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(54) NON-LETHAL WIRELESS STUN PROJECTILE SYSTEM FOR IMMOBILIZING A TARGET BY NEUROMUSCULAR DISRUPTION

NICHT TÖDLICHES DRAHTLOSES STUN-PROJEKTILSYSTEM ZUR IMMOBILISIERUNG EINES ZIELS DURCH NEUROMUSKULÄRE UNTERBRECHUNG

SYSTEME DE PROJECTILE NEUTRALISANT SANS FIL ET NON MORTEL POUR L'IMMOBILISATION D'UNE CIBLE PAR INTERRUPTION NEUROMUSCULAIRE

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Description

FIELD AND BACKGROUND OF THE INVENTION

[0001] The present invention relates to a non-lethal wireless stun projectile system, and more specifically to a projectile that is launched from a conventional weapon; upon impact with a human target the system stuns and disables the target by applying a pulsed electrical charge. The electric round is defined as non lethal ammunition directed to incapacitate a human, to prevent him from moving for a short time, to prevent him from committing a crime and to allow authorized personnel to arrest the target.

[0002] The electric projectile operates by transmitting electric pulses to the target, paralyzing the target for a short time without clinical after effects. Upon impact the projectile attaches itself to the target and gives the same effect as a regular handle electrical shocker. The pulses of electrical current produced by the projectile are significantly lower than the critical cardio-vibration level and therefore the electric pulses are non-lethal. The electrical pulses cause neuromuscular-disruption, which incapacitates a living object.

[0003] Increasing attacks on unarmed civilian targets around the world have put governments and law enforcement officials into a difficult position. It is necessary to quickly and effectively stop terrorists and avoid civilian injury, but terrorists are hard to distinguish from innocent civilians and terrorists strike in areas that are not suitable to the positioning of large forces of dedicated guards. Therefore, in order to stop terrorists quickly before they can cause devastating damage, some police forces have adopted a "shoot them in the head" policy. Obviously, such a policy can lead to civilian casualties and controversy. On the other hand, caution in such cases can lead to massive civilian casualties as well as the death of the arresting officer. Also police often desire to apprehend a suspect who is fleeing. Obviously lethal force is inappropriate, but to allow a dangerous criminal to escape is also undesirable.

[0004] Therefore law enforcement officials seek a non-lethal weapon that can stop a terrorist without killing innocent civilians. One such weapon, currently popular, is commercialized under the trademark TASER gun [the weapon is disclosed in U.S. Pat. No. 3,803,463 issued April 9,1974 and now expired and 4,253,132 issued Feb. 24 1981 and now expired, improvements of the weapon have been disclosed in U.S. patent No. 5,654,867 issued Aug. 5 1977 and U.S. Pat. No. 6,636,412 issued Oct. 21, 2003]. The TASER gun shoots two darts with barbed electrodes connected to by wires to the gun body. The wires supply a pulsed electrical potential between the two darts. When both darts hit a target, the barbed electrodes penetrate skin or clothing. An electric circuit is completed and current flows through the target between the electrodes, incapacitating the target. The obvious disadvantages of the TASER gun are 1) the range is limited to the length of the wires 2) both darts must hit the target or the gun has no effect 3) movement of the target or the gun can produce tension on the wires, ripping the electrodes from the target and ending the stunning effect 4) the weapon is difficult to reload and can not be used again quickly in case one of the darts misses the targets, or if it becomes necessary to stun a second target 5) the TASER gun is a dedicated weapon and is very inconvenient for regular police officers who are also required to carry a conventional weapon.

[0005] US 2005/073796 A1 discloses a wireless projectile according to the preamble of claim 1 and a method of stunning a target according to the preamble of claim 13. It is related to an apparatus for immobilizing a target including electrodes deployed after contact is made between the apparatus and the target. Spacing of deployed electrodes may be adapted for the delivery of an immobilizing stimulus signal.

[0006] US 5 962 806 A is related to a projectile for delivering a stunning electrical shock to a target. Such projectile has a projectile body, an electric circuit housed within the projectile body, a plurality of electrodes, coupled to the electric circuit, for delivering an electrical shock to the target; and an adhesive material or mechanical attachment system, coupled to the projectile body, for attaching the projectile to the target.

[0007] GB 2 384 042 A is related to a projectile for delivering a stun electric charge comprising a body with a rear container housing one or more electric storage cells. A module incorporates a voltage step-up transformer with an associated electronic control circuit board. A forward nose portion has a series of collapsible or compressible elements and an outer inflatable or expandable membrane with an associated gas producing charge or gas storage device and a detonator or sensor to produce inflation on or just before impact with a target. The nose has two axially aligned electrodes connected to opposed poles of the high voltage generator or transformer. A nose plate is arranged to move rearwardly on target impact allowing the electrodes to penetrate the target outer layer to deliver the electric charge.

[0008] JP 2002 075737 A discloses a thin-film transformer is constituted in such a way that a laminated multicoil is formed, by laminating upon another a plurality of double winding integrated coils , each of which is formed by forming either one of a pair of primary and secondary main windings of a thin plate-like non-winding coil and the other coil on the non-winding coil and magnetic cores 18 are assembled with the multicoil from the upside and downside.The transformer can be designed in a multi-output and multi-terminal state and can be automated.

[0009] What is needed is a projectile that can be used without hesitation in situations where it may be difficult to absolutely identity or isolate a target. Ideally the projectile should incapacitate the target at a variety of ranges, should be easily loaded fired and reloaded into a conventional firearm (for example an automatic 45 caliper pistol, an M16 assault rifle, a revolver, a standard issue police pistol, or a shotgun) and the projectile should not cause permanent injury. Furthermore, it is desirable that the target remains incapacitated for a few minutes (long enough to secure the area and take the target into custody).

[0010] The projectile should be characterized by the following properties:

a. no clinical after effects;
b. wireless (which means not requiring a wire attachment to a stationary power source);
c. self powered;
d. fired from standard /in use weapons without any change in the weapon;
e. ballistic performance similar to standard ammunition;
f. may be stored and handled safely like standard ammunition;
g. may be stored for long time periods (on the order of months or years);
h. can be adapted to different calibers.

SUMMARY OF THE INVENTION

[0011] The present invention is a non-lethal wireless stun projectile system. More specifically the present invention is a projectile according to claim 1 and a method of stunning a target according to claim 13. The projectile is launched from a conventional weapon; upon impact with a human target the system stuns and disables the target by applying a pulsed electrical charge. The electric round is defined as non lethal ammunition directed to incapacitate a human, to prevent him from moving for a short time, to prevent him from committing a crime and to allow authorized personnel to arrest him.

[0012] The electric projectile operates by transmitting electric pulses to the target, paralyzing the target for a short time without clinical after effects. Upon impact the projectile attaches itself to the target and gives the same effect as a regular handle electrical shocker. The pulses of electrical current produced by the projectile are significantly lower than the critical cardio-vibration level and therefore the electric pulses are non-lethal. The electrical pulses cause neuromuscular-disruption, which incapacitates a living object.

[0013] According to the teachings of the present invention there is provided a wireless projectile for stunning a target including: an impact reduction subsystem to protect the target from impact damage caused by impact of the projectile onto the target, an attachment mechanism to secure the wireless projectile to the target upon impact of the wireless projectile upon the target and an energy delivery subsystem that supplies energy to the target thereby stunning the target after the wireless projectile is secured to the target by the attachment mechanism.

[0014] According to further exemplary features described below, the wireless projectile also includes an integral ring to facilitate launching of the wireless projectile by means of firing of the wireless projectile from a conventional firearm.

[0015] According to still further exemplary features, the wireless projectile of the current invention is configured to be launched by a conventional firearm. Particularly, the size, shape and weight of the projectile are similar to those of a conventional bullet and the projectile is packaged in a cartridge for launching from a gun.

[0016] According to still further exemplary features, the wireless projectile includes a stability wing, which creates drag, slowing the projectile and preventing impact damage to the target. The stability wing further supplies aerodynamic stability so that the ballistic of the projectile remains flat as much as possible even at reduced velocity.

[0017] According to still further exemplary features, the attachment mechanism of the wireless projectile remains safe from accidental deployment until the mechanism is armed. Arming of the projectile occurs upon launch.

[0018] According to still further exemplary features, the tachment mechanism of the projectile is triggered and deployed on proximity to the target.

[0019] According to still further exemplary features, the attachment mechanism of the wireless projectile is triggered upon impact of the wireless projectile with the target.

[0020] According to still further exemplary features, during storage of the projectile, the energy delivery subsystem of the projectile is in a non-active state in order to save charge. The energy delivery subsystem is activated upon impact of the wireless projectile with the target.

[0021] According to still further exemplary features, the energy delivery subsystem of the projectile includes a battery, and the battery is stored in a non-active state in order to save charge. The battery is activated upon impact of the wireless projectile with the target.

[0022] According to still further exemplary features, the impact reduction subsystem of the projectile includes a deformable pad. The deformable pad is located on an impact zone of the wireless projectile. Upon impact with a target, the pad deforms and spreads the energy of impact in space and time, preventing impact damage to the target.

[0023] According to still further exemplary features, the impact reduction subsystem of the projectile includes a mobile subassembly. The mobile subassembly is not rigidly attached to the impact zone of the projectile and can move in relation to the impact zone of the projectile.

[0024] According to still further exemplary features, the mobile subassembly includes at least one component selected from the group consisting of the energy delivery subsystem, the attachment mechanism, a spider arm, a battery, a transformer, and a capacitor.

[0025] According to still further exemplary features, motion of the mobile subassembly relative to the impact zone activates a component of the system.

[0026] According to still further exemplary features, the projectile includes a mobile subassembly and further includes an energy absorbing connection. The energy absorbing connection cushions deceleration of the mobile subassembly and reduces the force of impact of the projectile upon a target.

[0027] According to still further exemplary features, the projectile includes a mobile subassembly and an energy absorbing connection. The energy absorbing connection includes a friction connector, a spring, a hydraulic shock absorber, a serrated track or a flexible latch.

[0028] According to still further exemplary features, the impact reduction subsystem includes a sub-projectile. The sub-projectile impacts the target separately from an impact zone on the projectile body. Thereby the mass associated with the impact zone of the projectile body is reduced (because the projectile body does not include those components mounted in the sub-projectile; therefore their mass does not contribute to the force of impact of the projectile body). Thereby reducing the momentum associated with the impact zone, which reduces impact damage to the target.

[0029] According to still further exemplary features, the projectile includes a sub-projectile. The sub-projectile is connected to the projectile body and the impact zone of the projectile body by a wire. Upon impact of the projectile body upon the target, the wire wraps around the target thereby securing the impact zone to the target at a first location and securing the sub-projectile to the target at a second location.

[0030] According to still further exemplary features, the energy delivery subsystem of the projectile produces an electrical potential. The electrical potential is applied as a voltage difference between the impact zone of the projectile body and a sub-projectile such that when the impact zone is near the target at a first location and the sub-projectile is near the target at a second location, electrical energy passes through the target as an electrical current from the first location to the second location.

