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(54) Title: **SIGHTING SYSTEM**

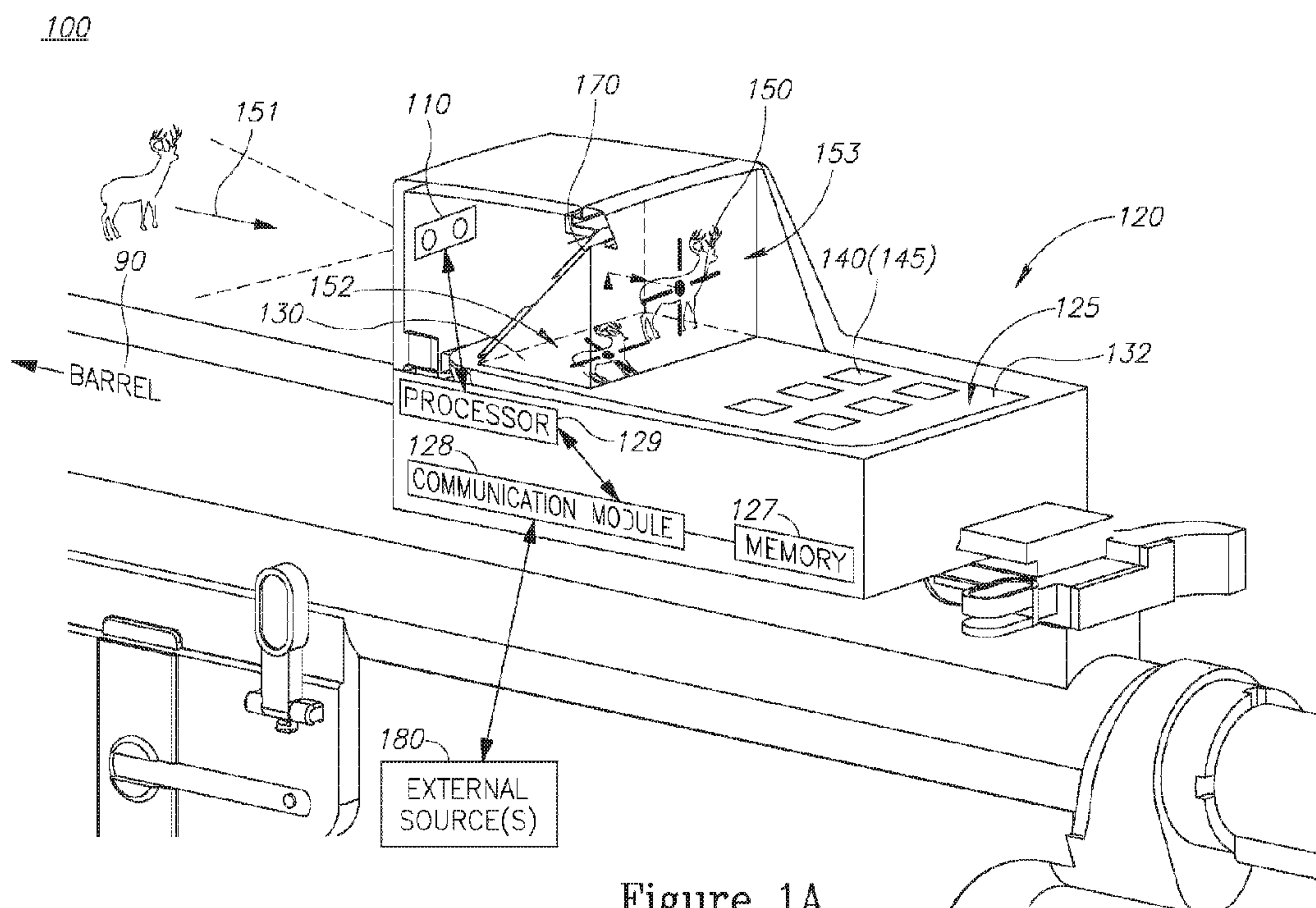


Figure 1A

(57) **Abrégé/Abstract:**

Sighting systems and respective methods are provided, which utilize one or more image sensors to capture target images and display them in a display device, in association with a sight symbol, at a specified region which is reflected toward the user. Another part of the display device is used to provide a graphical user interface which allows the user adjust the sight symbol for boresighting and for further operational needs. The display device and associated optical elements are held by a housing attached to the firearm. Internal and/or external information may be presented on the reflected display part to provide and enhance the displayed information. The sighting system may utilize a single flat touchscreen to provide both the image with the sight symbol, which is reflected from the touchscreen toward the user, and the user interface.

