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(54) PROXIMITY GUN SAFETY DEVICE

(57) A gun safety device (10) mounted on a gun (100) which automatically prevents the gun from firing when it detects an object is in close proximity to the barrel of the gun. The safety device having a proximity detection system (20) and a data processing device (12) for identifying whether the gun is pointed at a close object, and for generating a disable signal when the gun is identified to be pointed at a near object, and a safety seizer operable to prevent the gun from discharging in response to receiving the disable signal from the data processing device.

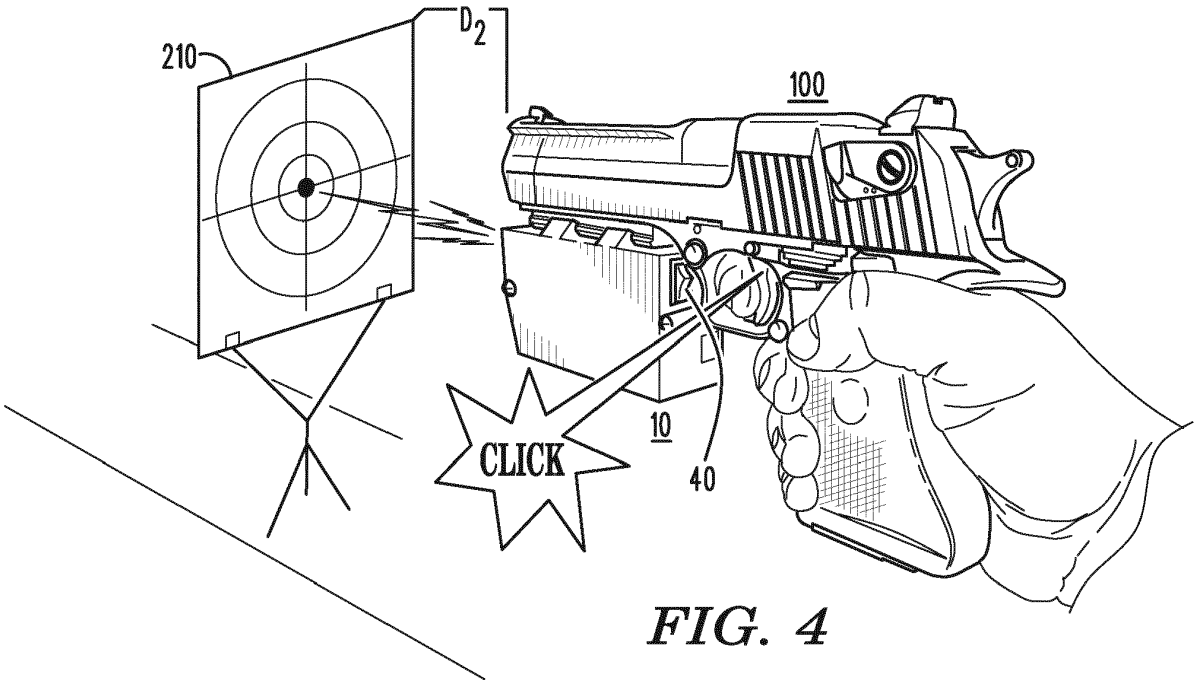

FIG. 4

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Description

FIELD OF THE INVENTION

[0001] The present invention generally relates to an improved safety system and device for firearms.

BACKGROUND

[0002] The system utilizes proximity detection systems to protect persons from friendly fire, specifically to prevent accidents, during training and when in closed quarters. In particular, the system utilizes proximity detectors and an electromechanical safety mechanism to prevent an accidental firing of a gun at a range that is predetermined to be too close for safe firing.

[0003] United States Patent No. 5,713,149 ('149 Patent), which issued to Cady et al., discloses an Electronic Trigger Lock. The '149 Patent describes an electronic trigger lock which contains a back plate which blocks access to the trigger from one side of a firearm. This back plate has a member extending from it which contains a first series of ratchet teeth. Next, an electronic portion of the electronic trigger guard is provided to block access to the other side of the trigger. This electronic portion is contained within an outer housing. A user interface is located on the exterior of the outer housing for entering information into the electronic trigger lock. This interface may be comprised of translucent colored buttons. Also, this user interface is illuminated. The outer housing has an opening for receiving the member extending from the back plate. This opening contains a second series of ratchet teeth which are adapted to engage the first series of ratchet teeth on the member. A solenoid is located inside the outer housing to enable the release of the first series of ratchet teeth from the second series of ratchet teeth. Finally, a processor, internal to the outer housing, is provided for energizing the solenoid upon receiving a predefined code from the user interface.

