



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.11.2012 Bulletin 2012/47

(51) Int Cl.:
F41A 17/08 (2006.01) **F42B 5/08** (2006.01)
F41A 17/06 (2006.01) **F41A 19/62** (2006.01)

(21) Application number: **11400030.0**

(22) Date of filing: **18.05.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) **Radio controlled cartridge ammunition**

(57) Embodiments relate to radio controlled cartridge ammunition (20;30) for a weapon (26), wherein the ammunition comprises control circuitry (21) adapted to enable and/or disable a mechanism for the ignition of the propellant charge (32) of the ammunition (20;30) in response to a wireless radio control signal. Thereby the control circuitry (21) may be adapted to extract, from the wireless radio control signal received at the ammunition's geographical location, information indicative of said geographical location, and to compare the extracted information with information indicative of a geographical area where the ammunition (20;30) is allowed to be fired off the weapon (26). Hence, the ignition mechanism may be controlled based on the result of the comparison.

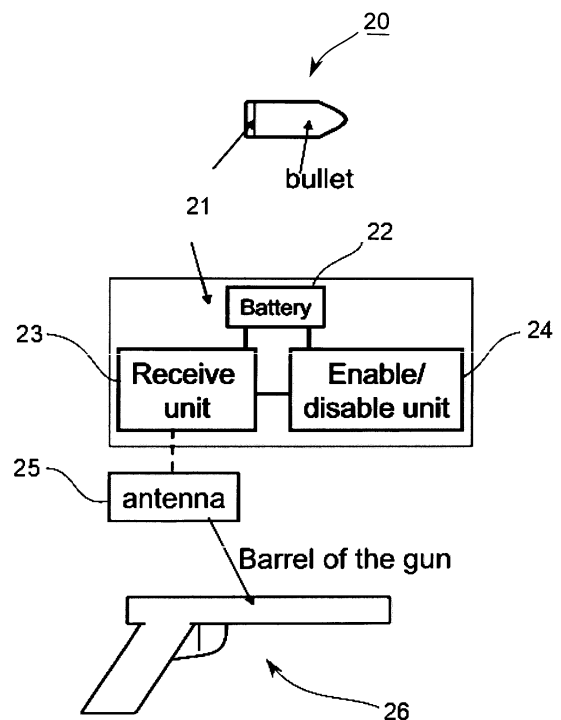


Fig. 2

Description

[0001] Embodiments of the present invention generally relate to wireless communications and, more specifically, to controlling the firing of ammunition, such as gun bullets, with the help of wireless radio signals.

Background

[0002] In the past, unfortunately far too many deadly gun rampages committed with mostly private handguns have occurred throughout the world, killing dozens or even hundreds of innocent people who accidentally were at the wrong place at the wrong time and thereby also leading to nervous breakdowns of their relatives and friends. Examples of such dramatic gun rampages include school and/or university shootings initiated by mentally disordered students as a means of revenge or a last desperate means for drawing up attention. Often such shootings end with the killing or the suicide of the perpetrator.

[0003] As a consequence, many legal accentuations have been called for, including, e.g., a prohibition of shooting video games, better monitoring of gun club members, directives to have all ammunition deposited with police, and provisions to have gun club members store their weapons at the club house. Also a complete prohibition of youths' access to guns in gun clubs has been demanded, as well as less violence on TV.

[0004] Following such demands some governments have passed legislation to improve handgun security e.g. with electronic nation-wide weapons registry, increased age limitations for large-caliber weapons as well as unannounced, random inspections in gun-owner homes. Also, obligatory biometric security systems are to be introduced once they are technically feasible. However, a ban on several fighting games trivializing and encouraging violence was not yet passed neither was a limitation on the number of guns owned nor an obligation to store guns with shooting clubs.

[0005] Since purely legal measures to prevent crimes do not always lead to the envisaged results, also technical measures against crimes committed with handguns may be considered. These include e.g. blocking solutions, which directly block a weapon itself. However, such solutions are elaborate and difficult for retroactive introduction.

[0006] Therefore improved technical measures are required to prevent the uncontrolled use of weapons and ammunition and, hence, fatal crimes like, e.g., the above-mentioned gun rampages.

Summary

[0007] Embodiments may be based on the finding that radio signals available today and in the future may be used to control the firing of ammunition, e.g. a bullet, off a weapon. By means of wireless radio signals ammunition

may be controlled such that its firing off is possible only within predefined geographic areas, such as, e.g., shooting stands of gun clubs or in the wilderness. Hence, embodiments mainly but not exclusively address bullets or ammunition and the related weapons of private persons, such as gun club members or amateur hunters.

[0008] Embodiments may be further based on the finding that an ignition mechanism of the ammunition may be modified, such that ignition and hence firing off the ammunition can only happen if the ammunition has previously been armed by a radio controlled procedure. Embodiments, hence, virtually provide intelligent ammunition which allows to be fired off only under certain circumstances.

[0009] Embodiments provide ammunition for a weapon, the ammunition comprising control circuitry adapted to enable and/or disable an ignition mechanism of the ammunition for firing the ammunition off the weapon in response to a wireless radio control signal. That is, the ammunition itself may be armed or disarmed based on the wireless radio control signal.

[0010] Hence, according to embodiments, ammunition may only be primed if it is in reach of at least one wireless radio control signal. Such a wireless radio control signal may be transmitted either at certain time instants or it may only be transmitted within a limited geographic area such as a shooting drill ground, etc. That is, according to an embodiment the ammunition may only be armed in certain geographic areas corresponding to permitted areas, such as shooting stands or the like. For this purpose the control circuitry may be either adapted to "listen" to a special wireless radio control signal and to control the ignition mechanism based on the reception of said special wireless radio control signal. According to further embodiments the control circuitry may also be adapted to extract, from the wireless radio control signal received at the ammunition's current geographical location, information indicative of said current geographical location, in order to compare the extracted information with information indicative of the geographic area where the ammunition is allowed to be fired from the weapon, and to control the ignition mechanism based on the result of the comparison.