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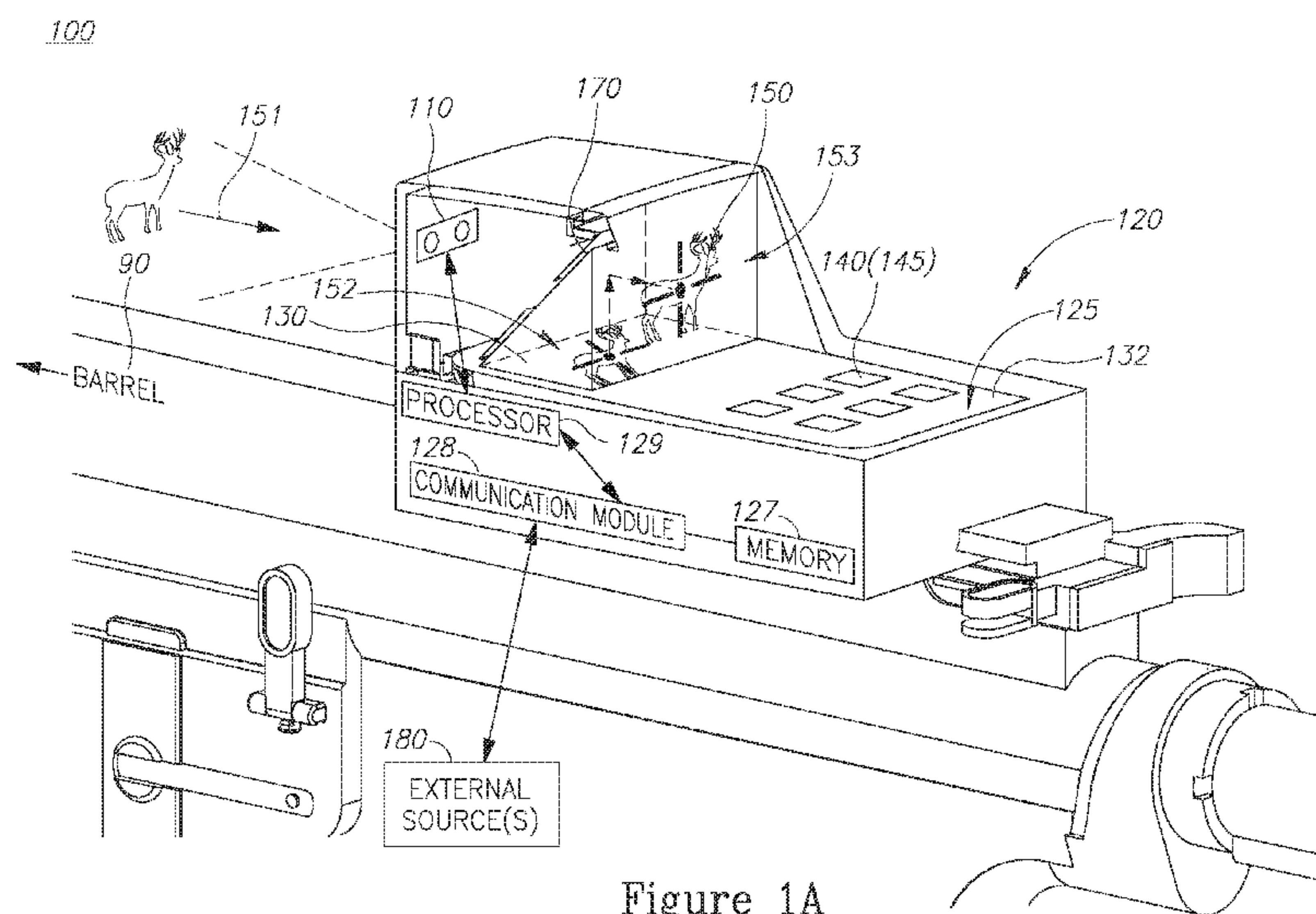