[0004] United States Patent No. 8,179,247 ('247 Patent), which issued to Ivtsenkov et al., discloses an Interrogator-Transponder RF System for Prevention of Hunting Accidents. The '247 Patent describes the RF system for preventing hunting accidents comprising RF interrogator mounted on the firearm and RF transponder attached to hunter's coat, wherein sharp-diagram K-band RF channel of the interrogator, which is directed along the sightline of hunter's rifle, provides alert information about "friendly targets" that could be under fire, such as other hunters or persons and animals equipped with said transponder; and if they are, the system develops alert signal: "Do not shoot". Also, the system is optionally equipped with a trigger lock automatically preventing friendly fire.

[0005] United States Patent No. 9,175,915 ('915Patent), which issued to Harvey, describes an Apparatus and Methods for Safe Use and Storage of Firearms and Weapons. The '915 Patent describes a lock for a firearm or weapon is disclosed that enables the weapon when control is established by a user while the weapon is in a storage location or holding device. The weapon remains operable as long as the user continuously remains in control but is disabled until returned to the storage location or device if the user relinquishes control. Storage and user zones are defined by weapon location or input devices such as a grip safety. Mechanical devices or signals transfer the zone determinations to a logic device. When the logic device, which may be mechanical, electronic or implemented in other way, determines that the weapon is considered to be both in the storage zone and the user zone and it causes transition to an operable state. The logic device causes transition to an inoperable state if the weapon is determined not to be in either zone.

[0006] United States Patent No. 9,354,010 ('010 Patent), which issued to McCulloch, describes a Firearm Breathalyzer. The '010 Patent discloses a system for locking a firing mechanism of a firearm in response to blood-alcohol content can include a breathalyzer system and a lock system. The breathalyzer system can be configured to connect to a firearm and include an input port for receiving fluid and a processing module for analyzing blood-alcohol content of the fluid. The lock system can be configured to connect to the firearm and be operably connected to the breathalyzer system for receiving a signal from the breathalyzer system so as to disable a firing mechanism of the firearm in response to the blood-alcohol content of the fluid being sensed to be above a threshold.

[0007] United States Patent No. 9,393,869 ('869 Patent), which issued to Oiki et al. describes a Vehicle Acceleration Suppression Device and Vehicle Acceleration Suppression Method. The '010 Patent discloses a total certainty factor indicating a total degree of certainty of the parking frame certainty degree and the parking frame entering certainty degree is calculated based on a parking frame certainty degree indicating the degree of certainty that a parking frame is present in a travel direction of a vehicle, and a parking frame entering certainty degree indicating the degree of certainty that the vehicle enters the parking frame. When the total certainty factor is low, acceleration of the vehicle controlled according to an operation amount of an accelerator pedal for instructing a driving force by operation of a driver is suppressed with a low suppression degree, as compared with a case where the total certainty factor is high. Further, the acceleration of the vehicle is suppressed with a lower suppression degree as the vehicle speed of the vehicle is higher.

BRIEF SUMMARY

[0008] Gun Safety is a paramount interest for gun owners, legislators, educators, and many other interest groups. One of the largest problems for the modern gun educator is that training is difficult, time consuming, and

dangerous. In order for a person to be properly trained with a firearm he or she must, necessarily, handle a weapon loaded with live ammunition. Even in the hands of a skilled and trained operator firearms can pose a safety hazard, but when training new users this risk is particularly acute. Certain training regimens are implemented by skilled firearm educators, but these are not foolproof, and many firearm owners prefer to train their kin themselves in private or semi-private settings. Sadly, there are still many firearms accidents that occur in such training systems yearly.

[0009] Therefore there is a need for a device that increases the safety of firearms training regimens, and in particular, can prevent the firing of a firearm loaded with live ammunition under a particular set of circumstances. Therefore is a principal object of the present invention to provide a proximity triggered gun lock for a trigger-operated gun which with a high degree of accuracy and precision allows the gun owner or operator to fire the weapon only when there is sufficient distance between the muzzle of the gun and the target.

