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(54) REACTIVE FIREARM TARGET

(57) A reactive firearm target is provided. The reactive firearm target includes a shoot-through, ricochet-free surface, a rigid support having a first end coupled to a portion of the shoot-through, ricochet-free surface, and a hinge mechanism coupled to a second end of the rigid support, wherein the hinge mechanism is configured to swing from a first position to a second position when the shoot-through, ricochet-free surface is contacted by a firearm projectile.

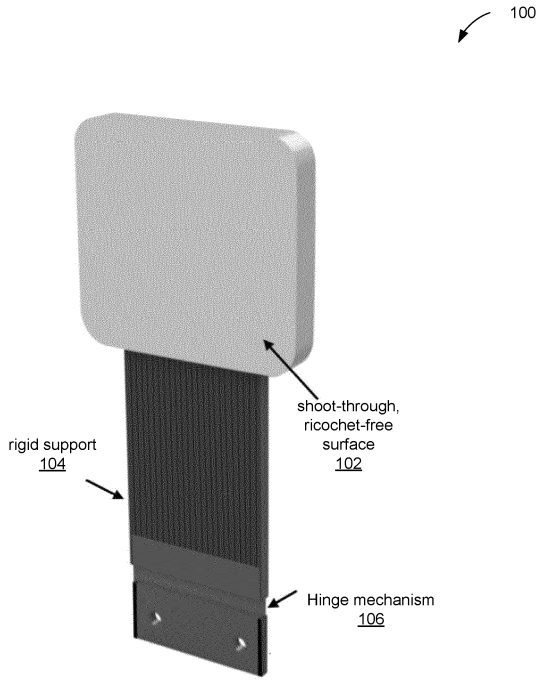

FIGURE 1

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Description

CLAIM FOR PRIORITY

[0001] This application claims the benefit of U.S. Provisional Application No. 63/394,183 (Attorney Docket GIL1P003+), entitled "MULTI-WINDOWED, SHOOT THROUGH, TARGET SYSTEMS FOR CLOSE DISTANCE LIVE FIRE TRAINING," and filed August 1, 2022, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to target systems for firearm training.

BACKGROUND

[0003] The operation of firearms can be very dangerous. Every round fired from a firearm has the potential of causing death or serious injury. Shot placement accuracy is critical when trying to stop a life threatening attack. Poor shot placement can cause a failure to protect life and the possible death or injury of innocent life.

[0004] For this reason, firearm training systems are key to ensuring that firearm users develop necessary firearm handling skills. Live fire training for firearms, which is conventionally used for firearm training, uses full metal jacketed ammunition at close distances and thus requires 100% shoot through targets that are ricochet free for safety. Static targets, including paper and cardboard targets, are typically used for this type of training, and can be viewed after every shot allowing the firearm operator to evaluate their firearm handling skills. In particular, the target will show the target location hit by the operator's round, which allows the operator to adjust their aim to make a better shot in subsequent rounds.

[0005] However, there are some limitations for firearm training systems that rely on static targets. In particular, the static nature of the targets prevents the operator from obtaining real-time feedback. For example, the operator must "walk-back" the paper/cardboard target in order to closely analyze their shot placement.

[0006] There is thus a need for addressing these and/or other issues associated with the prior art.

SUMMARY

[0007] A reactive firearm target is provided. The reactive firearm target includes a shoot-through, ricochet-free surface, a rigid support having a first end coupled to a portion of the shoot-through, ricochet-free surface, and a hinge mechanism coupled to a second end of the rigid support, wherein the hinge mechanism is configured to swing from a first position to a second position when the shoot-through, ricochet-free surface is contacted by a firearm projectile.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Figure **1** illustrates a reactive firearm target, in accordance with an embodiment.

Figures 2A-C illustrate various swing motions of the reactive firearm target of Figure **1,** in accordance with embodiments.

Figures 3A-B illustrate front and back views of a firearm training system having a plurality of the reactive firearm target described with reference to Figure **1,** in accordance with embodiments.

Figure **4** illustrates various designs for the firearm training system of Figures 3A-B, in accordance with embodiments.

Figures 5A-B illustrate the coupling of the reactive firearm target of Figure **1** to a rigid backing of the firearm training system of Figures 3A-B, in accordance with embodiments.

Figures 6A-D illustrates various hit detection sensors for the firearm training system of Figures 3A-B, in accordance with embodiments.

Figure **7** illustrates a hit detection sensor array for the firearm training system of Figures 3A-B, in accordance with an embodiment.

Figure **8** illustrates the firearm training system of Figures 3A-B having video motion detection, in accordance with an embodiment.

Figure **9** illustrates the firearm training system of Figures 3A-B having a look back camera and reflective film for shoot back flash simulations, in accordance with an embodiment.

DETAILED DESCRIPTION

[0009] Figure **1** illustrates a reactive firearm target **100,** in accordance with an embodiment. The reactive firearm target **100** may be formed with, at the very least, the features described below with reference to Figure **1.** Of course, additional features may also be included. Additionally, the reactive firearm target **100** may be implemented in a firearm training system, as described in more detail below with reference to the subsequent figures.

[0010] The reactive firearm target **100** refers to a target to be shot with a firearm projectile during firearm training/practice. The firearm refers to any type, model, etc. of firearm, such as a handgun, rifle, etc. The firearm projectile refers to any type of projectile capable of being projected from the firearm during normal operation of the

firearm by an operator (i.e. user).

[0011] As illustrated, the reactive firearm target **100** includes a shoot-through, ricochet-free surface **102.** The shoot-through, ricochet-free surface **102** is a surface intended to be shot with the firearm projectile, and thus may also be referred to herein as the "target surface". The surface **102** is constructed such that, upon contact, the firearm projectile will shoot through the surface and will not ricochet off the surface in a direction back towards the firearm. In an embodiment, the shoot-through, ricochet-free surface **102** may be a flexible self-healing polymer.

[0012] The reactive firearm target **100** also includes a rigid support **104** having a first end coupled to a portion of the shoot-through, ricochet-free surface **102.** The rigid support **104** refers to a mechanism configured to support the shoot-through, ricochet-free surface **102** in a position that allows the surface **102** to be used as a shooting target. To allow the surface **102** to be used for accuracy training/practice, the rigid support **104** may be sufficiently rigid to provide a steady positioning of the surface **102** until contacted by the firearm projectile. Likewise, the first end of the rigid support **104** may be rigidly coupled to the portion of the shoot-through, ricochet-free surface **102.** In an embodiment, the rigid support **104** may be formed of a multi-channel reinforced stiff polymer board.

[0013] The reactive firearm target **100** further includes a hinge mechanism **106** coupled to a second end of the rigid support **104.** In an embodiment, the hinge mechanism **106** may be formed of a long fiber reinforced material. With respect to the present description, the hinge mechanism **106** is configured to swing from a first position to a second position when the shoot-through, ricochet-free surface **102** is contacted by the firearm projectile. In particular, a force of the firearm projectile upon the surface **102** may cause the hinge mechanism **106** to swing. Thus, the hinge mechanism **106** may swing the rigid support **104** and its coupled shoot-through, ricochet-free surface **102,** when the shoot-through, ricochet-free surface **102** is contacted by the firearm projectile.

