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(54) **ELECTROSHOCK WEAPON FOR IMMOBILIZING SEVERAL TARGETS**

(57) The invention relates to a multiple-charge remote-acting electroshock weapon with electrical stunning means for use primarily by law enforcement agencies and also for civilian self-defence. Field of use: Multiple-charge remote-acting electroshock weapon for law enforcement services and civilian self-defence. Technical result: The creation of an electroshock weapon for effectively immobilizing several targets simultaneously, with more rapid reloading and a corresponding increase in overall operating reliability and efficiency. The present electroshock weapon comprises a housing, a source of electrical energy, an electronic circuit for generating a high stunning voltage, several firing cartridges, several mechanical cartridge locks with a human-powered actuator for deliberately unlocking a firing cartridge from the housing of the weapon, said actuator being activated by a finger of the user holding the weapon, and an electromechanical high-voltage switch for supplying a high stunning voltage to the firing cartridges.

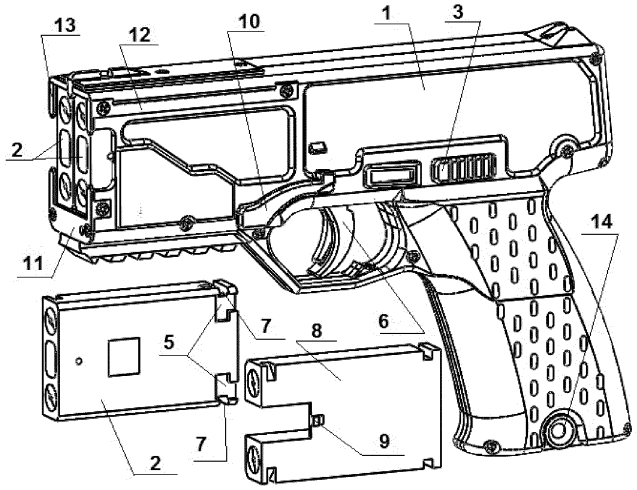

FIG. 1

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Description

Field of the invention

[0001] The invention relates to a multiple-charge remote-acting electroshock weapon (DESHO) with electrical stunning means for use primarily by law enforcement agencies and also for civilian self-defense.

State of the art

[0002] As an analog of the proposed invention, widely known in the world DESHO TASER X26 [1] produced by the world's leading company in the field of electroshock weapons Taser Int. (currently Axon Enterprise, Inc. company ("Axon") USA) was chosen, which is the most widely used DESHO model in the world. DESHO TASER X26 having the form of a pistol is designed for temporary incapacitation (immobilization, defeat, holding in a state of paralysis) of biological targets (target, offender, biotarget) by electrical current at a distance or in direct contact with the target. Striking the target at a distance is achieved using a firing cartridge that throws at the target two probes (projectiles) equipped with devices for holding them on the target (barbed needles), each of which probes is connected by means of an insulated wire (current conducting wire) to the corresponding current carrying electrode on the cartridge. When the cartridge is loaded in the DESHO, the current carrying electrodes of the cartridge are electrically (or through a gap of 0.1-0.5) connected to combat (contact) electrodes of the DESHO that entered the front end of the DESHO, to which, when the DESHO is started, a high-voltage electrical current that strikes the target is supplied from an electronic high-voltage assembly comprised in the weapon, wherein a combat high-voltage spark discharge is formed between the combat electrodes. The firing cartridges have a propellant charge of a pyrotechnic substance initiated by a high-voltage electrical current that strikes the target, which is supplied to the pyro charge when the DESHO is turned on.

[0003] The charge is initiated and depressurizes a container with compressed gas using a cutting device, with throwing the probes with the current conducting wires at the target. The cartridge is rigidly attached to the DESHO by means of a mechanical lock located on the cartridge. The immobilization of the target at a distance is achieved by closing the electrical circuit through the body of the biological target by means of the current conducting wires connecting the combat electrodes of the DESHO with the probes thrown at the target. The immobilization of the biological target by the contact method (in direct contact mode) is carried out by direct interaction of the combat electrodes of the DESHO with the body of the biological target (pressing the combat electrodes against the body), without firing a shot.

[0004] Said DESHO has the following disadvantages. To fire a second shot, for example, in the event of a miss on the target or in order to immobilize another target that has appeared, it is necessary to disconnect the fired cartridge and load a new one into the DESHO. Locking the cartridge in the DESHO with a mechanical lock that can only be opened using both hands of the user requires from poorly trained user a few seconds to reload the DESHO with a new cartridge and fire again. During this time, the offender may attack the law enforcement officer, try to run away or use available weapon. In order to use the DESHO in direct contact mode, it is necessary to disconnect the cartridge first, because when trying to use the DESHO in direct contact mode with the cartridge attached, the cartridge is always fired, that is, a point-blank shot is made with mechanical injury to the target. This feature is an obstacle to the rapid use of the DESHO with the cartridge loaded therein in situations where immobilization of the target at close range is needed but a shot from an extremely short distance is undesirable, since it can cause serious mechanical injury to the target. The disadvantage of the analog is also the impossibility of displaying of a combat electrical spark discharge to the aggressor without a shot (for psychological impact aiming at reduction of aggressiveness, before use in direct contact or remotely), since supplying a high stunning voltage potential to the combat electrodes of the DESHO, to which the current carrying electrodes of the cartridge are always ajoined, is followed by the immediate initiation of the pyro charge of the cartridge with the production of a shot. At the same time, it is well known that when a user threatens to use electroshock weapon with the displaying of a combat electrical spark discharge accompanied by a characteristic noise and the spark discharge glow, the offender stops aggressive actions in many cases, realizing that he will have to deal with electricity and, accordingly, with subsequent pain. It is well known that aggressive animals (for example, dogs or wild animals) almost always stop aggression when a person demonstrates electrical discharges. Therefore, the DESHO analog can be used in direct contact mode (or for displaying of a combat electrical discharge) only with the firing cartridge disconnected from the weapon, which excludes rapid remote use of the weapon in case of need.

[0005] As a prototype of the proposed invention, widely known in the world double-charge DESHO Taser X2 was chosen [2] (from Axon company), made in the form of a pistol and consisting of a housing in which an electronic part generating a high stunning voltage is comprised, consisting of an inverter that converts low voltage (6-12 V) of a battery or accumulator into an increased voltage of 2-3 kV and two high-voltage assemblies that convert the voltage of 2-3 kV into an output high-voltage electrical current of 50 kV that strikes the target. Each high-voltage assembly consists of a set of capacitors, diodes, gas dischargers and a high-voltage pulse transformer. DESHO Taser X2 is loaded with two firing cartridges through which the high stunning voltage generated by the high-voltage assemblies and supplied to the combat electrodes of the DESHO is transmitted to the target through

the current conducting wires thrown from the cartridges and having devices for holding them on the target. At the same time, Axon company emphasized that a law enforcement officer, when firing from the DESHO, can immobilize two targets in succession (for example, two attacking offenders) with the current conducting wires thrown from the DESHO and keep both targets immobilized with the stunning electrical current at the same time. The new circuitry solution of Axon company is called the "Rotational-Pulse-Drive" system [3; 4] and characterized by the fact that the stunning electrical current voltage is transmitted to two targets from each of the high-voltage assemblies that do not work simultaneously, but sequentially, that is, each target receives bursts of stunning pulses from one or another high-voltage assembly operating alternately in series one after another, with sequences of action repeated (i. e. looped). Simultaneous operation of two high-voltage assemblies is not provided due to the impossibility to provide the supply of electrical power necessary for effective physiological impact to both targets from each high-voltage assembly in the dimensions of the DESHO having the form of a pistol. Due to the need in use of two high-voltage assemblies of known dimensions in any mode of operation (both one target and two targets immobilization), it is impossible to supply to one or two targets the full power generated by the inverter and the high-voltage assembly with the current output capabilities of modern power supplies (lithium batteries or accumulators) with the given overall dimensions of the weapon having a single firing cartridge (as in the DESHO TASER X26) and, accordingly, with the current output capabilities of modern power supplies (lithium batteries or accumulators). Therefore, in terms of the physiological effectiveness of the impact, which is determined primarily by the output electrical power of the DESHO, the prototype is significantly inferior to the analog considered above, which can supply the full power achieved by using a single high-voltage assembly with given dimensions of the weapon to a single target. Based on the results of the Taser X2 use, it was found that the "Rotational-Pulse-Drive" system can satisfactorily immobilize two targets simultaneously only under ideal but unachievable in practice conditions (with a large current loop of probes hit the target, with a biological target sensitive to electrical impact, without narcotic or alcoholic intoxication, and with a small own weight_of the biological target). Therefore, to date, there is not any video frame of immobilization of two targets at the same time, with a huge number of video frames in the network showing real use against offenders of the DESHO Taser models from Axon company during police operations.

[0006] Another disadvantage of the "Rotational-Pulse-Drive" system is that for the operation of each high-voltage assembly, the inverter of the prototype should supply a voltage of 2-3 kV to each of them in turn. The voltage supply from the inverter to the high-voltage assemblies in series is carried out by two solid-state switch units (high-voltage IGBT transistors). In fact, the DESHO Taser X2 has two generators of high stunning voltage that operate independently of each other, with a single high-voltage inverter.

[0007] The electronic components of the high-voltage assemblies are very expensive (high-voltage gas dischargers, capacitors, diodes), most particularly high-voltage pulse transformers, which should be made ultra-small with sufficient output power, that taking into account the voltages of the stunning electrical current necessary for weapons with electrical stunning means (40-80 kV), is the most difficult technical task in the manufacturing of such transformers in terms of providing reliable internal insulation of the winding to prevent electrical breakdowns between turns of the secondary winding, and also inter-winding breakdowns. A high-voltage pulse micro transformer providing the spark-over (air discharge) distance of up to 40 mm necessary for reliable striking a target with an electrical current is the most expensive part of any electroshock weapon. Furthermore, for producing the DESHO with the "Rotational-Pulse-Drive" system, it is necessary to have already two identical sets of expensive electronic components, since switching in said DESHO is carried out not based on the high-voltage of the stunning electrical current, but based on a voltage of 2-3 kV maximum, which entails the use of several high-voltage assemblies.

[0008] The high-voltage gas dischargers, capacitors, diodes, IGBT transistors of the size required for the production of modern electroshock weapons are not produced in Russia. Also in Russia there are no technologies for the production of high-voltage pulse microtransformers of a size available in the USA.

[0009] Furthermore, Axon company produced also the version DESHO Taser X3 [2] being loaded with three firing cartridges and having the "Rotational-Pulse-Drive" system. The principle of striking of three targets simultaneously does not differ from that described above and is implemented by using already three high-voltage assemblies, which further increases the cost of the DESHO, reduces the effectiveness of each target striking and, in addition, increases dimensions of the DESHO to unacceptable for comfortable carrying by law enforcement officers in a holster on the body both due to the increased size because of presence of the additional high-voltage assemblies and due to increased thickness with an increase in the number of firing cartridges more than two. At present, although the production of the Taser X3 version has been discontinued, said DESHO, which are already available to the US police, are being used. Based on many years of experience in the use of multi-charge DESHO by US law enforcement agencies, experts from law enforcement agencies and the US Department of Justice believe that two-charge DESHO versions are sufficient for police practice. DESHO Taser X3 can also be considered as a prototype of the proposed invention. At the time, the police and other law enforcement agencies in Russia do not have multi-charge DESHO versions, and even more so DESHO versions with the function of

immobilizing several targets with electrical current at the same time, like the Taser X2 DESHO models.

[0010] The patents of Axon company, even when replacing American electronic components with those purchased by the Russian Federation from the People's Republic of China, do not allow copying the considered scheme into Russian DESHO, with no prospect of export to developed and developing countries of the world.

[0011] At the same time, the tenders for the supply of DESHO to law enforcement agencies held all over the world (except for internal tenders in Russia) consider the function of immobilizing several targets at the same time to be necessary due to the requirements for the functionality of modern DESHO, already established by Axon company, the world's leader in the DESHO development and production. For example, for many years, the leader of domestic production and development of DESHO, OOO MART-GRUPP company, for many years of trying to participate in tenders for the foreign police market does not win a single tender if Axon presents its products in the same tender.

[0012] The disadvantage of the prototype also lies in the fact that the firing cartridges are attached to the weapon by means of a mechanical lock with no automatic separation from the weapon after the shot. On the line of the next shot, there may be current conducting wires from the previous shot already stretched towards the target, that will inevitably change the trajectory of the probes motion in the new shot that will not hit the target even with correct aiming. The disadvantage of the prototype also lies in the fact that for reloading the weapon, the fired cartridges have to be removed from the cavity of the DESHO (the front hollow cavity in the housing of the DESHO for installing firing cartridges) using both hands of the user to open the mechanical lock. It is impossible to remove the fired cartridge after a shot automatically or using one hand with which the user is holding the weapon. Therefore in order to reload the weapon when it is necessary to continue firing quickly, the user loses time to remove the fired cartridge using both hands.

[0013] Due to the need to use both hands of the user to remove fired cartridges, the time for the second shot is increased, whereby reloading with a new cartridge instead of the fired one is impossible without the use of both hands of the user. To reload the prototype weapon with the cartridges, the user must release the handle of the weapon intercepting the weapon by the housing, press the button of the mechanical lock for the cartridges in the housing, which is located practically on the front end of the weapon, with the finger of said hand, grab the cartridge with his second hand and remove it from the cavity of the weapon. Again, loading with a new cartridge is done using both hands of the user, wherein the shooting hand still intercepts the weapon and the user must intercept the weapon handle again for subsequent shots. That is, the prototype weapon is unloaded and loaded slowly and inconvenient.