[0011] The regionally limited wireless radio control signal may, hence, have a certain frequency or carry a certain code which has to be identified by the ammunition in order to get armed. It may also carry GPS (Global Positioning System) data with which the control circuitry may determine or calculate a quite accurate estimate of the ammunition's current position or location. In other embodiments, the wireless radio control signal may carry information indicative of cells or base stations of a wireless communication system, such as WLAN (Wireless Local Area Network), GSM (Global System for Mobile Communication), UMTS (Universal Mobile Telecommunications System) or LTE (Long-Term Evolution) - just to name a few of many possible mobile or wireless communications systems. With such cell specific information the

control circuitry may also get an indication of the ammunition's current position or location.

[0012] Such extracted information may then be compared to data indicative of the permitted geographic area where the ammunition is allowed to be fired from the weapon. According to one embodiment, such data indicative of the permitted geographic area may be stored in the ammunition or the control circuitry. Therefore a (small) memory, such as e.g. a semiconductor memory, integrated with or coupled to the control circuitry may be implemented in the ammunition.

[0013] In order to program such built-in memory, embodiments of the ammunition may comprise a programming interface for receiving information indicative of a condition allowing the ammunition to be fired off the weapon. Hence, when selling such ammunition to private persons or gun clubs a signal or a code indicative of the gun club's geographic location may be programmed into the ammunition's memory, such that the ammunition may only be fired with the area of a predefined gun club, i.e., in case of a match between the programmed data and the data carried by the wireless radio control signal. For a hunter, e.g., a signal or a code indicative of his permitted hunting ground may be programmed. That is, in regions not corresponding to the programmed signals or codes, e.g. city-center regions or regions with public facilities, it will not be possible to arm embodiments of the ammunition.

[0014] Based on the result of this data comparison the ammunition's ignition mechanism, i.e. its ability to be fired off an adequate weapon, may then be enabled or left disabled (default ability to be fired off an adequate weapon, may then be enabled or left disabled (default state), depending on whether the comparison yielded that the ammunition's current location corresponds to the geographic area for which legal use of a weapon with ammunition is allowed, in particular for private persons. Such an area may e.g. be a coverage area (or a part thereof) of a certain cell of a wireless communication system, i.e., a geographic area where a cell-ID identifying the cell's serving base station may be received. The cell or a part thereof may e.g. cover a gun club or the like. Outside this permitted area, i.e. when the wireless radio signal carrying the specific cell-ID may not be received, the ammunition's ignition mechanism will be or become disabled.

[0015] For processing the wireless radio control signal at the ammunition, embodiments of the ammunition comprise a control circuitry which comprises receiving circuitry adapted to receive the wireless radio control signal. Further, enabling/disabling circuitry may be provided at the ammunition which is coupled to the receiving circuitry and adapted to generate an electrical signal which enables or disables the ignition mechanism of the ammunition in response to the received wireless radio control signal.

[0016] The receiving circuitry may comprise at least a simple radio signal receiver, depending on the complexity

of the underlying wireless communication system and/or the wireless radio signal. Typically, such receivers include RF (Radio Frequency) front-ends comprising mixers and filters for converting a received signal from an RF band to an intermediate or base band signal domain. Downstream to the RF front-end there may be arranged a back-end receiver, e.g. including at least a simple signal processor for extracting, among other things, the aforementioned information indicative of the ammunition's current geographical location.

[0017] In order to receive the wireless control signal, a cartridge or hull of the ammunition may be adapted to serve as an antenna means according to some embodiments. This is possible since the cartridge of the ammunition will typically be metallic. According to other embodiments the cartridge of the ammunition may also be adapted to provide contacts or contact means for enabling an electrical contact of the ammunition's control circuitry with an external antenna for receiving the wireless radio control signal. Such an external antenna may e.g. be a barrel of the weapon or gun, although this will most likely not be exactly fitted to the frequency of the radio signal and, hence, not provide best reception qualities. Of course, also solutions with better external antennas mounted to the weapon or gun are possible. To summarize, the ammunition may be configured to use at least parts of the weapon as an antenna means for receiving the wireless radio control signal.

[0018] The ammunition may comprise means for converting a mechanical impulse from a gun-hammer into an electrical signal used for ignition. Such means may comprise e.g. a piezoelectric device and a spark gap, wherein the piezoelectric device and the spark gap are electrically connected. The piezoelectric device has a location within the ammunition such that it can be hit by the hammer of the weapon. The spark gap has a location within the ammunition such that it can cause a spark ignition in response to the hit by the weapon's hammer to fire off the ammunition. That is, the spark gap or its electrodes may be located close to or inside the ammunition's gun powder reservoir. Thus hitting the piezoelectric crystal with the hammer will trigger a spark ignition which again triggers an explosion which finally fires the ammunition off the weapon.

[0019] When the ignition mechanism is disabled, the spark gap, i.e. its electrodes, may be electrically shorted by a switch in closed position. When the ignition mechanism is enabled the switch may be brought to an open position. There are many possible embodiments of such a switch (e.g. transistors), depending on the complexity of the electrical circuitry implemented within the ammunition. According to one embodiment the switch may be realized by a fuse, such that in the disarmed state the spark-gap is electrically shorted by the switch or fuse thus preventing ignition of the ammunition. A radio command received by the antenna and processed by the receiving unit will trigger an enable switch controller which opens the short or melts the fuse. According to some

embodiments of the switch, this procedure is repeatable in order to also get back from the armed state in the disarmed state.

[0020] According to some embodiments the electrical circuitry of the intelligent ammunition is off power as long as the ammunition is not loaded into its weapon. In that powered-off state the ammunition is of course also disarmed. In other words, the ammunition's electrical or control circuitry may be configured to be supplied with power (only) in case the ammunition is loaded into the weapon. This may be realized by concepts where a power supply is located within the ammunition and only activated when the ammunition is loaded or by external power supplies, which may, e.g., be located in the weapon and deliver power to the ammunition's circuitry during the time when the ammunition is loaded into said weapon. Hence, according to one embodiment the ammunition may comprise a built-in electric power supply for its control circuitry or chip and contact means to enable the built-in power supply for the control chip when the ammunition is loaded into the weapon. According to another embodiment the ammunition may comprise contact means adapted to enable an electrical contact with an external power supply for the control circuitry when the ammunition is loaded into the weapon.

