever for opening and closing breechblock 2, which holds latch 26 in the position in which it retains internal reloading lever 24 until breechblock 2 is closed. Said reloading levers (23, 24), said shaft 25 and said latch 26 will not be described any further herein, since they are per se known to those skilled in the art and are not, as such, subjects of the present invention.

Preferably, fire interference device 3 according to the present invention is designed to permit repeating an attempt to fire a piece of ammunition by rearming the firing pin, in particular blowback mass 21, through said

reloading levers (23, 24), without breechblock 2 having to be moved, which is an important thing for safety in case of a dud round, e.g. when the piece of ammunition is struck but not activated, so that deflagration does  
5 not occur.

In a preferred, but merely illustrative and non-limiting, embodiment of fire interference device 3 according to the present invention, said fire interference device 3 is adapted to prevent any upward  
10 movement of safety element 22, e.g. in the form of a safety rod, of breechblock 2, thus preventing blowback mass 21 from snapping when the fire button has not been pressed or firing has been inhibited, e.g. because a cannon is within wooded field or misaligned. Fire  
15 interference device 3 according to the present invention operates hydraulically and is electrically controlled by the fire control logic, e.g. a control unit 30.

In a preferred, but merely illustrative and non-limiting, embodiment, fire interference device 3 is made  
20 up of two portions: a fixed portion 31 ceiling-mounted to cradle 12 of firearm 1; and a movable portion 34, mounted to breech ring 13. Fixed portion 31 mainly includes: an electro-hydraulic actuator 32, enclosed in sealed box 320 and acting, with its movable part, in

particular with said rod 321B, upon cylindrical cam 33 via mechanical transmission 324.

Electro-hydraulic actuator 32 includes hydraulic piston 321 controlled by solenoid valve 322, which, when  
5 powered by control unit 30, in particular with 28V direct voltage, allows pressurized oil to flow into chamber 321A of hydraulic piston 321, thereby causing rod 321B to be retracted into hydraulic piston 321.

Said cylindrical cam 33, driven by electro-  
10 hydraulic actuator 32 via mechanical transmission 324, engages first arm or horizontal arm 351 of angle lever 35 fixed to breech ring 13. In particular, said mechanical transmission 324 consists of fork-shaped lever 324A and external lever 324B.

15 Movable portion 34 of fire interference device 3 mainly consists of: an angle lever 35, made up of three arms: a first arm or horizontal arm 351, adapted to be actuated by cylindrical cam 33; a second arm or vertical arm 352, adapted to engage safety element 22, in  
20 particular a safety rod. Angle lever 35 comprises a third arm or counterweight arm 353, adapted to act as a balance counterweight. Said third arm or counterweight arm 353 is also adapted to activate the "released firing pin" consent.

Movable portion 34 of fire interference device 3 further comprises a retaining lever 36 adapted to lock angle lever 35 during the counter-recoil of recoiling mass 14, so that angle lever 35 will only release safety  
5 element 22, in particular the safety rod, and allow said safety element 22 to snap, particularly upwards, when said first arm or horizontal arm 351 of angle lever 35 is engaged by cylindrical cam 33, particularly in its second configuration or lowered configuration,  
10 particularly when the system is aligned and out of wooded field and the fire button has been pressed.

Retaining lever 36 is cleared from cylindrical cam 33 before the latter hits said first arm or horizontal arm 351 of angle lever 35 during the counter-recoil of  
15 recoiling mass 14.

In the present embodiment of fire interference device 3, when electro-hydraulic actuator 32 is not powered, or not activated, cylindrical cam 33 is in the first configuration or raised configuration and does not  
20 act upon either retaining lever 36 or angle lever 35. In the first configuration, said retaining lever 36 holds angle lever 35 in the position in which it locks safety element 22.