[0010] This object, as well as other objects which will become apparent from the discussion that follows, is achieved, in accordance with the present invention, by providing a trigger-locking (in at least one embodiment being battery-powered) or firing interrupt device which is configured to be disposed on a gun includes a proximity detector, data receiver, a data memory and a logic device for determining whether the distance is within an applicable range. In the case that there is an unacceptable distance indicated within the device the safety is activated and/or the trigger is locked.

[0011] The advantages of such an application become clear when one is experienced in firearms, shooting ranges, and a typical training environment. Typically, training is conducted at a gun or firing range. By necessity there will be more than one person in the proximity of the trainee when he or she is in operation of the live firearm he or she is being trained to use. Oftentimes these sessions will be conducted in groups, both to reduce the cost to each individual trainee, but also because certified trainers are often in short supply. Thus there will be one or more inexperienced shooters handling a live firearm in a relatively enclosed area. This poses significant risks to each shooter himself, but also to the trainer and other trainees. The first risk is self-inflicted wounds such as shooting oneself in the leg by accidentally pulling the trigger while the gun is loaded. Another risk is hitting another trainee or the trainer. A final risk is hitting a target, wall, or other similar surface and creating a dangerous ricochet or shrapnel. By controlling the distance at which a gun can be fired, many of these dangers can be significantly reduced because proper targets will be located at a predicable range from the barrel of a gun.

[0012] Experienced shooters will note that this is a training device, and is not practically applicable to use in conjunction with a typical gun used in hunting or self defense, but its applicability for training and other analogous activities will become clear in the foregoing discussion. To achieve these objectives, a Proximity Gun Safety Device and associated methods having the following features is proposed.

[0013] A first embodiment of the invention contemplates an apparatus comprising: a firearm comprising a handle, body, barrel, frame, firing mechanism, and trigger, and a safety device mounted to the frame of the firearm, the safety device comprising a proximity detector aligned in parallel with the barrel of the firearm, a data processing device, the data processing device taking inputs from the proximity detector and the data processing device comparing the proximity of the gun barrel to a predetermined range of distances, and the data processing device sending an output through a signaling mechanism, and wherein the output of the signaling mechanism selectively disables the firing mechanism of the firearm when the proximity detector has detected an object within from the barrel of the firearm.

[0014] In another preferred embodiment of the invention the disclosure contemplates a firearm safety device for preventing accidental shootings comprising: a power supply, a proximity detecting device electronically connected to the power supply and for generating information on the environment in front of the firearm safety device, a user input located on the exterior of the safety device allowing a user to selectively turn on/off the safety device and allowing the user to input a set of distance parameters, a processor connected to the power supply and capable of processing information from the proximity detecting device and the user input and outputting a signal to disable or enable firing of a firearm, and an electromechanical firing interrupt device configured for receiving the signal from the processor and selectively preventing firing of a firearm.

[0015] In another embodiment of the invention the disclosure contemplates, a method of selectively firing a firearm comprising: providing a firearm comprising a handle, body, barrel, frame, firing mechanism, and trigger, providing a safety device and mounting said safety device to the frame of the firearm, the safety device comprising a proximity detector aligned in parallel with the barrel of the firearm, a data processing device, the data processing device taking inputs from the proximity detector and outputting an output, orienting the firearm towards a target, pulling the trigger on the firearm, and detecting the distance between the barrel of the firearm and the target with the proximity detector, comparing distance between the barrel of the firearm and the target to a predetermined set of values in the data processing device, and selectively disabling the firing mechanism of the firearm when the distance detected is not within a predetermined range of values.

[0016] Such embodiments do not represent the full scope of the invention. Reference is made therefore to the claims herein for interpreting the full scope of the invention. Other objects of the present invention, as well as particular features, elements, and advantages there-

of, will be elucidated or become apparent from, the following description and the accompanying drawing figures.

DESCRIPTION OF THE DRAWINGS

[0017] The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

Figure No. 1 is a perspective view of a representative firearm and the proximity range detector and electromechanical safety mechanism according to the present invention.

Figure No. 2 is a perspective view of representative firearm and the proximity range detector and electromechanical safety mechanism mated together according to the present invention.

Figure No. 3 is a perspective view of the representative firearm and the proximity range detector and electromechanical safety mechanism mated together and firing downrange in a representative scenario.