[0014] In an embodiment, a first end of the hinge mechanism **106** is coupled to the second end of the rigid support **104,** and a second end of the hinge mechanism **106** is configured to be mounted to a rigid backing (not shown). In an embodiment, the second end of the hinge mechanism **106** may have coupled thereto a high density polyethylene (HDPE) stiffener. In an embodiment, the second end of the hinge mechanism **106** (e.g. together with the HDPE stiffener) may include one or more openings for mounting the second end of the hinge mechanism **106** to the rigid backing with one or more couplers (e.g. rivets, zip ties, etc.). In this embodiment, when the shoot-through, ricochet-free surface **102** is contacted by the firearm projectile, the hinge mechanism **106** will swing its first end coupled to the rigid support **104** while its second end is held steady to the rigid backing.

[0015] In an embodiment, the hinge mechanism **106** may be considered open when in the first position and may be considered at least partially closed when in the second position. For example, the hinge mechanism **106** may be at 180 degrees when in the first position and at less than 180 degrees when in the second position. With respect to the rigid backing described above, the hinge mechanism **106** may be coupled thereto in a position such that it is operable to swing the rigid support **104** in a knock-down motion, a swing up motion, or a side swing motion.

[0016] To this end, the firearm target **100** described herein may be operable to be "reactive" when the shoot-through, ricochet-free surface **102** is contacted by the firearm projectile, namely by swinging the surface **102** from the first (initial, target position) to the second position. This swinging action may in turn provide instant visual feedback to the firearm operator. In particular, movement of the shoot-through, ricochet-free surface **102** may indicate to the operator that the firearm target **100** has been hit, whereas no movement of the shoot-through, ricochet-free surface **102** may indicate to the operator that the firearm target **100** has not been hit. Further, since the surface **102** is constructed using a shoot-through material, the operator may subsequently analyze the surface **102** to view the shot placement with respect to the target.

[0017] More illustrative information will now be set forth regarding various optional architectures and uses in which the foregoing method may or may not be implemented, per the desires of the user. It should be strongly noted that the following information is set forth for illustrative purposes and should not be construed as limiting in any manner. Any of the following features may be optionally incorporated with or without the exclusion of other features described.

[0018] Figures 2A-C illustrate various swing motions of the reactive firearm target **100** of Figure **1,** in accordance with embodiments. The various swing motions refer to the motion of the rigid support and shoot-through, ricochet-free surface with respect to a steady backing to which the hinge mechanism is coupled.

[0019] As illustrated in Figure **2A,** the firearm target **100** may be situated such that the shoot-through, ricochet-free surface is in an upright position prior to being contacted by the firearm projectile (i.e. the hinge mechanism is in full extension with the rigid support holding the target surface in an upright position). Contact of the firearm projection will cause the hinge mechanism to swing the rigid support and coupled target surface in a downward (i.e. knock-down) motion.

[0020] As illustrated in Figure **2B,** the firearm target **100** may be situated such that the shoot-through, ricochet-free surface is in a downward position prior to being contacted by the firearm projectile (i.e. the hinge mechanism is in full extension with the rigid support holding the target surface in a downward position). Contact of the firearm projection will cause the hinge mechanism to swing the rigid support and coupled target surface in an upward (i.e. swing up) motion.

[0021] As illustrated in Figure **2C,** the firearm target

100 may be situated such that the shoot-through, ricochet-free surface is in a horizontal position prior to being contacted by the firearm projectile (i.e. the hinge mechanism is in full extension with the rigid support holding the target surface in a horizontal, or sideward position). Contact of the firearm projection will cause the hinge mechanism to swing the rigid support and coupled target surface in a sideways (i.e. side swing) motion.

[0022] Figures 3A-B illustrate front and back views of a firearm training system **300** having a plurality of the reactive firearm target described with reference to Figure **1,** in accordance with embodiments. It should be noted that while the firearm training system **300** is shown as including multiple reactive firearm targets, other embodiments are contemplated in which a firearm training system includes only one reactive firearm target. Thus, the firearm training system **300** may be configured to include one or more of the reactive firearm targets described above in Figure **1.**

[0023] As shown, the firearm training system **300** includes a plurality of the reactive firearm target **100** described with reference to Figure **1.** Optionally, the firearm training system **300** may also include conventional static targets, as desired.

[0024] Each reactive firearm target **100** is coupled to a rigid backing **302,** which provides steady support for the reactive firearm target **100.** The rigid backing **302** may be formed of a shoot-through, ricochet-free material, such as a multi-channel reinforced stiff polymer board. The rigid backing **302** may be resistant to wind and twisting. Each reactive firearm target **100** may be coupled to the rigid backing **302,** on an end of the hinge mechanism opposite the end of the hinge mechanism coupled to the rigid support of the reactive firearm target **100.** Each reactive firearm target **100** may be coupled to the rigid backing **302** via one or more couplers (e.g. rivets, zip ties, etc.).

[0025] In an embodiment, the rigid backing **302** includes an opening (i.e. window) 304 that frames the shoot-through, ricochet-free surface of the reactive firearm target **100.** Thus, the firearm projectile may travel through the opening to contact the shoot-through, ricochet-free surface. In an embodiment, the rigid backing **302** may include a plurality of openings that each frame the shoot-through, ricochet-free surface of a respective one of the reactive firearm targets **100.** The reactive firearm target **100,** when contacted by a firearm projectile, swings in a motion (e.g. knock-down, swing up, side swing) that is respective to the rigid backing **302.**

[0026] It should be noted that the materials used to construct at least the reactive firearm target **100** and the rigid backing **302** may be shoot-through and ricochet-free such that they are safe to shoot at a distance of 2 feet with full metal jacketed ammunition. For example, the rigid backing **302** may be made of a semi-rigid polymer with structural channels. Accordingly, the firearm training system **300** may be rigid and light weight. A 24"x 72" life-size target frame with 5 firearm targets **100** can weigh less than 3 pounds and can be accelerated at 20m/s sq. A 24"x 36" target frame with 4 reaction targets can weigh less than 2 pounds and can be accelerated at 20m/s sq. These firearm targets **100** are ideal for live fire animations in shoot houses, in vehicles, on cables, on rails, and drones.

[0027] Figure **4** illustrates various designs for the firearm training system **300** of Figures 3A-B, in accordance with embodiments. As shown, the firearm training system **300** may be designed with different graphics and different layouts of reactive firearm targets. For example, the firearm training system **300** may be designed based upon a type of threat on which the operator is being trained (e.g. knife threat, firearm threat, etc.).

[0028] Figures 5A-B illustrate the coupling of the reactive firearm target of Figure **1** to a rigid backing of the firearm training system of Figures 3A-B, in accordance with embodiments.

[0029] In Figure **5A,** the firearm target is situated such that the shoot-through, ricochet-free surface is in an upright position prior to being contacted by the firearm projectile (i.e. the hinge mechanism is in full extension with the rigid support holding the target surface in an upright position). The shoot-through, ricochet-free surface and a portion of the rigid support of the firearm target are framed by an opening of the rigid backing. A hold up support is also coupled to the rigid backing which is operable to support the firearm target in the upright position. Contact of the firearm projection will cause the hinge mechanism to swing the rigid support and coupled target surface in a downward (i.e. knock-down) motion.

[0030] As illustrated in Figure **5B,** the firearm target **100** is situated such that the shoot-through, ricochet-free surface is in a downward position prior to being contacted by the firearm projectile (i.e. the hinge mechanism is in full extension with the rigid support holding the target surface in a downward position). The shoot-through, ricochet-free surface and a portion of the rigid support of the firearm target are framed by an opening of the rigid backing. Contact of the firearm projection will cause the hinge mechanism to swing the rigid support and coupled target surface in an upward (i.e. swing up) motion.

[0031] Figures 6A-D illustrates various hit detection sensors for the firearm training system of Figures 3A-B, in accordance with embodiments. A hit detection sensor refers to an electronically or mechanically activated sensor that triggers a signal when activated. The sensor may be formed of a shoot-through, ricochet-free material, in an embodiment.

