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- (73) Patenthaver: **Rheinmetall Waffe Munition GmbH, Heinrich-Ehrhardt-Strasse 2, 29345 Unterlüss, Tyskland**
- (72) Opfinder: **BILGER, Gerhard, Siebenlinden 9, 78730 Lauterbach, Tyskland**
Maier, Bernhard, Sägewerkstr. 2, 78727 Oberndorf, Tyskland
- (74) Fuldmægtig i Danmark: **Larsen & Birkeholm A/S Skandinavisk Patentbureau, Banegårdspladsen 1, 1570 København V, Danmark**
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FR-A- 648 914
JP-U- S 648 093
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DescriptionMethod and device for determining the wear of a weapon barrel

- 5 The invention relates to a device and a method with which a simple, more realistic manifestation of wear of a weapon barrel is determined and/or can be determined.

The firing load, that is to say, the firing frequency of the weapon barrel has a great influence on the wear of a weapon. The wear can then be considered together with
10 other data such as the total number of shots and the barrel statics, when adjusting or aligning the weapons system by the fire control system (DE 197 16 198 C2). On the other hand, the wear of a weapon barrel also determines the inspection intervals for the weapon, the possible replacement of the weapon barrel, and/or its disposal, etc.

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A device and a method for determining the wear of a barrel are disclosed in DE 602 07 797 T2 (EP 1 291 599 B1). Here the basic concept is the measurement of the cross-section of a barrel by means of an endoscopic tool, such as a laser head, for the purposes of inspection of the inner wall of the barrel. A device for determining
20 the wear of a firearm is also disclosed in DE 42 03 585 C2. Here a sensor measures the duration and frequency of the deflection of a moving part of the firearm from its neutral position. DE 10 2007 056 500 B3 describes a testing device with which the wear of a weapon barrel can also be determined.

- 25 JPS648093U discloses a relevant device of the related art. The object of the invention is to demonstrate a device and a method for more effective determination of the wear of a weapon barrel.

The object is achieved by the features of patent claim 1 and patent claim 10,
30 respectively. Advantageous embodiments are listed in the subsidiary claims.

The invention is based on the possibility that the wear of a weapon barrel can be described by the number of shots, and the said wear can then be determined by

means of this quantity. What is disadvantageous in this simple variant, however, is that the "shots" that are concomitantly counted include even those that are "fired", for example, when loading the weapon with ammunition. Such counts during the loading operation reduce the service life of a weapon barrel – which is specified as
5 "XXX shots per barrel".

In addition to the simple determination of wear, the invention is based on the concept of incorporating a shot counter so as to carry out a shot count that is independent of the loading and/or unloading operations of the weapon. Here only
10 the actual (live) shots are to be counted, as only these have a direct influence on the service life of the barrel.

AT 43 643 B discloses a shot counter, which consists essentially of a counter that is connected to a movable part of the breech mechanism, so that with each actuation
15 of the breech mechanism, the number of shots fired is recorded. The link between the breech mechanism and the counter is ensured by a movable rod.

CH 21 03 62 A describes a pulse counter as a shot counter of a machine gun. This operates in accordance with basic electromagnetic principles.
20

A further shot counter can be found in DD 28 29 77 A. This uses a permanent magnet, which is attached to a movable striking pin, which is guided past a magnetic sensor.

25 A tamper-proof shot counter is proposed in DE 10 2007 056 421 A. This comprises a piezo element, which is triggered by the force of the breech mechanism movement and increments a shot counter by one. The stress-free counter is for its part sealed.

Another approach for a shot counter is demonstrated in DE 60 222 708 T2. Here
30 the counting device interacts with an electronics unit that analyses the cartridge cases ejected from the cartridge chamber.