Figure No. 4 is a perspective view of the representative firearm and the proximity range detector and electromechanical safety mechanism mated together and the lock triggering during an attempt to fire downrange in a representative scenario.

Figure No. 5 is a side on view of representative gun and an electronic electromechanical safety mechanism according to an embodiment of the current invention.

DETAILED DESCRIPTION

[0018] Referring now the drawings with more specificity, the present invention essentially provides a proximity based gun safety device. The preferred embodiments of the present invention will now be described with reference to Figs. 1-5 of the drawings. Variations and embodiments contained herein will become apparent in light of the following descriptions.

[0019] Looking now to Fig. 1 a representative safety device 10 and representative firearm 100 are shown. Gun 100 includes a body 110, a handle 120 integral with the body, a barrel/nozzle 130 with an opening 131 for providing for the passage of projectiles 200 a trigger apparatus 140, and a rail 150. The gun 100 as constructed above is known in the art and is considered only to be illustrative. The gun or firearm utilized with locking apparatus 10 may preferably have additional features according to the user's desires. In addition, it will be appreciated by those skilled in the art that different embodiments of a gun may be used without departing from the scope of the invention. Moreover, the gun need not be a typical handgun or pellet gun as depicted and may also be a rifle, shotgun, submachine gun, or other firearms contemplated but not shown.

[0020] Looking with greater detail at safety device or apparatus 10, a preferred embodiment of the invention is shown. Outer case 11 houses internal electronics (not shown) that utilize proximity detector 20 to make decisions related to the firing of firearm 100. Typically the proximity detector 20 will be either an ultrasonic rangefinder or a laser rangefinder. In some embodiments it may be desirable to utilize both forms of rangefinders or other proximity detection methods that are rated for use in human safety applications. Apparatus 10 is locked onto the firearms mount or rail 150 at locking point 30 which also may selectively engage with the firing mechanisms of firearm 100. In most embodiments apparatus 10 will have an adjusting switch or mechanism 40. In some embodiments switch 40 will merely be an "on/off" switch similar to a typical safety on a firearm, however, in other preferred embodiments switch 40 is capable of setting preferred minimum and maximum ranges of firing (e.g. fire only if minimum distance detected is greater than two (2) meters, or only fire if distance detected is within the range of three to twelve (3-12) meters, or other desired distances). In a typical, simplified embodiment the locking apparatus will not allow firing if an object is detected less than a meter from the barrel of the gun. Because of geometry, even small increases in minimum threshold distances (such as a few feet) greatly decreases the risk of an accidental death or injury related to the use of firearms. Because of the nature of the parts, the locking apparatus has an incredibly fast response time (less than 50 milliseconds in most embodiments) thus even an untrained shooter who abruptly directs barrel 130 towards a close target will be unlikely to fire on the target within the response time of the system.

[0021] Moreover, one essential feature of the current invention is that the proximity 20 detector is aligned in parallel with the barrel of the firearm, which may be understood to mean to those skilled in the art that it is mounted to the firearm such that its axis of target ranging aligns closely with the firearm's barrel axis.

[0022] Looking now towards Figs. 3 and 4 exemplary operation of the device is shown. In Fig. 3 target 210 is situated an appropriate distance (D1) from the barrel of the gun and the proximity detector of apparatus 10. Signals 215 that are read by the detector 20 indicate to apparatus 10 that the target is far enough away from the gun and thus when the user pulls the trigger projectile 200 is successfully fired. In Fig. 4, however, target 210 is oriented at a close distance (D2) with respect to the end of the barrel of the gun and the proximity detector 20. Thus, apparatus 10 interrupts the firing mechanism of firearm 100 and no projectile is fired.

[0023] Although not typically appreciated by those skilled in the art, your chances of being struck by a stray bullet (or shrapnel caused as a result thereof) increase dramatically the closer you are to the muzzle of a gun (just as it is more difficult to intentionally hit a target the farther away a target is). In various simulations it has been shown that an average human target one (1) foot

away from an erratic shooter would be hit in approximately 15-20% of cases, however, in a simulation where the target was just seven (7) feet away from the barrel the target was hit in fewer than 1% of cases. This is consistent with hypothetical mathematical models that demonstrate that accidental injuries follow an inverse-square law as follows:

$$P = \frac{k * A_s}{d^2}$$

Where:

P = Probability of the target being hit
k = A constant derived from the ballistics of the firearm and ammunition
A_s= Surface area of the target oriented towards the barrel
D = Distance to the target

Thus, by doubling the distance you quarter the probability of an accidental injury due to discharge of the firearm.