[0032] In the present embodiments, the sensor may be operable to detect when the hinge mechanism of the reactive firearm target swings from a first (i.e. unhit) position to a second (i.e. hit) position, and then responsive to the detection causes instant feedback to be provided to an operator of the firearm. The sensor may be an optic switch, a magnetic switch, a proximity switch, or a contacts switch, as described with reference to Figures 6A-D. The instant feedback may be an audible sound (e.g. ring), a light output (e.g. green light), a message output

(e.g. text message output to a mobile device of the operator), a vibration (e.g. caused on the mobile device of the operator), or a visual display (e.g. a screen displaying a shooting score).

[0033] Figure **6A** shows an optic switch, comprised of a dual fiber optic sensor on one side and a reflector on another side. In the example shown, the dual fiber optic sensor is situated on the rigid backing, whereas the reflector is situated on the rigid support of the reactive firearm target, however it should be noted that these sensor components may be situated vice versa. In either case, the dual fiber optic sensor and the reflector are situated so as to be adjacent to one another (with or without direct contact) when the reactive firearm target is in an initial (i.e. unhit) position, and so as to be non-adjacent with one another when the reactive firearm target has swung to a hit position.

[0034] When the dual fiber optic sensor and the reflector are adjacent to one another, the dual fiber optic sensor senses its own light output reflected from the reflector, and does not trigger the instant feedback. When the dual fiber optic sensor and the reflector are not adjacent to one another, the dual fiber optic sensor does not sense its own light output, and in response triggers the instant feedback.

[0035] Figure **6B** illustrates a magnetic switch, comprised of a magnetic sensor and a flexible magnet. The magnetic switch components are situated similar to the optic switch components, and thus operate similarly to sense a hit on the reactive firearm target and to trigger the instant feedback accordingly.

[0036] Figure **6C** illustrates a proximity switch, comprised of a proximity sensor and a conducting element. The proximity switch components are situated similar to the optic switch components, and thus operate similarly to sense a hit on the reactive firearm target and to trigger the instant feedback accordingly.

[0037] Figure **6D** illustrates a contacts switch, comprised of a contacts element and a conductor element. The contacts switch components are situated similar to the optic switch components, and thus operate similarly to sense a hit on the reactive firearm target and to trigger the instant feedback accordingly.

[0038] Figure 7 illustrates a hit detection sensor array for the firearm training system of Figures 3A-B, in accordance with an embodiment. A hit detection sensor array refers to an electronically activated sensor array that triggers a signal when activated. The sensor array may be formed of a shoot-through, ricochet-free material, in an embodiment.

[0039] In the present embodiments, the sensor array may be operable to detect when the hinge mechanism of each reactive firearm target swings from a first (i.e. unhit) position to a second (i.e. hit) position, and then responsive to the detection causes instant feedback to be provided to an operator of the firearm.

[0040] As shown, the sensor array includes an light emitting diode (LED) array transmitter on one end of the rigid backing and a LED array receiver on another end of the rigid backing. Light from the transmitter is blocked from receipt by the receiver when the reactive firearm targets are in an initial (i.e. unhit) position. Light from the transmitter is received by the receiver when the reactive firearm targets are in a hit position.

[0041] Figure **8** illustrates the firearm training system of Figures 3A-B having video motion detection, in accordance with an embodiment. As shown, each window of the rigid backing in which a reactive firearm target is situated is designated as a video motion detection area. The video motion detection area is an area in which an external camera detects motion of the respective reactive firearm target (i.e. detects movement from an unhit position to a hit position). Responsive to the detection, a system coupled to the camera and receiving an indication of the detected motion causes instant feedback to be provided to an operator of the firearm.

[0042] Figure **9** illustrates the firearm training system of Figures 3A-B having a look back camera and reflective film for shoot back flash simulations, in accordance with an embodiment. The shoot back flash simulating device, which may be comprised of the look back camera (e.g. a shoot though polymer look back camera) and/or reflective film, is triggered to emit a simulated shoot back indication when the shoot-through, ricochet-free surface of the reactive firearm target is contacted by a firearm projectile. For example, a focused light pulse source can be mounted on the rigid backing, and the light pulse could be controlled by a sound impulse or a remote switch triggered by an instructor or a digital light controller. The operator would see and hear the target firing at them with a flash and bang.

[0043] While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

Claims

1. A reactive firearm target device, comprising:

a shoot-through, ricochet-free surface;
a rigid support having a first end coupled to a portion of the shoot-through, ricochet-free surface; and
a hinge mechanism coupled to a second end of the rigid support, wherein the hinge mechanism is configured to swing from a first position to a second position when the shoot-through, ricochet-free surface is contacted by a firearm projectile.

2. The reactive firearm target device of claim 1, wherein the shoot-through, ricochet-free surface is a flexible self-healing polymer.

3. The reactive firearm target device of claim 1, wherein the rigid support is a multi-channel reinforced stiff polymer board.

4. The reactive firearm target device of claim 3, wherein the first end of the rigid support is rigidly coupled to the portion of the shoot-through, ricochet-free surface.

5. The reactive firearm target device of claim 1, wherein the hinge mechanism is a long fiber reinforced material.

6. The reactive firearm target device of claim 1, wherein a first end of the hinge mechanism is coupled to the second end of the rigid support, and wherein a second end of the hinge mechanism is configured to be mounted to a rigid backing.

7. The reactive firearm target device of claim 6, wherein the second end of the hinge mechanism includes one or more openings for mounting the second end of the hinge mechanism to the rigid backing with one or more couplers.

8. The reactive firearm target device of claim 1, wherein the hinge mechanism is open when in the first position and is at least partially closed when in the second position.

9. The reactive firearm target device of claim 1, wherein the hinge mechanism is at 180 degrees when in the first position and is at less than 180 degrees when in the second position.

10. A firearm training system, comprising:

    at least one reactive firearm target device as recited in claim 1; and
    a rigid backing to which a second end of the hinge mechanism of each reactive firearm target device is mounted.

11. The firearm training system of claim 10, wherein the rigid backing includes an opening that frames the shoot-through, ricochet-free surface.

12. The firearm training system of claim 10, wherein the firearm training system includes a plurality of reactive firearm target devices.

13. The firearm training system of claim 12, wherein the rigid backing includes a plurality of openings that each frame the shoot-through, ricochet-free surface of a respective one of the reactive firearm target devices.

14. The firearm training system of claim 10, wherein the hinge mechanism is configured to swing in one or more of the follow motions:

    (i) a knock-down motion;
    (ii) a swing up motion; or
    (iii) a side swing motion.

15. The firearm training system of claim 10, further comprising:
at least one sensor that:

    detects when the hinge mechanism swings from a first position to a second position, and
    responsive to the detection, causes instant feedback to be provided to an operator of the firearm.

16. The firearm training system of claim 15, wherein each sensor of the at least one sensor is one of:

    an optic switch,
    a magnetic switch,
    a proximity switch, or
    a contacts switch.

17. The firearm training system of claim 15, wherein the instant feedback is at least one of:

    an audible sound,
    a light output,
    a message output,
    a vibration, or
    a visual display.

18. The firearm training system of claim 10, further comprising:
a shoot back flash simulating device that is triggered to emit a simulated shoot back flash when the shoot-through, ricochet-free surface is contacted by a firearm projectile.