[0031] According to still further exemplary features, the attachment mechanism of the projectile further serves as a conduit to transfer the energy from the energy delivery subsystem to the target.

[0032] According to still further exemplary features, the attachment mechanism of the projectile is an electrode and further serves as a conduit to transfer electrical energy from the energy delivery subsystem to the target.

[0033] According to still further exemplary features, the attachment mechanism of the projectile includes a barbed hook.

[0034] According to still further exemplary features, the attachment mechanism includes: a first barbed hook and a second barbed hook. The first barbed hook engages the target at a first angle and said second barbed hook engages the target at an opposing angle. Thus the two barbed hooks grasp and entangle the target.

[0035] According to still further exemplary features, the attachment mechanism includes a spider arm.

[0036] According to still further exemplary features, the attachment mechanism includes a spider arm and the spider arm springs out from the side of the wireless projectile.

[0037] According to still further exemplary features, the attachment mechanism includes a spider arm and a mobile subassembly. The mobile subassembly is mobile in relation to an impact zone of the projectile. Motion of the mobile subassembly relative to the impact zone serves to embed the spider arm into the target.

[0038] According to further exemplary features, the separator substrate of the galvanic cell has a thickness of less than 50 μm.

[0039] According to still further exemplary features, the electrodes of the galvanic cell each have a thickness of less than 100 μm.

[0040] According to still further exemplary features, the separator substrate of the galvanic cell is a dielectric when in a dry state.

[0041] According to still further exemplary features, the galvanic cell is activated at the time of use by applying the electrolyte fluid to the separator substrate.

BRIER DESCRIPTION OF THE DRAWINGS

[0042] The invention is herein described, by way of example only, with reference to the accompanying drawings, where:

FIG. 1 is an external view of a first embodiment of a stun projectile having mechanical spider arm electrodes in an unarmed state (e.g. before launch);

FIG. 2 is a cutaway view of the first embodiment of a stun projectile in the unarmed state;

FIG. 3 is a close-view of the mechanical subsystem of the first embodiment of a stun projectile in the unarmed state (e.g. during storage and loading into a weapon);

FIG. 4 is a close-view of the mechanical subsystem of the first embodiment of a stun projectile in an armed state (e.g. during flight);

FIG. 5 is a close-view of the mechanical subsystem of the first embodiment of a stun projectile interacting with a target in an engaged state (after impact);

FIG. 6 is a cutaway view of a second embodiment of a stun projectile in an unarmed state; the second embodiment includes mechanical spider arm electrodes and a mobile subassembly;

FIG 7 is a cutaway view of the second embodiment of a stun projectile in the engaged state;

FIG. 8 is an external view of a third embodiment of a stun projectile having flexible spider arms electrodes;

FIG. 9 is an external view prior to launch of a fourth embodiment of a stun projectile consisting of two sub-projectiles;

FIG. 10 is an external view of the fourth embodiment of a stun projectile during flight;

FIG. 11 is an external view of the fourth embodiment of a stun projectile engaging a target.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0043] The principles and operation of a non-lethal wireless stun projectile system according to the present invention may be better understood with reference to the drawings and the accompanying description.

[0044] Figure 1 shows an external view of a first embodiment **10** of a stun projectile according to the present invention. Figures 1, 2 and 3 show embodiment **10** in an unarmed state. In the unarmed state, the projectile can be safely handled safely and will not be set off even under moderate stress, for example dropping the projectile from a height of 1.5 meters. The stun projectile is loaded into a conventional firearm for launch while in the unarmed state. The projectile and particularly the attachment mechanism remain unarmed until launch (for example being fired from a gun) at which time the acceleration of launch causes arming the projectile and the attachment mechanism (see Figures 3, 4, and 5 with accompanying description). Embodiment **10** is built of two main subassemblies a mechanical subassembly (see Figures 1, 2, 3, 4 and 5) and an electrical subassembly (see Figures 2, 6, 7 and 8). The mechanical subassembly serves as an attachment mechanism to secure the projectile to the target. The electrical subassembly serves an energy delivery subsystem to deliver a pulsed electric shock to the target.

[0045] Shown in the Figure 1 is a projectile body **12.** Projectile body **12** is hollow and houses the active elements of the projectile as illustrated in subsequent figures. Four slits **14,** in the side of projectile body **12,** serve as passageways through which spider arms **20** (see Figures .3, 4, and 5) spring out and are deployed upon impact. Spider arms **20** serve as an attachment mechanism, to secure the projectile to a target **40** (see Figure 5).

[0046] Projectile **10** may be fired at a range of 10 - 30 meter without killing. The electrical round is quite heavy. Therefore in order to avoid permanent injury at such short ranges, impact is minimized by an impact reduction subsystem. The impact reduction subsystem acts to: 1) increase the impact area, spreading the impact energy over a wide area and 2) soften the impact by distributing the impact energy over a relatively long time. Increasing the impact area and distributing the impact over time is achieved by means of a deformable pad **16** located on the impact zone of the projectile. In embodiment **10,** the preferred ballistic is a flat trajectory as much as possible, (AMAP) in order to achieve, easy aiming and better accuracy. Therefore, the impact is perpendicular and the impact zone is the front of the projectile (marked by deformable pad **16).**

[0047] Deformable pad **16** collapses and flattens on impact thus spreading the impact energy on larger area and spreading the impact energy over a larger time (required for deformable pad **16** to collapse) then the impact area and time of a solid bullet. Spreading the impact energy decreases the possibility of injury. To further decrease the probability of permanent injury, the impact zone in embodiment **10** is free of hard elements to eliminate any penetration possibility or "hard" impact that can cause fatal injury. The design considers maximum *energy/area* of 30 Joule/cm^2 should not be exceeded to avoid long-term impact damage.

[0048] Also shown in Figure 1 is an Integral ring **18** that seals and keeps the pressure in the cartridge. Integral ring **18** includes a circular groove **19** that allows the ring to expand due to the pressure while firing and to improve the sealing between the projectile and the cartridge. This effect works all along the travel of the projectile in the cartridge. Typical dimensions of the seal are 0.2 mm protruding, 1 mm thickness and 4mm groove depth or release of material around.

[0049] Figure 2 shows a cutaway view of embodiment **10** of a stun projectile according to the present invention. Illustrated are projectile body **12,** slits **14,** deformable pad **16,** spider arms **20,** batteries **52,** a high voltage transformer **54,** a low voltage transformer **56,** and a capacitor **58.**

[0050] Figure 3 shows a cutaway view of the top half of the front section of embodiment **10** of a stun projectile according to the present invention in the unarmed (safe) configuration. Embodiment **10** is symmetrical; therefore the bottom half is a mirror image of the top half. Therefore, the bottom half is not shown. The mechanical assembly of the projectile can be seen including spider arm **20,** barb **22,** safety pin **24,** safety pin release spring **26** and arming element **28.** Arming element **28** has a slot **38.** Also shown are spider arm catch **30,** pendulum weight **32** and hinge pin **34.** Spider arm **20** is held stationary by spider arm catch **30** and cannot deploy. Similarly, spider arm catch **30** is held stationary by hinge pin **34** and pendulum weight **32.** In the unarmed state, pendulum weight **32** cannot swing forward because the path in front of pendulum weight **32** is blocked by safety pin **24.** Also seen in Figure 3 is battery **52,** which will be described in more detail in the description associated with Figures 15 and 16.

[0051] Figure 4 shows embodiment **10** in the armed state during flight. Spider arm **20** is still held stationary by spider arm catch **30.** Nevertheless, in Figure 4, the projectile of embodiment **10** is armed. Specifically at launch (shooting the bullet), inertial forces cause arming element **28** to slide backwards, lining up slot **38** in arming element **28** with safety pin **24.** Then safety release spring **26** pushes safety pin **24** into slot **38.** Thus, safety pin **24** no longer blocks movement of pendulum weight **32.** Consequently, spider arm catch **30** and pendulum weight **32** are free to rotate around hinge pin **34.**

[0052] Figure 5 illustrates the stun projectile of embodiment **10** as the attachment mechanism is triggered into an engaged state. When the armed projectile of embodiment **10** (as shown in Figure 4) impacts target **40** (as shown in Figure 5), inertial forces push pendulum weights **32** forward causing pendulum weights **32** and spider arm catches **30** to rotate around hinge pins **34** releasing and thereby triggering spider arms **20a-d.** Upon release, Spider arms **20a-d** spring out of the sides of the projectile through slits **14** to engage target **40,** attaching the projectile to target **40.**

[0053] The attachment mechanism of the projectile of embodiment **10** includes four spider arms **20a, 20b, 20c, 20d,** each with a corresponding barb **22a, 22b, 22c,** and **22d.** Due to the semicircular trajectory of spider arms **20a-d,** each arm engages target **40** at a different angle. Barbs **22a-d** are thin and sharp. Therefore barbs **22a-d** and consequently spider arms **20a-d** penetrate clothes skin and other materials, hooking into the flesh of target **40** to bind target **40** preventing target **40** from releasing himself from the projectile of embodiment **10** Particularly, spider arm **22a** engages the target at a first angle and spider arm **22c** engage target **40** at an opposing angle. Similarly spider arms **22b** and **22d** engage target **40** in opposite directions. It will be understood to one skilled in the art of non-lethal weapons, that because barbs **22a** and **22c** engage target **40** from opposing sides and in opposing directions they grasp, entangle and hook target **40,** attaching the projectile to target **40** and making it exceedingly difficult for target **40** to disentangle himself from the projectile of embodiment **10.** The same effect is achieved by the opposing barbs **22b** and **22d.** Because spider arms **20a-d** approach the target in a semi-circular arc from outside the edges of the projectile, spider arms **20a-d** do not interfere with front impact zone of deformable pad **16** that is deformed during impact

[0054] Impact also initiates the electrical subsystem of the stun projectile. The electrical subsystem is not shown in embodiment **10,** but is illustrated in embodiment **100,** Figure 6. The electrical subsystem is also the energy delivery subsystem for delivering electrical shocks to the target. The energy delivery subsystem of embodiment **100** includes batteries **52** to supply electrical energy, an oscillator (not shown) to convert energy from batteries **52** from direct current to alternating current. The energy delivery subsystem also includes spring electrodes **108** to transfer the alternating electrical current to low voltage transformer **56.** The energy delivery subsystem also includes a high voltage transformer **54** to transform pulses of low voltage current from low voltage transformer **56** to high voltage pulses of current. In this process of transformation, low voltage AC current is rectified and is stored on a capacitor **58.** Capacitor **58** is discharged through high voltage transformer **54,** in which the low-voltage pulse is transformer to high-voltage pulse. The last links in the energy delivery subsystem are spider arms **20,** which serve as electrodes transferring charge from high voltage transformer **54** to a target **40.**

[0055] Specifically, embodiment **100** (Figure 6) includes a rigidly mounted subassembly **102** rigidly connected to projectile body **12.** Rigidly mounted subassembly **102** includes mechanical elements (not shown) and batteries **52.** A mobile subassembly **104** slides along a guide rod **106**. Thus mobile subassembly **104** can move in relation to projectile body **12** and in relation to the impact zone of the projectile (deformable pad **16).** Mobile subassembly **104** includes high voltage transformer **54,** low voltage transformer **56,** capacitor **58** and spring electrical contacts **108.** Mobile subassembly **104** also includes a flexible latch **110.** As mobile subassembly **104** slides along guide rod **106,** flexible latch **110** slides along a serrated track **112** slipping in and out of serrations thus absorbing energy.

