A trigger assembly (10) comprising a trigger mechanism (12) and a firing device (16). The firing device (16) comprises a control assembly (40) and an actuator (18) which is operatively coupled to the control assembly (40). The actuator (18) comprises an actuation rod (20) moveable between a first rod position (26) and a second rod position (28). The firing device (16) further comprises a lever (30) which is operatively connected to the trigger mechanism (12) and to the actuation rod (20), the lever (30) being moveable between a first lever position (32) and a second lever position (34) relative to the actuation rod (20) wherein movement of the actuation rod (20) to the second rod position (28) causes the lever (30) to move to the second lever position (34) causing the trigger mechanism (12) to release.
A FIRING DEVICE

This invention relates to a firing device and particularly, but not exclusively, a firing device which forms part of a trigger assembly of a firearm.

The term "firearm" as used throughout this application is intended to mean a weapon discharged by an explosive charge and includes a shotgun, for example.

A firearm can be used in a sport such as clay pigeon shooting. A typical shotgun is fired by an operator pulling a mechanical trigger with a finger. The typical force that has to be overcome by the operator to pull the mechanical trigger is around 15N to 25N.

This force can be difficult for certain people to overcome and can in some instances result in the operator causing an unintended motion of the shotgun sideways or downwards as the operator attempts to overcome the pull force of the mechanical trigger. This unintended movement means that it may be difficult for an operator to make an accurate shot at a target which is important in a shooting sport.

This force can also be difficult to overcome if the operator has a physical impairment, especially in his/her hands. The operator may, for example, have a tremor or weak strength in the hands due to arthritis, or loss of finger(s)/thumb digits.

One known method for overcoming this difficulty is to modify the trigger assembly of the firearm to lighten the force required to pull the mechanical trigger and release a shot.

A problem with this method is that the operator may accidentally repeatedly pull the lightened mechanical trigger, resulting in "fan fire" or "double discharge" (i.e. repeated firing of the shotgun) wherein simultaneous discharge of a second barrel or rapid succession of a second barrel discharge would occur in a double barrelled shotgun, for example. This repeated firing is extremely undesirable and potentially unsafe.

There is, therefore, a need for a firing device to allow an operator to have a more accurate aim of the firearm by preventing unintended motion of the firearm and reducing the risk of accidental repeated firing of the firearm.

According to a first aspect of the invention there is provided a trigger assembly comprising:
a trigger mechanism and a firing device, the firing device comprising:
a control assembly;
an actuator operatively coupled to the control assembly and comprising an
actuation rod moveable between a first rod position and a second rod position; and
a lever operatively connected to the trigger mechanism and to the actuation rod,
the lever being moveable between a first lever position and a second lever position
relative to the actuation rod wherein movement of the actuation rod to the second rod
position causes the lever to move to the second lever position causing the trigger
mechanism to release.

The actuation rod enables movement of the lever which allows the trigger mechanism to
become released. In this way, the actuation rod provides the force needed to operate the
trigger mechanism.

Preferably the lever is moveable between the second lever position and the first lever
position to move the actuation rod back to the first rod position.

This movement returns the actuation rod to the first rod position ready for the next
operation of the firing device.

Preferably a first end of the actuation rod abuts a first end of the lever when the actuation
arm is in the second position.

Such an arrangement means that the actuation rod makes contact with the lever to allow
movement of the lever to the second lever position.

Optionally the control assembly is electrically coupled to the actuator to control
movement of the actuation rod.

The electrical coupling means that the control assembly can control the actuator and
therefore the operation of the trigger mechanism.

The control assembly may include a timer. A timer allows control of the length of time of
certain actions of the firing device. The length of time can be pre-set or changed after
every use.
In an embodiment of the invention the timer controls the amount of time the actuation rod is in the second rod position.

Such an arrangement permits the trigger mechanism's release to be controlled for a pre-determined amount of time to ensure that the actuation rod is fully extended to the second rod position and therefore the lever has also moved to the second lever position to fully release the trigger mechanism.

Preferably the timer controls the amount of time the actuation rod is in the first rod position before it can be moved to the second rod position.

This arrangement means that the trigger mechanism's second release cannot be unintentionally/accidentally released immediately after the first has been released therefore preventing unintentional operation of the trigger mechanism.

The control assembly may comprise an input member. The input member permits communication from the operator to the control assembly.

The input member may be a push button switch. The push button switch provides simple and easy way of communication from the operator to the control assembly and therefore operation of the trigger mechanism can be carried out at a press of a button.

Preferably the control assembly is adapted to receive instructions from the input member to change from an inactive mode to an active mode to move the actuation rod from the first rod position to the second rod position, and to change from the active mode to the inactive mode to move the actuation rod from the second rod position to the first rod position.