[0014] As the prototype of the firing cartridge for the proposed invention. a cartridge for a multi-charge DESHO according to the patent [5] was chosen. In this case, it is necessary to indicate the shortcomings of the weapon according to that patent, which uses only cartridges of this type. The cartridges have a propellant charge of a pyrotechnic substance being initiated from a low voltage electrical current supplied via cartridge start contacts to a charge igniter when a trigger (trigger element) is pressed, to throw current conducting wire at the target. After the first shot and before the second shot, the fired cartridge with the current conducting wires is automatically extracted from the housing of the DESHO by a spring compressed when loading (installing) the cartridge into the housing of the pistol immediately after the trigger is released. After the second shot and before the third shot, the second fired cartridge with the current conducting wires is also automatically extracted from the housing of the DESHO immediately after the trigger is released. The third fired cartridge with the current conducting wires is also automatically extracted from the housing of the DESHO after the trigger is released. That is, the extraction of fired cartridges with the current conducting wires being stretched to the target for its immobilization is stopped immediately after the trigger is released by the user. Therefore, the main disadvantage of the DESHO using cartridges according to the patent [5] is that it does not have the function of arrest (immobilization with seizure) of the offender, which function is already considered standard in the DESHO models from Axon company. The arrest function as implemented in all DESHO models from Axon company, in which the firing cartridges after firing, hitting the target, and releasing the trigger by the user of the DESHO are not automatically extracted from the DESHO, but are removed from the DESHO only manually. In the DESHO from Axon company, when the trigger is released after a shot and hitting the target by the current conducting wires, fired cartridges are not automatically removed from the weapon and still connect the DESHO to the target with the current conducting wires until the fired cartridge is manually removed, and the stunning current voltage is still supplied to the target even after releasing the trigger, during the timer operation (up to 5-15-30 s) depending on the specific DESHO version or purpose (police or civilian). Therefore, the law enforcement officer hits the target, releases the trigger, puts the DESHO on the ground, and handcuffs the immobilized offender while the timer delivers the stunning electrical current to the target keeping the target immobilized. In this way, the main number of arrests (seizures) of offenders involving the use of DESHO has been made in the United States for more than 20 years. In Russia, the DESHO with the arrest function has not yet entered service in security services. In the DESHO according to the patent [5], the cartridges are automatically extracted after releasing the trigger, so the arrest of the offender after release of the weapon from user's hands and the release of both hands for seizure is impossible. In addition, the disadvantage

of such prototype DESHO according to the patent [5] lies in the fact that the extraction of fired cartridges with the current conducting wires in the process of firing can only be done after the gas engine of the cartridge has been activated. In case of its failure, for example, if the piston of the gas engine does not extend after the shot (due to seizing, sticking or blocking of gas engine parts resulted from the backwardness of domestic technologies in manufacturing precision, freezing (if moisture gets into gas engine parts in the cold season)) or is not fixed in the extended position after the shot, due to reasons similar to those described above or inaccuracies during the manufacturing of the piston or elements fixing it in the extended position, the cartridge will not be extracted. Furthermore, the failure of extraction after the first shot, for example, of the first firing cartridge, makes the defeat of the second target by the second (and subsequent) shot ineffective, since the stunning electrical current voltage that should be supplied to the second (and then subsequent) target after firing the second (and subsequent) cartridge at the target is bypassed by the first target, which was hit with the current conducting wires of the first cartridge being fired but not extracted. That is, in case of failure to extract one cartridge hit the target with current conducting wires, the next shot at the next target will be "short circuited" (bypassed), wherein the stunning electrical current voltage that should be transmitted to the next target will be bypassed by the target hit first. Therefore, no stunning effect on the second and subsequent targets occurs. But even if the current conducting wires of the first shot do not hit the target, and the device for automatic extraction of the first fired cartridge fails, the second shot fired at the target will almost always be ineffective in terms of striking the target, since the current conducting wires from the first shot inevitably cross when falling to the ground, both in the case of a miss with both current conducting wires and a miss on target with one current conducting wire. In Russia, there are no technologies for the production of analogs of the high-voltage current conducting wire DuPont™ Tefzel® ETFE [2] with an electrical insulation strength of 11-16 kV alternating current (for one core) used in all versions of the DESHO from Axon company. The current conducting wires in all versions of Russian DESHO without exception are a usual mounting wire of the type MS, MSE or MGTF with sintered or twisted without sintering winding made of fluoroplastic-4D and designed for a rated voltage of 250-500 V alternating current (for a common core of a stranded wire). Therefore, in the case of crossing of the current conducting wires of all DESHO vesions produced and used in Russia, taking into account the high stunning voltage in the DESHO, an inevitable electrical breakdown of the insulation of the current conducting wires occurs in the DESHO forming corresponding short circuit of the current conducting wires with bypassing of the electrical current designated for striking the target. For the second shot at the target unaffected by the first shot, it is necessary to quickly extract the fired cartridge with the current conducting wires crossed after the first shot.

[0015] In this case, the extraction of the cartridge with the failed gas engine from the housing of the DESHO according to the patent [5] can be performed only with two hands of the user, wherein user's hand holding the weapon must intercept it by the housing. The user must hold the weapon with one hand and press a head (pressure piece) of a mechanical spring lock of the cartridge having the gas engine failed with his other hand to extract it. With one hand of the user holding the weapon during firing, said manipulation of extraction of the cartridge with the failed gas engine cannot be performed due to the location of the heads of the mechanical spring locks behind a trigger guard of the housing of the weapon and out of reach of the fingers of the hand holding the weapon and at the same time due to the need to press the heads perpendicular to the longitudinal axis of the weapon from below to extract the cartridge. Due to the need for the user to use both hands in the event of the gas engine failure, the time period for reloading with a new cartridge instead of the fired one increases, since the user is forced to use his second hand to extract the fired cartridge first and only then to install a new cartridge into the weapon. Given more than 25 years of the widest practice of using DESHO by the US police, it is known that in many cases of stopping offender's aggression, law enforcement officer uses his second hand to hold handcuffs, a flashlight or a firearm and therefore simply physically cannot quickly use it to extract the fired cartridge for subsequent reloading with a new one.

[0016] As follows from the practice of using multiply-charge DESHO by the US police, in multiple cases a second shot is fired at the same target as the first one. It is done if the first shot for some reason did not hit the target (missing on the target with one or two current conducting wires, current conducting wire breakage, penetration of probes into thick folds of clothing, etc.). That is, the second shot is used mainly as a reserve or spare, although it can be used to immobilize the second offender after the first one (Taser X2) with simultaneous immobilization of both targets at the same time. For the reliable striking an aggressive and armed target, in order to exclude the possibility of missing on the target with one cartridge and the loss of time for the law enforcement officer to realize that the target was not hit (with the corresponding possibility for the offender to use weapon), quick shots at the target are used, with two cartridges one after the other (duplicate shot), as well as in the usual practice of using firearms in US law enforcement agencies (striking the same target with several quick successive shots at once). In DESHO according to the patent [5], double striking a target with quick-following shots is impossible, since when the trigger is released after the shots, the cartridges with the current conducting wires being stretched to the target are automatically extracted from the weapon and the electrical impact on the target is abandoned.

Disclosure of the invention

[0017] The purpose of the invention is to create a DESHO for effective immobilizing several targets at the same time, with the possibility of making an arrest while eliminating the likelihood of bypassing the DESHO, with the possibility of finish loading and accelerated reloading the weapon, with a correspondingly increased reliability and efficiency, with the possibility of using low-cost firing cartridges, and with the possibility of producing the DESHO in Russia and exporting abroad. The proposed weapon in terms of the set of properties obtained and flexibility of use surpasses the best DESHO samples (analog and prototype) of the "Axon Enterprise, Inc." company, which is the world's leader in the DESHO development.

[0018] This purpose is achieved in that an electroshock weapon comprises a housing, a power supply, an electronic circuit for setting the sequence of the firing cartridges initiation and generating a high-voltage electrical current that strikes the target, which circuit includes a generation timer, a trigger element, at least two firing cartridges with throwable current conducting wire, cartridge locks for locking in the housing, spring ejectors of the firing cartridges, additional elements for deliberately locking firing cartridges in the housing, wherein the devices for locking the firing cartridges in the housing have human-powered actuators for deliberately unlocking the firing cartridges from the housing of the weapon, said actuators being actuated by the finger of the user's hand holding the weapon, the timer has a control element for setting the time of generation of the high-voltage electrical current that strikes the target independently of the position of the trigger element after the shot, an electromechanical high-voltage switch unit is located in the housing for alternately intermittent or continuous supply of the high stunning voltage to the firing cartridges having a switch of operation of the electromechanical high-voltage switch unit to the continuous supply of high stunning voltage to one or another cartridge.

[0019] An additional feature of the proposed weapon is that it has a manual mechanical contactor of the outputs of the high-voltage switch unit for supplying high stunning voltage to the firing cartridges.

[0020] An additional feature of the claimed weapon is that the timer control element for setting the time of generation of the high-voltage electrical current that strikes the target is mechanically or electrically connected to additional devices for deliberately locking firing cartridges in the housing.

[0021] An additional feature of the claimed weapon is that the electromechanical high-voltage switch unit uses a stepper motor or a servo motor as a drive.

[0022] An additional feature of the claimed weapon is that the electromechanical high-voltage switch unit uses a collector or brushless electric motor as a drive.

[0023] An additional feature of the claimed weapon is that the electromechanical high-voltage switch unit has at least one position sensor for the movable contacts.

[0024] An additional feature of the claimed weapon is that the electromechanical high-voltage switch unit uses at least one long-stroke solenoid with a movable system of connected permanent magnets as a drive.

[0025] An additional feature of the claimed weapon is that it has a switch to disable the operation of the electromechanical high-voltage switch unit.

[0026] An additional feature of the claimed weapon is that the electronic circuit for setting the sequence of the firing cartridges initiation has a switch selector of the sequence of the firing cartridges initiation.

Brief description of the drawings

[0027]

FIG. 1. General view of the DESHO and firing cartridges (with automatic unlocking from the housing when fired and a simplified design) from the left.
FIG. 2. General view of the DESHO and firing cartridges (with automatic unlocking from the housing when fired and a simplified design) from the right.
FIG. 3. View of the DESHO with the half of the housing removed and a view of the section of the DESHO from above.
FIG. 4. Section of the DESHO in two different planes.
FIG. 5. DESHO with removed half of the housing, the pressure piece of the locks for deliberately locking cartridges and a pusher-type drive.
FIG. 6. Design of the firing cartridge with automatic unlocking.
FIG. 7. Design of the firing cartridge of a simplified design.
FIG. 8. Block diagram of the high-voltage switch unit of the DESHO with 2 firing cartridges.
FIG. 9. Block diagram of the high-voltage switch unit of the DESHO with 3 firing cartridges.
FIG. 10. DESHO with the high-voltage switch unit of the solenoid drive and a rotary actuator of the firing cartridge mechanical locks, a general view and a view with the half of the housing removed.
FIG. 11. DESHO with the solenoid drive switch unit sections from above to different depths.
FIG. 12. Block diagram of the high-voltage switch unit with a solenoid drive.
FIG. 13. Experimental sample of the DESHO with half of the housing removed.
FIG. 14. High-voltage switch units with a solenoid drive and with an electric motor drive, top view.
FIG. 15. High-voltage switch units with a solenoid drive and with an electric motor drive, side view.

Implementation of the invention

[0028] FIG. 1 and FIG. 2. DESHO consists of a housing 1 assembled from two symmetrical halves, in the cavity (pocket) of the housing there are firing cartridges 2 fixed

in the housing 1 when loading. Outside the housing, there are actuators 3 on both sides for extracting cartridges from housing 1 when the weapon is unloaded for storage or reloaded with new cartridges to replace the fired ones. In FIG. 1, DESHO is loaded with cartridges 2 providing automatic unlocking from the housing when fired. As an example, both a cartridge with automatic unlocking and a cartridge of a simplified design (the cartridge of reduced cost, see below) are presented below.

[0029] The firing cartridge 2 (hereinafter referred to as type 2) with automatic pyrotechnic unlocking from the housing when fired does not fundamentally differ from firing cartridges according to the patent [5] but has a gas engine which, unlike the cartridges according to the patent [5], does not push a protrusion out of the cartridge when fired, but pulls a movable protrusion 4 on the cartridge 2 inside the cartridge case flush with the generatrix of the surface of the cartridge case. On the cartridge case 2, recesses 5 for locking the cartridge in the housing 1 by the piece of a trigger mechanism and recesses 7 of deliberately locking in the housing 1 are made. The firing cartridge 8 (hereinafter referred to as type 8) of reduced cost (simplified design) does not have a gas engine but also has a protrusion 9 made integral with the case of the cartridge.

[0030] The firing cartridge 2 providing automatic pyrotechnic unlocking from the housing when fired does not fundamentally differ from the firing cartridges according to the patent [5], but it has a gas engine which, unlike the cartridges according to the patent [5], does not extend the protrusion from the cartridge when fired as in the patent [5], but pulls a movable protrusion 4 on the cartridge 2 into the cartridge case flush with the generatrix of the cartridge case. The internal design of the cartridges is described with reference to FIG. 6 and FIG. 7.

[0031] A trigger 6 is designed to start the electronic circuit of the DESHO that generates high stunning voltage pulses, initiates shots of firing cartridges 2 or 8, locks them in housing 1 at the time of firing and the time period during which the target is stunned by the electrical current, and also unlocks the cartridges from the housing 1 after the shot. On each side of the housing, there are pressure pieces 10 of the locks for deliberately locking of the cartridges in the housing 1.

[0032] At the front end of the housing 1, there is a common combat electrode 11 and combat electrodes 12 and 13. Between electrode 11 and electrode 12 and between electrode 11 and electrode 13 there are so-called "combat (or working) spark gaps" in which "combat (or working) spark electrical discharge" is produced by the high-voltage assembly of the DESHO both in the case of the contact use of the DESHO and in the case of a remote shot with a firing cartridge.

[0033] In the handle of the DESHO, there is a power source in the form of an electrical battery (or accumulator) 14 of a removable or permanent type, at the end of the housing 1 there is a safety trigger 15 and buttons (switches) 16 for setting modes of the DESHO operation, and also a display indicator 17 of the operation of the weapon electronic systems can be located thereon. To implement the following embodiments of the claimed DESHO operation, there may be more than 2 buttons 16 (shown in the figure), however, various necessary modes of operation can be implemented by programming using a different number and duration of pressing only two buttons, as it is customary when programming various electronic devices with touch or button programming widely used today, with a small number of buttons or touch points on the programmable electronic circuit.