In the present embodiment of fire interference  
25 device 3, when electro-hydraulic actuator 32 of fire

interference device 3 is powered, i.e. activated, said electro-hydraulic actuator 32 retracts its movable part 321A, which, by actuating mechanical transmission 324, causes cylindrical cam 33 to switch into the second  
5 configuration or lowered configuration. While switching to said second configuration or lowered configuration, cylindrical cam 33 first releases first arm or horizontal arm 351 of angle lever 35 from the action of said retaining lever 36 by displacing said retaining lever  
10 36, and only afterwards acts upon said first arm or horizontal arm 351 to lower it, in particular by causing said angle lever 35 to rotate about axis 350. The lowering of first arm or horizontal arm 351 of angle lever 35 causes a clockwise rotation of angle lever 35  
15 about axis 350, resulting in: safety element 22 snapping upwards; rotation of shaft 25 of external reloading lever 23; release of internal reloading lever 24; and release of blowback mass 21.

In particular, after the activation of electro-  
20 hydraulic actuator 32, said retaining lever 36 rotates about an axis 360 to switch from an interfering position, in which it prevents angle lever 35 from rotating about axis 350, to a clearing position, in which it allows angle lever 35 to rotate about axis 350.

Describing now in more detail one possible embodiment of fire interference device 3 according to the present invention, Figure 1 schematically shows, in a perspective transparency view, a portion of a firearm 1 comprising a fire interference device 3 according to the present invention. Figure 1 shows a cradle 12 of a firearm 1, which partly houses a breech ring 13 and a recoiling mass 14.

Figure 2 shows, in a perspective view, one possible embodiment of a fire interference device 3 according to the present invention, acting upon a safety element 22, and reloading levers (23, 24) of a blowback mass 21. In particular, Figure 2 shows a fixed portion 31, which comprises an electro-hydraulic actuator 32 secured, through a sealed box 320, to a cradle 12 of a firearm. Figure 2 shows the terminal part of a hydraulic circuit 19 connected to a solenoid valve 322 to drive a hydraulic piston 321. Said hydraulic piston 321 is connected to a cylindrical cam 33 via a mechanical transmission 324. Said cylindrical cam 33 acts upon a movable portion 34 comprising a first lever 35, in the form of an angle lever, and a retaining lever 36. Said angle lever 35 is connected to a return spring 354.

Said angle lever 35 is adapted to act upon a safety element 22, which acts upon a shaft 25 whereon an

external reloading lever 23 and an internal reloading lever 24 are fixed, the latter being adapted to interact with a latch 26. Said movable portion 34 is fixed to a recoiling mass 14 of the firearm.

5           Figure 3A shows a partly sectional side view of one possible embodiment of a fire interference device 3 according to the present invention. In particular, Figure 3A shows fixed portion 31 of fire interference device 3, and one can see that electro-hydraulic actuator  
10 32 is fixed to cradle 12 of the firearm through sealed box 320. The figure also shows the terminal part of hydraulic circuit 19 that supplies hydraulic piston 321 enclosed in sealed box 320. In Figure 3A one can see the valve body of solenoid valve 322 adapted to drive said  
15 hydraulic piston 321. A rod 321B of hydraulic piston 321 is connected to mechanical transmission 324, particularly to a fork-shaped lever 324A, the latter being connected to the shaft about which cylindrical cam 33 rotates. Figure 3A shows electro-hydraulic actuator  
20 32 in the powered or activated condition and the arrangement of mechanical transmission 324 when cylindrical cam 33 is in the second configuration or lowered configuration. Dashed contour lines show the positions of cylindrical cam 33 in said first  
25 configuration or raised configuration and of said fork-

shaped lever 324A when electro-hydraulic actuator 32 is not powered or activated. Figure 3A also shows a return spring 332 connected to cylindrical cam 33 to hold cylindrical cam 33 in said first configuration or raised  
5 configuration.

Figure 3A also shows the position of a proximity sensor 355 adapted to sense changes in the position of said third arm or counterweight arm of the angle lever, and to accordingly issue an electric/electronic signal  
10 to activate a "released firing pin" consent.

Figure 3B shows, in a plan view, a detail of one possible embodiment of a mechanical transmission 324 connected to an electro-hydraulic actuator 32. In particular, Figure 3B shows the terminal portion of rod  
15 321B connected to fork-shaped lever 324A, which at its opposite end is hinged to external lever 324B along axis 330 about which cylindrical cam 33 rotates, which is fixed to external lever 324B through a pin 331 acted upon by return spring 332.