[0056] When the projectile of embodiment **100** impacts a target (not shown), deformable pad **16** is quickly crushed and projectile body **12** and rigidly mounted subassembly **102** decelerate abruptly. On the other hand, mobile subassembly **104** continues to travel forward, sliding along guide rod **106** towards rigidly mounted subassembly **102.** Mobile subassembly **104** is decelerated by the energy absorbing connection between flexible latch **110** and serrated track **112.** Therefore, the rate of deceleration of mobile mounted subassembly **104** is less than the rate of deceleration of projectile body **12** and rigidly mounted subassembly **102.** It is understood by one skilled in the art of momentum absorbing devices that force of impact is proportional to the rate of deceleration and mass being decelerated. Therefore, by mounting mobile subassembly **104** on an energy-absorbing track, the force of impact of the projectile of embodiment **100** on a target is significantly lessened. This decreases the probability that the target will suffer impact damage. Thus, mobile subassembly **104,** spring electrical contacts **108,** flexible latch **110** and serrated track **112** along with deformable pad **16** are all included in the impact reduction subsystem of embodiment **100.**

[0057] Upon impact of the projectile of embodiment **100** with a target, inertial forces causes mobile subassembly **104** to slide forward along guide rod **106.** Soon after impact between the projectile of embodiment **100** and the target, mobile subassembly **104** slides to the end of guide rod **106.** Then mobile subassembly **104** collides with rigidly mounted subassembly **102.** Collision with mobile subassembly **104** pushes activator button **602** (see Figure 16) activating batteries **52.** Subsequently, in the absence of extreme inertial forces (on the order of the inertial forces of launch and impact of the projectile), mobile subassembly **104** is held together with rigidly mounted subassembly **102** by the force of the connection between flexible latch **110** and serrated track **112** as is shown in Figure 7. While mobile subassembly **104** and rigidly mounted subassembly **102** are held together, spring electrical contacts **108** connect low voltage transformer **56** via an oscillator to battery terminals **604a** and **604b** (see Figure 16) (each spring electrical contact **108** connects to one battery terminal **604** on each) of batteries **52** thus supplying direct current to the oscillator supplying alternating electric current to low voltage transformer **56.** Low voltage transformer **56** is electrically connected to capacitor **58,** and also is in turn connected to high voltage transformer **54.** Low voltage transformer **56** charges capacitor **58** to maximum. Capacitor **58** discharges through high voltage transformer **54** to spider arms **20** passing high voltage pulses of electric current through the target **40** and incapacitating the target **40..** Thus, the electrical system is inactive until impact with the target when motion of the mobile subassembly **104** relative to the impact zone of the projectile causes batteries **52** to be activated and connected to low voltage transformer **56,** high voltage transformer **54** and capacitor **58.** It will be understood by one skilled in the art of electrical devices that prior to impact with a target (for example while the projectile is being stored and while the projectile is in flight) batteries **52** are not activated and not connected to low voltage transformer **56,** high voltage transformer **54** or capacitor **58.** Therefore, a maximum charge is preserved in batteries **52** during storage for maximum stunning effect upon the target upon impact.

[0058] Deceleration of mobile subassembly **104** is timed such that the collision between mobile subassembly **104** and rigidly mounted subassembly **102** occurs after the triggering, deployment and extension of spider arms **20** (see figure 7). At the moment of collision between mobile subassembly **104** and rigidly mounted subassembly **102,** momentum from mobile subassembly **104** is transferred through rigidly mounted subassembly **102** to deployed spider arms **20.** This transferred momentum drives spider arms **20** further into the target making it more difficult for the target to untangle himself from the projectile of embodiment **100.**

[0059] The stun projectile of embodiment **100** has the following electrical parameters:

- output voltage is 50-100 kilovolt (*kV*)
- output current is from 1-10 microampere (μA)
- pulse duration is of 10 microsecond - 10 millisecond (*ms*)
- repetition rate of 10-40 *Hz*
- working time is from 1 to 5 minute (*min*).

[0060] Also shown if Figure 7 is a stability wing **114.** Stability wing **114** is mounted on a hinge **116.** Hinge **116** permits stability wing **114** to be folded against projectile body **12** during storage and loading into a weapon. Stability wing **114** is held in the folded (closed) position by the cartridge of the projectile. When the projectile is launched, the projectile is freed from its cartridge, and stability fin **114** opens. In flight, stability fin **114** serves two purposes. First stability wing **114** creates drag and slows the projectile, decreasing the probability of impact damage to the target. Furthermore, due to its aerodynamic characteristics stability wing **114** increases the stability of the projectile. Thus even at low velocities, ballistic performance remains high and the trajectory remains flat AMAP.

[0061] Figure 8 illustrates an alternative embodiment **200** of a stun projectile according to the present invention. Instead of a hinged spring-loaded spider arms (as in embodiments **10** and **100),** the attachment mechanism of embodiment **200** includes flexible spider arms **220** made of flexible wire. When the impact zone **210** of the stun projectile of embodiment **200** impacts a target (not shown), inertial forces cause flexible spider arms **220** to bend towards the target and those forces further drive barbs **222** at the ends of flexible spider arms **220** into the target. Except for the mechanics of spider arms **220,** the stun projectile of embodiment **200** works in a similar manner to the stun projectile of embodiments **10** and **100.** When flexible spider arms **220** are in contact with the target, they act as an electrode disabling the target by passing high voltage current into the target. Because flexible spider arms **220** do not include moving parts, they can be produced more cheaply than spider arms **20** of embodiments **10** and **100.** The stun projectile of embodiment **200** also includes hooks **222** on impact zone **210** of the projectile. Hooks **222** are short and do not penetrate through clothing into a human, but hooks **222** are designed to fasten themselves onto clothing holding the projectile to the target. In the projectile of embodiment **200,** electrical potential is applied across opposing flexible spider arms **220** (thus some of flexible spider arms **220** have a positive electrical potential and others of flexible spider arms **220** have a negative electrical potential, The potential difference drives electrical energy [current] through the target from between positively and negatively charged flexible spider arms **220** similar to embodiment **10** Figure 5). Alternatively, positive potential can be applied to hooks **222** and negative potential to spider arms **220.** Thus current passes through the target between spider arms **220** to hooks **222.**

[0062] Figure 9 illustrates a stun projectile according to another embodiment **300.** The stun projectile of embodiment **300** is shown in Figure 9 before launch. Shown are sub-projectiles **302a** and **302b.** A high voltage wire **304** connects sub-projectiles **302a** and **302b.** Before launch, high voltage wire **304** is wound up and inserted into a unified capsule along with sub-projectiles **302a** and **302b** as shown in Figure 9.

[0063] Upon launch the capsule falls away revealing (Figure 10) the impact zone of sub-projectile **302a.** The impact zone is the exterior of sub-projeclile **302a** and contains hooks **222,** which are designed hold human clothing. Due to elastic properties of high-voltage wire **304,** sub-projectiles **302a** and **302b** move apart to distance limited by the length of high voltage wire **304** (10-50 cm). Each sub-projectile **302a** and **302b** rotates in space and flies toward target **40.** Also upon launch, an inertial switch (not shown) turns on the electrical systems and activates the batteries (not shown) of sub-projectiles **302a** and **302b** (the electrical system of sub-projectiles **302a** and **302b** are similar to the electrical system illustrated in Figure 2). In embodiment **300,** battery **52** is contained by sub-projectile **302a** and high voltage transformer **54,** low voltage transformer **56,** and capacitor **58** are all contained in sub-projectile **302b**

[0064] Figure 11 illustrates attachment of the stun projectile of embodiment **300** to target **40.** The attachment mechanism of embodiment **300** includes high voltage wire **304,** which winds around target **40** and hooks **222,** which stick to target **40.** When the impact zone of sub-projectile **302a** strikes target **40,** hooks **222** on sub-projectile **302a** stick to target **40.** Elastic properties of high-voltage wire **304** cause the high-voltage wire **304** to wrap around target **40.** Furthermore, as high-voltage wire **304** wraps around target **40,** sub-projectile **302b** impacts target **40** separately from the impact zone (of sub-projectile **302a).** Then, hooks **222** on sub-projectile **302b** stick to target **40.** Once both sub-projectiles **302a** and **302b** are in proximity of target **40,** the electrical potential difference between sub-projectiles **302a** and **302b** drives a pulsed current through target **40,** stunning and disabling him. Note that because sub-projectile **302a** contains the impact zone of the projectile, sub-projectile **302a** is also referred to as the body of the projectile.

[0065] The advantages of embodiment **300** are:

a) The mass of the projectile is divided in two parts and therefore the force of the impact shock is decreased with respect to a monolith bullet.

b) Electrodes of embodiment **300** do not have to touch or penetrate the skin of target **40.** Thus probability of significant damage to the skin of target **40** is decreased. Because the positive and negative electrodes (on sub-projectile **302a** and **302b** respectively) are separated at the range of 10-50 cm, high voltage current will pass through and affect target **40** even when the electrodes are separated from the skin of target **40** by clothes and an air gap.

c) Embodiment **300** requires fewer hooks to hold back the shocker at the surface of interaction than embodiments **10, 100** and **200.**

d) The necessity to hold back a bullet only at the clothes, not at the human body, leads to decrease of dimensions of hooks, which finally decreases potential damage caused by hooks on the human tissue if the projectile impacts target **40** near a sensitive spot.

e) Dividing a bullet at two parts (or more) can increase the rifle sight range.

[0066] Producing an electric shock that will incapacitate an adult human being for 5 minutes using a mechanism the size of standard ammunition requires that the electrical components (battery **52,** high voltage transformer **54,** low voltage transformer **56,** and capacitor **58)** be smaller and more efficient than those currently available. In the present invention, miniature electrical components are produced using novel applications of thin film technology.

[0067] High-voltage transformer **54** is produced using thin-film technology.

Claims

1. A wireless projectile (10, 100) for stunning a target, the projectile is configured to be launched from a conventional weapon and attach itself to the target, the projectile comprising:

a) an impact zone (16); and

b) an energy delivery subsystem (elements 20, 52, 54, 56, 58 and 108 combined) for supplying an energy to the target thereby stunning the target, and

c) a mobile subassembly (104) of the wireless projectile (10, 100) which is configured to move in relation to said impact zone (16) **characterized in that** said mobile subassembly (104) has at least one energy absorbing connection (110-112) between said mobile subassembly (104) and the projectile body (12) such that said mobile subassembly (104) is decelerated by said energy absorbing connection upon impact.