Figure 1A

(57) **Abstract:** Sighting systems and respective methods are provided, which utilize one or more image sensors to capture target images and display them in a display device, in association with a sight symbol, at a specified region which is reflected toward the user. Another part of the display device is used to provide a graphical user interface which allows the user adjust the sight symbol for boresighting and for further operational needs. The display device and associated optical elements are held by a housing attached to the firearm. Internal and/or external information may be presented on the reflected display part to provide and enhance the displayed information. The sighting system may utilize a single flat touchscreen to provide both the image with the sight symbol, which is reflected from the touchscreen toward the user, and the user interface.

SIGHTING SYSTEM

BACKGROUND OF THE INVENTION

1. TECHNICAL FIELD

5 [0001] The present invention relates to the field of sighting systems, and more particularly, to digital imaging sighting systems.

2. DISCUSSION OF RELATED ART

10 [0002] Sight improvements are carried currently in several directions. One direction optically introduces illumination into the sight, another direction implements holographic sights and a third direction is enhancing telescopic sights.

SUMMARY OF THE INVENTION

15 [0003] One aspect of the present invention provides a comprising: at least one image sensor, a display device having a display, the device configured to receive images from the at least one image sensor and display the received images on a specified region of the display along with a sight symbol, a housing attachable to a firearm and configured to receive the display device, an optical element set within the housing to reflect the specified region of the display towards a user of the firearm, and a graphical user interface (GUI), operable outside the specified region of the display, the GUI configured to enable the user to adjust at least a position of the sight symbol in the specified region of the display, wherein the GUI comprises a touchscreen.

20 [0004] These, additional, and/or other aspects and/or advantages of the present invention are set forth in the detailed description which follows; possibly inferable from the detailed description; and/or learnable by practice of the present invention.

25

BRIEF DESCRIPTION OF THE DRAWINGS

30 [0005] For a better understanding of embodiments of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings in which like numerals designate corresponding elements or sections throughout.

[0006] In the accompanying drawings:

[0007] **Figures 1A-1D** are high level schematic illustrations of sighting systems, according to some embodiments of the invention.

[0008] **Figure 2** is a high level schematic flowchart of a method, according to some embodiments of the invention.

5

DETAILED DESCRIPTION OF THE INVENTION

[0009] Prior to the detailed description being set forth, it may be helpful to set forth definitions of certain terms that will be used hereinafter. The term “sight symbol” as used in this application refers to any graphic element which is added to an image or a video stream to denote a location
10 on the image or video images. For example, the term “sight symbol” as used in this application refers to reticles, dots, lines, circles, arrows and so forth. Furthermore, while used in singular, the term “sight symbol” may comprise multiple graphical elements and graphical elements relating to multiple aiming points, i.e., the sight symbol may be configured to indicate multiple targets.

[0010] With specific reference now to the drawings in detail, it is stressed that the particulars
15 shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the
20 description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

[0011] Before at least one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the
25 drawings. The invention is applicable to other embodiments or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

[0012] Sighting systems and respective methods are provided, which utilize one or more sensors to capture target images and display them in a display device, in association with a sight symbol,
30 at a specified region which is reflected toward the user. Another part of the display device is used to provide a graphical user interface which allows the user adjust the sight symbol for boresighting and for further operational needs. The display device and associated optical elements

are held by a housing attached to the firearm. Internal and/or external information may be presented on the reflected display part to provide and enhance the displayed information. The sighting system may utilize a single flat touchscreen to provide both the image with the sight symbol, which are reflected from the touchscreen toward the user, and the user interface. In
5 certain embodiments, the sighting systems and respective methods may be used for hunting purposes.

[0013] **Figures 1A-1D** are high level schematic illustrations of sighting systems **100**, according to some embodiments of the invention. Sighting system **100** is illustrated mounted on a firearm **90**. The view in **Figure 1A** is perspective, with a longitudinal section through sighting system
10 **100**. **Figures 1B-1D** schematically illustrate alternative mounting configurations of sighting system **150** on firearm **90**.