[0034] FIG. 3. Firing cartridge of the type 2 or type 8 is locked in the housing 1 by the protrusion 4 or 9 on the cartridge case and a movable spring-loaded mechanical lock 18 (placed in each half of the housing 1) moving vertically down relative to the housing of the weapon when interacting with the spring-loaded pusher-type drive 19 (which is also located in each half of the housing 1) and connected to the actuator 3. When the user presses the actuator 3 with his finger and the pusher-type drive 19 is accordingly moved forward relative to the housing of the weapon, it interacts with the mechanical lock 18, moving it down relative to the housing of the weapon, at the same time the protrusion 4 or 9 of the cartridge is released from the mechanical lock 18 and the cartridge is pushed out (extracted) from the housing of the weapon by one of two spring-loaded ejectors (extractors) located in the housing 1, the ejecting springs of which are compressed by the cartridge cases when the cartridges are loaded into the weapon cavity for installing cartridges. Therefore, when pressing the actuators 3 with the thumb or forefinger of the hand holding the weapon, it is possible to deliberately unload the weapon from the cartridges loaded therein when it is necessary to unload the weapon (for example, for storage) or extract the fired cartridge deliberately and quickly after the shot. FIG. 3 shows firing cartridge of the type 2, wherein extraction of firing cartridge of the type 8 is carried out in the same way.

[0035] The housing 1 comprises an electronic circuit that generates a high-voltage electrical current that strikes the target and includes as part thereof a control element with a micro controller for controlling circuit elements, including a high-voltage switch unit (see below), an inverter 20 (wherein the control element including a micro controller may also be located in the common case with the inverter), a high-voltage assembly 21 (including a set of capacitors, gas dischargers, a diode, a high-voltage pulse transformer), an electronic circuit for setting the sequence of the firing cartridges initiation, a timer for controlling the time of generation of the voltage that strikes the target, and a display indicator 17 of the operation of the electronic circuit, accumulator battery (and other information related to operation of the weapon), if necessary, and an accumulator 14 for the power supply of the DESHO.

[0036] The mechanical lock 18 can be driven both from the actuator 3 (button) using longitudinal movement relative to the length of the weapon or from the actuator

using transverse movement or rotary movement around a certain axis. Longitudinal, transverse or rotary movement of the actuator relative to the housing of the weapon is determined by the designer. Rotary movement and transverse movement of the actuator can be transmitted to the mechanical lock 18 by simple devices in the form of levers, inclined planes, rack and pinion gears or their combinations (for example, see FIG. 10) that are widely used and understandable to any person skilled in mechanical engineering. In the housing 1, there is also an electromechanical high-voltage switch unit 22 (having its base numbered) which includes an electric drive with rotation 23 (an electric motor without a transmission or with a gear transmission, for example, a servo motor (standard analog or digital steering machine of micro or nano class aircraft models), non-conductive tubular guides 24, a neodymium magnet 25, and a steel helical extension spring 26. The lower view of FIG. 3 shows a section of the DESHO from above with the non-conductive tubular guides 24, neodymium magnet 25, helical extension spring 26, shaft 27 of the electric drive 23, movable contacts 28 and 29 (representing the ends of the helical extension spring 26), segments 30 and 31 of a high-voltage cable connecting the fixed contacts 32 and 33 with electrodes 12 and 13, the brush contact 34 of the first output 35 of the high-voltage assembly 21, a non-conductive tubular case 36 of the protective spark gap, discharge electrodes 37 of the protective spark gap, and the second output 38 of the high-voltage assembly 21.

[0037] FIG. 4. When pressing the trigger 6 to fire a shot, it acts on the member 39 of the trigger mechanism with its front protrusion, which protrusion enters the recess 5 for the cartridge locking with its front tooth. At the final stroke of the trigger 6, it turns on the clock button 40 with its rear protrusion, which button starts the electronic circuit that generates a high-voltage electrical current striking the target and a low voltage electrical current initiating the propellant charge of the pyrotechnic substance of the cartridge with throwing the current conducting wires at the target, and also turns on the high-voltage switch unit 22 to the mode of operation previously set using the buttons 16. At the moment of firing, the gas engine of the cartridge moves the member 41 of the cartridge, which member has a protrusion 4 on its reverse side, inside the cartridge, so that the protrusion 4 disengages from the spring-loaded mechanical lock 18 and is kept from being extracted from the housing of the weapon by the spring-loaded ejector 42 only with the tooth of the member 39 entered the recess 5 for the cartridge locking. After hitting the target, the user releases the trigger 6, the tooth of the member 39 comes out of the recess 5 and the fired cartridge is unlocked from the housing 1 with the extraction of the cartridge having the current conducting wires thrown at the target from the housing 1 by the ejector 42, by means of its spring 43 compressed when loading the cartridge into the weapon. In the figure, contacts 44 for low voltage initiation of the pyrotechnic charge of the cartridge are also shown.

[0038] FIG. 5. In the figure, the pressure piece 10 and the pusher-type drive 19 are removed from the assembly of the DESHO for purposes of better visibility. If it is necessary to immobilize two offenders or quickly produce two shots following each other (double shot) to increase the reliability of striking or arresting single armed offender, taking into account the probability of the possible failure of immobilization due to the possibility of a break in the current conducting wire or non-fixation of the current conducting wire on the target after the first shot, the law enforcement officer using the DESHO presses the pressure pieces 10 of the locks before shooting with the index finger of the hand holding the weapon, moving them up relative to the housing of the weapon for deliberately locking of cartridges in the housing 1. Crossbars 45 of the locks 46 (connected to the pressure piece 10) enter the recesses 7 of the cartridge for deliberately locking it in the housing 1. In this case, even when the protrusion 4 is unlocked from the mechanical lock 18 (as shown in FIG. 5) (the mechanical lock 18 is lowered, the protrusion 4 of the cartridge is drawn in after the shot by the gas engine) and the trigger 6 is released, the cartridge 2 remains in the weapon, that is, the fired cartridge is not automatically extracted.

[0039] This allows, if the user moves two pressure pieces 10 up before firing, to immobilize two targets simultaneously with the current conducting wires from two cartridges (arrest mode) or to immobilize single armed target with the current conducting wires from two cartridges, for the reliability of striking the target with a duplicate shot.

[0040] FIG. 6. A power case 47 of the cartridge of the type 2, a front plug 48, a member 41 with a protrusion 4, a piston of the gas engine with a fork 49, gas channels 50, a channel plug 51, an electrically initiated pyrotechnic charge 52, throwable probes 53 with current conducting wire, a window 54 for the movement of the member 41 comprising the protrusion 4. When the electrical current voltage is applied to the pyrotechnic charge 52, the charge is initiated and the combustion gases generated by the charge pass through the channels 50 into barrel channels of the cartridge, with throwing the probes 53 having the current conducting wire at the target. At the same time, the combustion gases of the charge act on the piston with the fork 49 having bevels, which by means of interacting with the reciprocal bevels of the member 41 lower it in the window 54 so that the protrusion 4 of the member 41 being protruding above the generatrix of the case 47 before the shot falls into a position flush with the generatrix of the case 47 surface. After this, the cartridge is unlocked from the mechanical lock 18 and, accordingly, from the housing 1 of the weapon.

[0041] FIG. 7. A power case 55 of the cartridge of the type 8, gas channels 56, slotted plugs 57 of the barrel channels (similar to the cartridge of the type 2), an electrically initiated pyrotechnic charge 52, throwable probes 53 with laying of current conducting wire therein (laying is not shown on the section of the probes), a protrusion

9. After the electrical current voltage is applied to the pyrotechnic charge 52, the charge is initiated and the combustion gases generated by the charge pass through the channels 56 into the barrel channels of the cartridge with throwing the probes 53 having the current conducting wire at the target.

[0042] FIG. 8. High-voltage switch unit movable contacts 28 and 29 moving in the non-conductive tubular guides 24 are attached to the ends of a steel helical extension spring 26 (which may be coated with copper or silver) of an envelope line of a ring or disc neodymium magnet 25 coated with nickel to which the bending part of the spring 26 is attracted by magnetic force. The magnet 25 can be rotated by an electric drive 23 in turn controlled by the element 58 of the electronic circuit of the DESHO. The control element 58 may be a part of the inverter 20. A brush contact 34 adjoins the magnet 25, and its brush can either adjoin the magnet for direct galvanic contact or be separated from it with a small gap (the order of a fractions of a millimeter). The brush contact 34 is connected by a high-voltage cable to the first output 35 of the high-voltage assembly 21 generating a pulsed or alternating voltage of 40-80 kV, and the second output 38 of the high-voltage assembly 21 is connected to a common combat electrode 11 of the DESHO, which is also the common electrode of the firing cartridges. A protective spark gap with discharge electrodes 37 is connected electrically parallel to the high-voltage outputs 35 and 38 of the generator of the assembly 21.

[0043] The high-voltage switch unit operates as follows.

[0044] When the DESHO is operating (in direct contact or remote action mode), the high-voltage assembly 21, powered by the control element 58, which in turn is powered by an electrical battery or accumulator 14 and comprises an inverter 20, generates a high stunning voltage, which is supplied to the brush contact 34 through its first output 35 and to the common combat electrode 11 through the second output 38. Flexible spring 26 being attracted to the alternating-sign rotated magnet 25, which is driven by the electric drive 23 controlled by the element 58 according to the rotation algorithm with a certain frequency of change of the direction of rotation, moves in coordination with the rotation of the magnet 25 and connects alternately the movable contacts 28 and 29 with the fixed contacts 32 and 33, in such a sequence that, depending on the position of the movable contacts inside the tubular guides 24 and their contacting to the fixed contacts (direct contact or with a gap of fractions of a millimeter), the high-voltage of the electrical current is applied alternately to the electrode 12 and then to the common electrode 11 through the combat spark gap, or to the electrode 13 and then to the common electrode 11 through the combat spark gap.

[0045] In FIG. 8, the fixed contact 32 and the movable contact 29 are closed to form a high-voltage spark discharge in the working spark gap between the electrodes 12 and 11. In this case, if the current conducting wires of the firing cartridge 59 have already been thrown at the target and fixed thereon, then a high stunning voltage is supplied to the target through them. In FIG. 8; FIG. 9; and FIG. 10, the direction of throwing the current conducting wires from the firing cartridges is indicated by an arrow. When turning the magnet 25 in the opposite direction, the contacts 32 and 29 open, while the contacts 33 and 28 close. A spark discharge is formed in the gap between the combat electrodes 13 and 11 and, accordingly, is supplied to the current conducting wires of the cartridge 60 (and to the target when hitting the target). With alternating-sign rotation of the magnet 25, the high stunning voltage is applied alternately to the electrodes 11; 12 and 11; 13. When the current conducting wires of both cartridges are thrown at two targets, the high stunning voltage will be applied to both targets hit alternately through the current conducting wires.

[0046] When the high-voltage switch unit is turned on, the DESHO can operate according to several execution algorithms.

[0047] The simplest algorithm of operation in the case of shots at two targets from the DESHO provides for the operation of the high-voltage assembly 21 which continuously (while maintaining the maximum allowable time for supplying electrical current to a biological target according to established legal and medical standards) generates a high stunning voltage, while the switch unit alternately connects and disconnects the movable and fixed contacts in the tubular guides with a certain switching frequency thereby alternating the supply of high stunning voltage to both targets through current conducting wires thrown from the cartridges that remain fixed to the targets. In this version of the switch unit, at the moment of the position of the magnet 25 and, accordingly, the spring 26, in which both movable and fixed contacts are disconnected (middle (intermediate) position of the movable contacts in the tubular guides), an overvoltage occurs on the high-voltage pulse transformer of the high-voltage assembly 21, which can lead to an internal high-voltage breakdown of the transformer. Therefore, the transformer of the assembly 21 is protected by the protective spark gap in the spark discharge gap of which between the discharge electrodes 37 at the moment of complete separation of both movable and fixed contacts (the middle position of both movable contacts in the tubular guides 24) a parasitic high-voltage spark discharge occurs. The distance between the discharge electrodes 37 in the protective spark gap and, accordingly, the ignition voltage must be somewhat greater than these values for the electrodes 11; 12 and 11; 13. The simplest algorithm also uses the simplest version of the electric drive switch unit using a DC collector or stepper motor without position sensors for the movable contacts 28 and 29.

[0048] A more complex, energy saving algorithm involves use of the position sensors for movable contacts 28 and 29 or sensors for the angle of rotation of the magnet 25, or a sensor for the angle of rotation of the electric drive shaft 23. In this case, one position sensor (or two

position sensors) for the movable contacts being connected to the control element 58, turns off the switch unit 21 in the process of its operation at each position of the movable contacts 28 and 29 in which the high-voltage breakdown can occur in the switch unit 21 (the middle position described above (for ease of understanding) or the position approaching it (depending on the transformer reserve of the high-voltage pulse transformer in terms of breakdown through air distance in excess of the structural distance between the combat electrodes. Therefore, the parasitic spark discharge in the protective spark gap does not form, which makes it possible to reduce the power consumption from the power supply 14.

[0049] Another algorithm for the operation of the switch unit, also using the position sensors for the movable contacts, considers installation of only one pair of movable and fixed contacts in the closed position, depending on which firing cartridge has thrown the current conducting wires at the target. In this case, the full continuous power of the stunning electrical current voltage from the switch unit 21 will be supplied to the first target through the thrown current conducting wires of the first fired cartridge. When the current conducting wires of the second firing cartridge are thrown at the second target, the switch unit will supply the full continuous power of the stunning electrical current voltage to the second target while turning off the power supply to the first target.

[0050] The operation algorithms are set by the user using the buttons 16 of the programming control element 58, which organizes the operation of the switch unit and the generation of the stunning electrical current voltage.

[0051] When using a collector or brushless electric motor without a gearbox providing the highest possible switching speed of movable contacts (up to tens of Hertz) as electric drive, it is advisable to use position sensors for the movable contacts not only to eliminate the parasitic spark discharge in the protective spark gap, but also to turn off the electric motor of the electric drive when the movable contacts come to the extreme positions and turn on the motor with a smooth increase in current to prevent wear of the motor brushes due to high starting currents and self-induction currents when the motor is suddenly stopped. When using a steering machine as an electric drive, the angular position of the output shaft on which the magnet 25 is installed (and hence the position of the movable contacts) is always known without additional sensors, since the angular position sensor is always built into steering machine itself.