[0021] Although some embodiments of the ammunition may be fired off with conventional weapons, such as handguns or rifles, there may be other embodiments of the ammunition which require specifically adapted weapons, e.g., when a weapon needs to function as an external power-supply or when it needs to have installed a specific antenna device. Hence, embodiments also comprise a weapon for operating ammunition according to certain embodiments.

[0022] According to yet a further embodiment a method for controlling an ignition mechanism of ammunition for a weapon is provided. The method comprises a step of receiving, at the ammunition, a wireless radio control signal, and a step of enabling and/or disabling the ignition mechanism of the ammunition in response to the received wireless radio control signal. As described above, the ignition mechanism may only be enabled when the ammunition is loaded into said weapon according to some embodiments.

[0023] Some embodiments comprise a digital control circuit installed within the ammunition's control circuitry. As has been described before, such a digital control circuit, e.g. a digital signal processor (DSP), needs to be programmed accordingly. Hence, yet further embodiments also provide a computer program having a program code for performing embodiments of the method, when the computer program is executed on a computer or a digital processor.

[0024] Embodiments are hence directed towards a modification of an ammunition's ignition mechanism, such that ignition and, hence, firing off the ammunition can only take place if the ammunition is armed or activated by a radio controlled procedure. According to em-

bodiments, the ammunition's hull or cartridge does not contain a mechanical percussion cap anymore. Instead, it may comprise a piezoelectric ignition mechanism and a wireless controlled chip which may prime the ammunition only within a permitted area, such as a shooting stand. In order to achieve this, the mobile radio or GPS infrastructure may be used, e.g. for localization and priming of the ammunition. The built-in chip affects that the ammunition is disarmed except in the specific mobile radio cell or location, for which legal use is allowed.

[0025] Embodiments may therefore improve the annoying situation with respect to gun rampages or kidnapping mostly committed with private handguns that must actually only be used in the mentioned permitted areas. Firing such improved ammunition at public places, like schools, universities, or hospitals, becomes nearly impossible. Hence, embodiments may help to prevent crimes committed with private handguns and ammunition.

[0026] Required mobile radio network infrastructure for realizing embodiments already exists and required electronics for the ammunition is not very complex. One advantage of embodiments is a clearly improved possibility to disable and enable ammunition and thus weapons (e.g. by mobile radio network). No big effort on later implementation of embodiments for the weapons themselves is required. Embodiments of the ammunition may only be enabled in mobile radio cells where use of them is allowed (e.g. firing range). Thus the embodiments may clearly increase overall safety by improved crime prevention.

Brief description of the Figures

[0027] Some embodiments of apparatuses and/or methods will be described in the following by way of example only, and with reference to the accompanying figures, in which

- Fig. 1 schematically illustrates the intelligent ammunition concept of embodiments of the present invention;
- Fig. 2 schematically illustrates an embodiment of ammunition according to an embodiment;
- Fig. 3 shows details of a radio-controlled ammunition ignition mechanism according to an embodiment;
- Fig. 4a shows a block circuit diagram of a receive unit and an enable/disable unit of an ammunition according to an embodiment;
- Fig. 4b shows ammunition according to an embodiment with electrical contact in its cartridge;
- Fig. 5 illustrates a schematic block diagram of a

method for controlling an ignition mechanism of ammunition according to an embodiment.

Description of Embodiments

[0028] Various example embodiments will now be described more fully with reference to the accompanying drawings in which some example embodiments are illustrated. In the drawings, the thicknesses of layers and/or regions may be exaggerated for clarity.

[0029] Accordingly, while example embodiments are capable of various modifications and alternative forms, embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit example embodiments to the particular forms disclosed, but on the contrary, example embodiments are to cover all modifications, equivalents, and alternatives falling within the scope of the invention. Like numbers refer to like elements throughout the description of the figures.

[0030] It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.).

[0031] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes" and/or "including," when used herein, specify the presence of stated features, integers, steps, operations, elements and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.

[0032] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which example embodiments belong. It will be further understood that terms, e.g., those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0033] Fig. 1 schematically illustrates the intelligent ammunition concept according to embodiments of the present invention.

[0034] Exemplarily, three mobile radio cells 11a, 11b and 11c of a wireless communication system 10 are shown. Examples of wireless communication systems are Wi-Fi networks, e.g. WLAN (Wireless Local Area Network), 2nd generation mobile communication systems, like, e.g., GSM (Global System for Mobile Communication), 3rd generation mobile communication systems, like, e.g., UMTS (Universal Mobile Telecommunications System) or 4th generation mobile communication systems, like, e.g., LTE (Long-Term Evolution). Every network cell 11a, 11b and 11c is served by a corresponding base station 12a, 12b, and 12c, respectively. Depending on the used infrastructure the base stations 12a, 12b, and 12c may also be referred to as access points.

[0035] While the cell 11a exemplarily covers a geographic area of a firing or shooting range of a gun club or the like, the cells 11b and 11c cover public facilities, like schools, hospitals, etc. Hence, for the cells 11b and 11c the intelligent ammunition according to embodiments is blocked and thus ineffective since there are no firing ranges or other facilities within these cells, which would require active ammunition. In the cell 11a, however, the ammunition may be activated by a suitable enabling signal provided by the corresponding radio base station 12a. Following this concept, the ammunition and thus its related weapons may only be activated in very limited geographic areas by using existing wireless network infrastructure.

[0036] Fig. 2 shows the main required building blocks in order to realize the radio controlled ammunition concept which has been exemplified with reference to Fig. 1.

[0037] Fig. 2 schematically illustrates ammunition in form of a bullet 20 for a weapon 26, e.g. a hand gun, wherein the ammunition or bullet 20 comprises a control circuitry 21 adapted to enable and/or disable an ignition mechanism of the bullet 21 in response to a wireless radio control signal. The ignition mechanism shall launch the firing of the bullet 20 off the weapon 26.