[0014] Sighting system **100** comprises at least one image sensor **110** (e.g., visual range sensor(s) and/or infrared sensor(s)) and a display device **120** having a display **125**. Display **125** may be flat or curved. Device **120** is configured to receive images **151** (e.g., of a target) from image sensor(s)
15 **110** (e.g., by wire or wirelessly) and display (**152**) the received images on a specified region **130** of the display along with a sight symbol **150**. Sight symbol **150** may comprise any graphic element (e.g., reticle(s), dot(s), line(s), circle(s), arrow(s) etc.) which is added to an image or a video stream at region **130** to denote a location on the image or video images. In certain embodiments, sight symbol **150** may comprise multiple graphical elements and graphical
20 elements relating to multiple aiming points. Sight symbol **150** may be configured to indicate multiple targets.

[0015] A processor **129** in display device **120** may be configured to replace and enable adjusting the place of sight symbol **150** in image **152**. Data and/or data streams from image sensor(s) **110** may be passed through and processed by processor **129**, e.g. to adjust or enhance the images,
25 adjust overlay sight symbol **150**, measure various image and target parameters etc. Sighting system **100** may comprise a memory **127**, holding database(s) of internal data relating e.g., to target types, geographic and environment data and so forth. The internal data may be used to enhance displayed images **152** with respect to captured images **151**. Processor **129** may derive image features such as identification of objects or of faces and use internal data from memory
30 **127** to provide related information.

[0016] Sighting system **100** further comprises an optical element **170** (e.g., a prism or a mirror) configured to reflect specified region **130** of display **125** towards the user of firearm **90** so that

image **152** with sight symbol **150** is projected toward the user as image **153** with sight symbol **150**. Optical element **170** may be configured to reflect specified region **130** perpendicularly to display **125**.

[0017] Sighting system **100** may further comprise a housing **160** attachable to a firearm **90** and configured to receive display device **120**. Optical element may be set within housing **160**. Housing **160** and/or display device **120** may be attached to firearm **90** in any of various operational ways. For example, **Figure 1A** illustrates attaching housing **160** and display device **120** on top of firearm **90** with their long axis along or parallel to the line of sight between the user and the target. In another example, **Figure 1B** illustrates attaching housing **160** and display device **120** on top of firearm **90** with their long axis transverse (e.g., perpendicular or inclined at an angle) to the line of sight between the user and the target. In yet another example, **Figure 1C** illustrates attaching housing **160** and display device **120** on the side of firearm **90** with their long axis along or parallel to the line of sight between the user and the target. In any of the configurations, optical element **170** may be positioned to reflect specified region **130** of display **125** towards the user of firearm **90**. Sighting system **100** may be designed to reduce the exposure of the weapon and the user. The attachment configurations may further reduce the signature of the weapon and user. **Figure 1D** schematically illustrates embodiments in which display device **120** may comprise curved display **125** (see curved section **124**), having specified region **130** of display **125** directly curved to be comfortably visible to the user, e.g., at 90° to residual area **132** holding GUI **140** (see below). Certain embodiments comprise separate flat display parts (not shown) which are placed at an angle, e.g., perpendicularly, in place of curve **124** in display **125** (illustrated in **Figure 1D**).

[0018] Housing **160** may be configured to set display device **120** horizontally. Housing **160** may be mounted on firearm **90** by any rail system (e.g., Weaver or Picatinny rail mounts) to enable using sighting system **100** and specifically sight symbol **150** may be boresighted with respect to firearm **90** to correctly indicate the predicted impact point on the target.

[0019] Display device **120** may be a user communication device (e.g., a smartphone) or part thereof. Display device **120** may comprise a touchscreen as display **125** and be associated with processor **129** and/or memory **127** and/or communication module **128**. Housing **160** may be configured to enable insertion of display device **120** (e.g., of the user communication device) into housing **160** and define specified region **130** with respect to optical element(s) **170**. Image

sensor(s) **110** may be mechanically supported by housing **160**, e.g., attached thereto or associated therewith.