[0052] FIG. 9. The high-voltage switch unit can also switch the supply of high stunning voltage to three targets to be struck (i. e., to three firing cartridges) in the same manner as three-charge DESHO Taser X3 does.

[0053] The design of the switch unit for three firing cartridges without position sensors for the movable contacts differs from the design of the switch unit according to FIG. 8 in that the spark discharge gap of the protective spark gap (FIG. 8) is transferred to the working spark discharge gap 61 of the third firing cartridge 62 located between the contact electrodes 63 and 64, wherein the output 35 of the high-voltage assembly 21 is connected to the electrode 64, and the output 38 of the high-voltage assembly 21 is connected to the electrode 63. As described with the reference to FIG. 8, when the switch unit is operating, the spark discharge forms in the spark discharge gap of the protective spark gap when the movable contacts 28 and 29 in the tubular guides are in the middle position. In the case of transferring the function of the protective spark gap to the spark gap 61 of the third firing cartridge 62 in the middle position of the movable contacts in the tubular guides, the spark discharge is formed in the discharge gap 61, and when the current conducting wires of the third firing cartridge 62 are thrown at the target, the stunning electrical current voltage is supplied to the third target to be struck, at the middle position of the movable contacts. The distance between the discharge electrodes 63 and 64 in the discharge gap 61 and, accordingly, the ignition voltage of the spark discharge must be somewhat higher than these values for the discharge gaps 65 and 66 of the cartridges 67 and 68.

[0054] The claimed device in the above-mentioned versions with two or three firing cartridges does not comprise two or three sources of high stunning voltage (high-voltage assemblies) as in the prototype DESHO, but only one, which fact additionally reduces the cost of the DESHO as well as the lack of use of imported and expensive components for several high-voltage assemblies. At the same time, the overall dimensions of the proposed device make it possible to place it in the DESHO having the form of a pistol with dimensions similar to a firearm carried in a holster, and to produce the DESHO with high-voltage discharge switching for the Russian security services.

[0055] The distance between the discharge electrodes 37 in the protective spark gap and, accordingly, the ignition voltage must be somewhat higher than these values for the electrodes 12; 11 and 13; 11.

[0056] FIG. 10. In the upper view of the figure, a housing 69 of the DESHO, firing cartridges of the type 2 or type 8 (the cartridges of the type 8 are shown in the figure), a push and turn lever 70, a trigger 6, a switch 71 of the high-voltage switch unit, a power accumulator 14. The design and type of the DESHO combat electrodes do not differ from those shown in FIG. 1. The purpose and operation of the switch 71 of the high-voltage switch unit is described in the section "Embodiments of the DESHO operation modes" below.

[0057] In the lower view of the figure, the switch 71 (see description of its operation below) of the high-voltage switch unit is removed from the housing for purposes of better visibility of other parts. The cartridges are locked in the housing 69 by a protrusion 9 on the cartridge case, by means of movable spring-loaded lock 18 (placed in each half of the housing) that moves vertically down relative to the housing of the weapon when interacting with a spring-loaded pusher-type drive 72 (which is also placed in each half of the housing) and interacting with the carrier 73 having an axis passing through the wall of

half of the housing and connected to the push and turn lever 70. When the user presses the lever 70 with his finger, and the carrier 73 connected thereto is turned, accordingly moving the pusher-type drive 72 interacting with the carrier forward relative to the housing of the weapon, it interacts with the mechanical lock 18 moving it down relative to the housing of the weapon, and at the same time the protrusion 9 of the cartridge is unlocked from the mechanical lock 18 and the cartridge is pushed out (extracted) from the housing of the weapon by one of two spring-loaded ejectors (extractors) located in the housing, the ejection springs of which are compressed by cartridge cases during loading the cartridges into the cavity of the weapon for installing cartridges. Therefore, it is possible both unload the weapon from the cartridges loaded into it, when it is necessary to unload the weapon (for example, for storage), or quickly and deliberately extract the fired cartridge after the shot, by pressing the lever 70 with the finger of the hand holding the weapon.

[0058] The housing 69 comprises an electronic circuit that generates a high-voltage electrical current striking the target and includes as part thereof a micro controller for controlling circuit elements, an inverter 20, a high-voltage assembly 21, an electronic circuit for setting the sequence of the firing cartridges initiation, a timer for controlling the time of generation of the voltage striking the target, and a display indicator 17 of the operation of the electronic circuit, battery (and other information related to operation of the weapon), if necessary, and a battery 14 for the power supply of the DESHO. The housing 69 also comprises an electromechanical high-voltage switch unit 74 (having its base numbered) with solenoids 75, non-conductive tubular guides 76, and a protective spark gap 77.

[0059] FIG. 11 shows sections of the DESHO with the solenoid drive high-voltage switch unit from above to different depths where the switch design is visible. The solenoids 75 (winding is not shown), glass or plastic tubular guides 76, a protective spark gap 77, and springs 78 that are electrically connected to each other and also electrically connected to the output 35 of the high-voltage assembly 21. Each of the tubular guides 76 comprises the magnetic contact system consisting of a shell comprising two neodymium magnets 79 facing each other with the same poles, a non-magnetic separator 80 of the magnets, and a conductive connector 81 of the magnets. In the guides 76, there are fixed contacts 82 and 83 connected by segments of a high-voltage cable with the combat electrodes 13 and 12.

[0060] The described magnetic contact systems indeed are movable contacts of the switch unit set in motion with a long stroke (long stroke in a solenoid is a characteristic property of the coupled magnetic systems of the described design) by means of action of the electromagnetic field of the solenoids on the magnetic contact systems, which are successively supplied with electrical current pulses of the required duration and frequency from the control element 58 to move the magnetic contact systems inside the guides 76 with a frequency selected by the designer of the DESHO according to various requirements. High-voltage switch unit driven by a solenoid, in contrast to the high-voltage switch unit driven by an electric motor described above, can provide a high-voltage switching rate (commutation) with a frequency of up to a hundred Hertz or more (depending on the selected length of the maximum stroke of the magnetic system, weight of the system, and the electrical power supplied to the solenoids, and also from the selected constructive distance of the spark electrical breakdown in the air of the high-voltage assembly 21). The second output 38 of the high-voltage assembly 21 is connected to the common combat electrode 11 of the DESHO, which is also the common electrode of the firing cartridges. The protective spark gap 77 is connected electrically in parallel to the high-voltage outputs 35 and 38 of the generator assembly 21. The switching principle of the solenoid drive high-voltage switch unit does not differ from that described in FIG. 8, except for that solenoid drive is used instead of electromechanical drive of the movable contacts in the form of an electric motor. The high-voltage switch unit of the solenoid drive can switch the supply of high-voltage stunning current to three targets to be struck (i. e. to three firing cartridges), like the three-charge Taser X3 DESHO (USA) does, wherein the switching principle does not differ from that described in FIG. 9, i. e. the working spark discharge gap of the third firing cartridge functions as a spark discharge gap of the protective spark gap.

[0061] FIG. 12. Solenoids 75, tubular guides 76, a protective spark gap 77, springs 78, which are electrically connected to each other and also electrically connected to the output 35 of the high-voltage assembly 21. In each of the tubular guides 76, when current is applied to the solenoids from the control element 58, a magnetic contact system moves, which system consists of a non-magnetic shell comprising neodymium magnets 79 installed facing each other with the same poles, a non-magnetic separator 80 of the magnets, and a conductive connector 81 of the magnets (shown by a dashed line). In the guides 76 there are fixed contacts 82 and 83 connected by segments of a high-voltage cable with the combat electrodes 13 and 12. The high-voltage switch unit operates as follows.

[0062] When the DESHO is turned on (in direct contact or remote action mode), the high-voltage assembly 21, powered by the control element 58, which in turn is powered by an electrical battery or accumulator 14 and comprises an inverter 20, generates a high-voltage stunning current that, is supplied to the conductive springs 78 electrically connected to each other through its first output 35 and then through the connector 81 to the poles of the magnets facing the fixed contacts 82 and 83 on which conductive sharp tips can additionally be installed (as seen in FIG. 11). The solenoids alternately receive unipolar_pulses of the electrical current, according to the algorithm of supplying and switching off the current, generated by the control element 58 with a certain frequency,

wherein each of the two magnetic contact systems alternately makes long strokes compressing the springs 78, which, being expanded when the current in the solenoid is turned off, return the magnetic contact systems to their initial position (closed with the fixed contacts) in the guides 76, thereby breaking and closing the electrical circuit of the high-voltage electrical current supplied alternately to the electrode 12 and to the electrode 13.

[0063] In FIG. 12, electrical current is supplied by the element 58 to the solenoid, which is at the left in the figure. The left magnetic contact system is drawn into the solenoid by compressing the left spring 78 and, accordingly, the fixed contact 83 and the right contact magnetic system are closed forming a high-voltage spark discharge generated by the assembly 21 in the combat spark gap between the electrodes 11 and 12. Moreover, if the current conducting wires of the firing cartridge 84 are thrown and fixed on the target, then the high stunning voltage is applied to the target through them (the direction of throwing the current conducting wires from the firing cartridges is indicated by an arrow). When element 58 disconnects the electrical current from the left solenoid and the electrical current is applied to the right solenoid, the right magnetic contact system is drawn into the right solenoid and the contact 83 is disconnected from the right magnetic contact system, wherein the left magnetic contact system returns to the initial position by means of the compressed spring 78 and closes contact 82 for the formation of a high-voltage spark discharge in the combat spark gap between the electrodes 11 and 13 on the cartridge 85. With the sequential supply of electrical current to the right and left solenoids, the high stunning voltage from the assembly 21 will be supplied alternately to the electrodes 11; 12 and 11; 13. When throwing the current conducting wires of both cartridges at two targets, a high stunning voltage is applied alternately to both targets hit by current conducting wires.

[0064] The circuitry of the solenoid drive high-voltage switch unit allows to precisely know the position of the movable magnetic contact systems without special position sensors, since the open position of the fixed contacts of the switch unit and the magnetic contact systems is provided only at the moment the current is applied to the solenoid and, accordingly, the control element 58 at this moment can interrupt the supply of high stunning voltage to the magnetic contact system and the fixed contact at the same moment. Therefore, the operation of the assembly 21 will not occur in the middle position of the fixed contacts and movable magnetic contact systems, which means that the spark gap 77 in the solenoid drive switch unit can either not be used, or remain only as a safety measure in case of failure of the control element 58. Therefore, with the solenoid drive switch unit, even without the use of position sensors, it is possible to hold two targets simultaneously in an immobilized state without parasitic consumption of the energy of the DESHO power supply source for the formation of a spark discharge in the spark gap at the middle position of the magnetic contact systems in the process of switching. In addition, the switch unit driven by a solenoid drive has a lower inertia compared to switch unit driven by an electric motor and accordingly has a higher possible switching frequency that makes its use in the DESHO preferable.

Embodiments of the DESHO operation mode

[0065] According to the proposed invention, very diverse embodiments of the DESHO operation (use) exist.

[0066] If it is necessary to demonstrate a spark electrical discharge to the offender to remove aggression from him or to use weapon in direct contact mode (without shots), the user disables the operation of the part of the electronic circuit responsible for the sequence of the firing cartridges initiation for firing using one of the buttons 16. In this case, the low electrical current voltage is not generated and is not supplied to the electrical contacts 44 (see FIG. 4) for electrical initiation of the pyrotechnic charge of the cartridges. When said part of the electronic circuit is turned off by pressing the trigger 6, the electronic circuit generates only the stunning electrical current voltage with the formation of a combat spark discharge between the electrodes 11 and 12, 13 for displaying an electrical discharge or producing immobilizing effect on the target when electrodes 11 and 12, 13 come into contact with the body of the biological target. The DESHO can have a selector switch (for example, button 16) for the control of the part of the electronic circuit responsible for the sequence of the firing cartridges initiation. The selector switch can switch the production of the first shot from the right cartridge to the left one or vice versa. This function is used for the convenience of loading (reloading) a new cartridge instead of the fired one, depending on the right-handedness or left-handedness of the user, since it is more convenient to reload the weapon, in which one cartridge has been fired and extracted, with the hand that is closer to the side of the weapon with the empty cavity of the cartridge extracted.

[0067] Loading of the DESHO is carried out by inserting cartridges 2 into the cavity in front of the housing, wherein the springs 43 of the extractors 42 are compressed providing extraction of the cartridges from the cavities after the shot or when the DESHO is unloaded. When inserting the cartridges into the cavity, the protrusions 4 of the cartridges press the spring-loaded mechanical locks 18 down relative to the housing of the weapon, which locks snap onto the protrusions 4 fixing the cartridges in the housing 1 when the cartridges are fully inserted into the cavities. The weapon is unloaded by pressing the actuators 3 and therefore the same device for manually unlocking the cartridges from the housing of the weapon performs both the function of a device duplicating automatic extraction and the function of a device for weapon unloading.

[0068] When using the DESHO in remote action mode by default (without setting any additional modes of operation with the buttons 16), after the trigger is pressed,

the stunning electrical current voltage is supplied to the cartridge initiated, with continuous supplying for all the time until the user releases the trigger. When the trigger is pressed again, the stunning electrical current voltage is supplied to the second initiated cartridge, with continuous supplying for all the time until the user releases the trigger. In this case, the maximum single time and continuous time of supplying the stunning electrical current voltage to the target both in the direct contact mode described above and in all modes of operation described below, even if the user does not release the trigger or in arrest mode, can be interrupted programmatically in accordance with the law and biomedical standards (in the Russian Federation, continuous time is 3 s), in the USA, the same time varies from 5 s to 30 s, depending on the output power of the DESHO or expert recommendations). The maximum time for supplying the stunning electrical current voltage to the target also varies depending on the purpose of the DESHO (police or civilian). In police versions, both in the Russian Federation and in the United States, an increased exposure time to the target or an increased output power of the stunning electrical current or both is allowed. At the same time, use of single high-voltage assembly 21 in the claimed DESHO allows to obtain the maximum output power of the stunning electrical current for the type of inverter used and the power output of the power source (electrical battery or accumulator), which is fundamentally unattainable in the prototype DESHO comprising two high-voltage assemblies.