[0024] Looking now to Fig. 5 an embodiment of the firearm 100 and proximity safety device 10 is now shown in even greater detail. Safety device 10 possesses previously recited elements such as cover 11, detector, 20, mount 30, and switch 40, however it should now also be evident that it possesses a logic circuit, microchip, and/or electromechanical relay 12 for processing data collected from detector 20 and switch 40. In addition, in many cases detector 20 will have additional rendering and processing equipment 21 which may selectively feed and edit information before processing in processor 12 (or a similar detach processing apparatus or data processing device). In certain cases such equipment 21 will also contain the power supply of the safety device. When processor 12 makes a determination on whether the firearm 100 should fire, a signal is sent through wire or signal output 31. In certain cases an electrical interrupt 15 will prevent firing when the distance detected in detector 20 is not within the range of values set via input switch 40.

[0025] Accordingly, although the invention has been described by reference to certain preferred and alternative embodiments, it is not intended that the novel arrangements be limited thereby, but that modifications thereof are intended to be included as falling within the broad scope and spirit of the foregoing disclosures and the appended drawings.

Claims

1. An apparatus comprising:

a firearm comprising a handle, body, barrel, frame, firing mechanism, and trigger; and

a safety device mounted to the frame of the firearm, the safety device comprising a proximity detector aligned in parallel with the barrel of the firearm, a data processing device, the data processing device taking inputs from the proximity detector and the data processing device comparing the proximity of the gun barrel to a predetermined range of distances, and the data processing device sending an output through a signaling mechanism; and wherein
the output of the signaling mechanism selectively disables the firing mechanism of the firearm when the proximity detector has detected an object within a predetermined distance from the barrel of the firearm.

2. The apparatus of claim 1 wherein:

the signaling mechanism comprises a safety seizer coupled to the data processing device to receive the output, the safety seizer operable to disable the gun to prevent it from discharging in response to receiving a disable signal in the output.

3. The apparatus of claim 1 or claim 2 wherein:

the signaling mechanism comprises an electronic signaling wire that delivers an electrical interrupt to the firing mechanism of the firearm.

4. The apparatus of any preceding claim wherein:

the proximity detector comprises an ultrasonic rangefinder.

5. The apparatus of any preceding claim wherein:

the proximity detector comprises a laser rangefinder.

6. The apparatus of any preceding further comprising:

a processor in cooperation with the proximity detector, said processor preprocessing data from the proximity detector and directing said data to the data processing device.

7. A firearm safety device for preventing accidental shootings comprising:

a power supply;
a proximity detecting device electronically connected to the power supply and for generating information on the environment in front of the firearm safety device;
a user input located on the exterior of the safety device allowing a user to selectively turn on/off

the safety device and allowing the user to input a set of distance parameters;
a processor connected to the power supply and capable of processing information from the proximity detecting device and the user input and outputting a signal to disable or enable firing of a firearm; and
an electromechanical firing interrupt device configured for receiving the signal from the processor and selectively preventing firing of a firearm.

8. The safety device of claim 7 wherein:

the proximity detector comprises an ultrasonic rangefinder.

9. The safety device of claim 7 or claim 8 wherein:

the proximity detector comprises a laser rangefinder.

10. The safety device of any of claims 7 to 9 wherein:

the electromechanical firing interrupt device comprises a safety seizer coupled to the processor to receive the disable signal, capable of disabling a firearm to prevent it from discharging in response to receiving the disable signal.

11. The safety device of any of claims 7 to 10 wherein:

the processor compares a set of distance values received from the proximity detecting device to a set of distance values in the user input and determines whether to output a disable or enable signal based on whether distance values received from the proximity detecting device are within the parameters set by the user input.

12. The safety device of any of claims 7 to 11 wherein:

the processor can change the output from an enable signal to a disable signal in less than 50 milliseconds.