20 Figure 4A shows a perspective view of one possible embodiment of an electro-hydraulic actuator 32 comprised in fire interference device 3 according to the present invention. In particular, Figure 4A shows said electro-hydraulic actuator 32 comprised in fixed portion 31 of  
25 fire interference device 3 according to the present

invention. Figure 4A shows sealed box 320, from which connectors protrude which correspond to an inlet 322A and an outlet 322B of a solenoid valve 322 adapted to drive hydraulic piston 321.

5           Figure 4B shows one possible embodiment of the electric and hydraulic circuit diagram of electro-hydraulic actuator 32. In particular, Figure 4B shows control unit 30, which is electrically connected to said solenoid valve 322. Said control unit 30 is adapted to  
10 control said solenoid valve 322 through a direct-current voltage signal sent to solenoid valve 322, which comprises an inlet 322A and an outlet 322B suitably connected to a hydraulic circuit 19 of the firearm. Said solenoid valve 322 comprises, at outlet 322B, a shut-off  
15 valve 3221. Said solenoid valve 322 allows oil under pressure to enter chamber 321A of hydraulic piston 321. The oil entering said chamber 321A moves, in particular retracts, rod 321B in the direction indicated by the arrow.

20           Figure 5 shows a perspective view of one possible embodiment of fire interference device 3 according to the present invention, acting upon safety element 22, in a first operating configuration in which electro-hydraulic actuator 32 is off. In particular, Figure 5  
25 shows fixed portion 31 of fire interference device 3,

which comprises an electro-hydraulic actuator 32, in turn comprising a sealed box 320. Figure 5 shows the terminal part of hydraulic circuit 19 connected to solenoid valve 322, with inlet 322A and outlet 322B  
5 thereof. Said solenoid valve 322 drives a hydraulic piston, a rod 321B of which is visible in the drawing. Rod 321B is connected to a cylindrical cam 33 via a mechanical transmission 324 comprising a fork-shaped lever 324A and an external lever 324B. Said cylindrical  
10 cam 33 is in the first configuration or raised configuration, wherein it does not act upon a movable portion 34 comprising a first lever 35 in the form of an angle lever, adapted to rotate about an axis 350, and a retaining lever 36, adapted to rotate about an axis 360.  
15 In this configuration, said angle lever 35 is engaged with said safety element 22 through a second arm or vertical arm 352. In this configuration, said safety element 22 is acting upon a shaft 25, whereon an external reloading lever 23 and an internal reloading lever 24  
20 are fixed, the latter being adapted to interact with a latch 26. As mentioned above, Figure 5 shows electro-hydraulic actuator 32 in a non-activated or non-powered condition, i.e. it shows fire interference device 3 according to the present invention in a first operating  
25 configuration.

Figure 6 shows a side view of a detail of fire interference device 3 of Figure 5 in the first operating configuration, wherein electro-hydraulic actuator 32 is in the non-activated or non-powered condition. In particular, Figure 6 shows a part of fixed portion 31, in particular cylindrical cam 33, which is not acting upon retaining lever 36 of movable portion 34 of fire interference device 3, fixed to recoiling mass 14. In fact, cylindrical cam 33 is in the first configuration or raised configuration, and is not acting upon a contact portion 363 of retaining lever 36. In this configuration, an abutment portion 362 of retaining lever 36 prevents first lever 35 from rotating, since first arm or horizontal arm 351 of first lever 35 is acting upon said contact portion 363 of retaining lever 36. Figure 6 shows how first lever 35 is held in this configuration by a return spring 354, so that second arm or vertical arm 352 stays engaged with said safety element 22.

In Figure 6 one can see that safety element 22 allows internal reloading lever 24 to act upon blowback mass 21, thereby locking it and preventing it from snapping for firing a piece of ammunition when breechblock 2 is closed.