[0020] Display device **120** may further comprise a graphical user interface (GUI) **140** (e.g., a touchscreen). GUI **140** may be operable outside specified region **130** of display **125**, for example
 5 over an area **145** (i.e. a GUI area **145** dedicated for GUI **140**) in residual area **132** of display **125**. GUI **140** may be configured to enable a user to adjust at least a position of sight symbol **150** in specified region **130** of display **125**, to boresight sight symbol **150** with respect to firearm **90**. In certain embodiments, with display device **120** as a user communication device such as a smartphone, display **125** of the user communication device may be separated into display region
 10 **130** which is reflected via optical element **170** and display region **132** with GUI **140** (over the whole region **132** or part thereof). Buttons and controllers (e.g., device specific or part of the user communication device) which are beyond display **125** may also be used to adjust any of the features of sighting system **100** such as sight symbol **150**, characteristics of display **130** and parameters of GUI **140**. In any spatial configuration of housing **160** and display device **120**, GUI
 15 **140** may be positioned on display **125** in a conveniently operable, possibly user-adjustable position and manner.

[0021] Display device **120** may comprise a touchscreen as display **125** with specified region **130** reflected via optical element(s) **170** to the user and with residual area **132** in which GUI area **145** is defined. GUI area **145** may encompass whole residual area **132** or part thereof. GUI area **145**
 20 may be adjustable and residual area **132** may comprise one or more GUI's **140**.

[0022] GUI **140** may be further arranged to enable a user adjust at least one of: a type of sight symbol **150**, a color thereof, a position thereof with respect to an estimated range, and graphical or animation parameters of sight symbol **150**. The user may adjust via GUI **140** the color, position or type of sight symbol **150** according to selected ranges, munition or scenario. The user
 25 may adjust via GUI **140** displayed image **130**, either with respect to parameters thereof (e.g., brightness, contrast, magnification) and/or with respect to the operation of image sensor(s) **110**, e.g., optical magnification, type of sensor (e.g., switching visual range and infrared sensors) or image processing parameters. GUI **140** may be further arranged to enable a user adjust any display parameters. At least some of the image processing may be carried out by processor **129**.

30 [0023] GUI **140** may be configured to operate at a section **132** of display **125** that is closer to the user than specified display region **130**, while displayed region **130** which is more remote from the user, is reflected to be viewed approximately along the user's line of sight to the target.

[0024] Display device **120** may comprise a communication module **128**. In certain embodiments, display device **130** may be further arranged to communicate with at least one external information source **180** and display information therefrom at specified region **130**. For example, external information may comprise geographic data, hunting-related data, data about the targets, instructions, and so forth.

[0025] **Figure 2** is a high level schematic flowchart of a method **200**, according to some embodiments of the invention. At least parts of stages in method **200** may be carried out by processor **129**, for example using computer program product(s) comprising non-transitory computer readable storage media having computer readable program embodied therewith and configured to carry out any part of relevant stages of method **200**.

[0026] Method **200** comprises capturing images of a target (stage **210**), displaying the captured images on a specified region of a display in a display device, along with a sight symbol, (stage **220**) and reflecting the specified region of the display towards a user (stage **250**), e.g., perpendicularly to the display (stage **252**).

[0027] Method **200** may further comprise attaching the display to a firearm (stage **240**), in a non-limiting example position the length axis of the display along the line of sight of the firearm (stage **242**) and adjusting the position of the sight symbol with respect to the firearm barrel alignment (stage **245**).

[0028] Method **200** may further comprise adjusting, via a graphical user interface (GUI), the sight symbol in the specified region of the display (stage **230**) with respect to at least one of: a position thereof, a type thereof, a color thereof, a position thereof with respect to an estimated range, and graphical or animation parameters of the sight symbol.

[0029] Method **200** may further comprise configuring the GUI as part of the display device (stage **235**). Method **200** may further comprise using a user communication device as the display device (stage **260**).

[0030] Method **200** may further comprise configuring a housing having at least one optical element to receive the display device (stage **270**) wherein the specified region of the display is defined by a geometry of the housing and the at least one optical element (stage **275**).

[0031] Method **200** may further comprise displaying internal and/or external information on the specified region of the display (stage **280**).

[0032] In the above description, an embodiment is an example or implementation of the invention. The various appearances of "one embodiment", "an embodiment", "certain embodiments" or "some embodiments" do not necessarily all refer to the same embodiments.