Such an arrangement provides clear instructions to the control assembly from the operator to move the actuation rod and therefore the trigger mechanism.

Preferably the instructions from the input member to change the control assembly to the active mode when the control assembly is already in the active mode does not move the actuation rod from the first rod position to the second rod position.

Such an arrangement prevents a constant active mode being input accidentally to the control device, e.g. by the operator. Instead, an inactive input must be given to the
control assembly before it can become active again. In this way the control assembly prevents unintentional operation of the trigger mechanism.

Optionally the actuator includes a spring coupled to the actuation rod. Such an arrangement provides an aid in moving the actuation rod between the positions.

According to a second aspect of the invention there is provided a firing device, for activating a trigger mechanism, forming part of a trigger assembly according to a first aspect of the invention.

The firing device can be fitted to the trigger mechanism to augment a mechanical trigger and allow alternative operation of the trigger mechanism.

According to a third aspect of the invention there is provided a firearm comprising a trigger assembly according to a first aspect of the invention.

Such an arrangement permits an alternative operation of a firearm by using the trigger assembly described above.

When the invention is used with a single shot firearm, it is necessary to reload the firearm to cock the trigger mechanism after each shot. Some firearms, e.g. a double-barrelled shotgun, have two barrels which are pre-cocked. When the invention is used with this type of firearm, the lever moving back to the first lever position after a first shot means that the trigger mechanism engages with the trigger assembly such that a second barrel is selected. In this way, the firearm is ready for a second shot before it has to be reloaded again.

According to a fourth aspect of the invention there is provided a method of activating a trigger mechanism comprising the steps of:

a) arranging a lever to be operatively connected to the trigger mechanism of a firearm, the lever being arranged to move from a first lever position to a second lever position relative to an actuation rod of an actuator;

b) causing the lever to move from the first lever position to the second lever position resulting in the trigger mechanism to be released.

This aspect of the invention shares the same features and benefit as described hereinabove.
There now follows a brief description of preferred embodiments of the invention, by way of non-limiting examples, with reference to the accompanying drawings in which:

Figure 1 shows a side elevational view of a trigger assembly in a first position according to a first aspect of the invention;

Figure 2 shows a side elevational view of the trigger assembly shown in Figure 1 in a second position;

Figure 3 shows a side elevational view of a firing device according to a second aspect of the invention;

Figure 4 shows an exploded view of the firing device shown in Figure 3;

Figure 5 shows a perspective view of a firearm in use according to a third aspect of the invention;

Figure 6 shows a flowchart of the firearm in use shown in Figure 5.

A trigger assembly according to a first embodiment of the invention is designated generally by the reference numeral 10.

The trigger assembly 10 includes a trigger mechanism 12. The trigger mechanism 12 shown is an original Perazzi drop out trigger set 14. In other embodiments of the invention the trigger mechanism 12 may be another shotgun manufacturer's drop out trigger set, e.g. Beretta (RTM), Zoli (RTM).

The trigger assembly 10 further includes a firing device 16. The firing device 16 comprises an actuator 18 which includes an actuation rod 20. In the embodiment shown the actuator 18 is a solenoid 22 with a solenoid shaft 24 housed herewith. The actuation rod 20 is moveable between a first rod position 26 and a second rod position 28 and back to the first rod position with the aid of a spring 29. In this embodiment the spring 29 is a light compression spring 29 to help take the actuation rod 20 as far back as possible. The first rod position 26 is shown in Figure 1 and the second rod position 28 is shown in Figure 2.

The actuation rod 20 is operatively connected to a lever 30. The lever 30 is made from metal such as a high strength alloy or stainless steel. The lever 30 may instead be made from a high strength plastic.

The lever 30 is moveable between a first lever position 32 and a second lever position 34 relative to the actuation rod 20. In the embodiment shown the lever 30 is not physically
connected to the actuation rod 20, instead the actuation rod 20 abuts the lever 30 to move it between the first lever position 32 and the second lever position 34.

The lever 30 is operatively connected to the trigger mechanism 12. In the embodiment shown the lever 30 is pivotally connected to the trigger mechanism 12 so that when the lever 30 is in the first lever position 32 the trigger mechanism 12 is cocked and when the lever 30 is in the second lever position 34 the trigger mechanism 12 is released.

The actuation rod 20 is also operatively coupled to a control assembly 40. The control assembly 40 includes an input member 42 in the form of a push button switch 44. In other embodiments of the invention the input member 42 may comprise a different type of switch.

In the embodiment shown the push button switch 44 and the actuator 18 are located on a cable conduit 46.

The control assembly 40 is adapted to receive instructions from the push button switch 44 so that when the push button switch 44 is pressed the control assembly 40 changes to an active mode and when the push button switch 44 is released the control assembly 40 changes back to an inactive mode.