Figure 7 shows a perspective view of fire interference device 3 of Figure 5 in a second operating

condition, wherein electro-hydraulic actuator 32 is in the activated or powered condition. In particular, compared with Figure 5, Figure 7 shows that electro-hydraulic actuator 32 has been actuated, via activation  
5 of solenoid valve 322, and the movable part thereof, in the form of rod 321B, has been retracted, so that mechanical transmission 324 has caused cylindrical cam 33 to switch into the second configuration or lowered configuration. In this configuration, cylindrical cam 33  
10 has rotated about axis 330 and displaced retaining lever 36, causing it to rotate about axis 360, thus releasing and pushing down said first arm or horizontal arm 351, thereby rotating first lever 35 about axis 350. Such movement of first lever 35 has allowed safety element 22  
15 to snap upwards, thereby permitting shaft 25 to rotate and unlock reloading levers (23, 24), thus releasing blowback mass and displacing latch 26.

Figure 8 shows a side view of fire interference device 3 of Figure 7 in the second operating  
20 configuration, wherein electro-hydraulic actuator 32 is in the activated or powered condition. In particular, compared with Figure 6, Figure 8 shows the movements performed by the various parts; in particular, it is possible to see that cylindrical cam 33 is in the second  
25 configuration or lowered configuration, having cleared

retaining lever 36 by pushing it at its contact portion 363, so that abutment portion 362 has released first arm or horizontal arm 351 of angle lever 35 and cylindrical cam 33 has been allowed to push down first arm or horizontal arm 351, causing angle lever 35 to rotate clockwise, overcoming the force of return spring 354.

Due to the movement of angle lever 35, second arm or vertical arm 352 is no longer acting upon safety element 22, which can thus snap upwards and release internal reloading lever 24, thereby releasing blowback mass 21, as shown by the arrows in Figure 8.

Figure 9A shows a side view of a further detail of fire interference device 3, illustrating the interaction between fixed portion 31 and movable portion 34 in the first operating configuration, wherein electro-hydraulic actuator 32 is off. In particular, Figure 9A shows cylindrical cam 33, which is adapted to rotate about axis 330, in the first configuration or raised configuration, in which it does not act upon contact portion 363 of retaining lever 36. The same retaining lever 36 retains, through abutment portion 362, first arm or horizontal arm 351 of the first lever. In Figure 9A one can see that said retaining lever 36 is adapted to rotate about axis 360 and is held in the position

shown by a return element 361, in the form of a coil spring.

Figure 9B shows a side view of the detail of fire interference device 3 of Figure 9A, illustrating the interaction between fixed portion 31 and movable portion 34 in the second operating configuration, wherein electro-hydraulic actuator 32 has been activated or powered. In particular, Figure 9B shows cylindrical cam 33 in the second configuration or lowered configuration, which, as it rotates, acts upon contact portion 363 of retaining lever 36 to displace said retaining lever 36 and clear first arm or horizontal arm 351 of the first lever of abutment portion 362, so that it can go down, in particular by rotating. As it acts upon said retaining lever 36, said cylindrical cam 33 causes said retaining lever 36 to rotate about axis 360. As visible in Figure 9B, return element 361 has extended, thus accumulating energy to return retaining lever 36 into the configuration shown in Figure 9A. In Figure 9B, for a better understanding, the arrows indicate the movements performed by the various parts involved.

The fire interference device 3 according to the present invention is particularly suited to be comprised in one or more firearms 1, in particular mechanical-percussion firearms. Preferably, each one of said

firearms 1 comprises: a cradle 12; a breech ring 13; a recoiling mass 14; a hydraulic circuit 19; and a breechblock 2, the latter comprising a safety element 22.

5        Said firearm 1 further comprises a blowback mass 21; an external reloading lever 23; and an internal reloading lever 24.

         In one possible embodiment of the firearm 1 according to the present invention, it is a naval gun.

10        By way of example, Figure 1 shows a portion of a firearm 1 according to the present invention.

         Fire interference device 3 according to the present invention prevents safety element 22 from moving in case a fire button has not been pressed, or firing has been  
15        disabled, and during the recoil of recoiling mass 14, while at the same time permitting a quick and reliable release of safety element 22 when a fire button has been actually pressed.

         Fire interference device 3 according to the present  
20        invention implements an actuator which is both reliable and reactive, as well as a kinematic chain for motion transmission from the actuator to the locking element of safety element 22 which is reliable, reactive, simple to manufacture and easy to maintain.