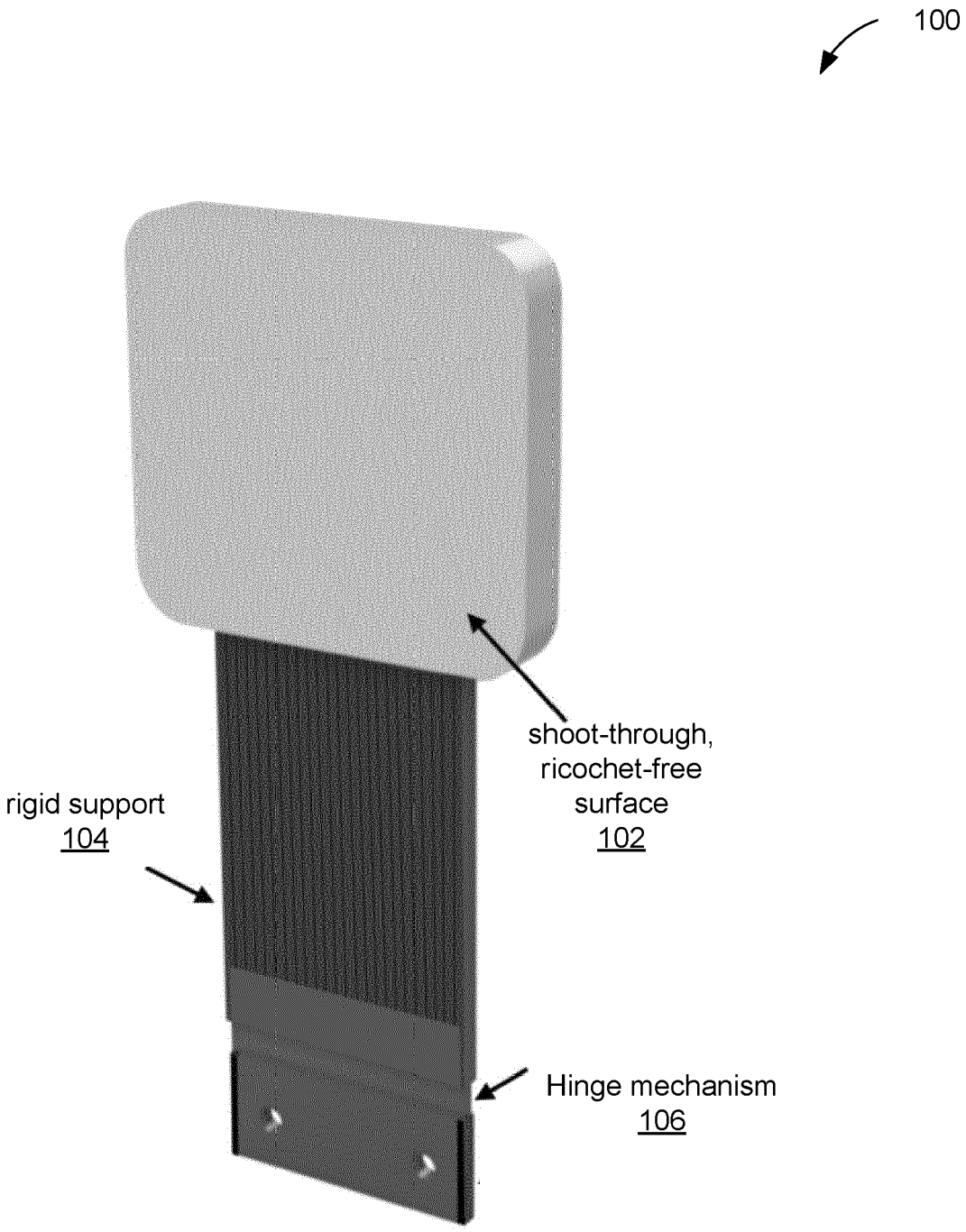
100
shoot-through, ricochet-free surface 102
rigid support 104
Hinge mechanism 106