The control assembly 40 further includes a power supply 48 in the form of a DC power pack 50. The control assembly 40 also includes a Programmable Integrated Circuit board (PIC) 52 which is powered by the DC power pack 50 and is electrically connected to the actuator 18 to power the actuator 18 and move the actuation rod 20 from the first rod position 26 to the second rod position 28 when the push button switch 44 is pressed.

The PIC 52 includes a timer (not shown) which is programmed to drop the power supplied from the PIC 52 to the actuator 18 to zero after a first pre-determined amount of time. The drop in power to zero enables the actuation rod 20 to move from the second rod position 28 with the aid of the light compression spring (29) back to the first rod position 26. The first pre-determined amount of time may be around 150 ms, for example.

The timer is also programmed to maintain the PIC 52 at a zero power for a second pre-determined amount of time after the actuation rod 20 has moved from the second rod
position 28 to the first rod position 26. The second pre-determined amount of time may be around 100 ms, for example.

The timer can be programmed to adjust the first and/or the second pre-determined amount of time.

The PIC 52 can be programmed to detect zero power from the push button switch 44 before permitting the power supply to the actuator 18 for a second time.

A firing device 16 according to an embodiment of the second aspect of the invention shares a number of features with the trigger assembly 10 and these are designated by the same reference numerals.

A firearm according to an embodiment of the third aspect of the invention is designated generally by the reference numeral 120. The firearm shares a number of features with the trigger assembly 10 and these are designated by the same reference numerals.

The firearm 120 as shown in Figure 5 includes a firearm body 122. The cable conduit 46 of the trigger assembly 10 is coupled to the firearm body 122 and is located externally to the firearm body 122. In other embodiments of the invention some or all of the cable conduit 46 may be housed within the firearm body 122.

The push button switch 44 of the trigger assembly is electrically connected to the rest of the control assembly 40 via a four core curly cable 124. In other embodiments of the invention another type of cable may be used.

The four core curly cable 124 is connected to the PIC 52 which is connected to the DC power pack 50 via a two core cable 126. Other cables may be used in other embodiments of the invention.

The DC power pack 50 and the PIC 52 are housed in individual casings 128 each of which can be easily carried by the operator by clipping each casing onto a belt, for example. The casings 128 could also be carried in a pocket. In other embodiments of the invention the DC power pack 50 and the PIC 52 are housed in the same casing.

The method of firing a firearm 120 via the trigger assembly 10 is described below. Before the push button switch 44 is pressed, the trigger mechanism 12 is cocked. In the case of
a double-barrelled shotgun, the trigger mechanism 12 is engaged with a first cocked firing mechanism (not shown) which is configured to fire a first shot from a first barrel (not shown) of the double-barrelled shotgun.

When the push button switch 44 is pressed control assembly 40 is active which turns on the power from the DC power pack 50 to power the PIC 52. The PIC 52 then supplies power to the actuator 18 thereby moving the actuation rod 20 to the second rod position 28. The actuation rod 20 moving to the second rod position 28 also moves the lever 30 to the second lever position 34 thereby releasing the trigger mechanism 12 and firing the first shot.

After the first pre-determined amount of time has passed the control assembly 40 changes to the inactive mode therefore the power supplied from the DC power pack 50 to the actuator 18 via the PIC 52 drops to zero. The zero power to the actuator 18 enables the actuation rod 20, with the aid of the light compression spring 29, to be pushed back to the first rod position 26 by the lever 30 which is returning to its first lever position 32 after the shot has been fired.

In the case of the double-barrelled shotgun, once the first shot has been fired the trigger mechanism 12 recoils and selects a second barrel (not shown) of the shotgun. This recoiling moves the lever 30 back to the first lever position 32 thereby pushing the actuation rod 20 back to the first rod position 26. The trigger mechanism is now engaged with a second cocked firing mechanism of the second barrel of the shotgun and is ready for a second shot to be fired.

In either case, the PIC 52 power is maintained at zero for the second pre-determined amount of time thereby preventing accidental release of the trigger mechanism 12 and simultaneous discharge or rapid succession discharge of a second barrel in the double barreled shotgun.

The push button switch 44 is released, zero power is detected by the PIC 52 and the control assembly 40 changes to the inactive mode which means that the firing device 16 is ready to begin the active cycle again once the push button switch 44 is pressed. If the control assembly 40 is not returned to the inactive mode, i.e. the push button switch 44 is remained pressed after the shot is fired, the firing device 16 will not activate and the firearm 120 will not fire.
CLAIMS:

1. A trigger assembly comprising:
   a trigger mechanism and a firing device, the firing device comprising:
   a control assembly;
   an actuator operatively coupled to the control assembly and comprising an
   actuation rod moveable between a first rod position and a second rod position; and
   a lever operatively connected to the trigger mechanism and to the
   actuation rod, the lever being moveable between a first lever position and a second lever
   position relative to the actuation rod wherein movement of the actuation rod to the
   second rod position causes the lever to move to the second lever position causing the
   trigger mechanism to release.