2. The wireless projectile of claim 1 further comprising:

d) an impact reduction subsystem to protect the target from impact damage caused by impact of the wireless projectile on the target;

e) an attachment mechanism to secure the wireless projectile to the target upon impact with the target, and

wherein said energy delivery subsystem supplies said energy when secured to the target by said attachment mechanism.

3. The wireless projectile of claim 1, wherein a component is configured to perform at least one action selected from the group consisting of arm upon launch, , and trigger upon impact with the target.

4. The wireless projectile of claim 1, wherein said energy delivery subsystem is configured to perform at least one action selected from the group consisting of activate upon impact with the target and activate a battery upon impact with the target.

5. The wireless projectile of claim 1, wherein said energy delivery subsystem includes at least one part selected from the group consisting of a thin film technology battery and a thin film technology transformer.

6. The wireless projectile of claim 1, wherein a component includes at least one part selected from the group consisting of said energy delivery subsystem, an attachment mechanism, a spider arm, a battery, a transformer, a capacitor, an energy absorbing connection, and a sub-projectile.

7. The wireless projectile of claim 1 wherein a component serves to attach the wireless projectile to the target.

8. The projectile of claim 1 wherein a component includes a first electrode configured to deploy and engage the target upon impact of said impact zone on the target, and wherein said first electrode is configured to pass an electric current through the target to a second electrode thereby stunning the target.

9. The projectile of claim 8, wherein said first electrode is configured to perform at least on action selected from the group consisting of extend out from a body of the projectile and bend upon impact of the projectile on the target.

10. The projectile of claim 8, wherein said first electrode includes a barbed hook.

11. The projectile of claim 8, wherein said second electrode is located on said impact zone.

12. The projectile of claim 8, wherein said second electrode is configured to deploy upon impact of the projectile on the target.

13. A method of stunning a target with a non-lethal projectile (10, 100), the projectile is configured attach itself to the target, the projectile comprising:

a) launching the projectile from a conventional weapon;
b) deploying a first electrode (20) to engage the target upon impact of the non-lethal projectile on the target,
c) passing an electric current from said first electrode (20) through the target, **characterized in**:
d) providing the non-lethal projectile (10, 100) with an impact reduction subsystem to decrease injury to the target caused by an impact of the non-lethal projectile (10, 100) upon the target, and said impact reduction subsystem includes a mobile subassembly (104) movable in relation to a projectile body (12) upon impact, said mobile subassembly (104) having at least one energy absorbing connection (110-112) between said mobile subassembly (104) and said projectile body (12), and
e) upon impact decelerating said mobile subassembly (104) by said energy absorbing connection.

14. The method of claim 13, wherein send step of deploying is in an arc shaped path.

Patentansprüche

1. Drahtloses Projektil (10, 100) zum Lähmen eines Ziels, wobei das Projektil dafür konfiguriert ist, aus einer herkömmlichen Waffe gestartet zu werden und sich am Ziel anzubringen, wobei das Projektil umfasst:

a) eine Aufprallzone (16);
b) ein Energieabgabe-Subsystem (Elemente 20, 52, 54, 56, 58 und 108 kombiniert) zum Übergeben einer Energie an das Ziel, wodurch das Ziel gelähmt wird; und
c) eine bewegliche Teilbaugruppe (104) des drahtlosen Projektils (10, 100), die dafür konfiguriert ist, sich in Bezug auf die Aufprallzone (16) zu bewegen, **dadurch gekennzeichnet, dass** die bewegliche Teilbaugruppe (104) mindestens eine energieaufnehmende Verbindung (110-112) zwischen der beweglichen Teilbaugruppe (104) und dem Projektilkörper (12) hat, so dass die bewegliche Teilbaugruppe (104) durch die energieaufnehmende Verbindung beim Aufprall abgebremst wird.

2. Drahtloses Projektil nach Anspruch 1, ferner umfassend:

d) ein Aufprallverringerungs-Subsystem, um das Ziel vor Aufprallschäden zu schützen, die durch den Aufprall des drahtlosen Projektils auf dem Ziel bewirkt werden;
e) einen Anbringungsmechanismus, um das drahtlose Projektil beim Zusammenprall mit dem Ziel am Ziel zu befestigen, und
worin das Energieabgabe-Subsystem die Energie übergibt, wenn es durch den Anbringungsmechanismus am Ziel befestigt ist.

3. Drahtloses Projektil nach Anspruch 1, worin eine Komponente ferner dafür konfiguriert ist, mindestens eine Aktion durchzuführen, die aus der aus Folgendem bestehenden Gruppe ausgewählt wird: Scharfmachen beim Start, und Auslösen beim Zusammenprall mit dem Ziel.

4. Drahtloses Projektil nach Anspruch 1, worin das Energieabgabe-Subsystem ferner dafür konfiguriert ist, mindestens eine Aktion durchzuführen, die aus der aus Folgendem bestehenden Gruppe ausgewählt wird: Aktivieren beim Zusammenprall mit dem Ziel und Aktivieren einer Batterie beim Zusammenprall mit dem Ziel.

5. Drahtloses Projektil nach Anspruch 1, worin das Energieabgabe-Subsystem mindestens ein Teil einschließt, das aus der aus Folgendem bestehenden Gruppe ausgewählt wird: eine Dünnschichttechnik-Batterie und ein Dünnschichttechnik-Transformator.

6. Drahtloses Projektil nach Anspruch 1, worin eine

Komponente mindestens ein Teil einschließt, das aus der aus Folgendem bestehenden Gruppe ausgewählt wird: das Energieabgabe-Subsystem, ein Anbringungsmechanismus, ein Spinnenarm, eine Batterie, ein Transformator, ein Kondensator, eine energieaufnehmende Verbindung und ein Subprojektil.

7. Drahtloses Projektil nach Anspruch 1, worin eine Komponente dazu dient, das drahtlose Projektil am Ziel anzubringen.

8. Projektil nach Anspruch 1, worin eine Komponente eine erste Elektrode einschließt, die dafür konfiguriert ist, sich beim Aufprall der Aufprallzone auf dem Ziel zu entfalten und sich im Ziel zu verhaken, und worin die erste Elektrode dafür konfiguriert ist, einen elektrischen Strom durch das Ziel zu einer zweiten Elektrode zu leiten, wodurch das Ziel gelähmt wird.

9. Projektil nach Anspruch 8, worin die erste Elektrode dafür konfiguriert ist, mindestens eine Aktion durchzuführen, die aus der aus Folgendem bestehenden Gruppe ausgewählt wird: Hervorstehen aus einem Körper des Projektils und Biegen beim Aufprall des Projektils auf dem Ziel.

10. Projektil nach Anspruch 8, worin die erste Elektrode einen Widerhaken einschließt.

11. Projektil nach Anspruch 8, worin die zweite Elektrode auf der Aufprallzone angeordnet ist.

12. Projektil nach Anspruch 8, worin die zweite Elektrode dafür konfiguriert ist, sich beim Aufprall des Projektils auf dem Ziel zu entfalten.

13. Verfahren zum Lähmen eines Ziels mit einem nichttödlichen Projektil (10, 100), wobei das Projektil dafür konfiguriert ist, sich am Ziel anzubringen, wobei das Verfahren umfasst:

a) Starten des Projektils aus einer herkömmlichen Waffe;
b) Entfalten einer ersten Elektrode (20), um sich beim Aufprall des nichttödlichen Projektils auf dem Ziel im Ziel zu verhaken;
c) Leiten eines elektrischen Stroms von der ersten Elektrode (20) durch das Ziel,
gekennzeichnet durch:
d) Versehen des nichttödlichen Projektils (10, 100) mit einem Aufprallverringerungs-Subsystem, um Verletzungen des Ziels zu vermindern, die **durch** einen Aufprall des nichttödlichen Projektils (10, 100) auf dem Ziel bewirkt werden, und wobei das Aufprallverringerungs-Subsystem eine bewegliche Teilbaugruppe (104) einschließt, die beim Aufprall in Bezug auf einen Projektilkörper (12) beweglich ist, wobei die bewegliche Teilbaugruppe (104) mindestens eine energieaufnehmende Verbindung (110-112) zwischen der beweglichen Teilbaugruppe (104) und dem Projektilkörper (12) hat; und
e) beim Aufprall erfolgendes Abbremsen der beweglichen Teilbaugruppe (104) **durch** die energieaufnehmende Verbindung.

14. Verfahren nach Anspruch 13, worin der Schritt des Entfaltens auf einem bogenförmigen Weg erfolgt.

Revendications

1. Projectile sans fil (10, 100) destiné à étourdir une cible, le projectile étant configuré de manière à être tiré à partir d'une arme conventionnelle et à se fixer sur la cible, le projectile comprenant :

a) une zone d'impact (16) ;
b) un sous-système de transfert d'énergie (éléments 20, 52, 54, 56, 58 et 108 combinés) destiné à transférer de l'énergie à la cible et à étourdir par conséquent la cible ; et
c) un sous-ensemble mobile (104) du projectile sans fil (10, 100), lequel est configuré de manière à se déplacer par rapport à ladite zone d'impact (16), **caractérisé en ce que** ledit sous-ensemble mobile (104) présente au moins une connexion d'absorption d'énergie (110 - 112) entre ledit sous-ensemble mobile (104) et le corps de projectile (12), de sorte que ledit sous-ensemble mobile (104) est freiné par ladite connexion d'absorption d'énergie lors de l'impact.

2. Projectile sans fil selon la revendication 1, comprenant en outre :

d) un sous-système de réduction d'impact destiné à protéger la cible contre un dommage d'impact causé par l'impact du projectile sans fil sur la cible ;
e) un mécanisme de fixation destiné à fixer le projectile sans fil à la cible lors de l'impact sur la cible ; et
dans lequel ledit sous-système de transfert d'énergie transfère ladite énergie lorsqu'il est fixé à la cible par ledit mécanisme de fixation.

3. Projectile sans fil selon la revendication 1, dans lequel un composant est configuré de manière à mettre en oeuvre au moins une action choisie dans le groupe comportant un armement lors du tir, et un déclenchement lors de l'impact avec la cible.

4. Projectile sans fil selon la revendication 1, dans lequel ledit sous-système de transfert d'énergie est configuré de manière à mettre en oeuvre au moins une action choisie dans le groupe comportant une activation lors de l'impact avec la cible et l'activation d'une batterie lors de l'impact avec la cible.

5. Projectile sans fil selon la revendication 1, dans lequel ledit sous-système de transfert d'énergie inclut au moins une pièce choisie dans le groupe comportant une batterie à technologie à couche mince et un transformateur à technologie à couche mince.

6. Projectile sans fil selon la revendication 1, dans lequel un composant inclut au moins une pièce choisie dans le groupe comportant ledit sous-système de transfert d'énergie, un mécanisme de fixation, un bras d'araignée, une batterie, un transformateur, un condensateur, une connexion d'absorption d'énergie, et un sous-projectile.

7. Projectile sans fil selon la revendication 1, dans lequel un composant sert à fixer le projectile sans fil à la cible.