FIGURE 1

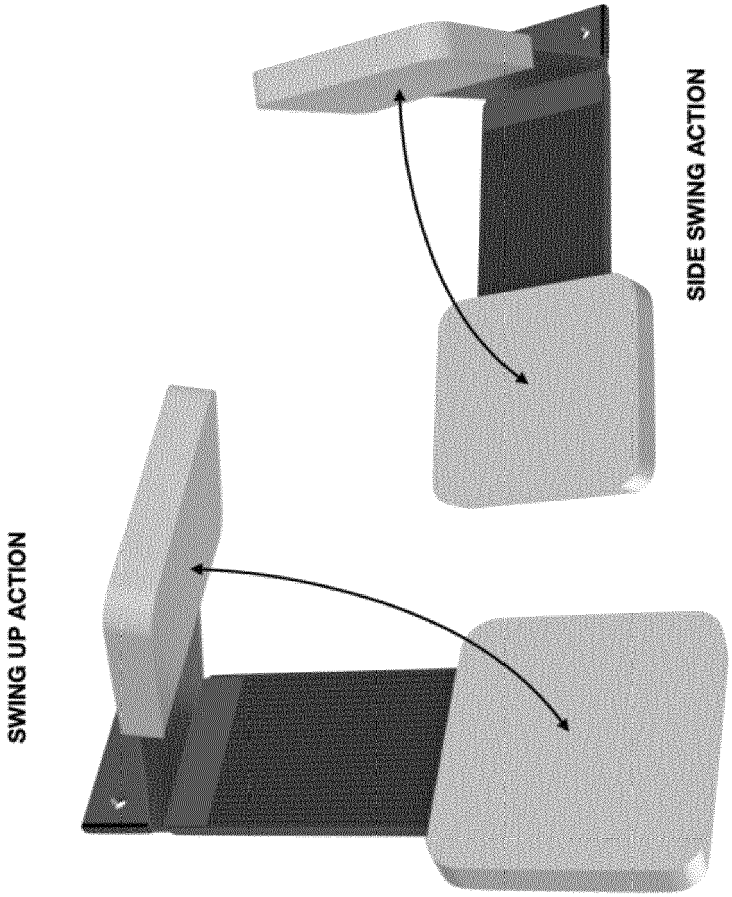

FIGURE 2C

FIGURE 2B

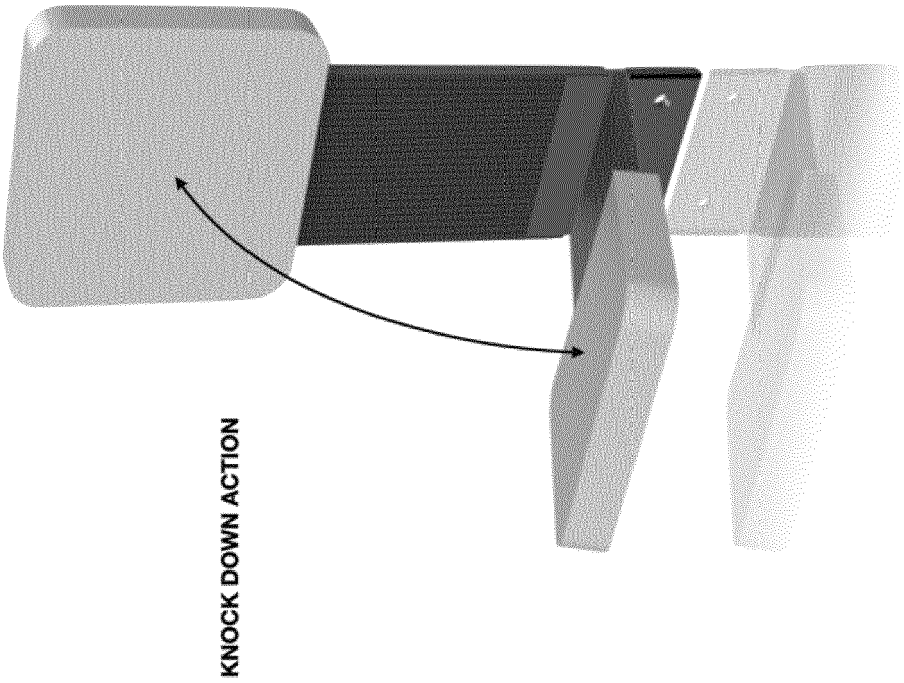

FIGURE 2A

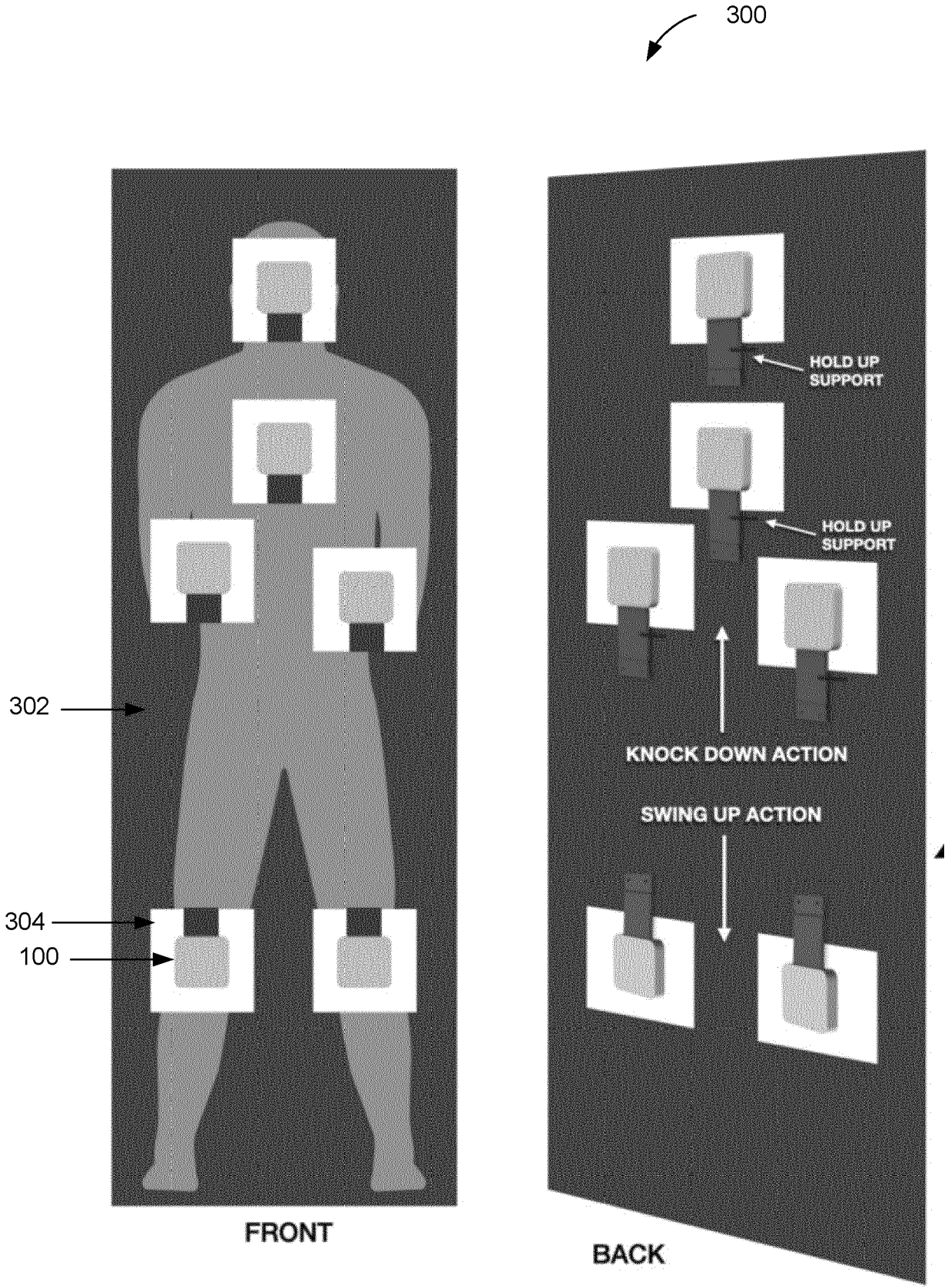

FIGURE 3A

FIGURE 3B

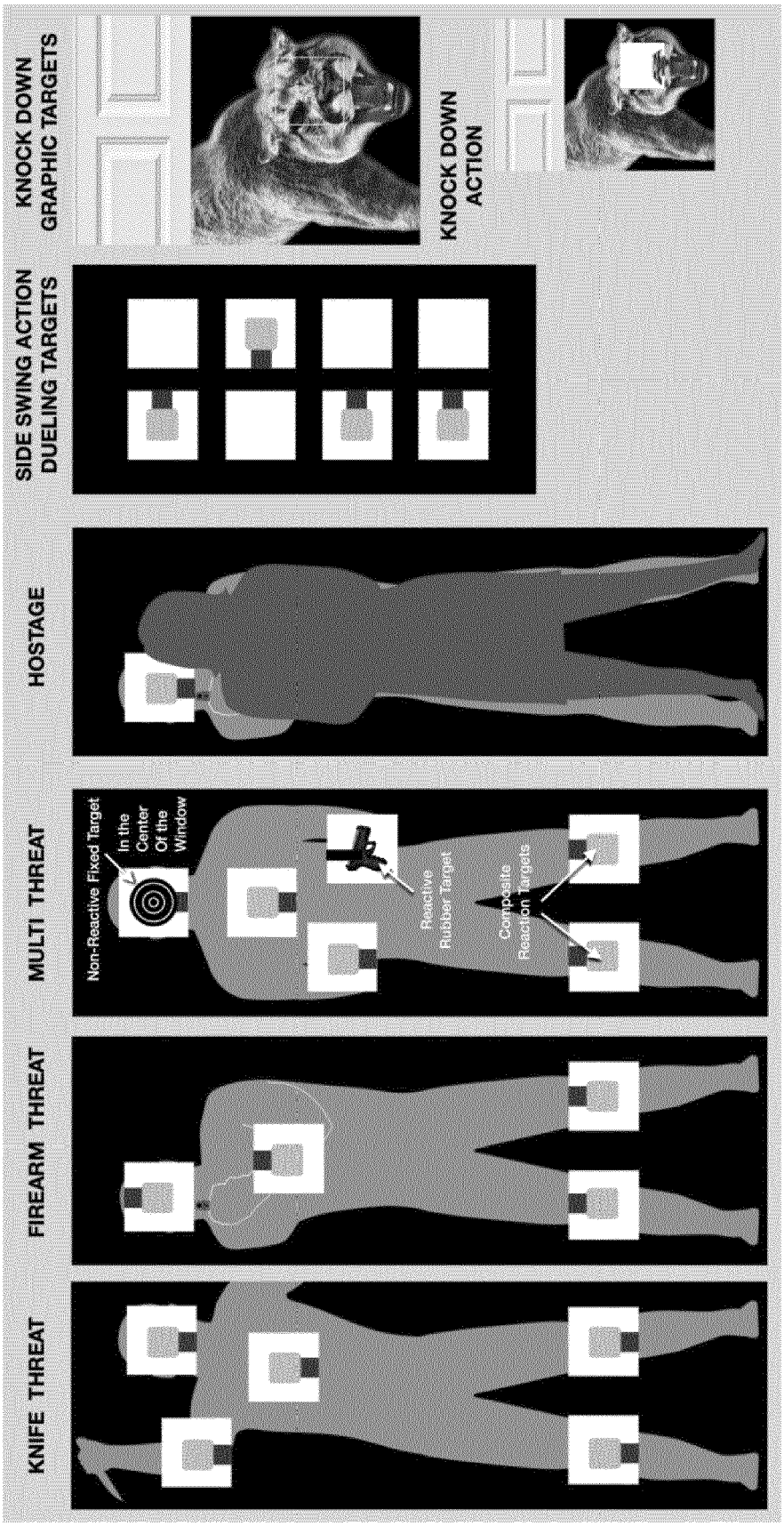
KNIFE THREAT
FIREARM THREAT
MULTI THREAT
HOSTAGE
SIDE SWING ACTION
DUELING TARGETS
KNOCK DOWN
GRAPHIC TARGETS
KNOCK DOWN
ACTION
Non-Reactive Fixed Target
In the
Center
Of the
Window
Reactive
Rubber Target
Composite
Reaction Targets