[0069] If it is necessary to arrest an offender, the user must press pressure pieces 10 of the locks 46 for deliberately locking the cartridges in the housing 1 and, using one of the buttons 16, turn the weapon operation mode into the timer operation mode (arrest mode) before using the DESHO, to continue the operation of the striking part of the electronic circuit for a certain predetermined time with interruption of operation at the end of the task or for intermittent supply (according to the established algorithm for supplying current and pause to restore the function of the respiratory and cardiac system of the biological target) of high-voltage electrical current striking the target to the biological target after releasing the trigger. The button for switching the electronic circuit operation to the arrest mode can be mechanically or electrically connected to the lock 46 or the pressure piece 10 of the locks (for example, using a magnetic element fixed in the lock 46 or piece 10) and a reed switch located in the housing 1 and connected to the button (or directly to the electronic part of the weapon), being turned on when the pressure piece 10 is switched to the arrest mode. This mode of the DESHO operation allows to strike the target with one or two shots, put the weapon with the working striking part of the electronic circuit on the ground and make an arrest the offender by handcuffing him. After making the arrest, the user should switch the weapon operation mode to the operation mode of the timer for continuous operation of the striking part of the electronic circuit. The extraction of fired cartridges is carried out by pressing the pressure pieces 10 of the locks with the index finger, moving them down relative to the housing of the weapon.

[0070] If it is necessary to arrest two offenders at once (for example, in case of an alleged conflict with two offenders), the user must press the pressure pieces 10 of the locks 46 for deliberately locking the cartridges in the housing 1 before using the DESHO, and switch the weapon operation mode to the mode of operation of the striking part of the electronic circuits and operation of the high-voltage switch unit using one of the buttons 16. One-time pressing the trigger results in switching the stunning electrical current voltage only to the cartridge initiated first by the switch unit, wherein the first target is struck, and when the trigger is pressed again, the second cartridge is initiated and the second target is struck while the switch unit starts to switch the stunning electrical current voltage to the first and second cartridges alternately maintaining immobilization of both targets.

[0071] If it is necessary to make a duplicate shot at an armed offender, the user has the opportunity to use the arrest mode with two quick one by one shots at the offender, but in this case, the full output power when using the switch unit 22 without a system for determining the position of closed and open movable and fixed contacts (position sensors) is not achieved, since part of the output power per unit of time will be spent on the formation of a parasitic spark discharge in the protective spark gap (see the description of the switch unit 22 operation). Therefore, it is advisable to implement the duplicated shot mode either if the switch 71 of the high-voltage switch unit is present (see FIG. 10) or when using the switch unit with a solenoid drive only, which is turned off (for example, with button 16) in the mode of use for producing a duplicated shot, since in the mode of stopping the switch unit (de-energization) with a solenoid drive, both movable contacts (of the magnetic systems) are always in a closed position with the fixed contacts (as in FIG. 11).

[0072] The switch (it is essentially a contactor) 71 is a lamellar plastic member with side protrusions moving on the upper surface of the housing of the DESHO in guides, and having an internal metallized electrical connector of the side protrusions. When the switch is moved forward, the side protrusions are connected to the combat electrodes 12 and 13, closing them together, and therefore, at any position of the movable contacts of the switch unit driven by the electric motor in the process of operation thereof, except for the middle position, stunning electrical current voltage from the high-voltage assembly 21 is simultaneously supplied to the electrodes 12 and 13. When using the switch unit driven by the electric motor with position sensors of movable contacts and the switch 71 to supply the full power to the combat electrodes, it is necessary to set (for example, using the button 16) the switch operation mode by moving the movable and fixed contacts into a permanent closed position when the DESHO is turned on, so that the middle position of the movable contacts is surely not reached.

[0073] If it is necessary to carry out preventive immo-

bilization, before using the DESHO and then if the offender does not obey, for the turning the arrest mode on, the user should press the pressure piece 10 of the lock 46 only of the second firing cartridge for deliberately locking the cartridge. After the first warning shot and extraction of the cartridge, in case of further disobedience of the offender to the requirements of the law enforcement officer, the user presses the button 16 thereby setting the arrest mode and fires again with the immobilization of the offender before handcuffing him.

[0074] The proposed weapon can use both the firing cartridges of the type 2 with automatic pyrotechnic unlocking from the housing and cartridges of the type 8 of reduced cost, since such cartridges do not comprise a number of parts that require high manufacturing accuracy and accordingly increase the cost of shot. The firing cartridge of the type 8 of reduced cost has a protrusion 9 made integral with the cartridge case. When such a cartridge is fired from the weapon, automatic extraction does not occur, but the user of the weapon, having the necessary skill in deliberately unlocking cartridges using the actuators 3 or lever 70 trained, can, in case of need, extract cartridges almost as quickly as with automatic extraction. For simultaneous immobilization of two targets or duplicate shot or arrest using cartridges of reduced cost, it is no longer necessary to use the locks 46 with their pressing pieces 10 that simplifies the use of the weapon. An example of DESHO without locks 46 for use with the cartridges of the type 8 is shown in FIG. 10. The cost of firing cartridges for DESHO is of great importance in the poor countries of the world, which prevents the widespread use of DESHO that is the most effective non-lethal weapons in the world, in particular in the Russian Federation. The cost of Axon cartridge for the prototype weapon is 40-50 US dollars or more [7], so two shots fired cost at least 100 US dollars, which is absolutely unacceptable for Russia. The cartridge of a simplified design according to the proposed invention, in terms of the number of parts and the required accuracy of their manufacture, even with backward domestic technologies, has a design that reduces its cost by several times compared to the Axon cartridge, which makes it possible to organize domestic production of such cartridges and export them to other countries.

[0075] The above description discusses the preferred embodiments of the present invention, which may be changed or modified without departing from the scope of the present invention as defined in the claims.

[0076] Comparison of the proposed technical solution with the identified prior art analogs did not reveal an identical match of the set of essential features of the invention. The proposed differences of the claimed electroshock weapon, which directly follow from the statement of the purpose of the invention, are not obvious to a person skilled in the field of electroshock devices.

Example of implementation

[0077] FIG. 13. Appearance of an experimental DESHO made by 3D prototyping, with half of the housing removed.

[0078] FIG. 14. High-voltage switch units with a solenoid drive and with an electric motor (servo motor) as a drive. In the solenoid drive switch unit, both magnetic contact systems are in a closed position with the fixed contacts 82 and 83, since power has not yet been supplied to one of the solenoids.

[0079] FIG. 15. High-voltage switch units with a solenoid drive and with an electric motor (servo motor) as a drive.

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[0080]

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3. https://www.policeone.com/police-products/less-lethal/press-releases/taser-x3-with-rotational-pulse-drivetm-to-launch-july-27-XMfZQTGxn1sGroLu/
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Claims

1. An electroshock weapon comprising a housing, a power source, an electronic circuit for setting the sequence of firing cartridges initiation and generating a high-voltage electrical current that strikes a target, which circuit comprises a generation timer, a trigger element, at least two firing cartridges with throwable current conducting wire, devices for locking cartridges in the housing, spring ejectors of the firing cartridges, wherein the weapon has additional devices for deliberately locking the firing cartridges in the housing, wherein the devices for locking the firing cartridges in the housing have human-powered actuators for deliberately unlocking firing cartridges from the housing of the weapon, said actuators being activated by a finger of the user's hand holding the weapon, the timer has a control element for setting the time for generation of the high-voltage electrical current that strikes the target, which control element

is independent of the trigger element position after a shot, the housing comprises an electromechanical high-voltage switch unit for alternately intermittent or continuous supply of the high stunning voltage to the firing cartridges, which switch unit has a switch for controlling the electromechanical high-voltage switch unit to continuously supply of the high stunning voltage to one or another cartridge.

2. The weapon according to claim 1, wherein the weapon has a manual mechanical contactor for the outputs of the high-voltage switch unit to supply high stunning voltage to the firing cartridges.

3. The weapon according to claim 1, wherein the timer control element for setting the time for generation of the high-voltage electrical current that strikes the target is mechanically or electrically connected to additional devices for the deliberately locking the firing cartridges in the housing.

4. The weapon according to claim 1, wherein the electromechanical high-voltage switch unit uses a stepper motor or a servo motor as a drive.

5. The weapon according to claim 1, wherein the electromechanical high-voltage switch unit uses a collector or brushless electric motor as a drive.

6. The weapon according to claim. 1, wherein the electromechanical high-voltage switch unit has at least one position sensor for movable contacts.

7. The weapon according to claim 1, wherein the electromechanical high-voltage switch unit uses at least one long-stroke solenoid with a movable system of connected permanent magnets as a drive.

8. The weapon according to claim 1, wherein the weapon has a switch to disable the operation of the electromechanical high-voltage switch unit.

9. The weapon according to claim 1, wherein the electronic circuit for setting the sequence of the firing cartridges initiation has a switch selector setting the sequence of the firing cartridges initiation.