8. Projectile selon la revendication 1, dans lequel un composant inclut une première électrode configurée de manière à se déployer et à mobiliser la cible lors de l'impact de ladite zone d'impact sur la cible, et dans lequel ladite première électrode est configurée de manière à faire circuler un courant électrique à travers la cible vers une seconde électrode, étourdissant par conséquent la cible.

9. Projectile selon la revendication 8, dans lequel ladite première électrode est configurée de manière à mettre en oeuvre au moins une action choisie dans le groupe consistant à s'étendre à partir d'un corps du projectile, et à se courber lors de l'impact du projectile sur la cible.

10. Projectile selon la revendication 8, dans lequel ladite première électrode inclut un crochet à ardillon.

11. Projectile selon la revendication 8, dans lequel ladite seconde électrode est située sur ladite zone d'impact.

12. Projectile selon la revendication 8, dans lequel ladite seconde électrode est configurée de manière à se déployer lors de l'impact du projectile sur la cible.

13. Procédé d'étourdissement d'une cible au moyen d'un projectile non létal (10, 100), le projectile étant configuré de manière à se fixer à la cible, le procédé consistant à :

a) tirer le projectile à partir d'une arme conventionnelle ;

b) déployer une première électrode (20) en vue de s'engager dans la cible lors de l'impact du projectile non létal sur la cible ;

c) faire circuler un courant électrique depuis ladite première électrode (20) à travers la cible, **caractérisé en ce qu'**il consiste à :

d) doter le projectile non létal (10, 100) d'un sous-système de réduction d'impact pour diminuer un dommage à la cible causé par un impact du projectile non létal (10, 100) sur la cible, et ledit sous-système de réduction d'impact inclut un sous-ensemble mobile (104) lequel est mobile par rapport à un corps de projectile (12) lors de l'impact, ledit sous-ensemble mobile (104) présentant au moins une connexion d'absorption d'énergie (110 - 112) entre ledit sous-ensemble mobile (104) et ledit corps de projectile (12) ; et

e) lors de l'impact, freiner ledit sous-ensemble mobile (104) par le biais de ladite connexion d'absorption d'énergie.

14. Procédé selon la revendication 13, dans lequel ladite étape de déploiement est mise en oeuvre en suivant une trajectoire en forme d'arc.