FIGURE 4

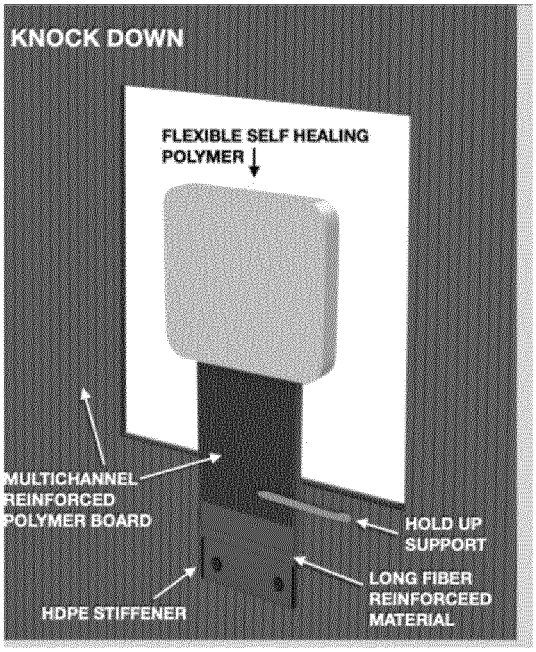

FIGURE 5A

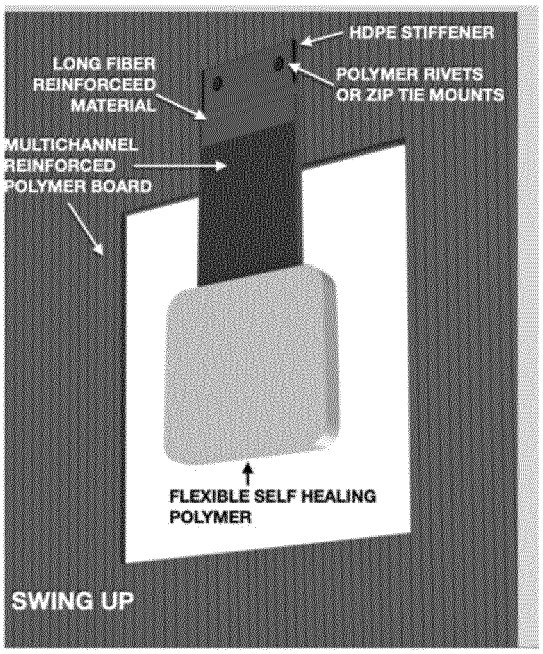

FIGURE 5B

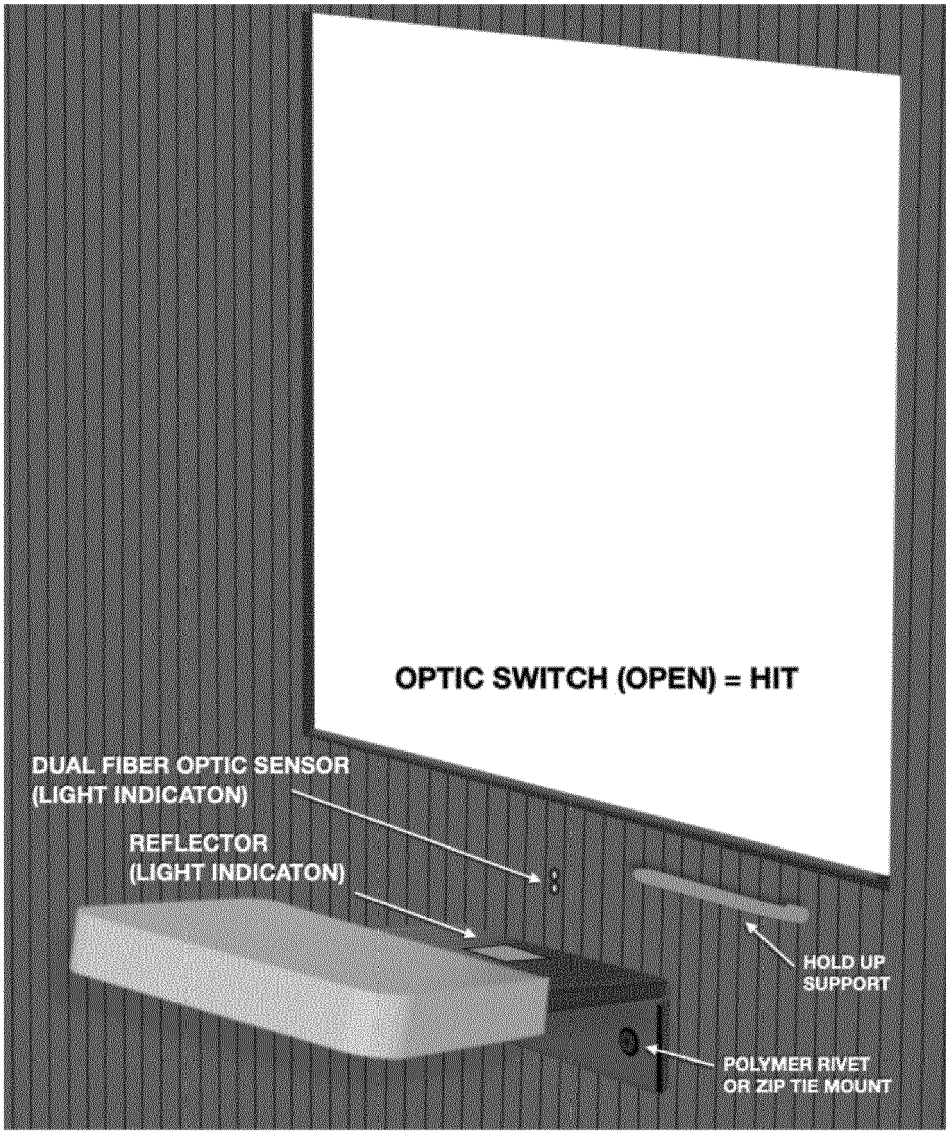
OPTIC SWITCH (OPEN) = HIT
DUAL FIBER OPTIC SENSOR
(LIGHT INDICATON)
REFLECTOR
(LIGHT INDICATON)
HOLD UP
SUPPORT
POLYMER RIVET
OR ZIP TIE MOUNT