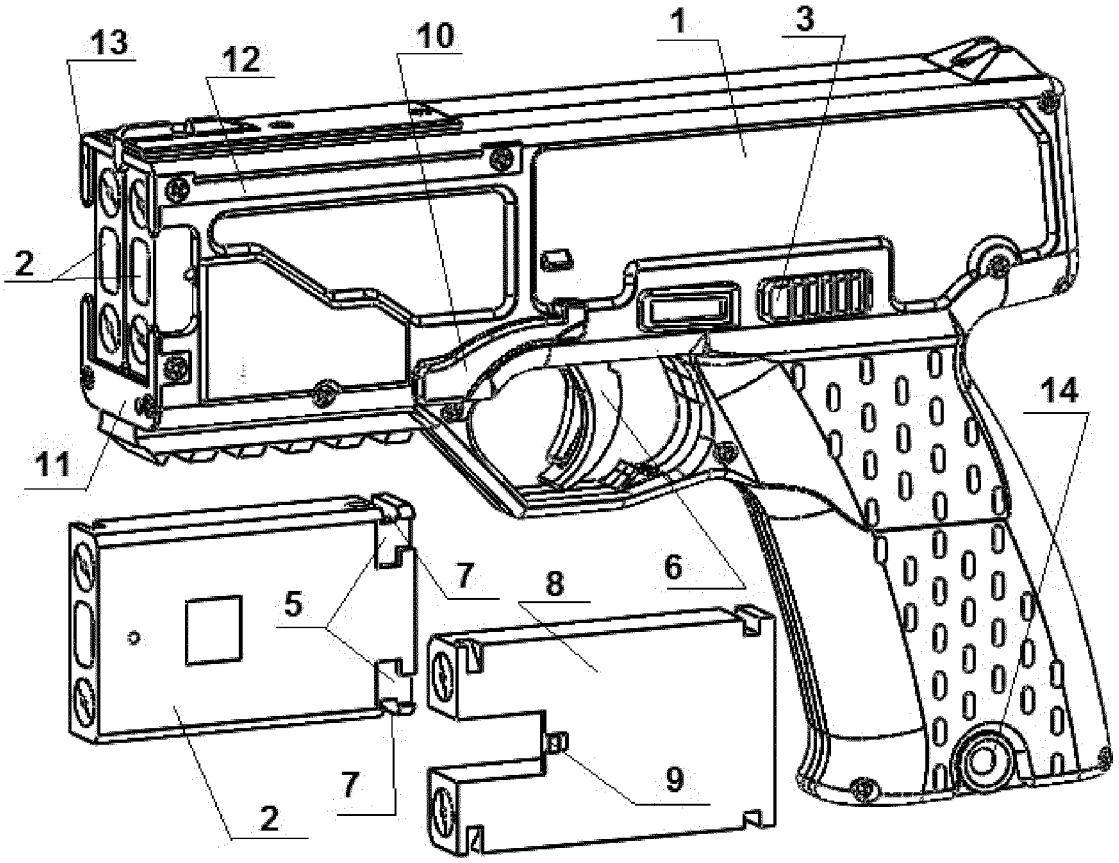

FIG. 1

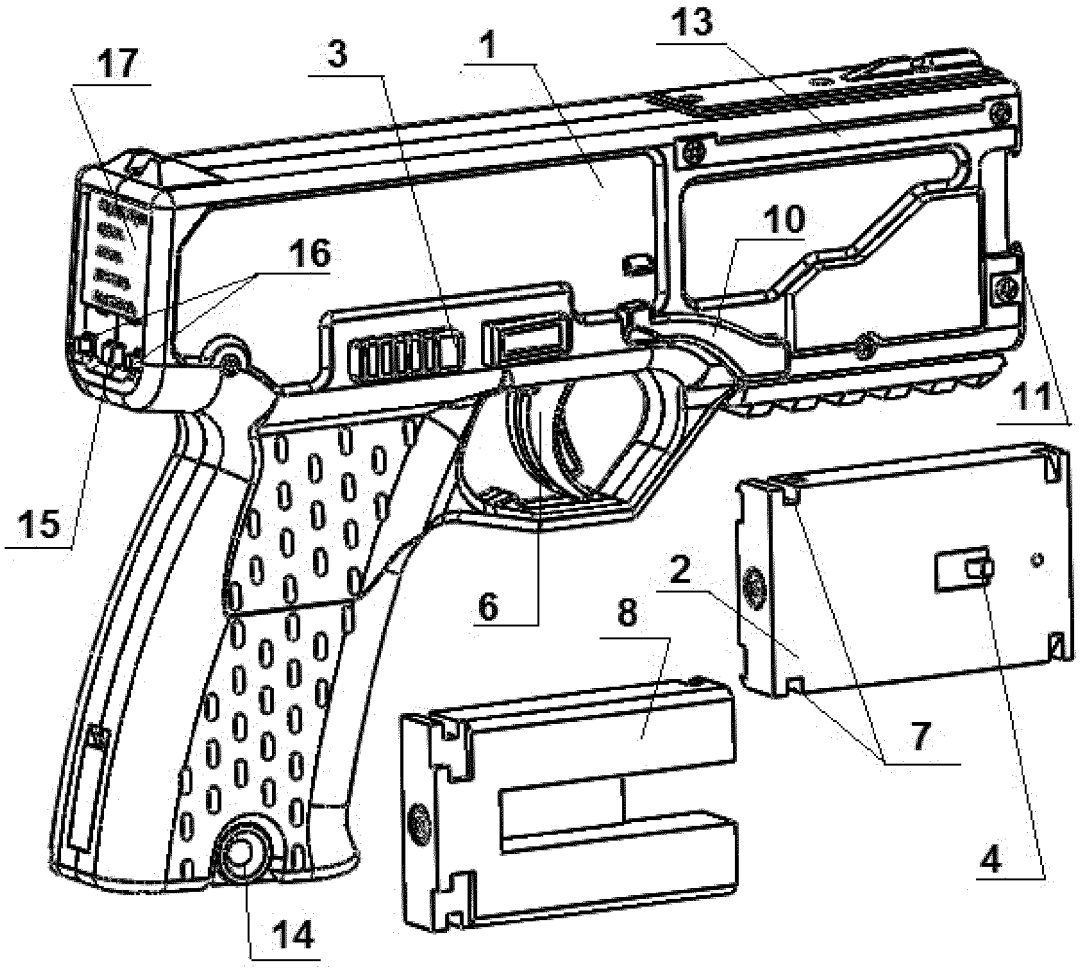

FIG. 2

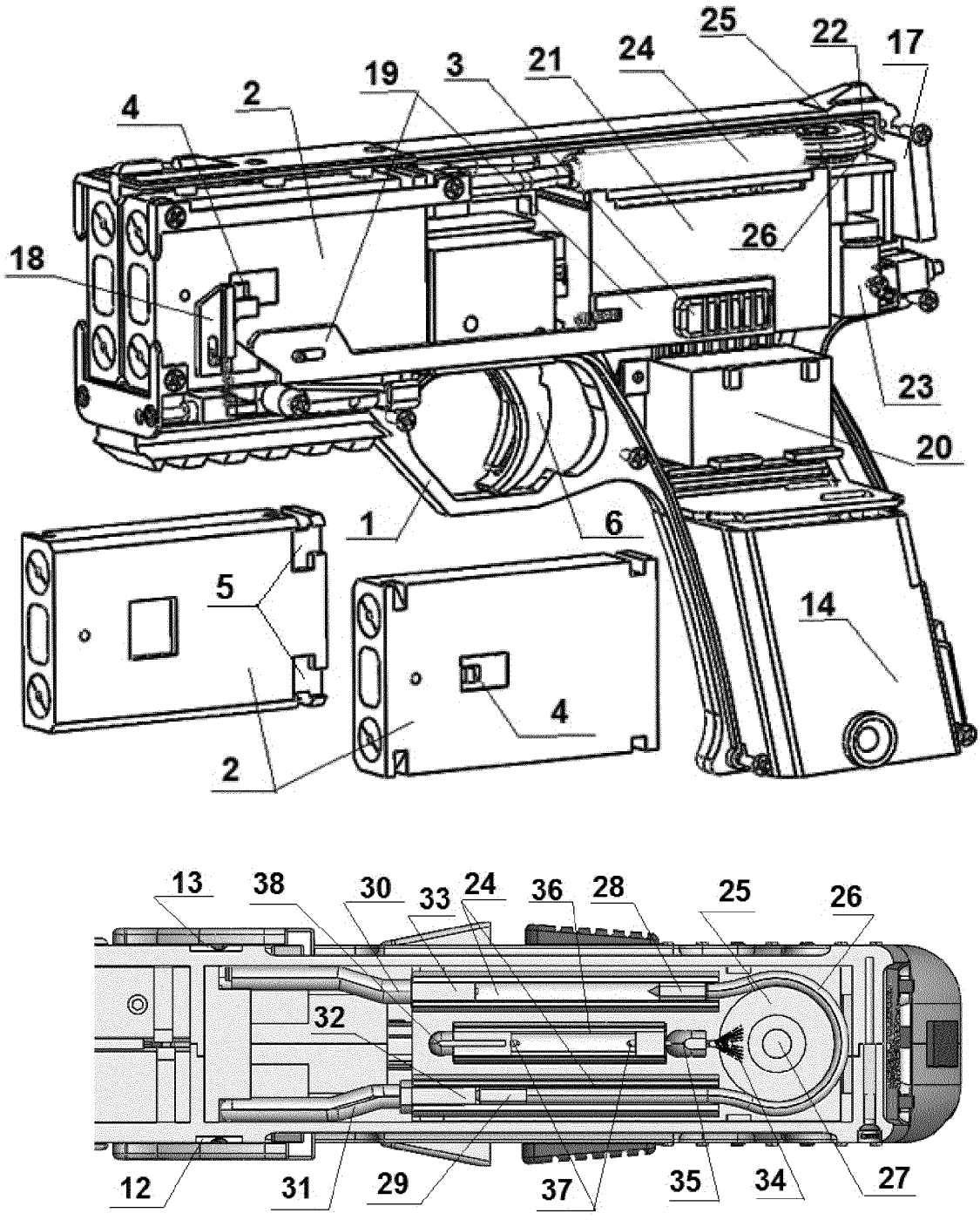
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FIG. 3

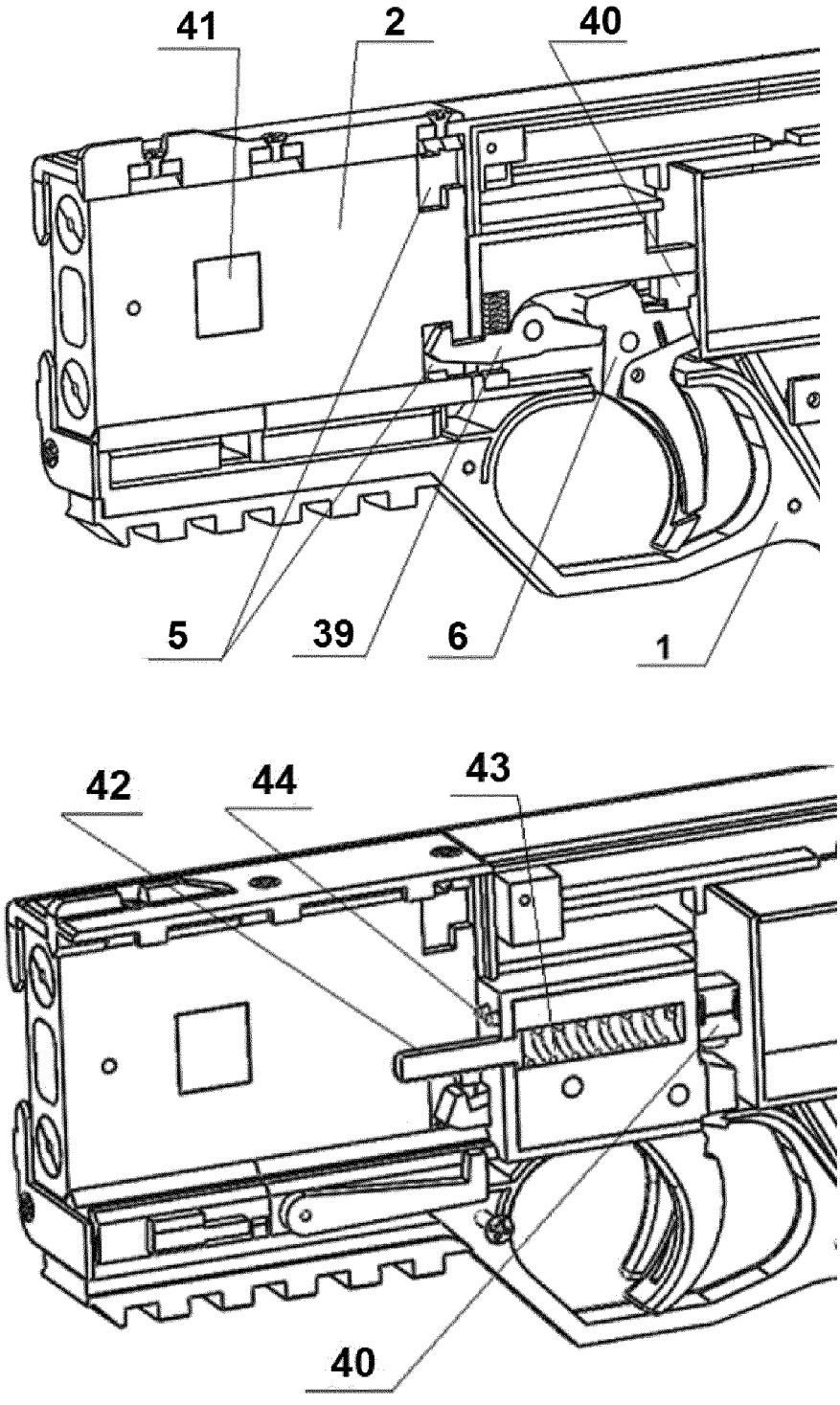

FIG. 4

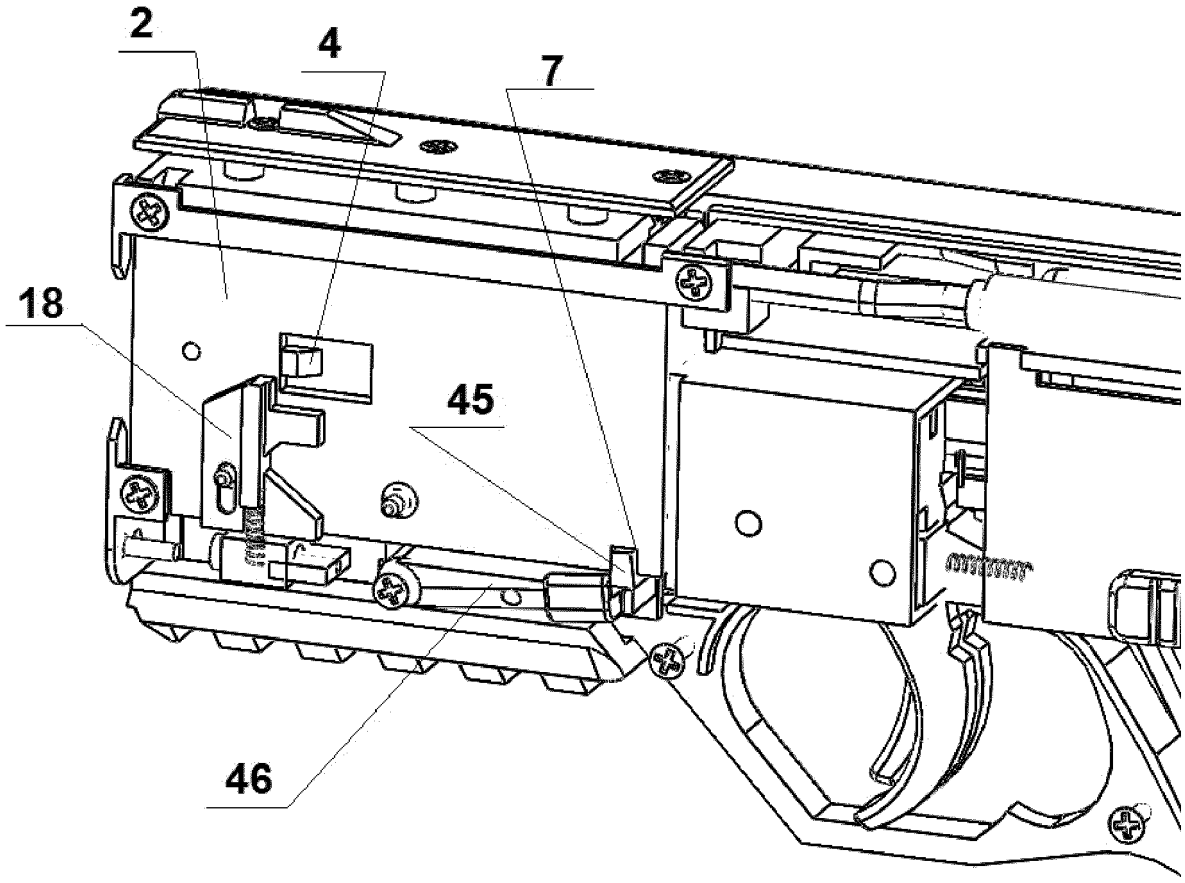

FIG. 5

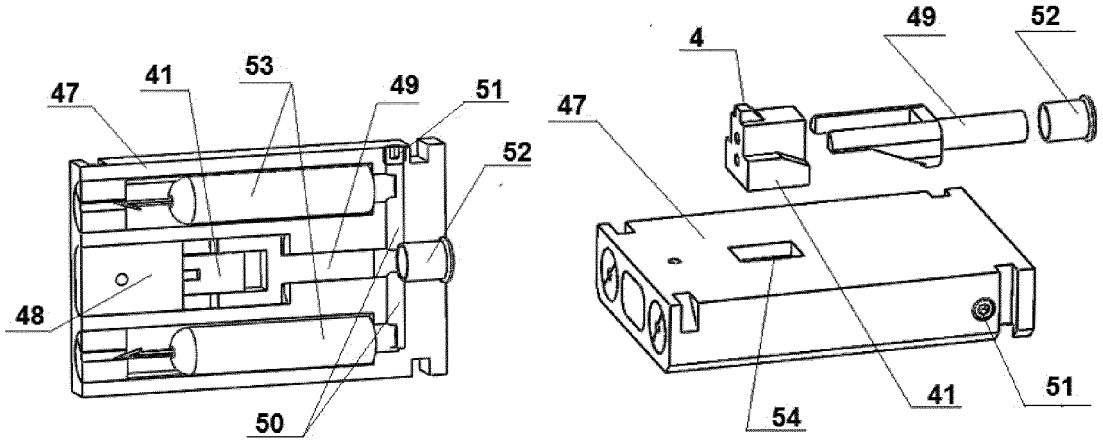

FIG. 6

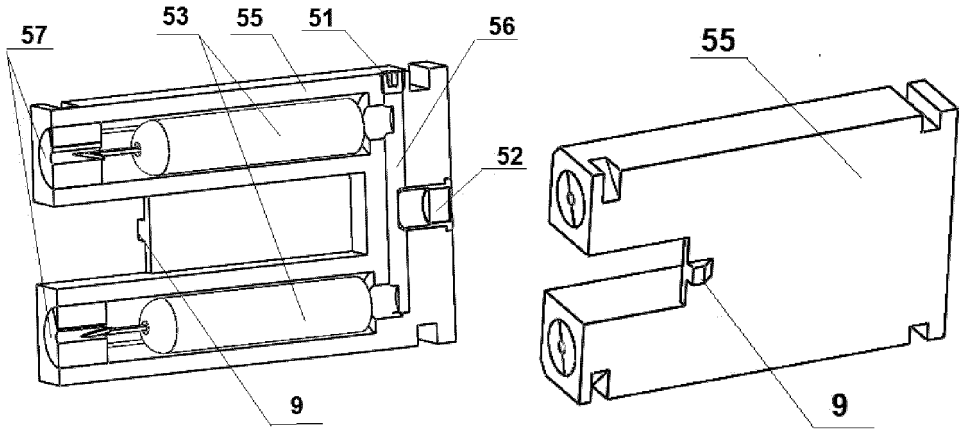
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FIG. 7