[0033] Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

[0034] Certain embodiments of the invention may include features from different embodiments disclosed above, and certain embodiments may incorporate elements from other embodiments disclosed above. The disclosure of elements of the invention in the context of a specific embodiment is not to be taken as limiting their use in the specific embodiment alone.

[0035] Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in certain embodiments other than the ones outlined in the description above.

[0036] The invention is not limited to those diagrams or to the corresponding descriptions. For example, flow need not move through each illustrated box or state, or in exactly the same order as illustrated and described.

[0037] Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

[0038] While the invention has been described with respect to a limited number of embodiments, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of some of the preferred embodiments. Other possible variations, modifications, and applications are also within the scope of the invention. Accordingly, the scope of the invention should not be limited by what has thus far been described, but by the appended claims and their legal equivalents.

CLAIMS

What is claimed is:

1. A sighting system comprising:
 - at least one image sensor,
 - a display device having a display, the device configured to receive images from the at least one image sensor and display the received images on a specified region of the display along with a sight symbol,
 - a housing attachable to a firearm and configured to receive the display device,
 - an optical element set within the housing to reflect the specified region of the display towards a user of the firearm, and
 - a graphical user interface (GUI), operable outside the specified region of the display, the GUI configured to enable the user to adjust at least a position of the sight symbol in the specified region of the display, wherein the GUI comprises a touchscreen.
2. The sighting system of claim 1, wherein the GUI is further arranged to enable a user adjust at least one of: a type of the sight symbol, a color thereof, a position thereof with respect to an estimated range, and graphical or animation parameters of the sight symbol.
3. The sighting system of claim 1, wherein the GUI operates at a section of the display that is closer to the user than the specified display region.
4. The sighting system of claim 1, wherein the optical element is configured to reflect the specified region perpendicularly to the display.
5. The sighting system of claim 4, wherein the housing is configured to set the display device horizontally, with a long axis of the display device parallel to the firearm.
6. The sighting system of claim 1, wherein the optical element is at least one of a prism and a mirror.
7. The sighting system of claim 1, wherein the at least one image sensor is mechanically supported by the housing.
8. The sighting system of claim 1, wherein the display device receives images from the at least one image sensor by wire or wirelessly.
9. The sighting system of claim 1, wherein the display device receives images from the at least one image sensor via a processor configured to process the images..
10. The sighting system of claim 1, wherein the at least one image sensor comprises at least one of a visual range sensor and an infrared sensor.

11. The sighting system of claim 1, wherein the display device is part of a user communication device.
12. The sighting system of claim 11, wherein the housing is configured to enable insertion of the user communication device into the housing and define the specified region with respect to the optical element.
13. The sighting system of claim 1, wherein the display device is further arranged to communicate with at least one external information source and display information therefrom at the specified region.
14. A method comprising:
 - capturing images of a target,
 - displaying the captured images on a specified region of a display in a display device, along with a sight symbol,
 - reflecting the specified region of the display towards a user, and
 - adjusting, via a graphical user interface (GUI), the sight symbol in the specified region of the display.
15. The method of claim 14, further comprising attaching the display to a firearm and adjusting the position of the sight symbol with respect to a firearm barrel alignment.
16. The method of claim 14, further comprising configuring the GUI as part of the display device.
17. The method of claim 14, wherein the adjusting is with respect to at least one of: a position of the sight symbol, a type thereof, a color thereof, a position thereof with respect to an estimated range, and graphical or animation parameters of the sight symbol.
18. The method of claim 14, wherein the reflecting is carried out perpendicularly to the display.
19. The method of claim 14, further comprising using a user communication device as the display device.
20. The method of claim 14, further comprising configuring a housing having at least one optical element to receive the display device wherein the specified region of the display is defined by a geometry of the housing and the at least one optical element.
21. The method of claim 14, further comprising displaying internal or external information on the specified region of the display.
22. A sighting system comprising:
 - at least one image sensor,

a display device having a curved display, the device configured to receive images from the at least one image sensor and display the received images on a specified region of the display that faces a user of the firearm, along with a sight symbol,

a housing attachable to a firearm and configured to receive the display device,

a graphical user interface (GUI), operable outside the specified region of the display, the GUI configured to enable the user to adjust at least a position of the sight symbol in the specified region of the display, wherein the GUI comprises a touchscreen.

