

## AMMUNITION COUNTER

### FIELD OF THE INVENTION

5           The present invention relates to the field of ammunition counters. In one aspect, the present invention relates to an ammunition counter for law enforcement military firearms or commercially available device including but not limited to flash gun for the identification of the location. It will be convenient to hereinafter describe the invention in relation to military firearms,  
10 however it should be appreciated that the present invention is not limited to that use only.

### BACKGROUND OF THE INVENTION

15           An accurate count of the number of ammunition rounds used by, and remaining in a firearm is of great importance to the user and those responsible for the ammunition and firearm use. With firearms of any type, particularly small and medium calibre weapons, it is frequently necessary to accurately determine the number of rounds fired by the firearm. This is  
20 particularly true when the firearm is being used especially in training or live firing situations such as those which occur in law enforcement or in the military.

          One of the security problems in recent years is the accountability of  
25 ammunitions being fired by the firer during live firing exercises. In training conditions, the accountability of every ammunition round being fired is extremely important to ensure that none of these ammunitions becomes available to unauthorized personnel or terrorists, thereby posing a security threat to the safety of the public at large.

30

          This difficulty of counting ammunitions exists in all types of firearms, including automatic and semi-automatic firearms.

Additionally, the total number of rounds fired through a firearm is also of great importance in order to monitor the service life of the firearm so that proper maintenance can be provided. This is true for not only hand held  
5 firearms, but also for large calibre or platform mounted firearms including that used by the helicopter, aircraft or tanks. With such information, preventative maintenance can be performed before the firearm or the mounting fails.

One of the ways to account for the expended ammunitions is to  
10 account for the number of empty cartridges associated to the number of expended ammunitions. Hence, if a training soldier collects 15 live rounds for a live-firing exercise and 10 live rounds were expended, the soldier shall return 10 empty cartridges and 5 unused live rounds or rounds which malfunction in the process of firing to fully account for those rounds that he  
15 collected and later fired. This method of accountability is highly inefficient because it is impractical to expect soldiers to pick up every empty cartridge every time a round is fired.

To date there have been various attempts to provide monitoring  
20 systems which can provide information regarding the number of rounds expended or remaining in a firearm. For example, the use of a hand gun in which a microprocessor counts the number of times the gun's slide mechanically engages a switch. Because this device requires a slide, the gun must be configured to interface mechanically with the monitoring device. This  
25 requires retooling of the slide, which, in addition to the expense, limits the ability to use this device as an after market application. For each different type of slide, different interfaces must be provided. Such a device is not readily adaptable for each type of firearm, nor can a single design of such a device possibly fit substantially all types of firearms, which are available. For  
30 example, such a device cannot be easily adapted to revolvers, which do not have slides. There are also substantial durability concerns arising out of the thermal issue and mechanical contact between the slide and the switch.

There therefore is a need in the art for an accurate monitoring device for counting the number of times a firearm is discharged, particularly which can be easily fitted to all types of firearms, but particularly small and medium  
5 calibre weapons used in training exercises.

The above discussion and any other discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material  
10 forms a part of the prior art base or the common general knowledge in the relevant art in Singapore or elsewhere on or before the priority date of the disclosure and claims herein.

An object of the present invention is therefore to provide for an  
15 ammunition counter capable of accurately determining the number of ammunition rounds fired by a firearm so that full accountability of supplied ammunitions may be monitored.

A further object of the present invention is to at least alleviate or  
20 overcome at least one disadvantage associated with the prior art.

## **SUMMARY OF THE INVENTION**

The present invention provides a counting device for firearm ammunition,  
25 comprising one or more sensors; a micro-controller; a display counter; a transmitter; a receiver; a computer network; and an electronic circuit means, wherein said electronic embedded system is arranged to combine signals from said sensors and the signal data is processed by the micro-controller so that relevant signals pertinent to the firing of rounds are positively identified to  
30 eliminate any false reading of rounds fired and malfunctioning of rounds and/or weapon and wherein data is transmitted wirelessly and in real time through the said transmitter to a computer for data storage or display.