13. A method of selectively firing a firearm comprising:

providing a firearm comprising a handle, body, barrel, frame, firing mechanism, and trigger;
providing a safety device and mounting said safety device to the frame of the firearm, the safety device comprising a proximity detector aligned in parallel with the barrel of the firearm, a data processing device, the data processing device taking inputs from the proximity detector and outputting an output;
orienting the firearm towards a target;
pulling the trigger on the firearm; and
detecting the distance between the barrel of the firearm and the target with the proximity detector;
comparing distance between the barrel of the firearm and the target to a predetermined set of values in the data processing device; and
selectively disabling the firing mechanism of the firearm when the distance detected is not within a predetermined range of values.

14. The method of claim 14 further comprising:

the user inputting a set of distance values through a user input, the inputted set of user values modifying the predetermined set of values in the data processing device.

15. The method of claim 13 or claim 14 wherein:

the proximity detector comprises an ultrasonic rangefinder and/or a laser rangefinder.

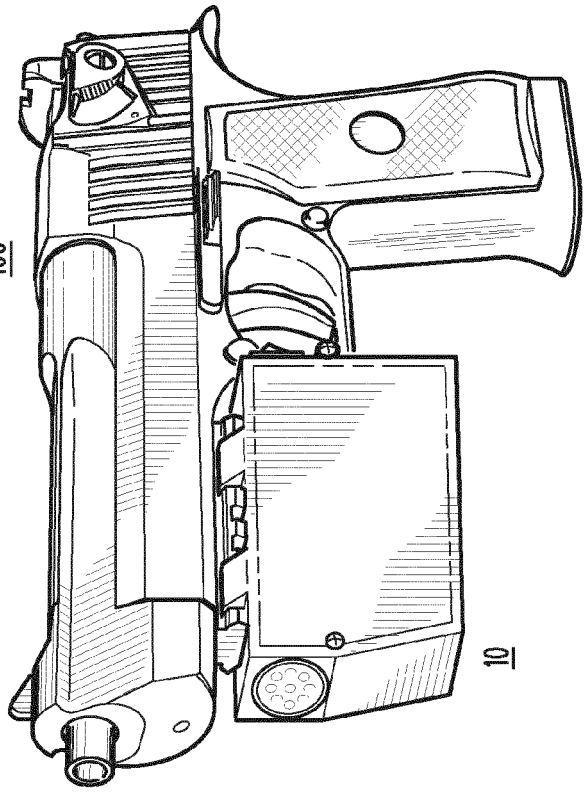

FIG. 2

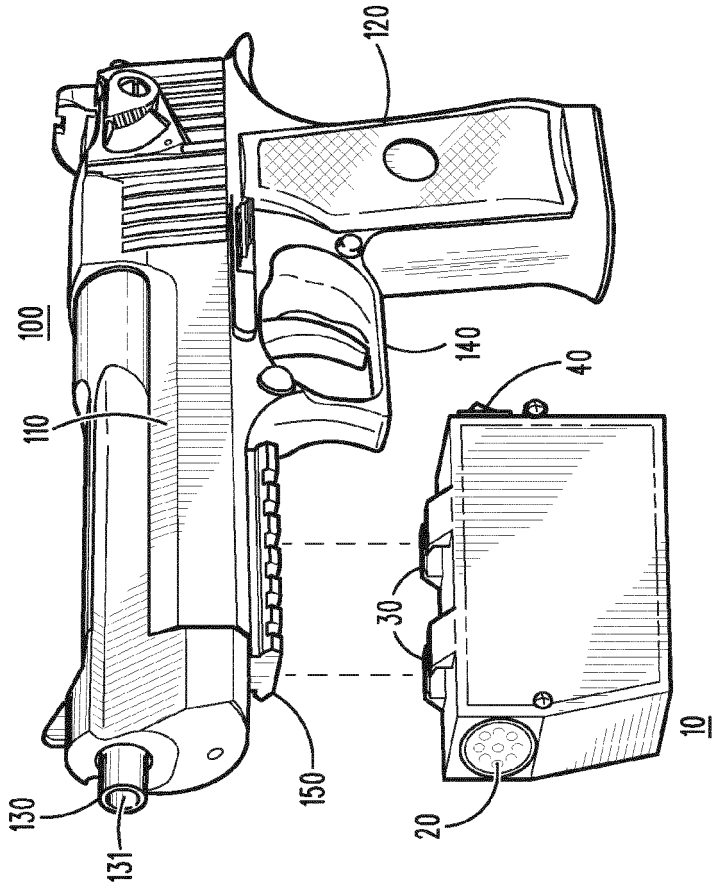

FIG. 1

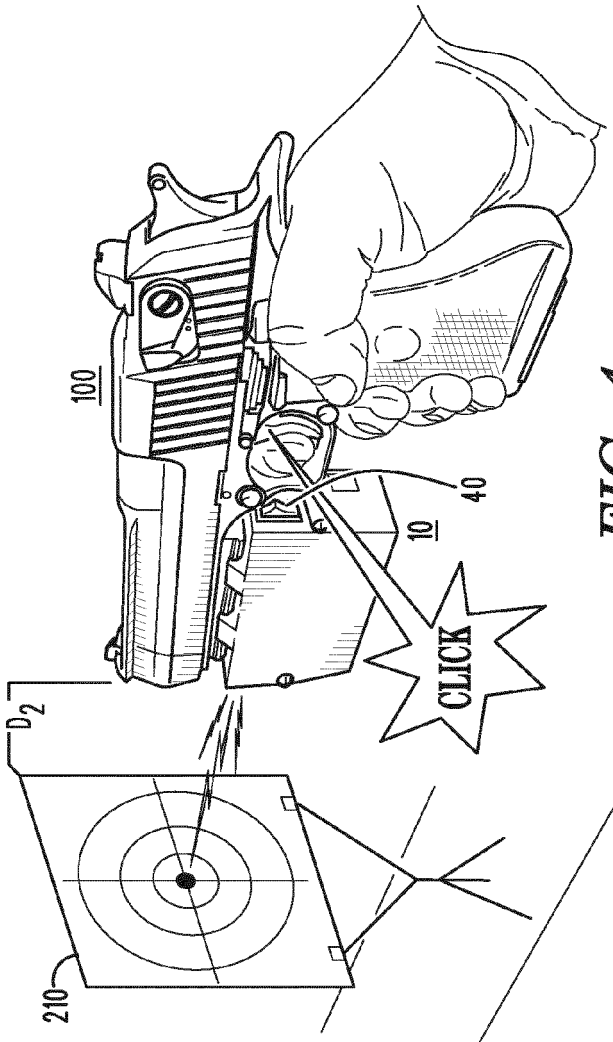

FIG. 4