[0038] For this purpose the control circuitry 21 may comprise a power supply 22, e.g. in form of a battery, for supplying electrical power to a receiving part 23 and an enabling and/or disabling part 24 coupled to the receiving part 23 of the control circuitry 21. The enabling circuitry 24 may be adapted to generate an electrical signal which enables or disables the ignition mechanism of the bullet 20 in response to a received wireless radio control signal. For receiving said wireless control signal the receiving circuitry 23 may be coupled to an antenna device 25. According to some embodiments, in particular for high frequency wireless signals, the cartridge of the bullet 20 may be adapted to serve as the antenna device 25 itself. However, the cartridge may also be adapted to provide contact means for enabling a contact of the bullet 20 with an external antenna 25 for receiving the wireless radio control signal. Due to the relatively small size of the bullet 20 a part of the weapon 26 may be used as said external antenna device 25, as indicated in Fig. 2. According to some embodiments this antenna part may e.g. be the

barrel of the weapon 26 although it may not be perfectly matched to the radio frequency of the wireless control signal. If a match of the antenna to the wireless signal is of great importance, also a dedicated external antenna device may be foreseen at the weapon.

[0039] The control circuitry 21 is implemented in each bullet 20 and makes the bullet active or inactive. The control circuitry 21 may be of the form of an integrated circuit, e.g. a semiconductor chip. According to some embodiments it may also be assembled of discrete electrical components, depending on the size of the bullet 20. The control circuitry 21 and thus the bullet 20 may be controlled by a mobile radio infrastructure as has been explained with reference to Fig. 1. In order to achieve this, the control circuitry 21 includes the receive unit 23 (coupled to antenna 25) as well as the enabling/disabling unit 24. Without an appropriate enabling signal, the bullet 20 is always blocked, i.e. its ignition mechanism will not work.

[0040] According to some embodiments the control circuitry 21 may be adapted to extract, from the wireless radio control signal received at the bullet's 20 current geographical location (e.g. in one of the cells 11a, 11b or 11c) via the antenna 25, information indicative of said geographical location. This extracted information may then be compared with information indicative of a geographical area where the bullet 20 is allowed to be fired from the weapon 26 (e.g. cell 11a), and to control the bullet's 20 ignition mechanism based on the result of the comparison. The control circuitry 21 may hence be adapted to extract geographic positioning data or cell identification information from the wireless radio control signal. In one case the control circuitry 21 may extract a cell-ID from the received wireless radio signal and compare it to a stored cell-ID which may indicate a permitted geographical area. Such a cell-ID may be an identifier of a base station or an access point. In the example illustrated in Fig. 1 the control circuitry 21 would hence only activate the bullet's ignition mechanism if the extracted information indicated that the bullet 20 is currently located in cell 11a corresponding to the firing range. In all other cells 11b and 11c the bullet 20 would remain deactivated and could therefore not be fired from weapon 26. Other embodiments may also allow an extraction of GPS data from the wireless control signal. Based on such data the bullet's current position could be determined and compared to geographical areas where a firing off is permitted. If the current position falls within such a permitted area the bullet 20 may be armed. Otherwise it remains or becomes disarmed.

[0041] After an overview of the radio controlled bullet concept has been provided with reference to the Figures 1 and 2, a radio-controlled bullet ignition mechanism according to an embodiment will be described in more detail turning now to Fig. 3.

[0042] Fig. 3 shows a bullet 30 according to an embodiment. Beside the already discussed control circuitry 21 the bullet 30 comprises a bullet head or projectile 31, an explosive area 32, and means 33, 34, 35 for converting

a mechanical impulse or force 36 from a gun-hammer (not shown) into an electrical signal used for ignition of the explosive area 32. The control circuitry 21 may be located in the bullet's cartridge, preferably in a region of reduced mechanical (shock) stress. For example, the means 33, 34, 35 for converting a mechanical impulse may comprise a piezoelectric device 33 with electrical contacts 34. Piezoelectricity thereby denotes an electrical charge which accumulates in certain solid materials (notably crystals, certain ceramics, and biological matter such as bone, DNA and various proteins) in response to applied mechanical strain. The piezoelectric device or crystal 33 may be preferably located in a position within the bullet 30 such that it can be hit by a hammer of the weapon 26. I.e., it may be located in the rear part of the bullet 30. Instead, the control circuitry 21 may be suitably located in a region of reduced mechanical (shock) stress between the piezoelectric crystal 33 and the explosive area 32. The electrical charge resulting from the hit by the hammer may result in voltages of thousands of Volts between the electrical contacts 34. These contacts 34 may be electrically connected to electrodes forming a spark gap 35 located in a position within the bullet 30 such that it can cause a spark ignition in the explosive area 32 in response to the hit by the weapon's hammer in order to fire off the bullet 30. Hence, for the bullet's ignition mechanism the hammer of the gun 26 hits the piezoelectric crystal 33 which is electrically connected to the spark gap 35 which is located close or inside the bullet's gun powder reservoir 32. Thus hitting the crystal 33 will trigger a spark ignition which again triggers the explosion which finally fires the bullet 30.

[0043] Fig. 4a shows a top level schematic 40 of the electronic unit 21 located in the bullet's cartridge.

[0044] The electronic control unit 21 may comprise a contact 41 for connecting an antenna device 25 to the control unit's receiving circuit 23, which again is coupled to the enabling/disabling circuit 24 and the power supply 22. The enabling circuit 24 may control a switch (or fuse) 42, which again may short electrodes of the spark gap 35 when in closed state. That is, in the closed state of the switch 42 the bullet's ignition mechanism is deactivated or disarmed since no spark ignition can take place in response to a mechanical impulse on the piezoelectric device 33 and a resulting high voltage between the spark gap's electrodes (35). A radio command of a wireless control signal received by the antenna 25 and processed by the receiving circuit 23 may trigger the enabling circuit 24 to open the short (or to melt a fuse), i.e. to put the switch 42 into open position. Thus a mechanical impulse onto the piezoelectric device 33 may cause a spark ignition inside or close to the bullet's propellant charge in reservoir 32 and hence firing of the bullet 20, 30 as described above. Thereby a distance between contacts 44a, 44b of the opened switch 42 (or fuse) should be chosen large enough in order to avoid an unwanted spark at the switch 42 instead of the desired spark at the spark gap 35.