In a preferred aspect, the invention provides for a counting device wherein said sensors include one or more of RFID (radiofrequency identification), smart card, an infra-red sensor, an acoustic sensor, a pressure  
5 sensor, an accelerometer, a photocell and thermal sensor.

Other aspects and preferred aspects are disclosed in the specification and / or defined in the appended claims, forming a part of the description of the invention.

10

In essence, the inventor has created a new device for attachment to a weapon or similar firearm. The device consists of sensors such as an infra-red sensor, an acoustic sensor, a pressure sensor, an accelerometer, a micro-controller, a transmitter, RFID and a display counter, and it is able to  
15 detect the firing of live rounds. Each time when a live ammunition is fired, there are characteristic signals of the firing of rounds by the weapon, such as an acoustic signal peculiar to a particular weapon, an increase in temperature, a high pressure gas exhaust due to discharge of round, a short burst of flash, followed by a recoiled force due to the firing of the ammunition, and the time  
20 difference between the signal such as the time between the acoustic signal and the signal of acceleration due to the recoil. Another mode of detecting the firing of live rounds could involve the detection of pressure through a pressure sensor each time a round is fired. A further mode of detecting the firing of live rounds could involve the detection of increase of temperature at  
25 the muzzle or the light flash from the muzzle each time a round is fired. The signals are sent to the microprocessor for processing and removal of noise so that an affirmative pattern of the firing of rounds from that weapon can be ascertained to avoid false account of rounds fired. This invention utilizes these characteristics associated to the firing of live ammunitions to determine  
30 and account for the number of ammunitions expended.

The present invention has been found to result in a number of advantages, in that the ammunition counter utilizes all available signals such as the acoustic signal made by firing of the firearm, the resulting recoil of the firearm the time difference between the signal and the sequence of the signal.

5 The signals can be processed by electronic devices and a microprocessor using an algorithm. Such algorithms include Boolean logic or other processes so as to filter off unwanted noise and retrieve only signals of a particular range pertinent to the firing of the rounds from the weapon.

10 Similarly, the accelerometer within the device detects the acceleration and the direction of the recoil when a live ammunition is fired, and when the acceleration of this said recoil falls within a certain range and in the direction opposite of the firing of the round. A signal is transmitted to the micro-controller. It is known that when a round or blank is fired there is an  
15 acceleration (recoil) in the direction opposite of the firing of rounds or blanks, similarly if the weapon is dropped on the floor or hit by an object, there is an acceleration due to gravity or impact. However, the ranges of acceleration in these scenarios are different. The accelerometer will detect the acceleration in different scenarios and send the signal to the microprocessor for data  
20 processing. If all signals are within the set range and if the sequence and the time between the signals are in order, then that a fired round or blank is confirmed even when a round malfunction during firing due to the fault of the weapon or the round itself, the difference in signals can be sensed by the microprocessor to ascertain a miss fire. The range of acceleration is  
25 necessary to ensure that when the accelerometer detects acceleration and its direction due to the recoil of firing and not due to an impact such as dropping of the rifle on hard ground or the weapon hit by an object. The processing of the signals such as acoustic and recoil signals and the sequence of the signals and the time between the signals by the micro-controller ensures that  
30 there are no false readings of ammunition being discharged.

In this manner, a firearm authority can determine accurately the exact number of rounds being fired by a user such as a soldier, a police or an armed person and the number of unused rounds necessary to return, this improves the accountability of every live round issued to the user and reduces the possibility of the rounds falling into the hands of unauthorized personnel or terrorists. This can be done through the real time transmission of the data of a round fired, a miss fire due to the jamming of the weapon or a round, to a receiver in the command centre of the firearm authority. The data is acquired through a computer programme and stored in a flat file database management system or a relational database which can be in a server as part of a local area network (LAN) or the database can be stored in a database server residing in a wide area network (WAN) through internet.