The individual solution envisages the equipment of the weapon with, for example,

a floating contact, preferably as a slide contact, for the measurement of the number of shots. In the case of the applicant's BK27, at least one additional (slide) contact of this type would have to be provided. This/these contact(s) is/are connected to the weapon when it is in the armed state. With each shot, the slide is briefly opened and closed once again. If this pulse sequence is located in a certain time cycle (firing cycle), a counter is incremented by one. Since when loading/unloading the weapon this cycle (time) is exceeded compared with a firing cycle, this cycle is not concomitantly counted. Alternative counts from the related art can also be incorporated here if the basic principle - that of taking account of the time difference - can be used here. In the evaluation of a time difference conclusions are drawn concerning a live shot or the loading/unloading operations. The loading operation itself is not counted as a shot in the result. In its simplest form, the weapon is therefore equipped or retrofitted with a second floating slide switch contact.

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A similar approach to the consideration of a time difference is disclosed in DE 101 48 677 A, which describes a handgun with a device for determining the number of shots. To determine the number of shots a microprocessor with a memory is provided, wherein the microprocessor is connected to a first and a second sensor. The first piezoelectric sensor sends a signal to the microprocessor when recording the recoil pulse during firing. When a slider slides back, a second signal is sent to the microprocessor. This determines a time interval between firing and the slide back of the slide and sends a counting pulse to the memory. By this means a live shot is to be distinguished from a defective shot. The utilisation of such an approach for a more optimal determination of wear of a weapon barrel, in particular an automatic weapon such as a machine gun, is not considered.

20

The loading of the ammunition is carried out electrically, for example by means of a motor, or manually. Only after a number of slide movements does the counting process start (again). During firing, the movement of the slide to the rear takes place as a result of the gas pressure and then as a result of spring force, where the measuring point is located.

30

If the shot counter is not being used, the microcontroller is set into a power-saving mode, so that the measuring current is minimised. This has the advantage that the battery life is increased.

- 5 As a result of the evaluation of the wear on the basis of the actual number of shots, that is, the number of live shots, it can be determined that the gun barrel must be replaced, etc (after a predefined number of shots).

10 With the aid of an embodiment with figures, the invention will be explained in more detail.

A space on the feeding slide 10 of a weapon 12 can be provided as the installation site for the shot counter 1. Figure 1 shows a possible feeding slide 10. Here the shot counter 1 is integrated on the companion piece 11 to a slide part 13 of the feeding slide 10. Contact springs - at least one - are identified with 14; these interact functionally with a mating contact preferably designed as a slide contact 15. The slide part 13 is moved when a shot is fired or during the loading operation in the direction Z. The sliding contact 15 leaves the contact spring(s) 14 and goes back to the starting position after each shot or after each loading operation, also manually controlled.

A flowchart illustrating the operation of the shot counter 1 in accordance with the invention is shown in Figure 2. If the pulse sequence is within, for example, 800 to 1800 shots/min - corresponding to 75 ms to 33 ms (predefined firing cycle) - the counter 1 is incremented by "1", and the shot is registered as such, i.e. as a "live shot". In the loading operation, the cycle is more than 75 ms. The latter is not concomitantly counted in a time analysis, the counter 1 is not incremented, because a shot has not occurred in the sense of a bullet or projectile passing through the weapon barrel. The time difference is determined based on the open contact time between the contacts 13, 14. The firing cycles that are generally predefined in weapons technology are for their part stored in the microcontroller 2.

In a particular embodiment the shot counter 1 can be brought into a stand-by mode

after the ammunition has been loaded, and can be activated by the opening of one or both of the contacts 13, 14.

5 In a simple embodiment the display of the number of shots can take place in the analogue form of a number, etc. In a preferred embodiment, however, provision is made for the microcontroller 2 to generate a signal - possibly also an additional
10 signal - that signals the wear condition based on comparative values, etc. Thus, the display can take the form, for example, of a colour display. For this purpose, the comparative values, etc., can be stored in the microcontroller 2. The display can
15 vary between green and red, wherein red is displayed, for example, when the wear point is reached for an inspection, maintenance or replacement. Other appropriate possibilities are sufficiently well known to the person skilled in the art.