[0045] Electric power supply for the electronic control unit 21 may be provided by means of an integrated battery device 22. In order to prevent discharge during a longer inactive period, the bullet's battery circuit may be open circuited per default and be closed e.g. by means of two power-supply contacts 43a, 43b ("Battery Enable"). The power-supply contacts 43a, 43b may e.g. be located at the perimeter of the bullet's cartridge such that they are shorted as soon as the ammunition 20, 30 is loaded into the weapon 26. That is, the control circuitry 21 may be configured to be supplied with electrical power when the bullet 20, 30 is loaded into the weapon 26. In particular, the bullet 20, 30 may comprise a built-in electric power supply 22 for the control chip 21 and contact means 43a, 43b to enable the built-in power supply 22 for the control chip 21 when the bullet 20, 30 is loaded into the weapon 26. Similarly, the contact with the antenna 25 may be provided when the bullet 20, 30 is loaded by means of an antenna contact 41a, 41b (see Fig. 4b).

[0046] According to other embodiments the power-supply for the electronic control unit 21 may also be located off the bullet 20, 30. For example, a power supply may also be provided by the weapon 26 when the bullet is loaded. For this case the contact means 43a, 43b may be adapted to enable an electrical contact with an external power supply for the control circuitry 21 when the bullet 20, 30 is loaded into the weapon 26.

[0047] As has been explained before, some embodiments provide ammunition with a programming interface for receiving information indicative of a condition or a geographic region allowing the ammunition to be fired from the weapon. This condition may be the presence of a certain wireless control signal indicating a specific geographic area which corresponds e.g. to at least one specific cell of a wireless communication system. Hence, a memory of the control circuit 21 may be programmed with a certain signal or code e.g. corresponding to a cell-ID of a base station serving a cell in which a permitted shooting range is located, thus allowing firing the ammunition 20, 30 only in said permitted area and nowhere else. Preferably, the programming of the ammunition may only be performed by trusted authority. Therefore, special authorization and/or signing procedures may be employed during the programming process.

[0048] Fig. 5 illustrates a high-level flow chart of a method 50 for controlling an ignition mechanism of ammunition 20, 30 according to an embodiment.

[0049] The method 50 comprises a step 51 of receiving, at the ammunition 20, 30, a wireless radio control signal, and a step 52 of enabling and/or disabling the ignition mechanism of the ammunition in response to the received wireless radio control signal. As described above, the ignition mechanism may only be enabled when the ammunition 20, 30 is loaded into said weapon 26 according to some embodiments.

[0050] The control circuit 21 may comprise a signal processor executing a computer program having a program code for performing or supporting at least one of

the above described method-steps when the computer program is executed on said processor. Hence, embodiments may provide a computer program having a program code for performing one of the above described methods when the computer program is executed on a computer or processor. A person of skill in the art would readily recognize that steps of various above-described methods can be performed by programmed computers. Herein, some embodiments are also intended to cover program storage devices, e.g., digital data storage media, which are machine or computer readable and encode machine-executable or computer-executable programs of instructions, wherein said instructions perform some or all of the steps of said above-described methods. The program storage devices may be, e.g., digital memories, magnetic storage media such as a magnetic disks and magnetic tapes, hard drives, or optically readable digital data storage media. The embodiments are also intended to cover computers programmed to perform said steps of the above-described methods.

[0051] To summarize, embodiments propose to modify the ignition mechanism of an ammunition, such as, e.g. a bullet, a grenade, a bazooka, etc., so that ignition and hence firing the ammunition can only happen if the ammunition is armed by a radio controlled procedure. According to embodiments, the ammunition's cartridge contains no percussion cap anymore. Instead it may feature a piezoelectric ignition mechanism and a wireless controlled chip which may prime ammunition only within a permitted area, such as a shooting stand. In order to achieve this, the mobile radio or GPS infrastructure could be used, e.g. for localization and priming of the ammunition. The built-in chip affects that the ammunition is ineffectual except in the specific mobile radio cell or location, for which legal use is allowed.

[0052] The description and drawings merely illustrate the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. Furthermore, all examples recited herein are principally intended expressly to be only for pedagogical purposes to aid the reader in understanding the principles of the invention and the concepts contributed by the inventor(s) to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof.

[0053] Functional blocks denoted as "means for ..." (performing a certain function) shall be understood as functional blocks comprising circuitry that is adapted for performing a certain function, respectively. Hence, a "means for s.th." may as well be understood as a "means being adapted or suited for s.th.". A means being adapted for performing a certain function does, hence, not imply

that such means necessarily is performing said function (at a given time instant).

[0054] Functions of various elements shown in the figures, including any functional blocks may be provided through the use of dedicated hardware, as e.g. a processor, as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, network processor, application specific integrated circuit (ASIC), field programmable gate array (FPGA), read only memory (ROM) for storing software, random access memory (RAM), and nonvolatile storage. Other hardware, conventional and/or custom, may also be included.

[0055] It should be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative circuitry embodying the principles of the invention. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Claims

1. An ammunition (20; 30) for a weapon (26), the ammunition comprising:

control circuitry (21) adapted to enable and/or disable an ignition mechanism of the ammunition (20; 30) in response to a wireless radio control signal.

2. The ammunition (20; 30) according to claim 1, wherein the control circuitry (21) is adapted to extract, from the wireless radio control signal received at the ammunition's geographical location, information indicative of said geographical location, to compare the extracted information with information indicative of a geographical area where the ammunition (20; 30) is allowed to be fired off the weapon (26), and to control the ignition mechanism based on the result of the comparison.
3. The ammunition (20; 30) according to claim 2, wherein the control circuitry (21) is adapted to extract positioning data or cell identification information from the wireless radio control signal.