2. A trigger assembly according to Claim 1 wherein the lever is moveable between
   the second lever position and the first lever position to move the actuation rod back to
   the first rod position.

3. A trigger assembly according to any one of the preceding claims wherein a first
   end of the actuation rod abuts a first end of the lever when the actuation rod is in the
   second position.

4. A trigger assembly according to any one of the preceding claims wherein the
   control assembly is electrically coupled to the actuator to control movement of the
   actuation rod.

5. A trigger assembly according to any one of the preceding claims wherein the
   control assembly includes a timer.

6. A trigger assembly according to Claim 5 wherein the timer controls the amount of
   time the actuation rod is in the second rod position.

7. A trigger assembly according to Claims 5 or 6 wherein the timer controls the
   amount of time the actuation rod is in the first rod position before it can be moved to the
   second rod position.

8. A trigger assembly according to any one of the preceding claims wherein the
   control assembly comprises an input member.
9. A trigger assembly according to Claim 8 wherein the input member is a push button switch.

10. A trigger assembly according to either of Claims 8 or 9 wherein the control assembly is adapted to receive instructions from the input member to change from an inactive mode to an active mode to move the actuation rod from the first rod position to the second rod position and to change from the active mode to the inactive mode to enable the actuation rod to move from the second rod position to the first rod position.

11. A trigger assembly according to Claim 10 wherein the instructions from the input member to change the control assembly to the active mode when the control assembly is already in the active mode does not move the actuation rod from the first rod position to the second rod position.

12. A trigger assembly according to any one of the preceding claims wherein the actuator includes a spring coupled to the actuation rod.

13. A firing device, for activating a trigger mechanism, forming part of the trigger assembly in any one of the preceding claims.

14. A firearm comprising a trigger assembly according to any one of the preceding claims.

15. A method of activating a trigger mechanism comprising the steps of:
   a) arranging a lever to be operatively connected to the trigger mechanism of a firearm, the lever being arranged to move from a first lever position to a second lever position relative to an actuation rod of an actuator;
   b) causing the lever to move from the first lever position to the second lever position resulting in the trigger mechanism to be released.

16. A method of activating a trigger mechanism according to Claim 15 comprising the further step of ensuring that the lever remains in the second lever position for a first predetermined amount of time.
17. A method of activating a trigger mechanism according to either of Claims 15 or 16 comprising the further step of ensuring that the lever remains in the first lever position for a second pre-determined amount of time.

18. A method of activating a trigger mechanism according to any one of Claims 15 to 17 comprising the further step of providing a control assembly operatively connected to the actuator wherein the control assembly comprises a push button switch to enable an operator to move the lever from the first lever position to the second lever position when the push button switch is pressed.

19. A method of activating a trigger mechanism according to Claim 18 comprising the further steps of:
   a) arranging the control assembly to receive instructions from the push button switch when the push button switch is pressed;
   b) causing the control assembly to change to an active mode when the push button switch is pressed thereby moving the lever to the second lever position; and
   c) causing the control assembly to change to an inactive mode when the push button switch is released.

20. A method of activating a trigger mechanism according to any one of the preceding claims further comprising the step of: arranging the actuation rod to extend through a spring, the spring being compressed when the actuation rod is in the second rod position.

21. A trigger assembly generally as herein described with reference to and/or as illustrated in the accompanying drawings.

22. A firing device generally as herein described with reference to and/or as illustrated in the accompanying drawings.

23. A firearm generally as herein described with reference to and/or as illustrated in the accompanying drawings.

24. A method of activating a trigger mechanism generally as herein described with reference to and/or as illustrated in the accompanying drawings.
FIG. 6

Push button is depressed and signal detected by PIC

Power is supplied to the PIC and transformed to low voltage required to power the circuit

D.C. power pack

Power is transformed by PIC to high voltage required to power solenoid

Solenoid

Solenoid is powered for around 150ms, during this time the mechanical trigger is activated

Mechanical trigger actuation

Shot discharged

After the 100ms delay and after the input from the push button to the PIC has returned to 0 volts the PIC awaits a further signal from the button being depressed to repeat the cycle and in turn discharge the second shot

PIC commences a further timing cycle of around 100ms in which time a delay is caused to prevent any discharge of a second shot

After a period of 150ms has elapsed the power is cut from the PIC to the solenoid releasing the trigger mechanism