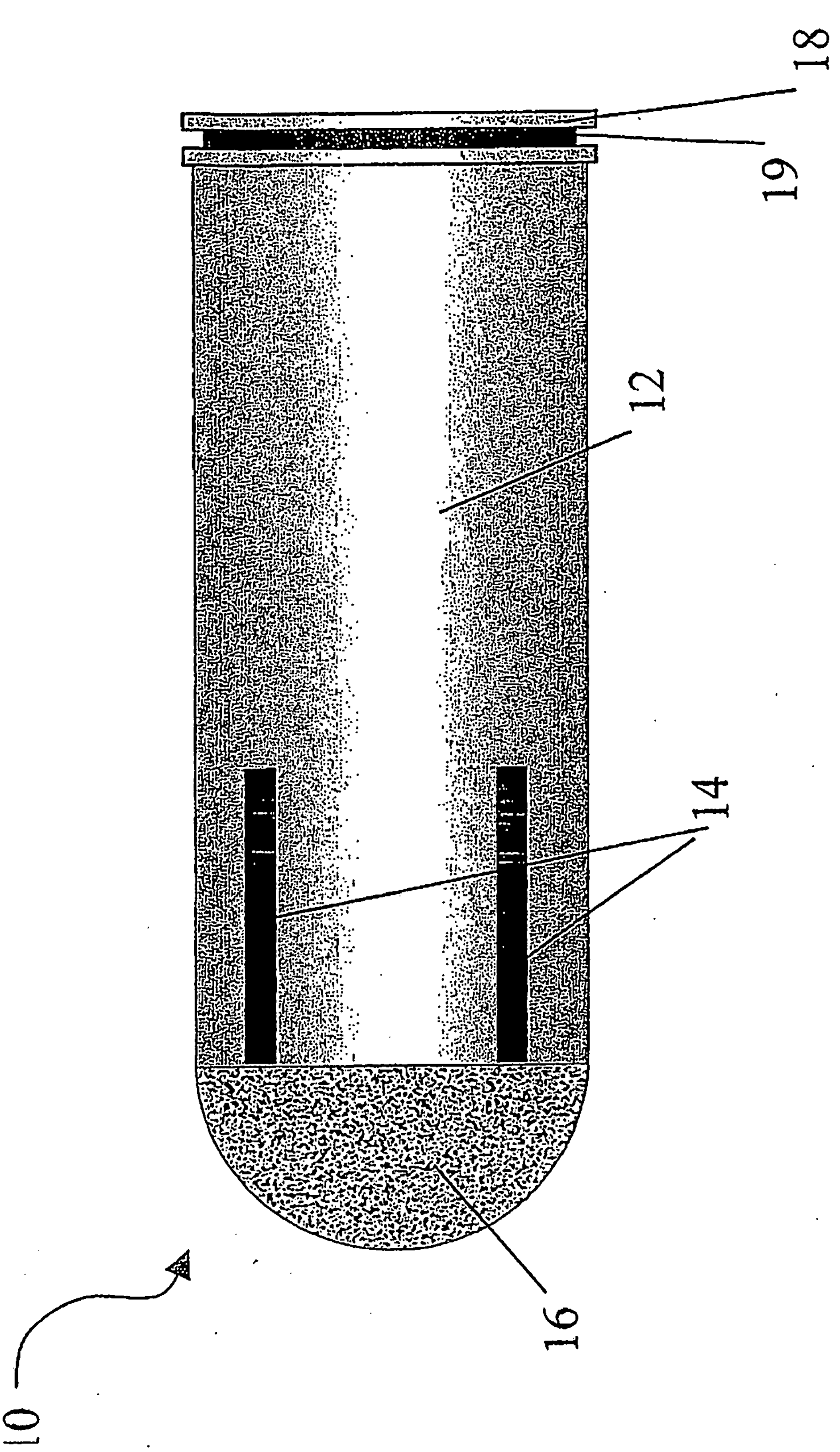


Figure 1

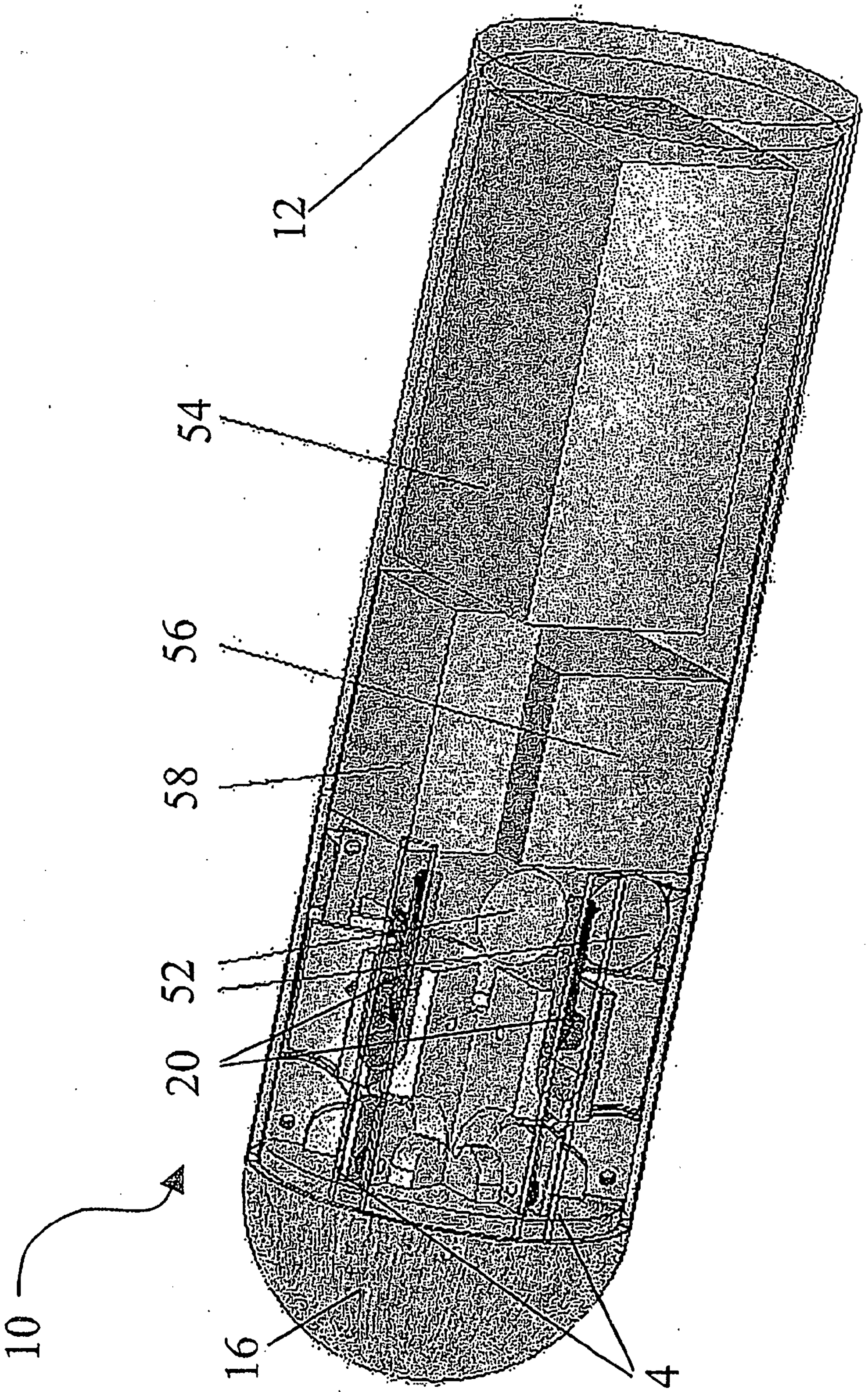


Figure 2

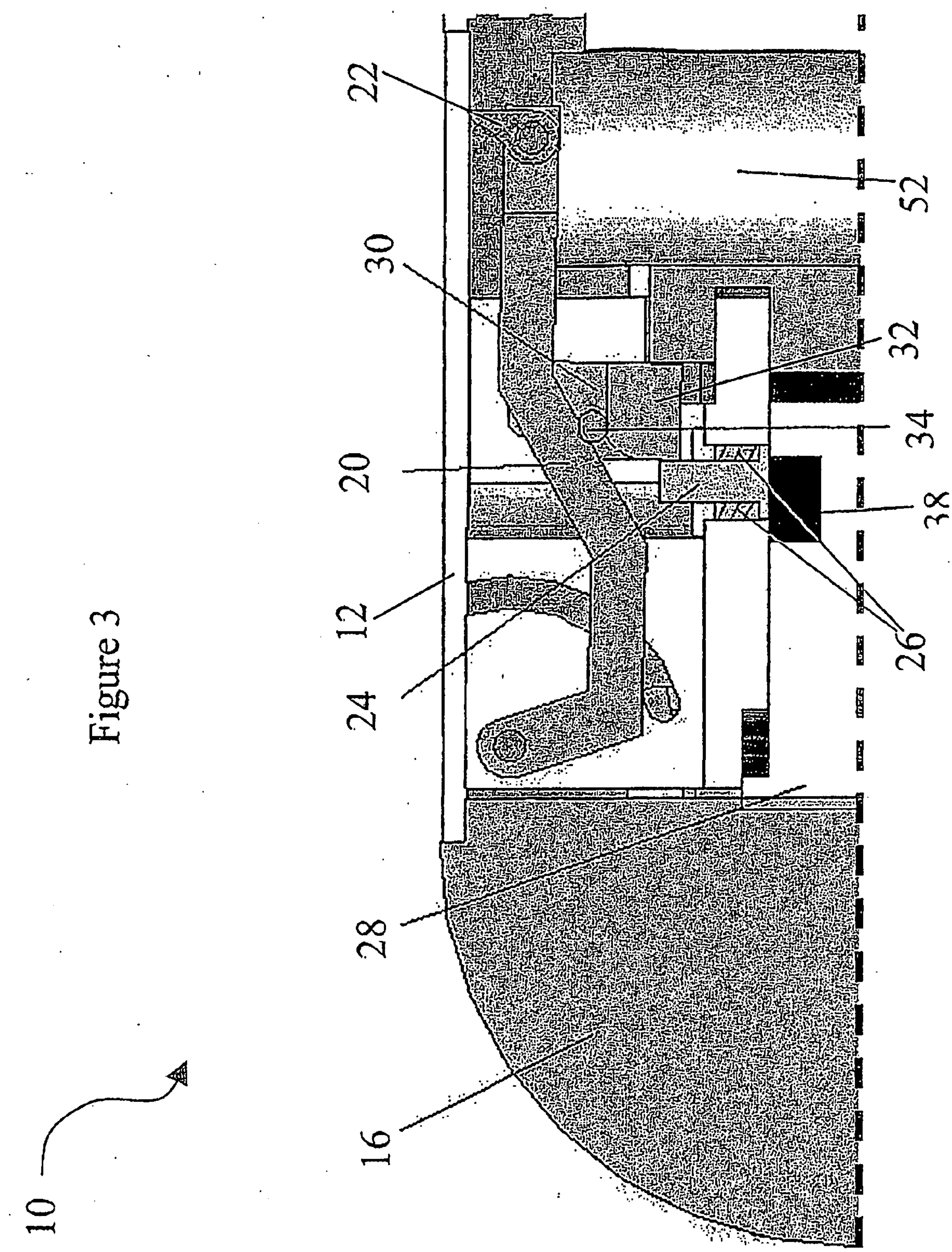


Figure 3

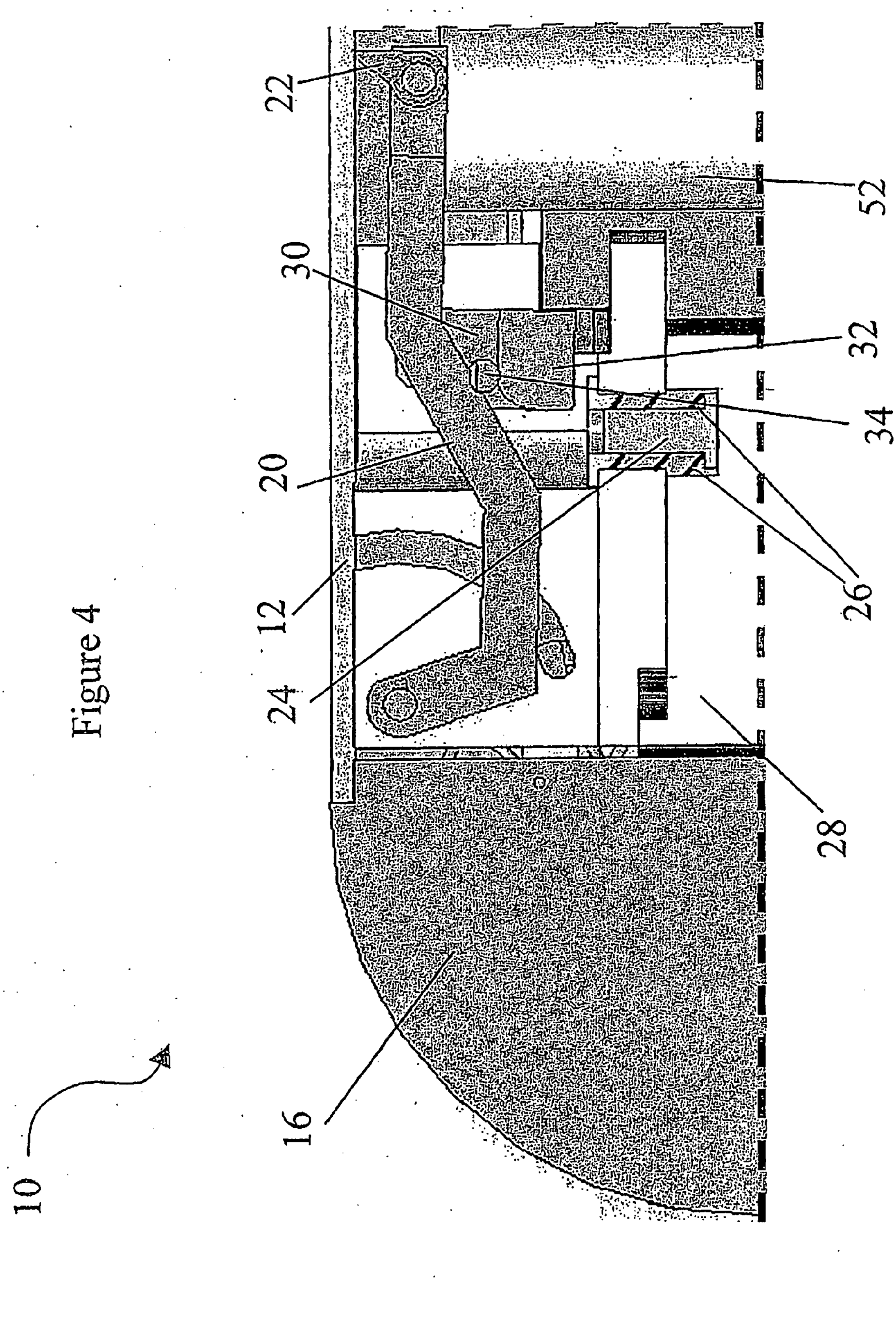
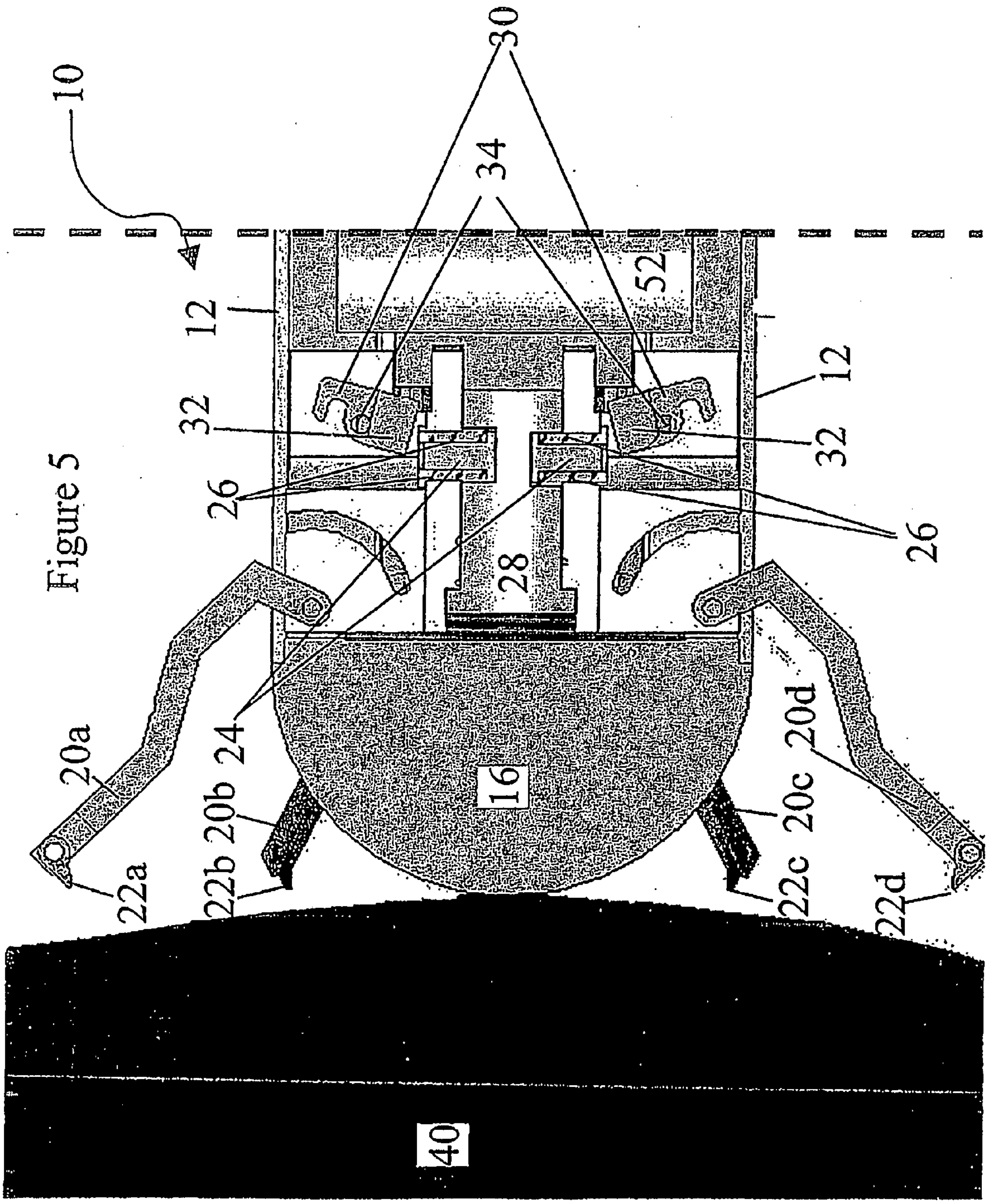


Figure 4


10
30
34
12
52
12
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26
28
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20a
20b
16
20c
20d
22a
22b
22c
22d
40