FIGURE 6A

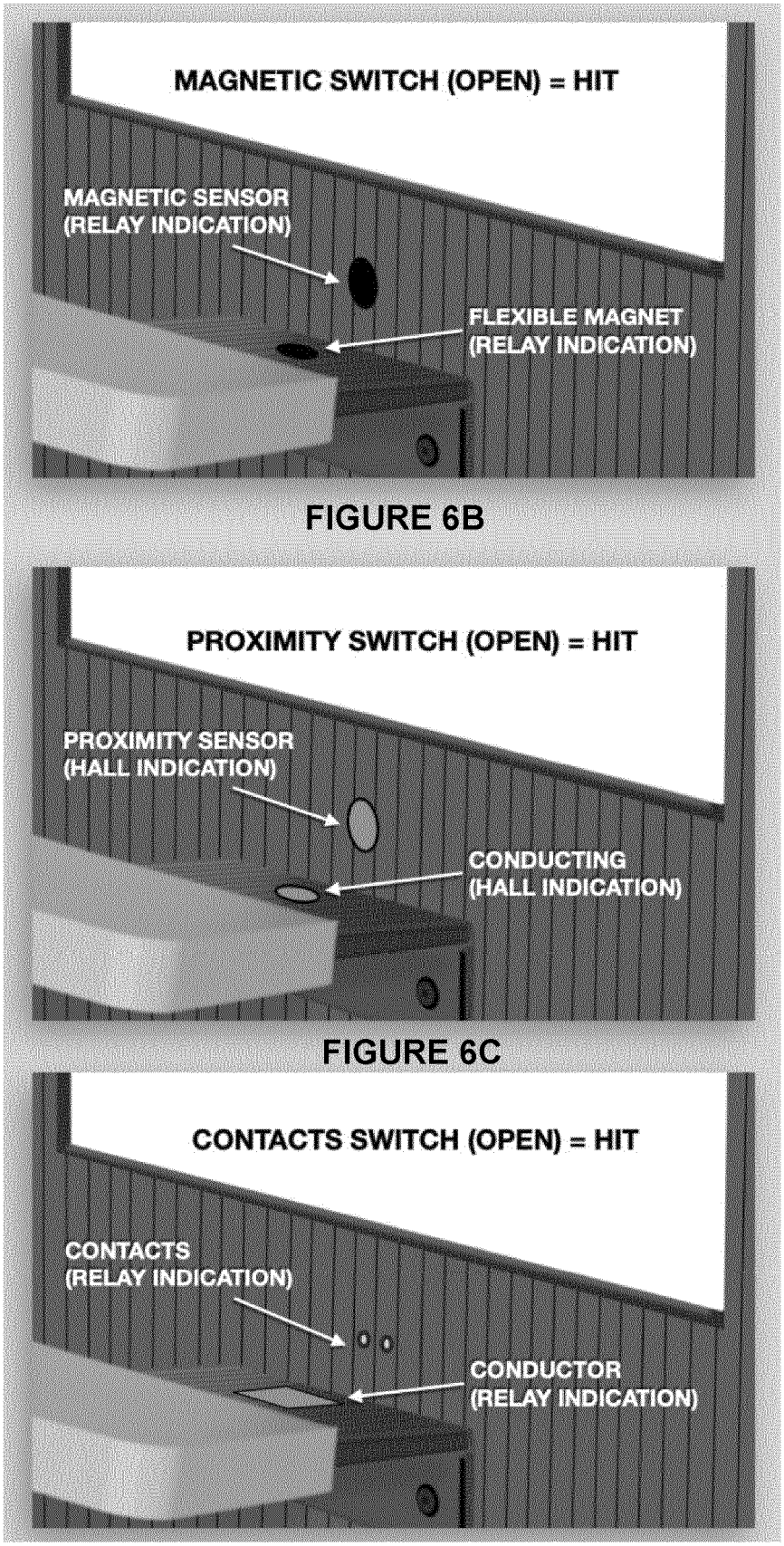

FIGURE 6B

FIGURE 6C

FIGURE 6D

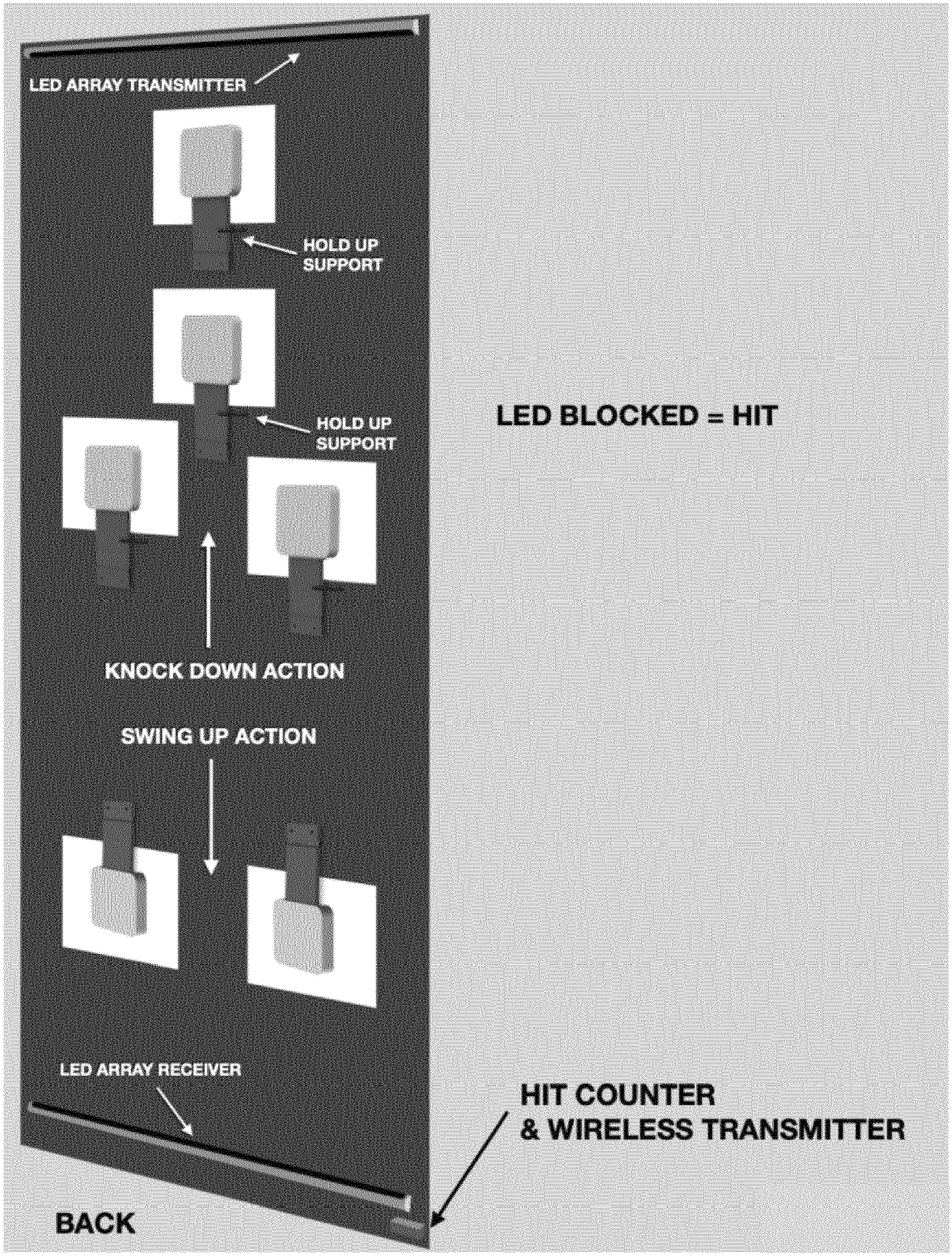
LED ARRAY TRANSMITTER
HOLD UP SUPPORT
HOLD UP SUPPORT
KNOCK DOWN ACTION
SWING UP ACTION
LED ARRAY RECEIVER
BACK
LED BLOCKED = HIT
HIT COUNTER & WIRELESS TRANSMITTER