In addition, fire interference device 3 according to the present invention provides a stable and reliable motion transmission chain, although a part of the same is fixed to cradle 12 and another part thereof is mounted  
5 to breech ring 13.

Fire interference device 3 according to the present invention has proven to be reliable and safe.

Any embodiments of fire interference device 3 which have not been illustrated or described herein, but which  
10 can be easily inferred by a person skilled in the art in light of the contents of the present patent application, shall fall within the scope of the present invention.

15

REFERENCE NUMERALS:

|                             |    |
|-----------------------------|----|
| Firearm                     | 1  |
| Cradle                      | 12 |
| Breech ring                 | 13 |
| 20 Recoiling mass           | 14 |
| Hydraulic circuit           | 19 |
| Breechblock                 | 2  |
| Blowback mass               | 21 |
| Safety element              | 22 |
| 25 External reloading lever | 23 |

|    |                            |      |
|----|----------------------------|------|
|    | Internal reloading lever   | 24   |
|    | Shaft                      | 25   |
|    | Latch                      | 26   |
|    | Fire interference device   | 3    |
| 5  | Control unit               | 30   |
|    | Fixed portion              | 31   |
|    | Electro-hydraulic actuator | 32   |
|    | Sealed box                 | 320  |
|    | Hydraulic piston           | 321  |
| 10 | Chamber                    | 321A |
|    | Rod                        | 321B |
|    | Solenoid valve             | 322  |
|    | Inlet                      | 322A |
|    | Outlet                     | 322B |
| 15 | Shut-off valve             | 3221 |
|    | Mechanical transmission    | 324  |
|    | Fork-shaped lever          | 324A |
|    | External lever             | 324B |
|    | Cylindrical cam            | 33   |
| 20 | Axis                       | 330  |
|    | Pin                        | 331  |
|    | Return spring              | 332  |
|    | Movable portion            | 34   |
|    | First lever                | 35   |
| 25 | Axis                       | 350  |

|    |                  |     |
|----|------------------|-----|
|    | First arm        | 351 |
|    | Second arm       | 352 |
|    | Third arm        | 353 |
|    | Return spring    | 354 |
| 5  | Proximity sensor | 355 |
|    | Retaining lever  | 36  |
|    | Axis             | 360 |
|    | Return element   | 361 |
|    | Abutment portion | 362 |
| 10 | Contact portion  | 363 |

## CLAIMS:

1. Fire interference device (3) for a firearm (1), adapted to prevent movements of a safety element (22), comprised in a breechblock (2) of a firearm (1), adapted  
5 to prevent the release of a blowback mass (21);  
said fire interference device (3) comprising:  
- a fixed portion (31), adapted to be mounted on a cradle (12) of the firearm (1), in turn comprising:  
- an electro-hydraulic actuator (32), adapted to be  
10 connected to a hydraulic circuit (19) comprised in the firearm (1);  
- a control unit (30), adapted to electrically control said electro-hydraulic actuator (32);  
- a cylindrical cam (33), whereupon said electro-  
15 hydraulic actuator (32) acts in order to actuate it, being adapted to assume a first configuration or raised configuration and a second configuration or lowered configuration;  
- and a movable portion (34), adapted to be mounted on  
20 a breech ring (13) of the firearm (1), in turn comprising:  
- a first lever (35), in turn comprising a plurality of arms including: a first arm or horizontal arm (351), whereupon said cylindrical cam (33) is

adapted to act; and a second arm or vertical arm (352), adapted to engage said safety element (22);

- a retaining lever (36) adapted to lock said first lever (35) during the counter-recoil of a recoiling mass (14) of the firearm (1),

said retaining lever (36) being adapted to cause the first lever (35) to be able to release the safety element (22) and allow it to snap only when the first arm or horizontal arm (351) of the first lever (35) is engaged by the cylindrical cam (33) in said second configuration or lowered configuration;

said cylindrical cam (33), while switching from said first configuration or raised configuration to said second configuration or lowered configuration, acts upon said retaining lever (36), clearing it from said first arm or horizontal arm (351), before the same cylindrical cam (33) starts acting upon the first arm or horizontal arm (351) of said first lever (35), thereby engaging it, during the counter-recoil of the recoiling mass (14).