4. The ammunition (20; 30) according to claim 1, wherein the control circuitry (21) comprises receiving circuitry (23) adapted to receive the wireless radio control signal and enabling circuitry (24) which is coupled to the receiving circuitry (23) and adapted to generate an electrical signal which enables or disables the ignition mechanism of the ammunition (20; 30) in response to the received wireless radio control signal.
5. The ammunition (20; 30) according to claim 1, wherein a cartridge of the ammunition (20; 30) is adapted to serve as an antenna means (25) or to provide contact means for enabling a contact with an antenna (25) for receiving the wireless radio control signal.
6. The ammunition (20; 30) according to claim 5, wherein the ammunition is configured to use parts of the weapon (26) as an antenna means (25) for receiving the wireless radio control signal.
7. The ammunition (20; 30) according to claim 1, wherein the ammunition comprises a piezoelectric device (33) and a spark gap (35), wherein the piezoelectric device (33) and the spark gap (35) are electrically connected, wherein the piezoelectric device (33) is located in a position within the ammunition (20; 30) such that it can be hit by a hammer of the weapon (26) and, wherein the spark gap (35) is located in a position within the ammunition (20; 30) such that it can cause a spark ignition in response to the hit by the weapon's hammer to fire off the ammunition (20; 30).
8. The ammunition (20; 30) according to claim 7, wherein the spark gap (35) is electrically shorted by a switch (42) in closed position when the ignition mechanism is disabled and, when the ignition mechanism is enabled, the switch (42) is brought to an open position.
9. The ammunition (20; 30) according to claim 1, wherein the control circuitry (21) is configured to be supplied with electric power when the ammunition is loaded into the weapon (26).
10. The ammunition (20; 30) according to claim 9, wherein the ammunition comprises a built-in electric power supply (22) for the control circuitry (21) and contact means (43a; 43b) to enable the built-in electric power supply (22) for the control circuitry (21) when the ammunition (20; 30) is loaded into the weapon (26).
11. The ammunition (20; 30) according to claim 9, wherein the ammunition comprises contact means adapted to enable an electrical contact with an ex-

ternal power supply for the control circuitry (21) when the ammunition is loaded into the weapon.

- 12.** The ammunition (20; 30) according to claim 1, wherein the ammunition comprises a programming interface for receiving information indicative of a condition allowing the ammunition (20; 30) to be fired from the weapon (26). 5
- 13.** A weapon (26) for operating ammunition (20; 30) according to claim 1. 10
- 14.** A method (50) for controlling an ignition mechanism of an ammunition (20; 30) for a weapon (26), the method comprising: 15
- receiving (51), at the ammunition (20; 30), a wireless radio control signal; and
- enabling and/or disabling (52) the ignition mechanism of the ammunition (20; 30) in response to the received wireless radio control signal. 20
- 15.** A computer program having a program code for performing the steps of the method of claim 14, when the computer program is executed on a computer or processor. 25

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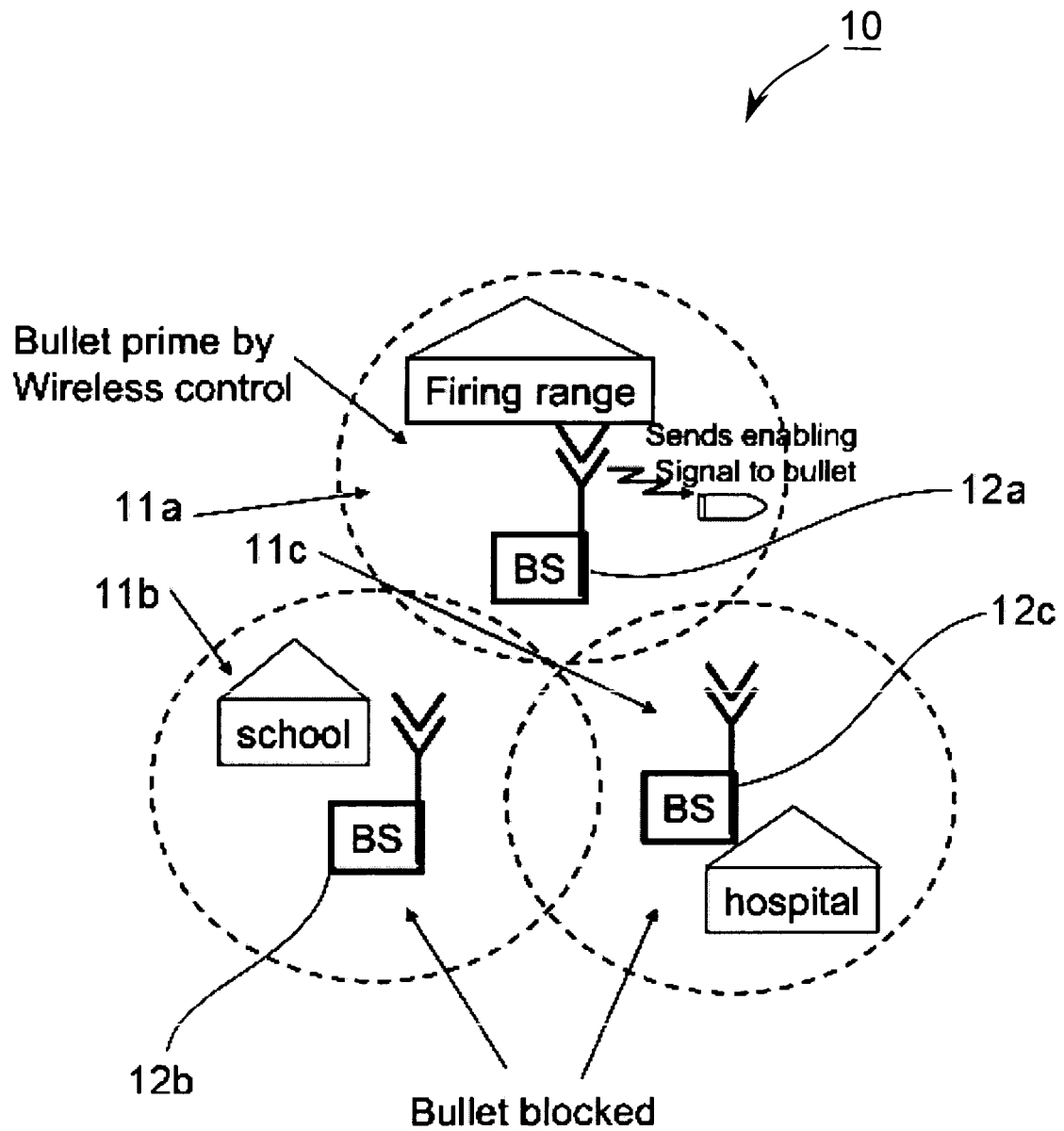