FIGURE 7

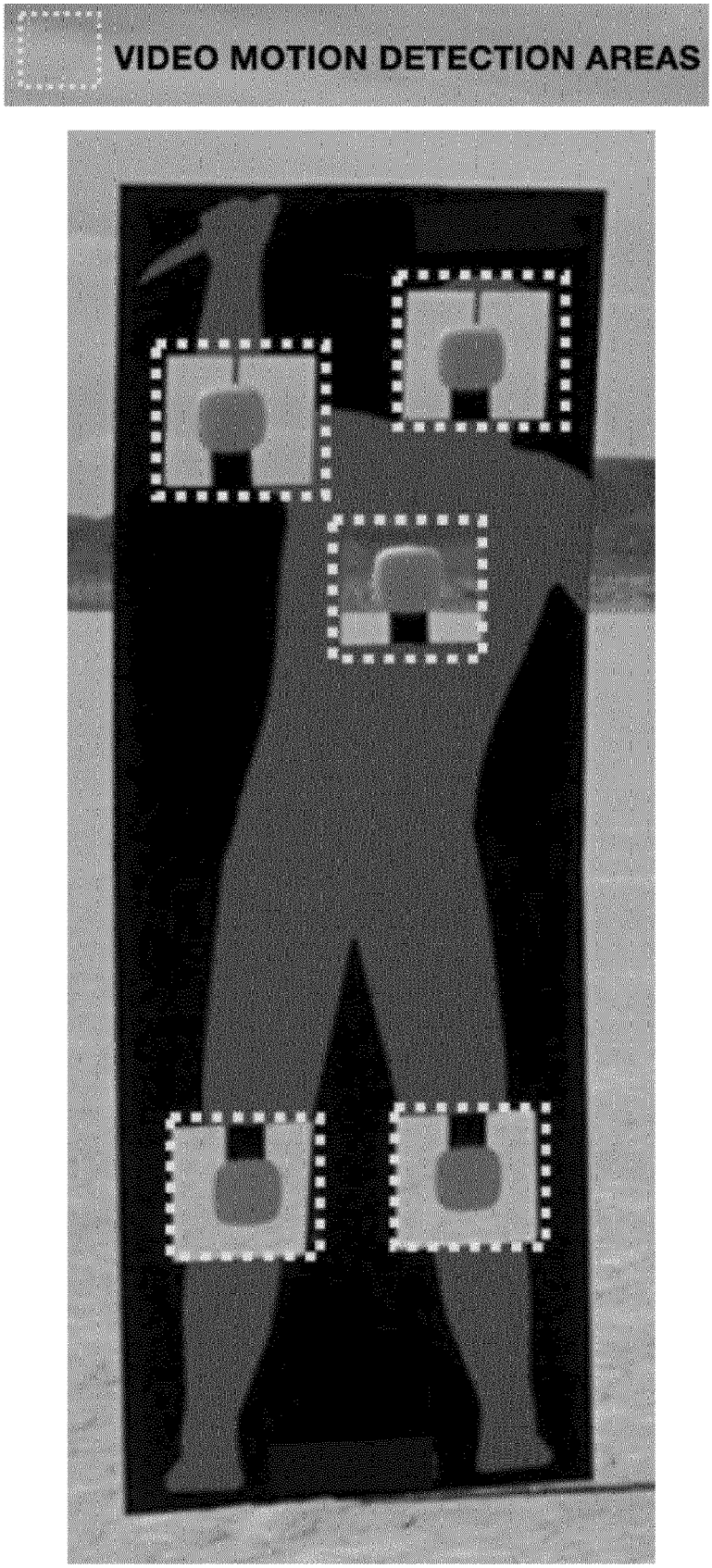

FIGURE 8

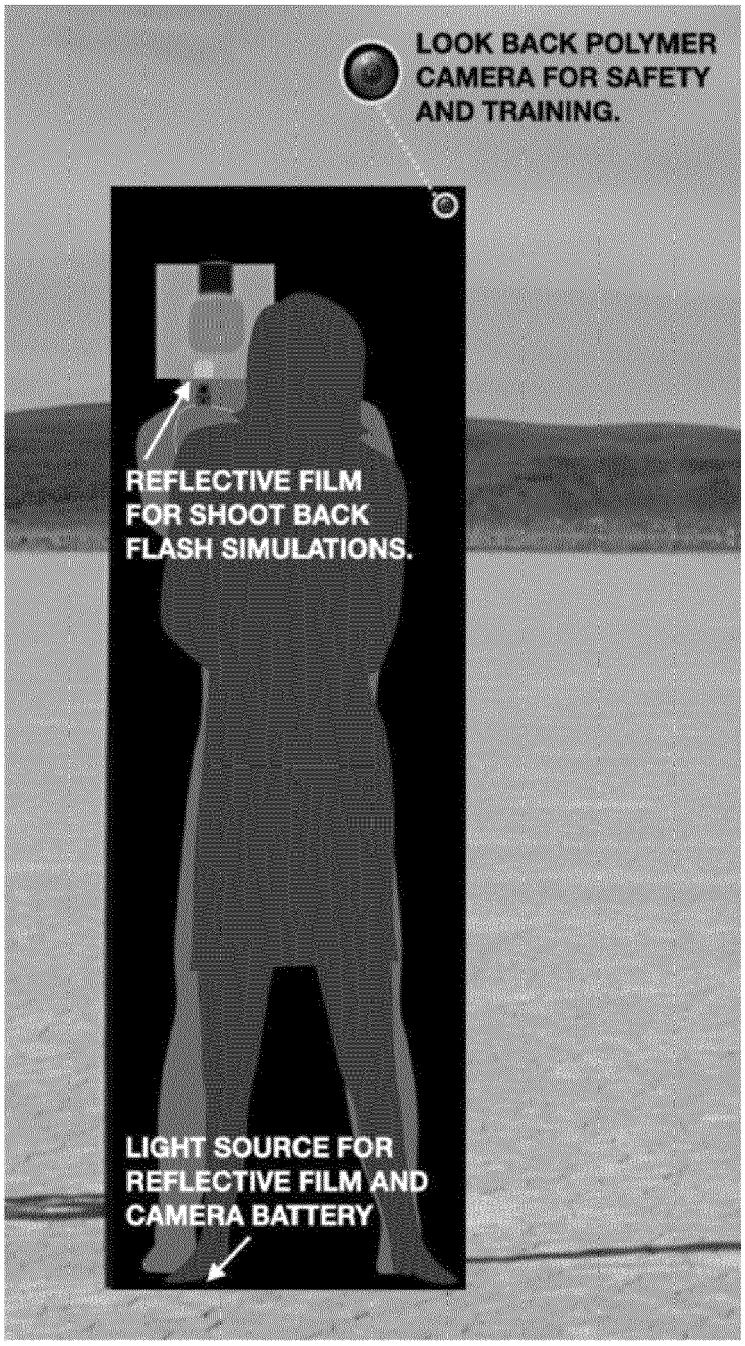
LOOK BACK POLYMER CAMERA FOR SAFETY AND TRAINING.
REFLECTIVE FILM FOR SHOOT BACK FLASH SIMULATIONS.
LIGHT SOURCE FOR REFLECTIVE FILM AND CAMERA BATTERY

FIGURE 9

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 7393

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Place of search	Date of completion of the search	Examiner
The Hague	18 December 2023	Vermander, Wim

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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