Figure 5

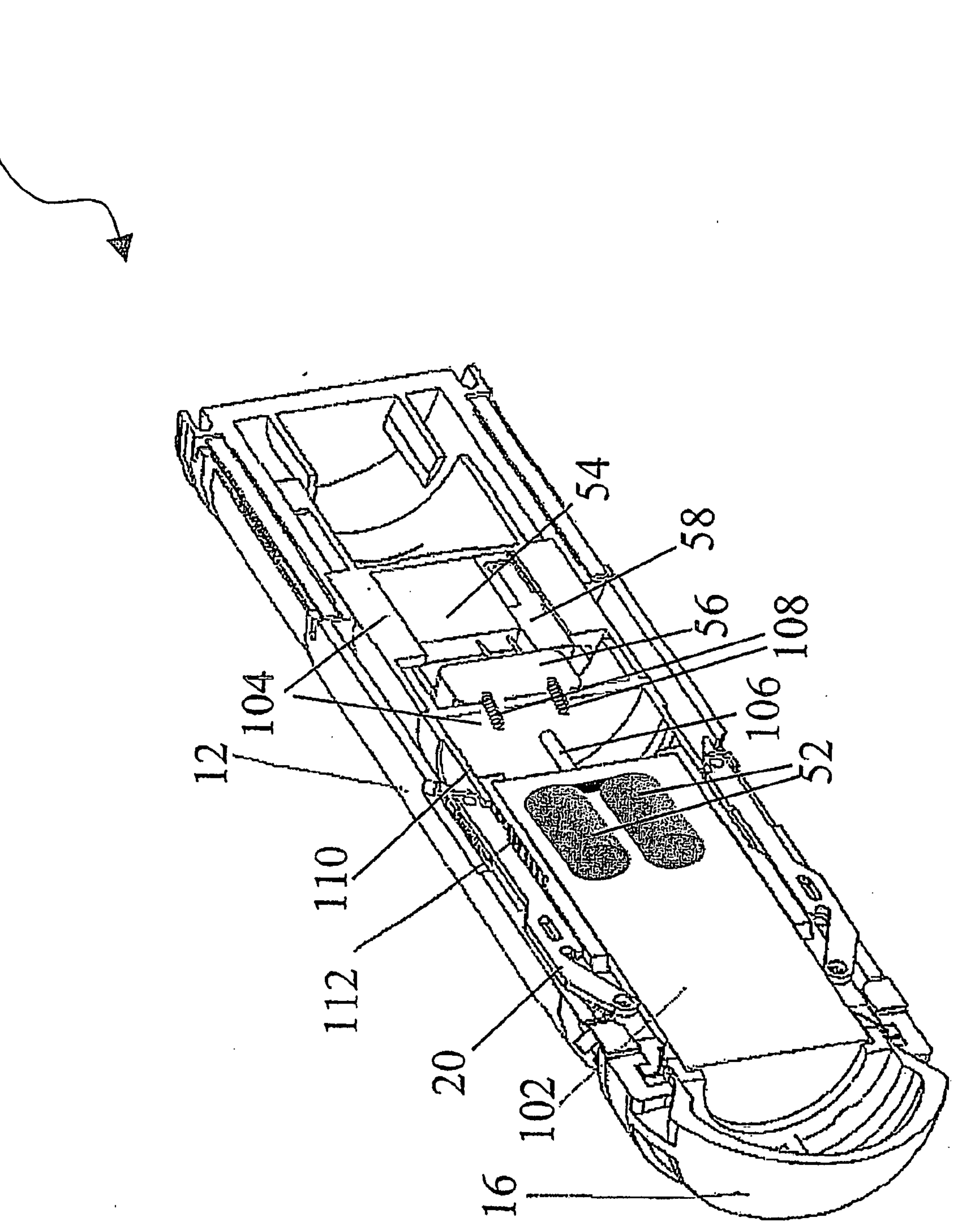


Figure 6

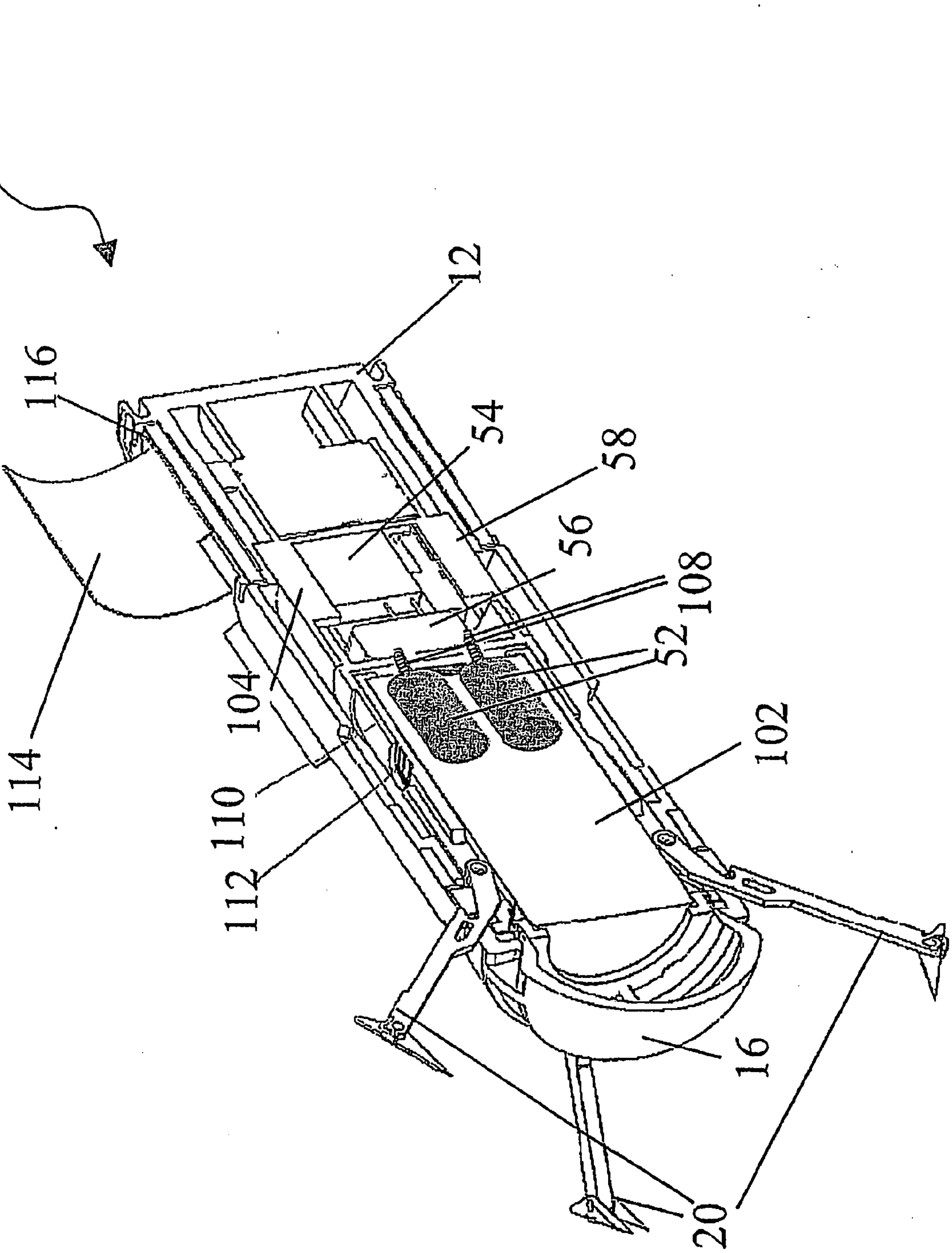


Figure 7

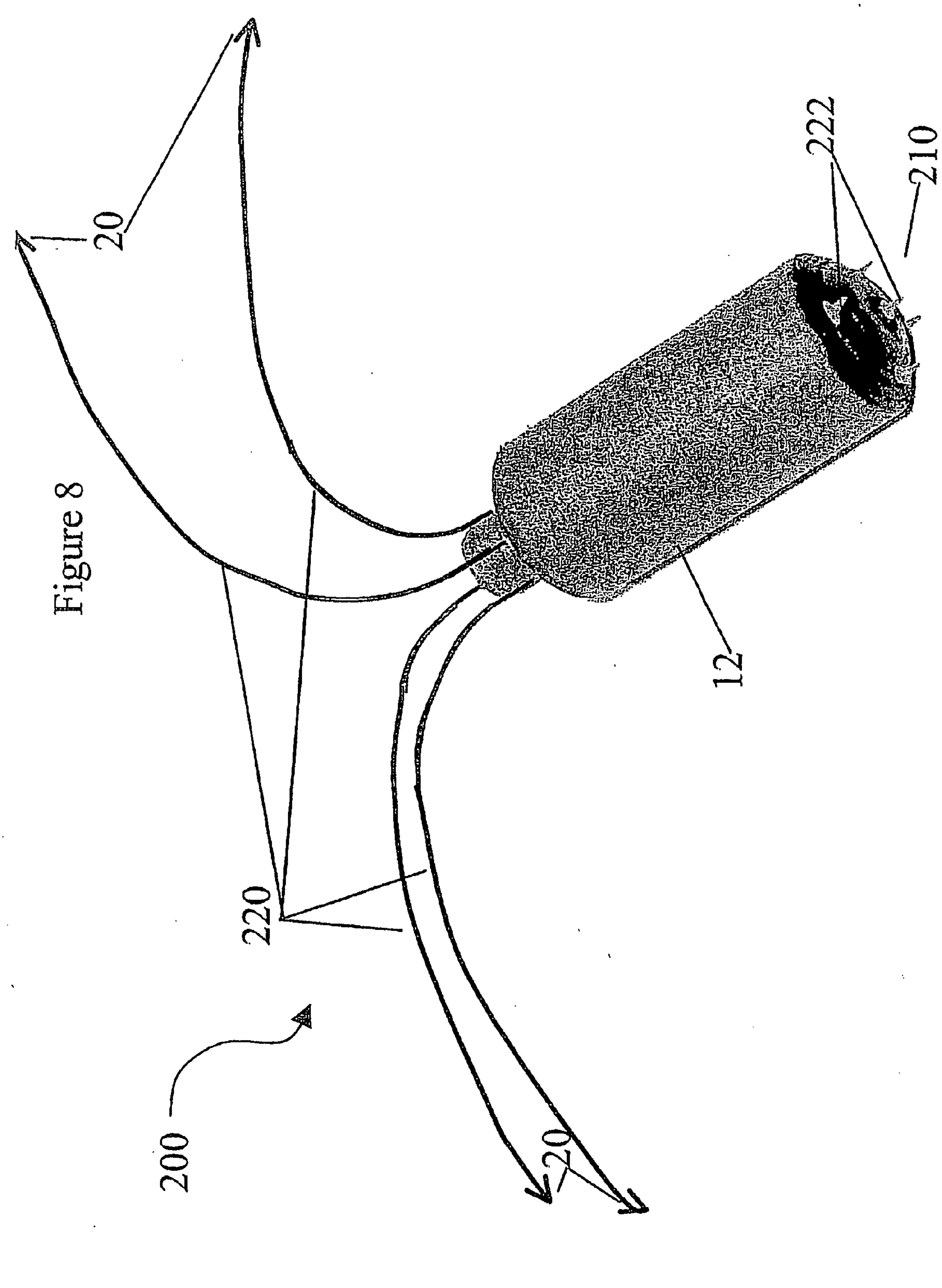


Figure 8

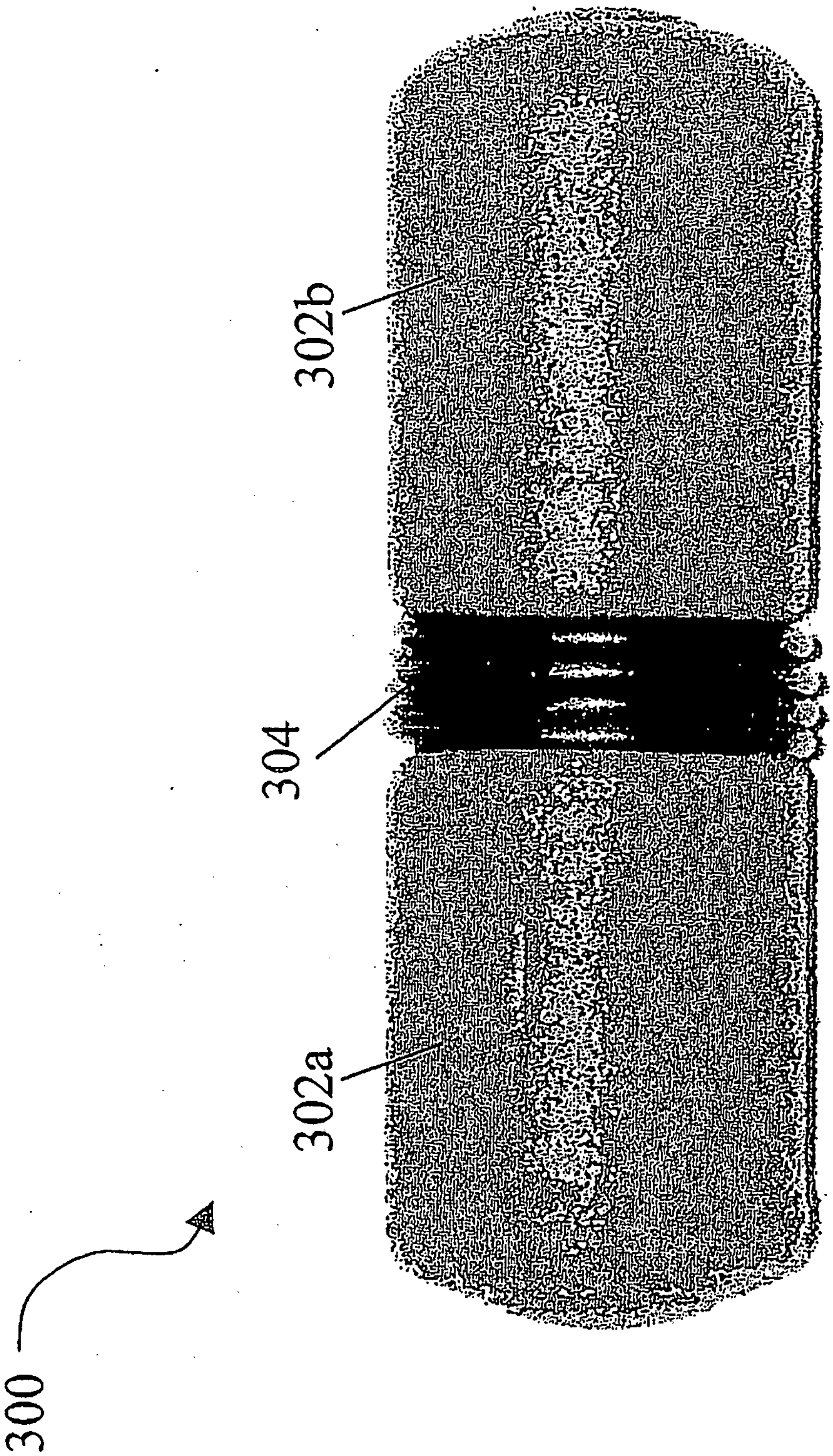