In fact, the user can use a smart card or a RFID to identify himself when he draws the rounds from the command centre of the firearm authority. The smart card or the RFID also opens up a database specifically for the user so that the data of the number of rounds fired or miss fired can be transmitted wirelessly and in real time to the database.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Further disclosure, objects, advantages and aspects of the present application may be better understood by those skilled in the relevant art by reference to the following drawings of preferred embodiments which are given

by way of illustration only, and thus are not limitative of the present invention, in which:

Figure 1 is a side view of a rifle with an ammunition counter attached,  
5 according to a preferred embodiment of the present invention;

Figure 2 is a plan view of a rifle and ammunition counter attached to a multiple mounting system (MMS) or a specially designed system according to a preferred embodiment of the present invention;

Figure 3 is a perspective view of an ammunition counter according to a  
10 preferred embodiment of the present invention;

Figure 4 is a plan view of a circuit layout according to a preferred embodiment of the present invention; and

Figure 5 is the IT infrastructure for wireless transmission of data from the ammunition counter to the radio receiver which is linked to a standalone  
15 personal computer on server or a database server in a local area network (LAN) or a wide area network (WAN) through internet.

## DETAILED DESCRIPTION OF THE INVENTION

20 Referring to the drawings wherein like reference numerals designate like or corresponding parts throughout the several views, and referring initially to Figure 1, an ammunition counter 11 is shown attached to the side of a rifle 10, particularly to the mounting system. The ammunition counter 11 is deliberately placed to not obstruct the operation of the rifle. Figure 2 shows a  
25 plan view of Figure 1, wherein it may be seen that the ammunition counter 11 is placed to the side of the mounting system.

Referring particularly to Figures 1, 3 and 4, ammunition counter 11 preferably consists of a counter container 16 made of a resilient material and  
30 having an internal cavity for containment of an acoustic sensor 22, accelerometer 23, microprocessor 25, counter display 26, relay 24 and electronic circuitry for counter 32.

Figure 3 shows a more detailed perspective view of a preferred ammunition counter design, consisting of a counter container 16, a rifle multiple mounting system 17 or a specially design mounting system (not shown), an amplifier 30, an acoustic sensor 22, an accelerometer 23, a counter display 26, electronic circuitry for counter 32, relay 24, a microprocessor 25, a battery 27 and a radio transmitter 19.

In use, a user is supplied with a certain number of rounds of ammunition for use in circumstances including training. A round of ammunition is fired from the rifle 10 and the acoustic sensor 22 within the device detects an acoustic signal, such acoustic signal may be amplified by the amplifier 30. The acoustic sensor 22 sends an electronic signal to the microprocessor 25 only when it receives a sound from the firing of the weapon. By way of an example, the sound can be within an acceptable range of decibels for SAR 21 only rifle, or other predetermined signal range as necessary for each weapon. The range of loudness is necessary to prevent the action due to signals other than the live firing of ammunition - such as firing by the neighbouring firer.

20

Similarly, the accelerometer 23 within the device powered by the battery 27 detects the direction and the acceleration of the recoil when a live ammunition is fired, and only when the acceleration of this said recoil falls within the range of the acceleration characterised by the type of the weapon used, is a correct digital signal transmitted to the microprocessor 25, which filters the unwanted signal and picks only the pertinent signal within the range of the recoil of the particular weapon.

The microprocessor 25 receives signals from the sensors such as the two input signals from each the acoustic sensor 22 and the accelerometer 23 and compares the lapse of time, that is the time between detecting the first signal transmitted due to receiving the loudness when a live round is fired or

missed fired and detecting the second signal transmitted due to receiving the acceleration of the recoil when the live round including blank is fired. If the lapse in timing is within a certain preset range, another digital signal is sent through the radio transmitter to the command centre and at the same time to  
5 the counter 26 displaying the number of live rounds fired. Signals from the missed fired rounds which have different acceleration and acoustic features will be transmitted to the command centre to be stored under the missed fired category of the database. The purpose of the comparing the time lapse is to ensure that the dual actions of the acoustic signal and the recoil acceleration  
10 and direction of the acceleration are sequential and are intimately associated as a single act when a firer fires a live round. This prevents any possible intervention by a third party to simulate the 2 actions, thereby triggering the displaying counter to incorrectly accept that a live round or a blank has been fired.