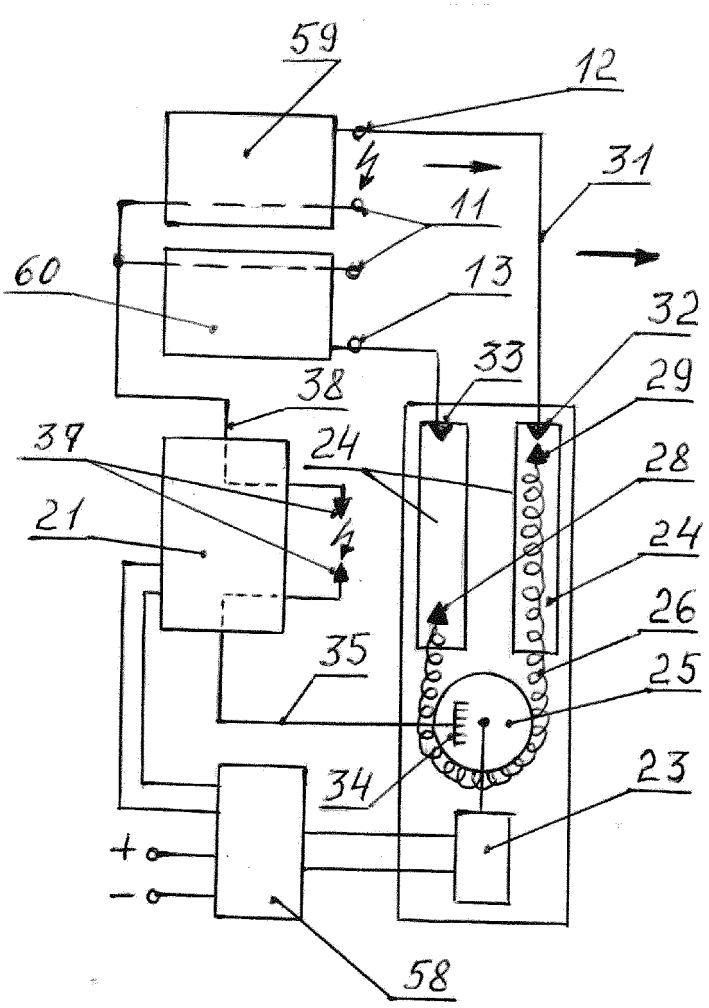
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FIG. 8