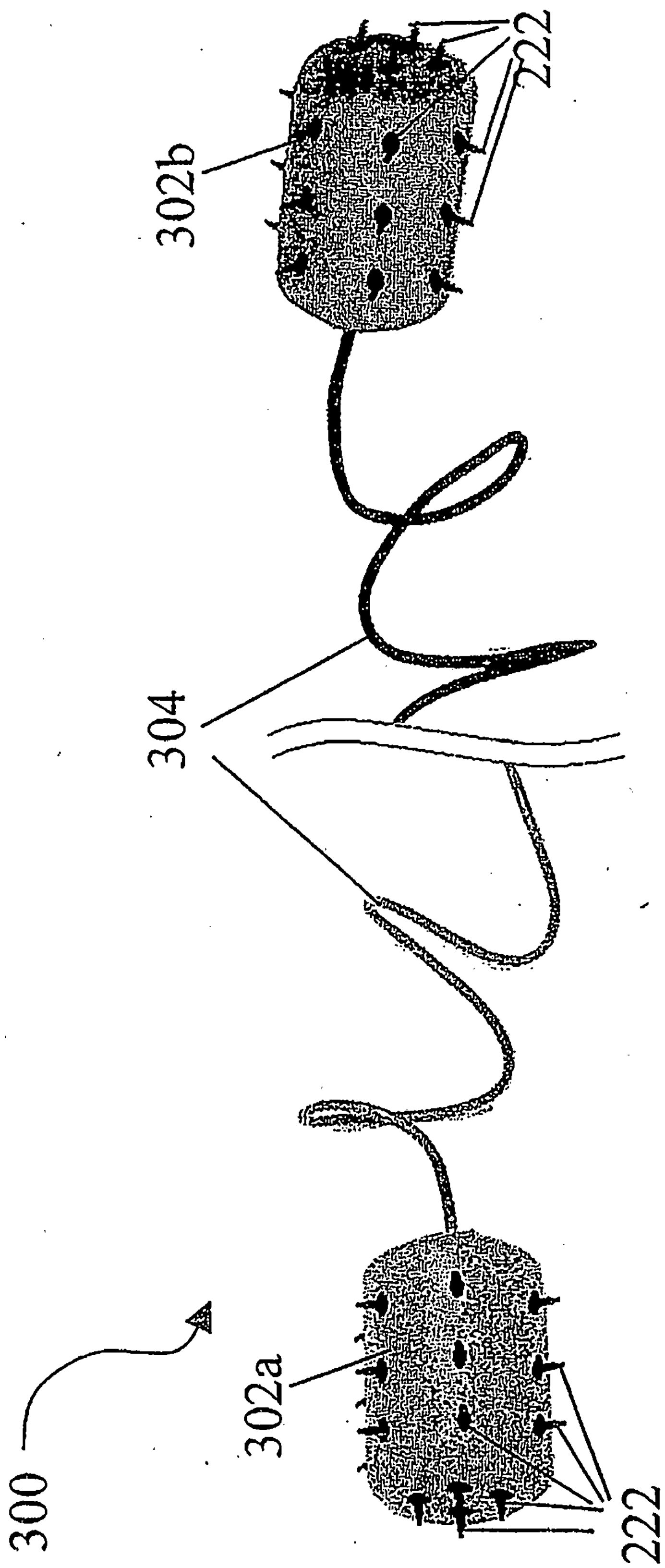


Figure 9

Figure 10



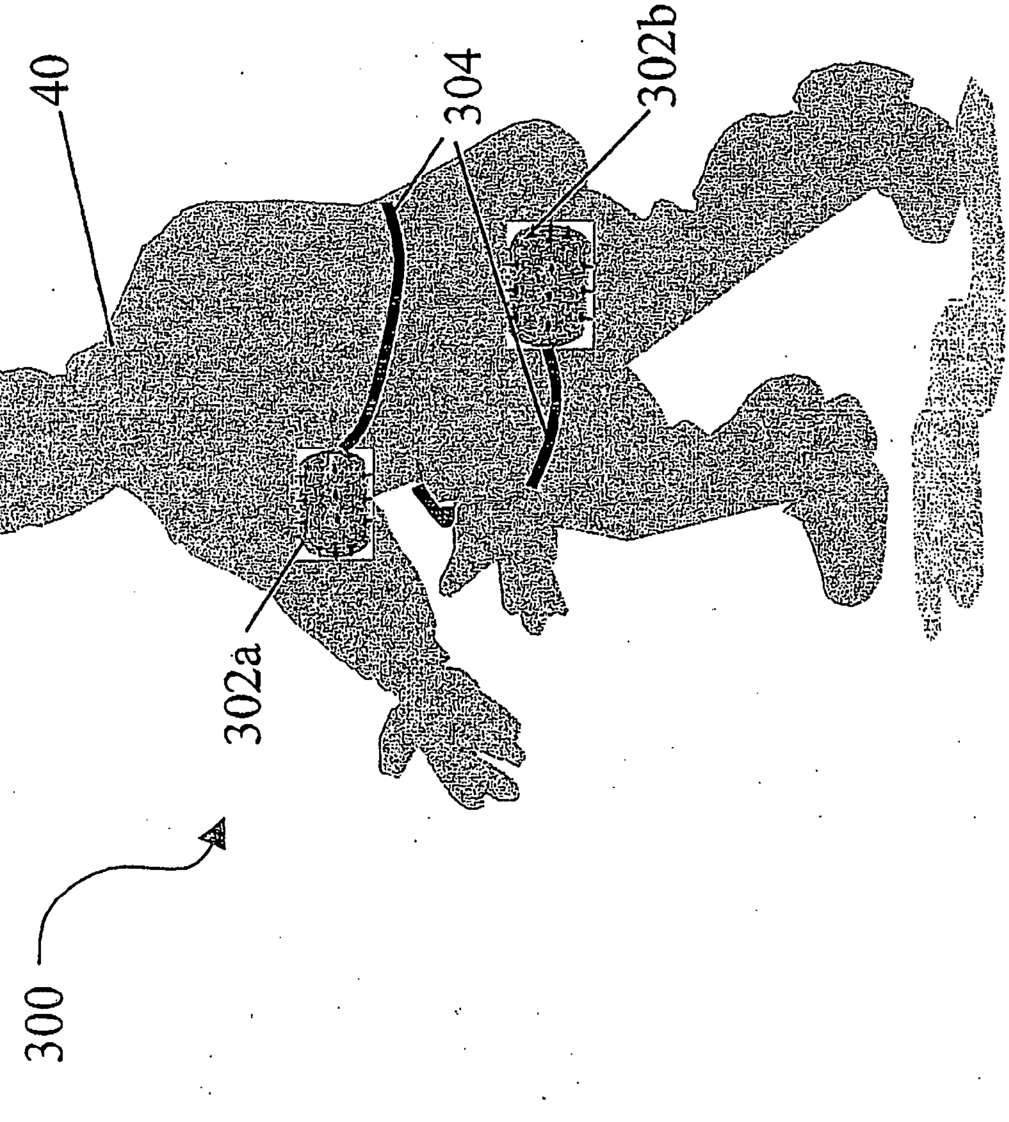


Figure 11

REFERENCES CITED IN THE DESCRIPTION

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