P A T E N T K R A V

1. Våben (12) med et løb samt med en skudtæller (1), der omfatter en mikrocontroller (2), der evaluerer en impulsfølge af skuddene, **kendetegnet ved, at**

5

- a. våbenet (12) er udrustet med en spændingsløs kontakt (15), der kan forbindes elektrisk med den på våbenet (12) anbragte skudtæller (1) via kontaktfjedre (14),
- b. skudtælleren (1) er integreret på en fødeglider (10) i våbenet (12), hvor
- c. en tidsforskel beregnes og evalueres til beregningen af skudcyklusserne ved
10 hjælp af den åbne kontakttid mellem kontakten (14) i skudtælleren (1) og den spændingsløse kontakt (15) på våbenet (12), og at
- d. forudbestemte skudcyklusser er lagret i mikrocontrolleren (2), hvor
- e. et skarpt skud befinder sig i den forudbestemte skudcyklus,
- f. mens ladningen og/eller afladningen overskrider den forudbestemte skudcyklus,
15 således at
- g. skudtælleren (1) øges med "1" ved et skarpt skud,
- h. mens ladningen og/eller afladningen af våbenet (12) ikke tæller med, og skudtælleren (1) ikke øges, hvor
- i. der ud fra det som skarpt skud identificerede skudantal i skudtælleren (1) drages
20 konklusioner vedrørende sliddet af løbet.

2. Våben (12) ifølge krav 1, **kendetegnet ved, at** den spændingsløse kontakt er en glidekontakt.

25

3. Våben (12) ifølge krav 1 eller 2, **kendetegnet ved, at** den forudbestemte skudcyklus udgør mellem 75 ms til 33 ms ved 800 til 1800 skud/min., hvor den ikke talte skudcyklus er større.

30

4. Våben (12) ifølge et af kravene 1 til 3, **kendetegnet ved** en analog visning af skudantallet.

5. Våben (12) ifølge et af kravene 1 til 3, **kendetegnet ved** en digital visning, hvortil mikrocontrolleren (2) genererer et signal, der signalerer slidtilstanden i løbet.

6. Våben (12) ifølge krav 5, **kendetegnet ved, at** sammenligningsværdier etc. for slidtilstanden lagres i mikrocontrolleren (2).