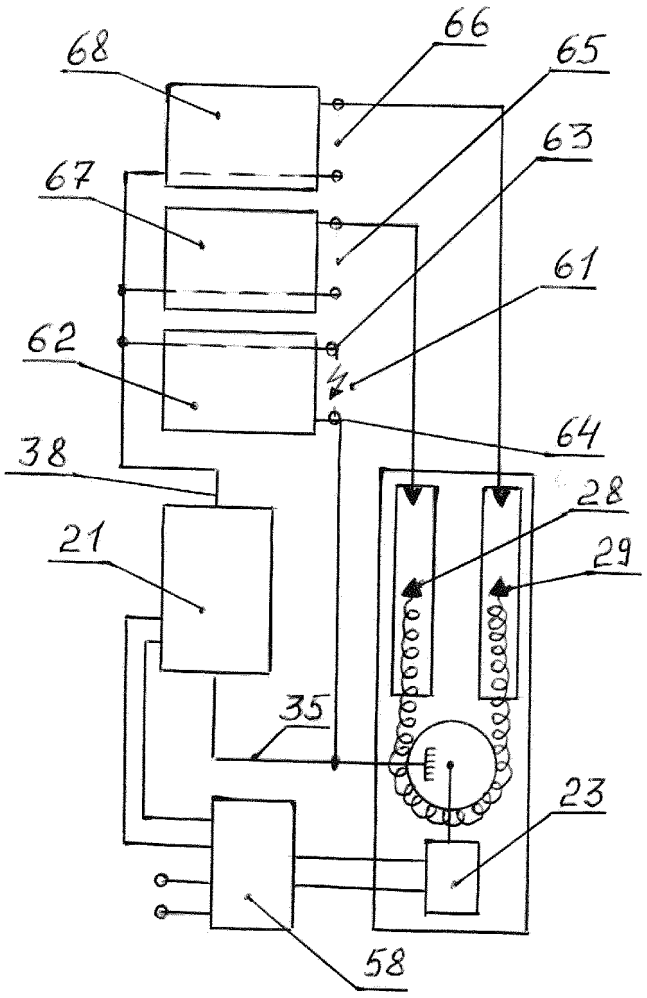

FIG. 9

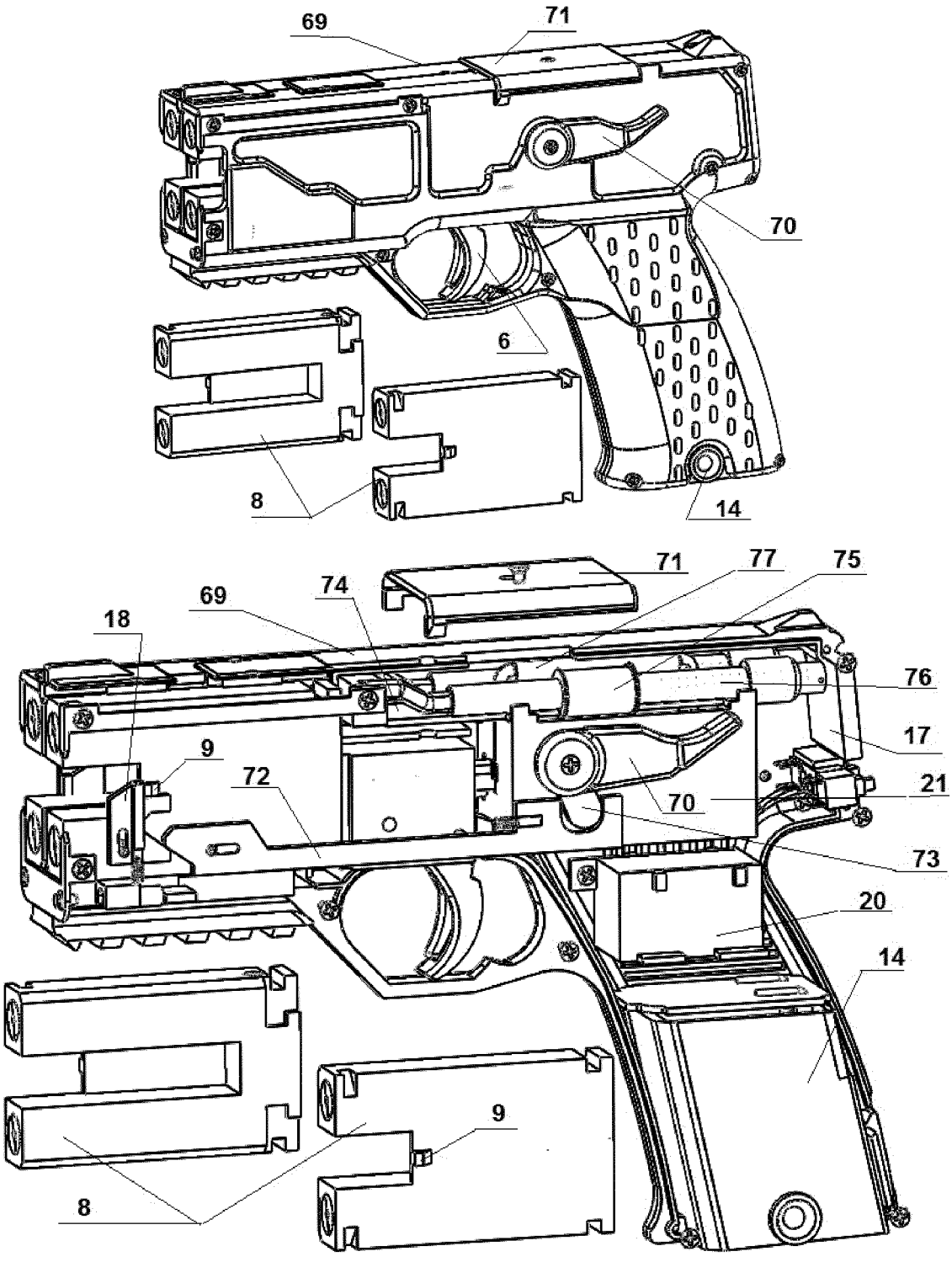

FIG. 10

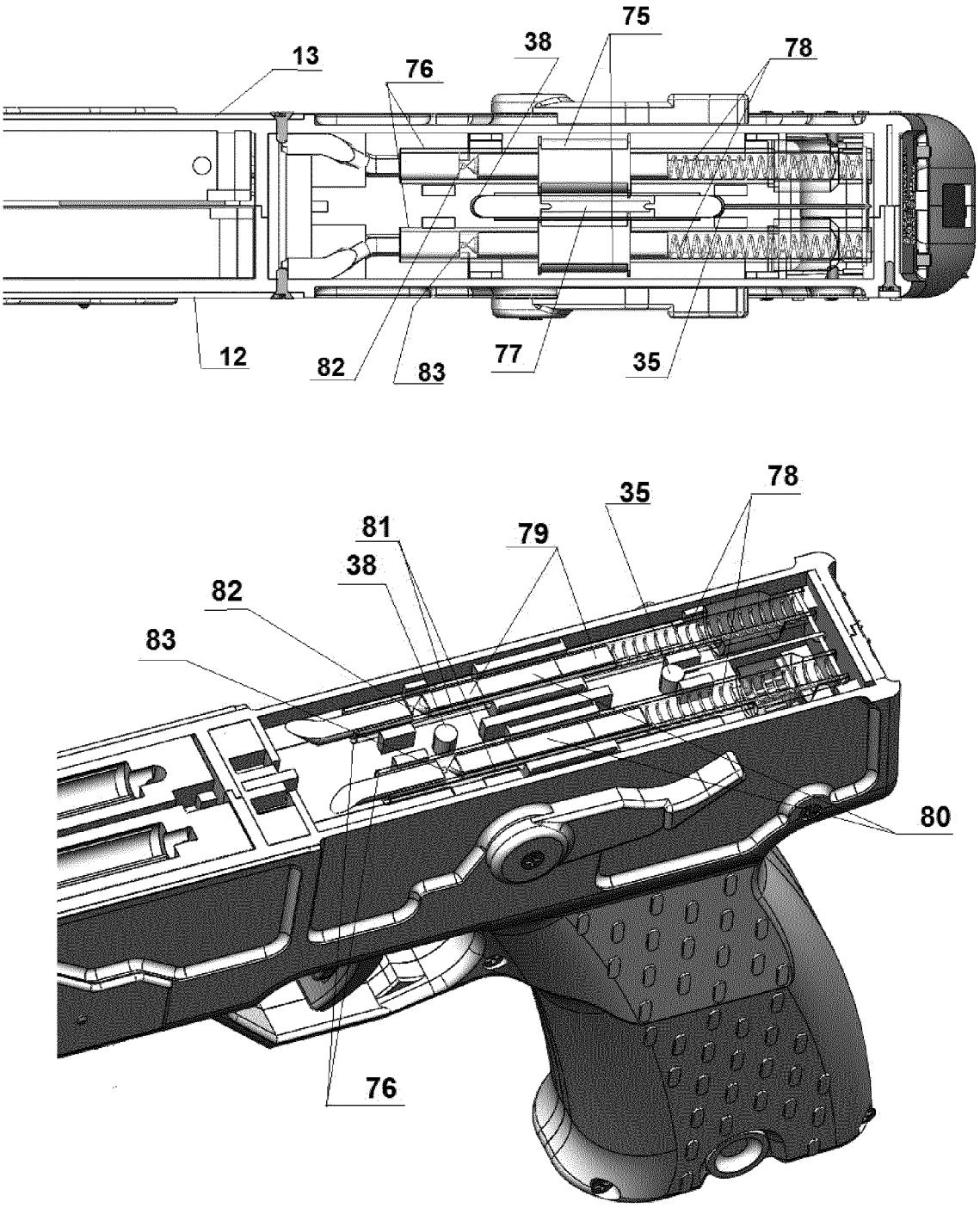

FIG. 11

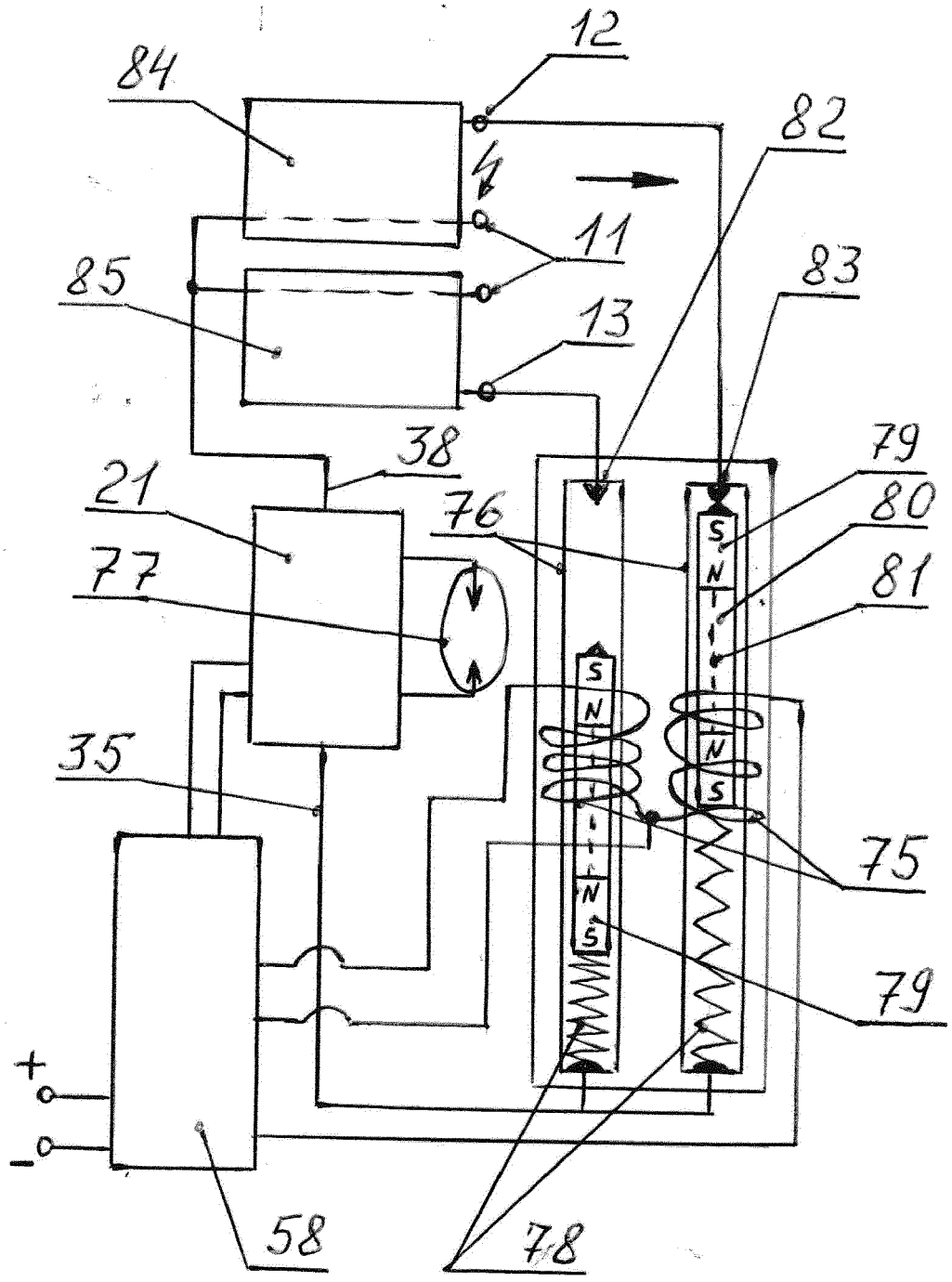

FIG. 12

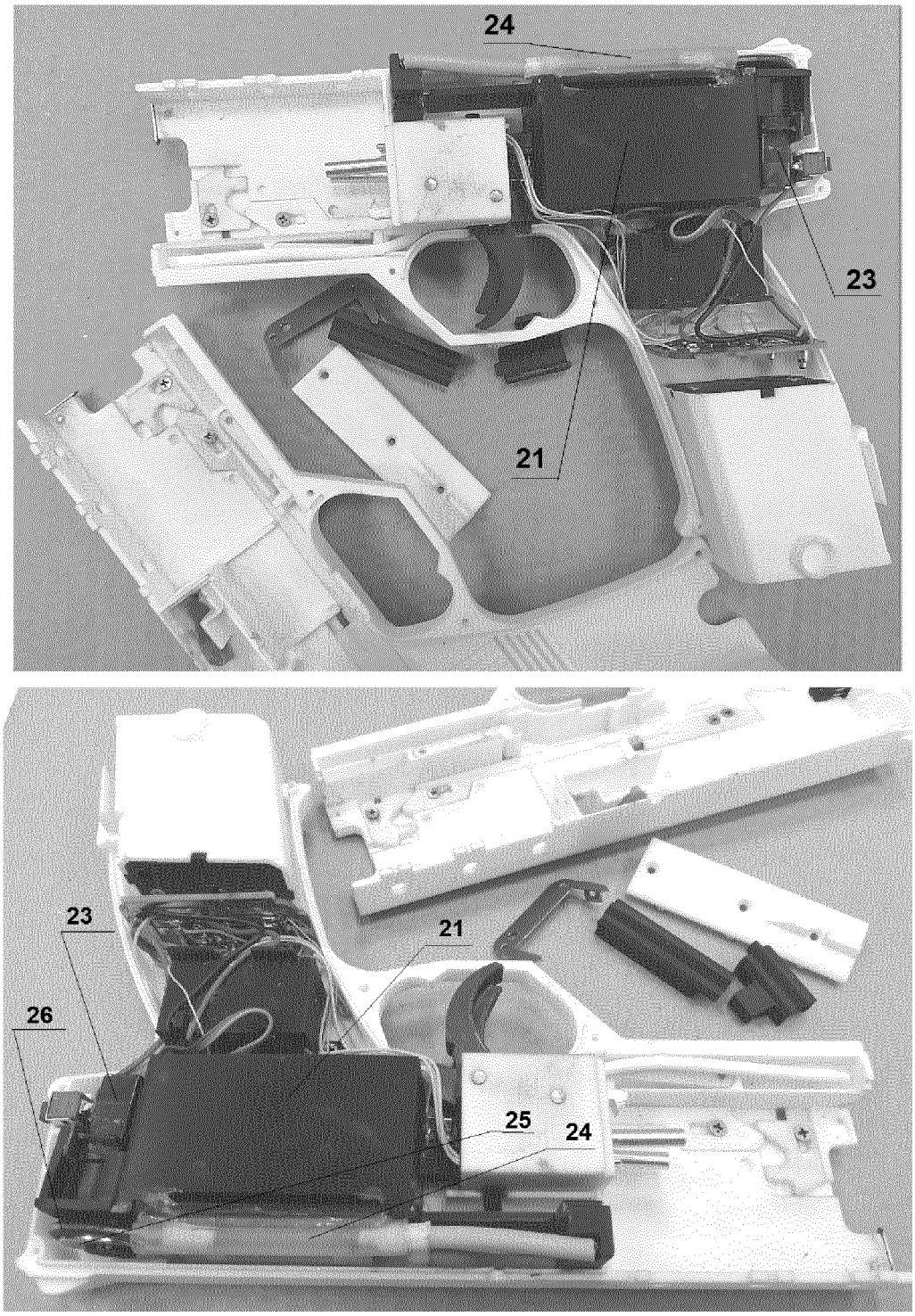

FIG. 13

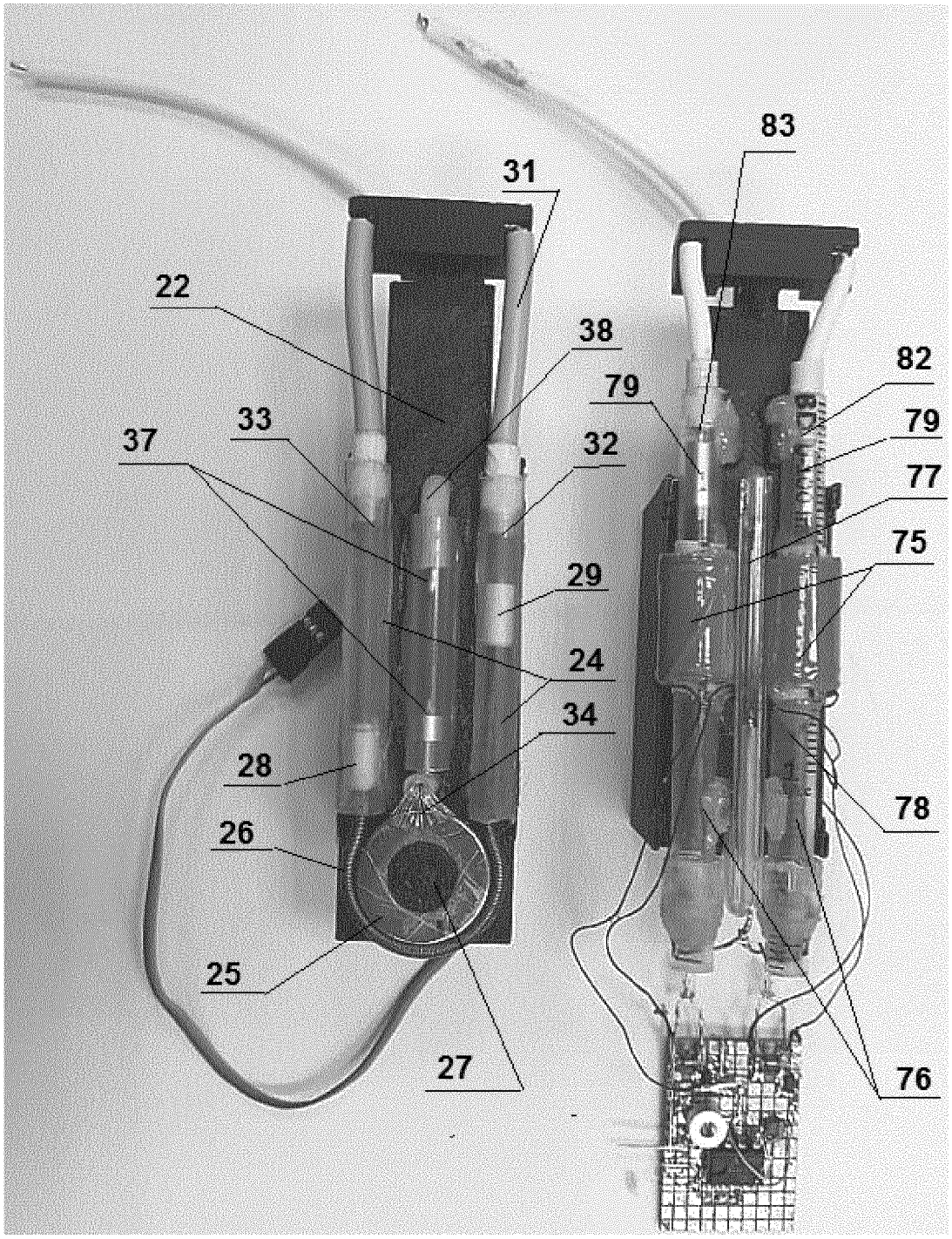

FIG. 14

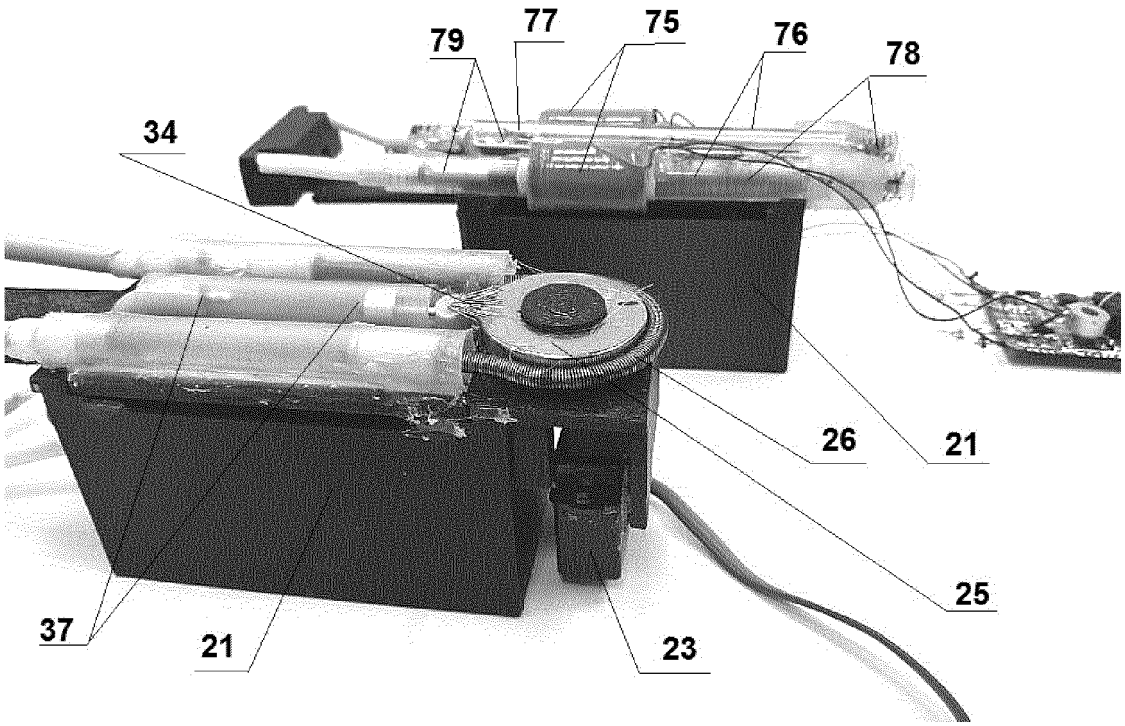

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2020/000519

A. CLASSIFICATION OF SUBJECT MATTER

F41B15/04 *(2006.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F41B 15/00-15/04, F41B 9/00, F41H 13/00, F42B 30/00-30/14, H05C 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Espacenet, PatSearch, PAJ, WIPO, USPTO, RUPTO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2684807 C2 (KLOCHKOV KONSTANTIN DMITRIEVICH et al.) 15.04.2019, claims 1, 5, 8, 10	1-9
A	US 3626626 A1 (UNITED STATES OF AMERICA AS REPRESENTED BY THE SECRETARY OF THE NAVY) 14.12.1971	1-9
A	RU 2462678 C (B&C WORLD CO. LTD) 27.09.2012	1-9
A	WO 2006/085990 A2 (MARK W. KROLL) 17.08.2006	1-9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
15 January 2021 (15.01.2021)	11 February 2021 (11.02.2021)
Name and mailing address of the ISA/ RU Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2462678 **[0080]**

Non-patent literature cited in the description

- **LADYAGIN YU.O.** Remote-acting electroshock weapons. Stalingrad Foundation Publishing House, 2017, 44 **[0080]**
- **LADYAGIN YU.O.** Remote-acting electroshock weapons. Stalingrad Foundation Publishing House, 2017, 173 **[0080]**