2. Fire interference device (3) according to claim 1, wherein said electro-hydraulic actuator (32) is enclosed in a sealed box (320) and comprises:

- a hydraulic piston (321), in turn comprising a chamber (321A) and a rod (321B); and

- a solenoid valve (322), the latter being adapted to control said hydraulic piston (321) as a function of the power supply applied to said solenoid valve (322) by said control unit (30);
- 5    said solenoid valve (322) being adapted to suitably control a flow of oil circulating under pressure in said hydraulic circuit (19) towards said chamber (321A) of the hydraulic piston (321), which moves the rod (321B) of the hydraulic piston (321).
- 10    3.    Fire interference device (3) according to claim 1 or 2, wherein said electro-hydraulic actuator (32) acts, through a movable part thereof, upon said cylindrical cam (33) via a mechanical transmission (324) comprising a fork-shaped lever (324A) and an external lever (324B).
- 15    4.    Fire interference device (3) according to claim 1, wherein said first lever (35) is an angle lever comprising three arms, wherein:
- said first arm or horizontal arm is adapted to be actuated by the cylindrical cam (33);
- 20    - said second arm or vertical arm (352) is adapted to engage the safety element (22);
- said angle lever (35) comprising a third arm or counterweight arm (353), adapted to act as a balance counterweight and to activate a "released firing pin"
- 25    consent.

5. Fire interference device (3) according to claim 1 or 4, wherein said first lever (35) is adapted to be constrained to the breech ring (13) in such a way that it can rotate about said axis (350).

5 6. Fire interference device (3) according to claim 1, wherein said retaining lever (36) comprises:

- a contact portion (363), whereupon said cylindrical cam (33) acts in order to clear the retaining lever (36);
  - an abutment portion (362), whereon said first arm or
- 10 horizontal arm (351) of said first lever (35) abuts, which is thus prevented from moving;
- said retaining lever (36) being adapted to rotate about an axis (360).

7. Fire interference device (3) according to claim 1,

15 wherein said fire interference device (3) is designed in a manner such that, in an operating configuration in which said electro-hydraulic actuator (32) is in an idle or non-powered or non-activated configuration, said cylindrical cam (33) is in said first configuration or

20 raised configuration;

in the first configuration or raised configuration, said cylindrical cam (33) does not act upon said retaining lever (36), the latter keeping said first lever (35) in a configuration in which it locks said safety element

25 (22).

8. Fire interference device according to claim 1 or 7,  
wherein said fire interference device (3) is designed in  
a manner such that, in an operating configuration in  
which said electro-hydraulic actuator (32) is in an  
5 actuation or powered or activated configuration, said  
electro-hydraulic actuator (32) withdraws a movable part  
thereof that causes the switching of said cylindrical  
cam (33);

the switching of said cylindrical cam (33) permits the  
10 switching from said first configuration or raised  
configuration to said second configuration or lowered  
configuration, so that, as said cylindrical cam (33) is  
switched, it releases said first arm or horizontal arm  
(351) of the first lever (35) from said retaining lever  
15 (36) and then lowers said first arm or horizontal arm  
(351);

the movement of the cylindrical cam (33) allows:

- said cylindrical cam (33) to act upon said retaining  
lever (36), causing it to rotate about an axis (360) and  
20 thus clearing it;
- said first arm or horizontal arm (351) of the first  
lever (35) to be lowered, thereby causing a rotation of  
the first lever (35) and consequently causing:
- the release of the safety element (22);

- a rotation of a shaft (25) on which both an external reloading lever (23) and an internal reloading lever (24) of the firearm (1) are mounted, resulting in them being released;
  - 5 - the release of the blowback mass (21).
9. Firearm (1) comprising:
- a cradle (12);
  - a breech ring (13);
  - a recoiling mass (14);
  - 10 - a hydraulic circuit (19);
  - a breechblock (2), the latter comprising a safety element (22);
- said firearm (1) being characterized in that it comprises a fire interference device (3) according to claim 1.
- 15 10. Firearm according to claim 9, wherein said firearm (1) is a naval gun.

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