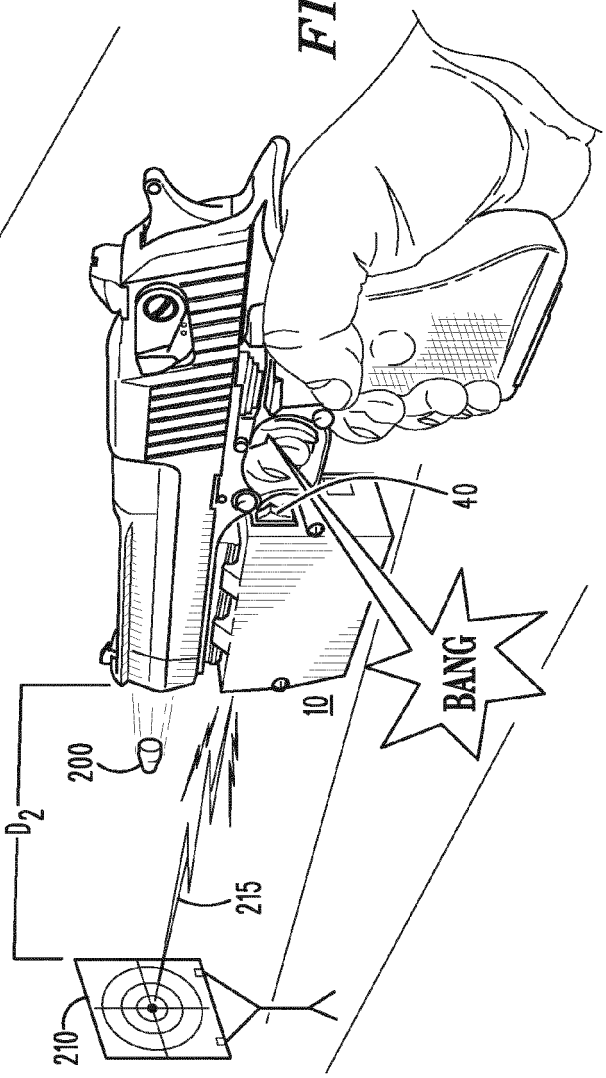

FIG. 3

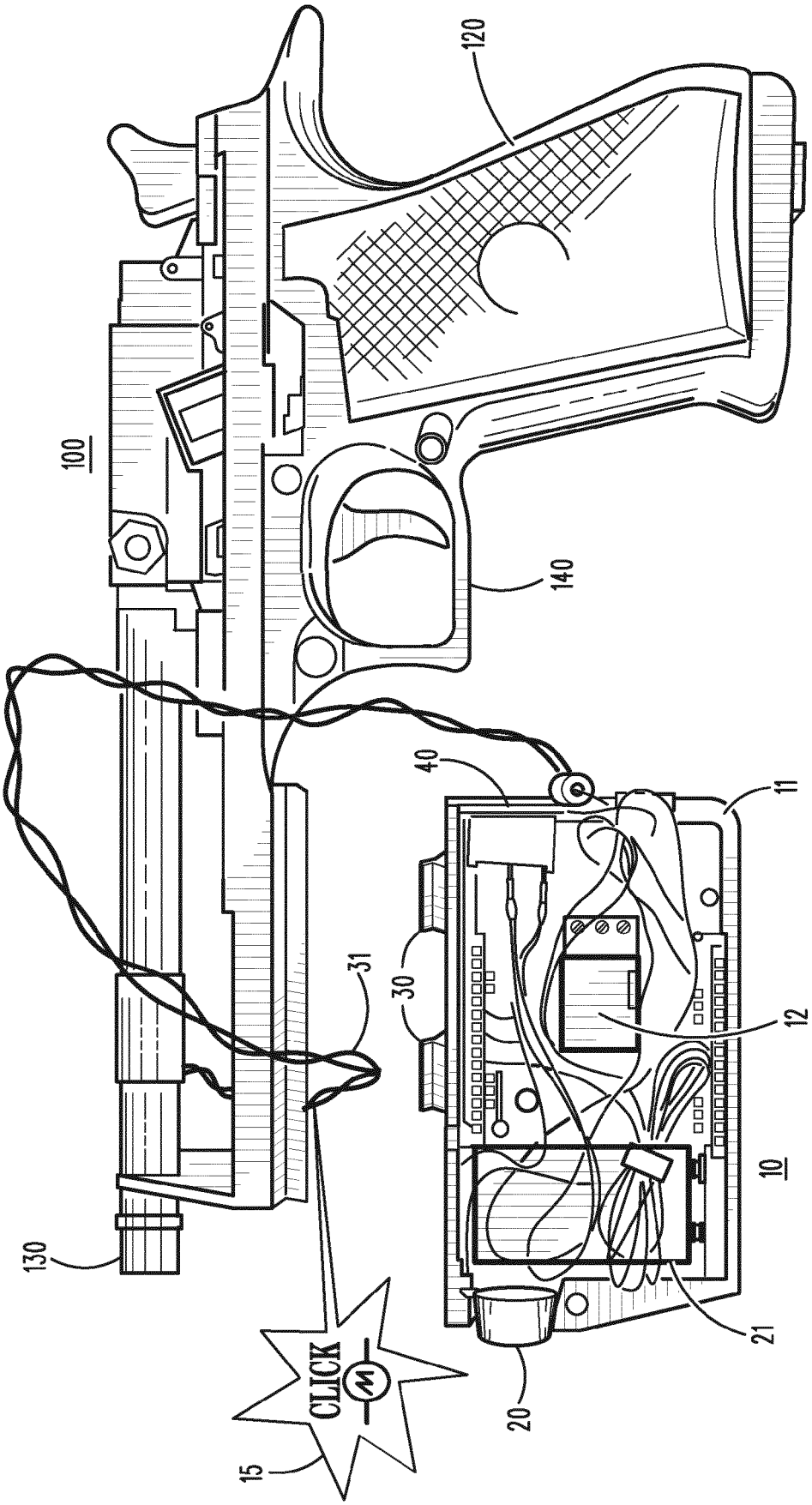

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 16 7402

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 44 36 799 A1 (KWIECINSKI GEORG [DE]) 18 April 1996 (1996-04-18) * the whole document *	1-15	INV. F41A17/02 F41A17/06 F41A17/08
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TECHNICAL FIELDS SEARCHED (IPC)

F41A

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 August 2017	Schwingel, Dirk

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 16 7402

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16-08-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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