15

After or during the firing in an event including training with the rifle, a user may observe the counter display to determine the number of rounds of ammunition used. A radio transmitter 19 may send data of the rounds fired or missed fired from the weapon to a receiver 63 in the command centre for  
20 downloading the number of rounds fired into a standalone personal computer or a server of a local area network (LAN) 61 or through internet access 67 to a remote server in a wide area network (WAN) 68. Alternatively, the data of the number of rounds fired by the weapon can be stored in database server 64 or a smart card or RFID 62 in order for the data to be downloadable batch format  
25 to download the data in batch format.

As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit  
30 the present invention unless otherwise specified, but rather should be construed broadly within the spirit and scope of the invention as defined in the appended claims. Various modifications and equivalent arrangements are

intended to be included within the spirit and scope of the invention and appended claims. Therefore, the specific embodiments are to be understood to be illustrative of the many ways in which the principles of the present invention may be practiced. In the following claims, means-plus-function

5 clauses are intended to cover structures as performing the defined function and not only structural equivalents, but also equivalent structures. For example, although a nail and a screw may not be structural equivalents in that a nail employs a cylindrical surface to secure wooden parts together, whereas a screw employs a helical surface to secure wooden parts together, in the

10 environment of fastening wooden parts, a nail and a screw are equivalent structures.

"Comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but

15 does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof."

## CLAIMS

1. A counting device for counting rounds of ammunition discharged from a firearm, comprising:
    - 5 at least a first sensor capable of sensing a first characteristic of the discharge;
    - at least a second sensor capable of sensing a second characteristic of the discharge which is different from said first characteristic;
    - a micro-controller;
    - 10 a counter display;
    - a radio transmitter; and
    - an electronic circuit means,

wherein said electronic circuit means is arranged to process signals from said sensors and said micro-controller so that relevant signal data pertinent to the firing of rounds are counted, and wherein said signal data is transmitted

  - 15 through said transmitter to a remote computer or a computer network for data storage or display.
- 
2. A counting device as claimed in Claim 1, wherein said sensors are
    - 20 selected from infra-red sensor, acoustic sensor, pressure sensor, accelerometer, photocell and thermal sensor.
  
  3. A counting device as claimed in Claim 2, wherein said micro-controller reads signals from both first and second sensors, including an acoustic
    - 25 sensor and accelerometer, and measures the time between receiving each signal and the sequence of the signal received and transmits a signal to the display counter if sensor signals are received within a certain time range and acoustic value of a relevant acceleration.

4. A counting device as claimed in Claims 2 or 3, wherein data signals from the sensors are sent to the display counter and/or transmitted through a wireless local- LAN and/or wide-area, WAN network through internet or stored in a database using a memory stick device.

5

5. A counting device as claimed in any one of Claims 2 to 4, wherein said uni-directional acoustic sensor sends an analogue signal to the microcontroller for the latter to determine whether the acoustic signal is within the predetermine range of the sound level within (in decibels) equivalent to the sound of the firing of a round and upon the sound level is determined to be within the predetermined range for that particular weapon, the signal is accepted as one of the parameters used to confirm the firing of a round.

6. A counting device as claimed in any one of Claims 2 to 5, wherein said acceleration sensor sends a signal to the micro-controller if the range and the direction received is within the predetermined range of acceleration due to recoil.

7. A counting device as claimed in any one of Claims 1 to 6, wherein boolean logic is used to confirm that a round fired by a weapon is within each predetermined range, direction, sequence and correct timing.

8. A counting device as claimed in any one of Claims 1 to 7, wherein said device further comprises a communication port, wherein information may be stored and accessed from the micro-controller via the communication port in batch mode.

9. A counting device as claimed in any one of Claims 1 to 8, wherein the components of said device are accommodated within the cavity of a substantially enclosed container which is mounted to the weapon through said weapon's accessory or attachment mounting means including a multiple  
5 mounting system.

10. A counting device as claimed in any one of Claims 1 to 9, wherein said container is conveniently attachable to the weapon without impeding the function and operation of the weapon.

10

11. A counting device as claimed in any one of Claims 1 to 10, wherein data is transmitted wirelessly in real time to a standalone personal computer or a server in a local area network or a server in a wide area network through internet.

15

12. A counting device as claimed in Claim 1, substantially as hereinbefore described with reference to the accompanying drawings.