Fig. 1

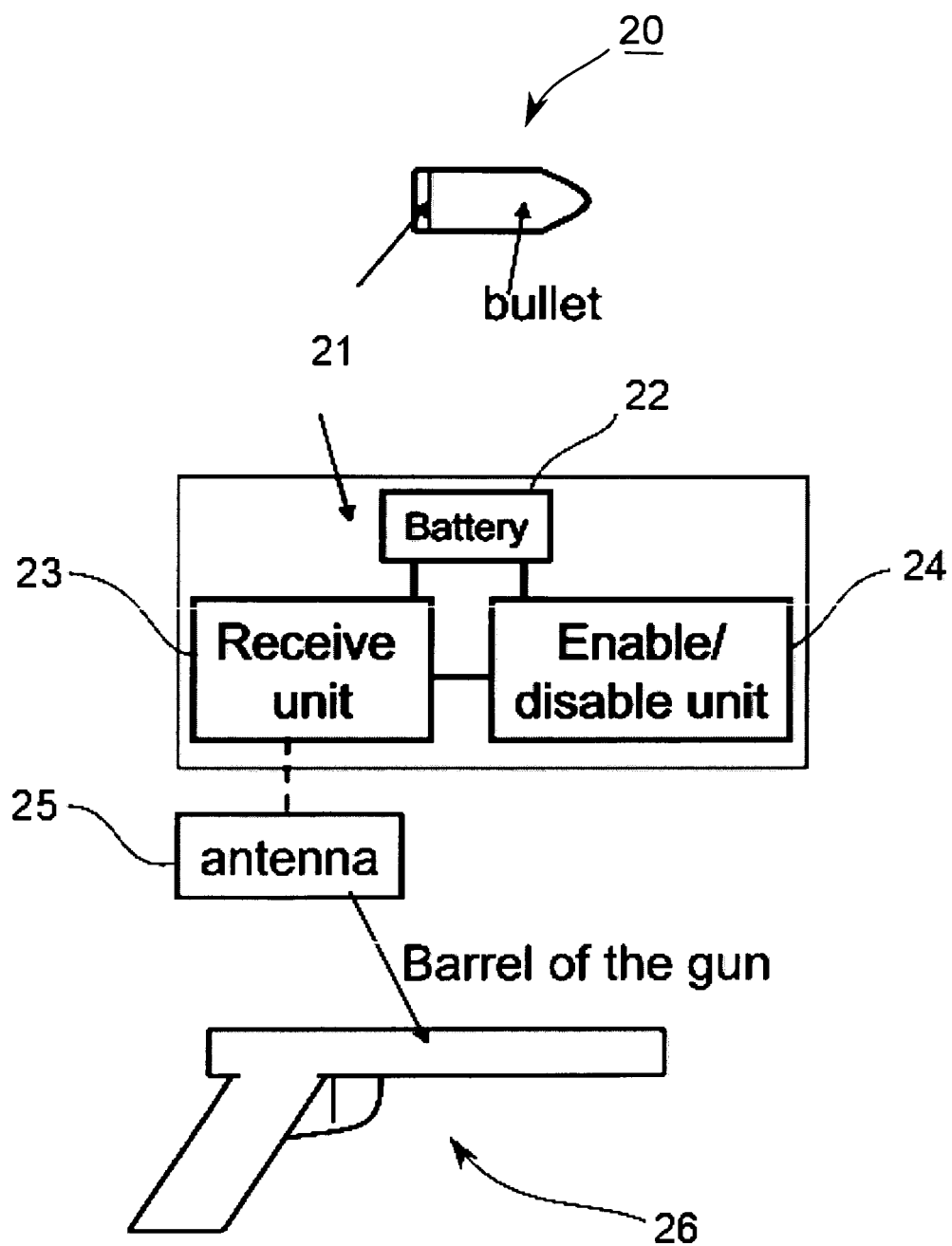


Fig. 2

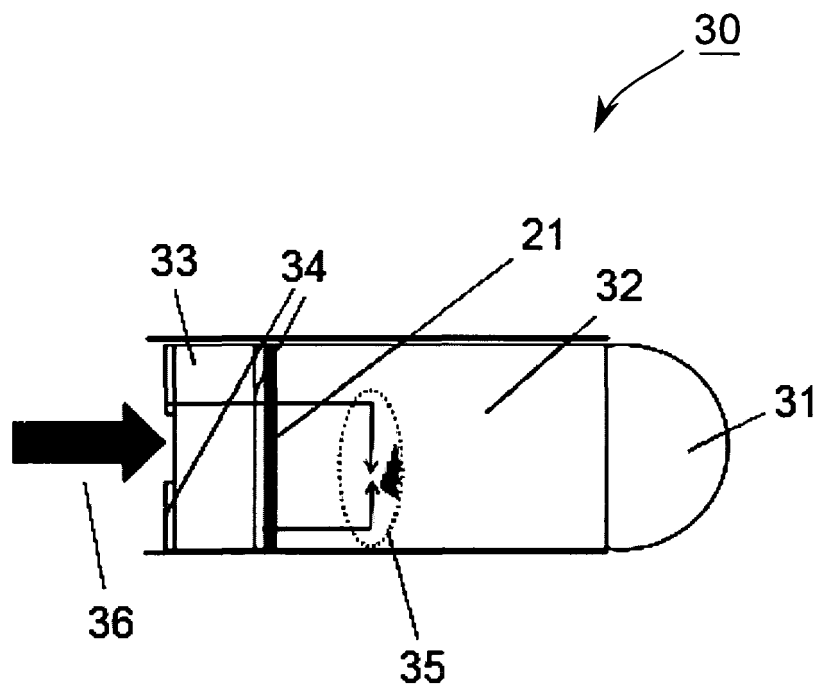


Fig. 3

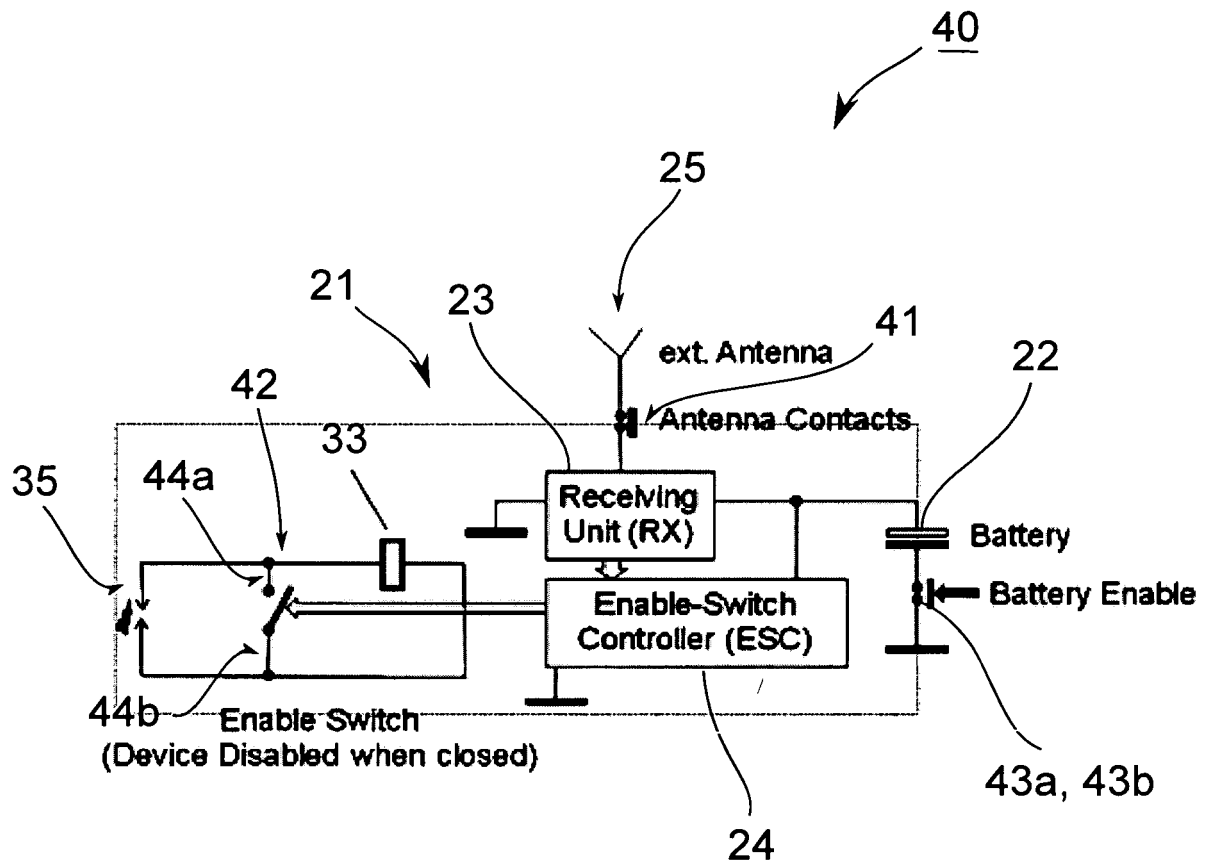


Fig. 4a

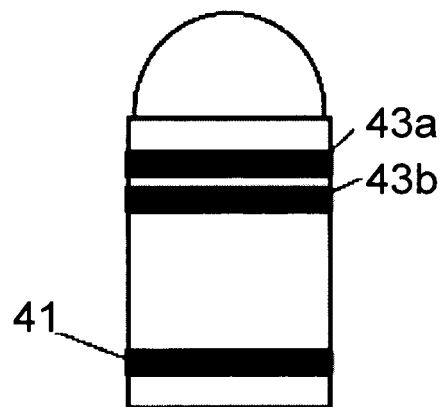


Fig. 4b

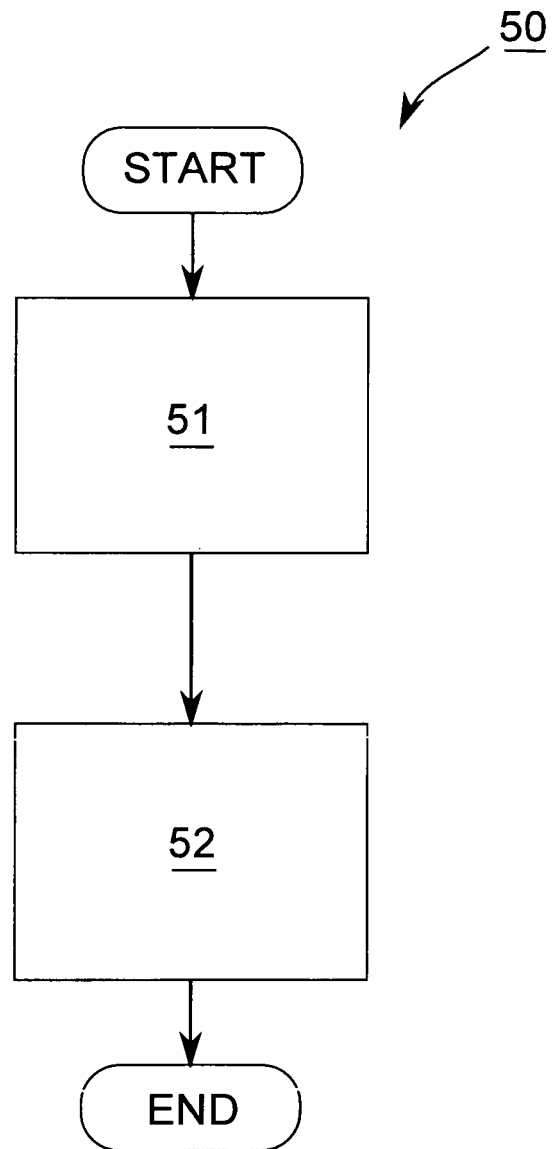


Fig. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 11 40 0030

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 October 2011	Examiner Van Leeuwen, Erik
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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