7. Våben (12) ifølge krav 5 eller 6, **kendetegnet ved, at** visningen sker i form af en farvevisning.

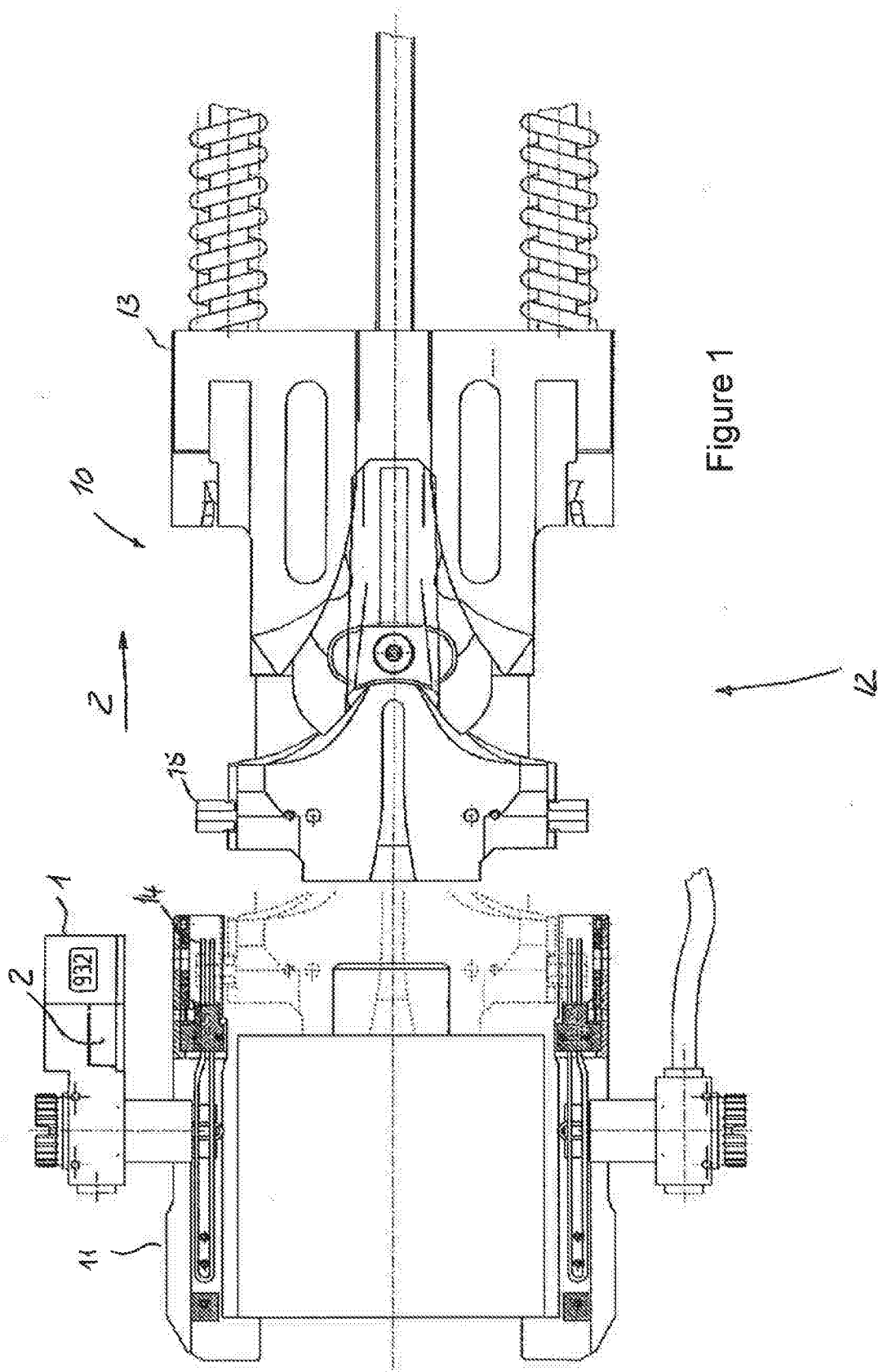
8. Våben (12) ifølge krav 7, **kendetegnet ved, at** visningen tenderer mellem grøn til rød.

9. Våben (12) ifølge krav 8, **kendetegnet ved, at** der vises rødt, når slidpunktet nås for en inspektion, vedligeholdelse eller en udskiftning.

10. Fremgangsmåde til beregning af sliddet af et løb i et våben (12) med en skudtæller (1), hvor våbenet (12) er udrustet med en spændingsløs kontakt (15), der kan forbindes elektrisk med den på våbenet (12) anbragte skudtæller (1) via kontaktfjedre (14), hvor skudtælleren (1) er integreret på en fødeglider (10) i våbenet (12), hvor skudtælleren (1) omfatter en mikrocontroller (2), der evaluerer en impulsfølge af skuddene, hvor forudbestemte skudcyklusser er lagret i mikrocontrolleren (2), hvor et skarpt skud befinder sig i den forudbestemte skudcyklus, mens ladningen og/eller afladningen overskrider den forudbestemte skudcyklus, således at skudtælleren (1) øges med "1" ved et skarpt skud, mens ladningen og/eller afladningen af våbenet ikke tæller med, og skudtælleren (1) ikke øges, og at der ud fra det som skarpt skud identificerede skudantal i skudtælleren (1) drages konklusioner vedrørende sliddet af løbet, hvor en tidsforskel beregnes og evalueres til beregningen af skudcyklusserne ved hjælp af den åbne kontakttid mellem en kontakt (14) i skudtælleren (1) og en kontakt (15) på våbenet (12).

11. Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** skudtælleren (1) efter ladning af ammunitionen bringes til standby og aktiveres ved åbning af kontakten/ kontakterne (14, 15).

5 12. Fremgangsmåde ifølge et af kravene 10 eller 11, **kendetegnet ved, at** mikrokontrolleren (2) sættes i sparemodus, når skudtælleren ikke benyttes, således at målestrømmen svarer til ca. <1 % af den aktive målestrøm.



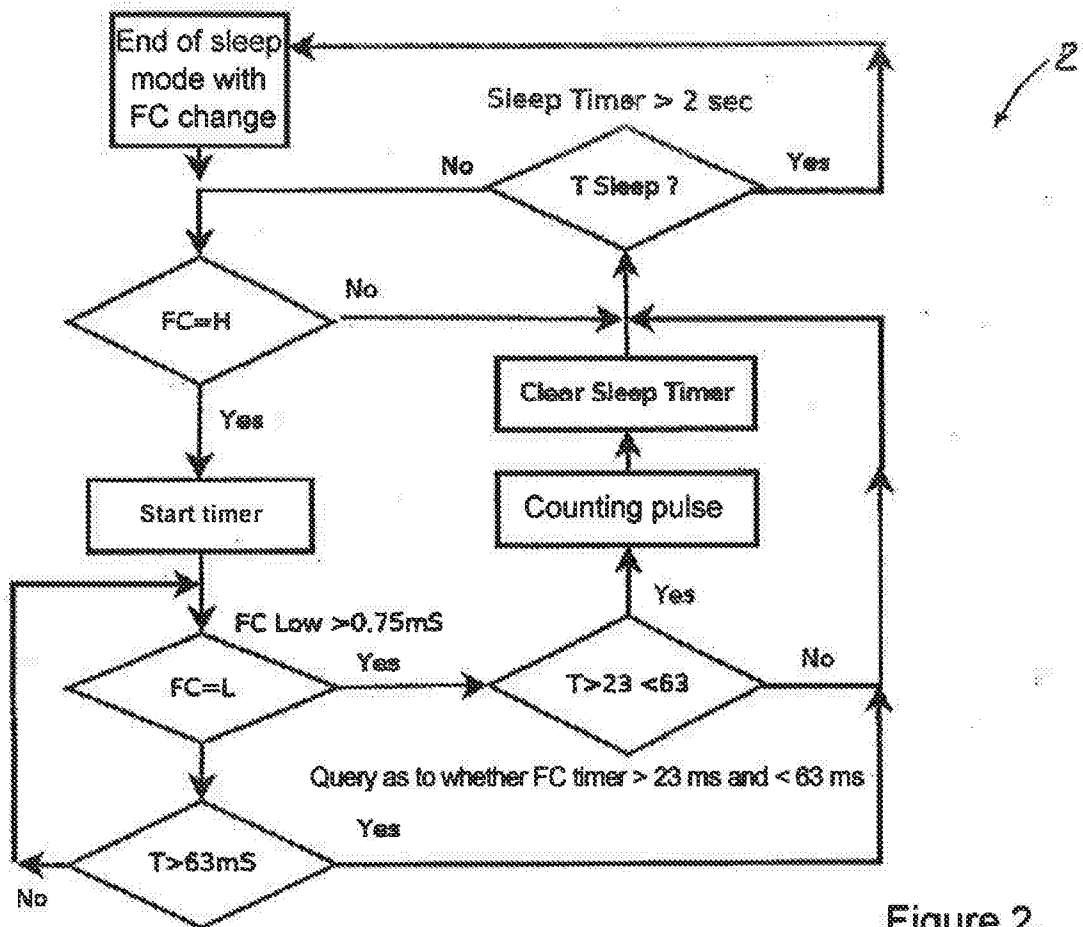


Figure 2