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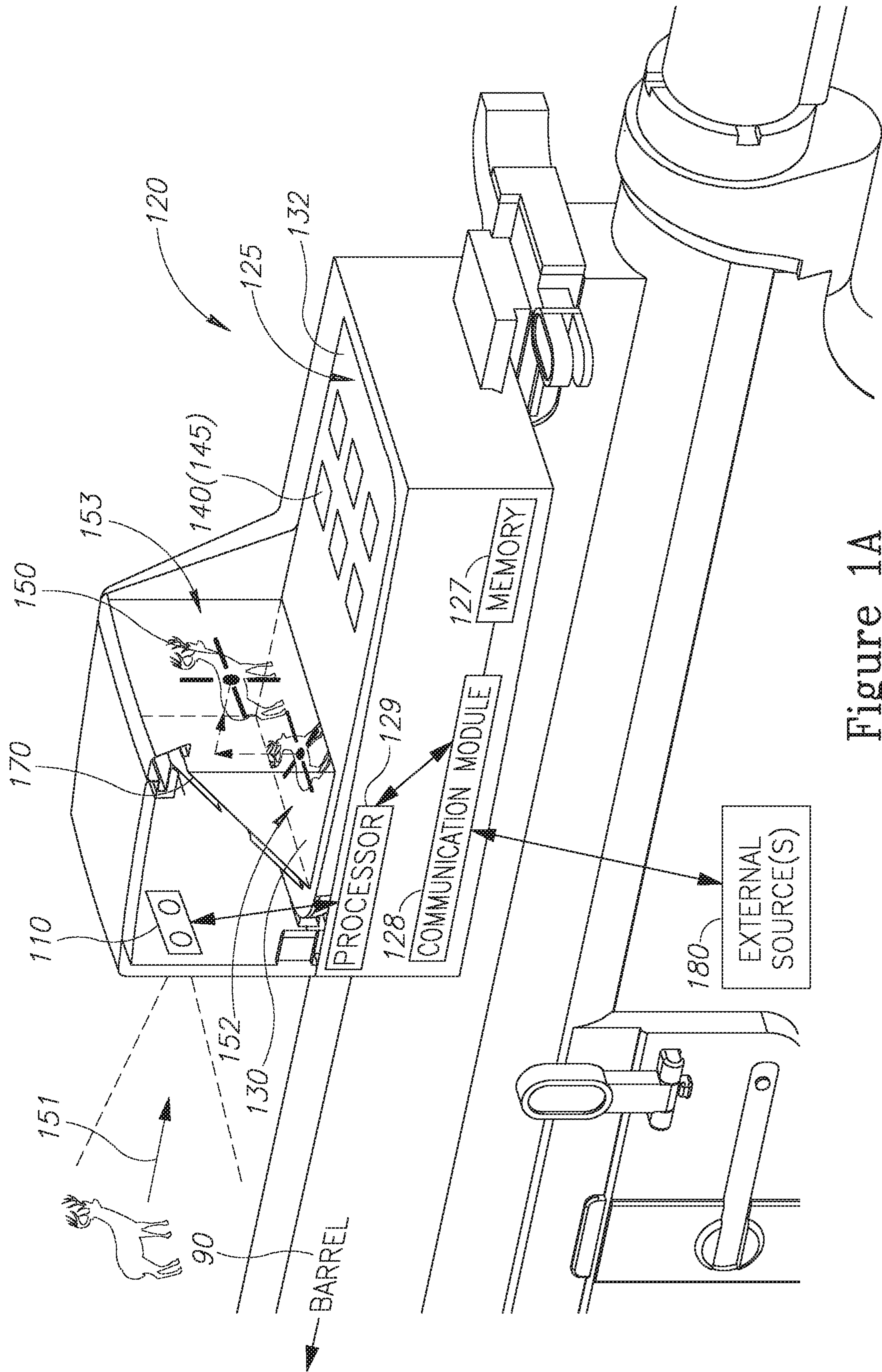


Figure 1A

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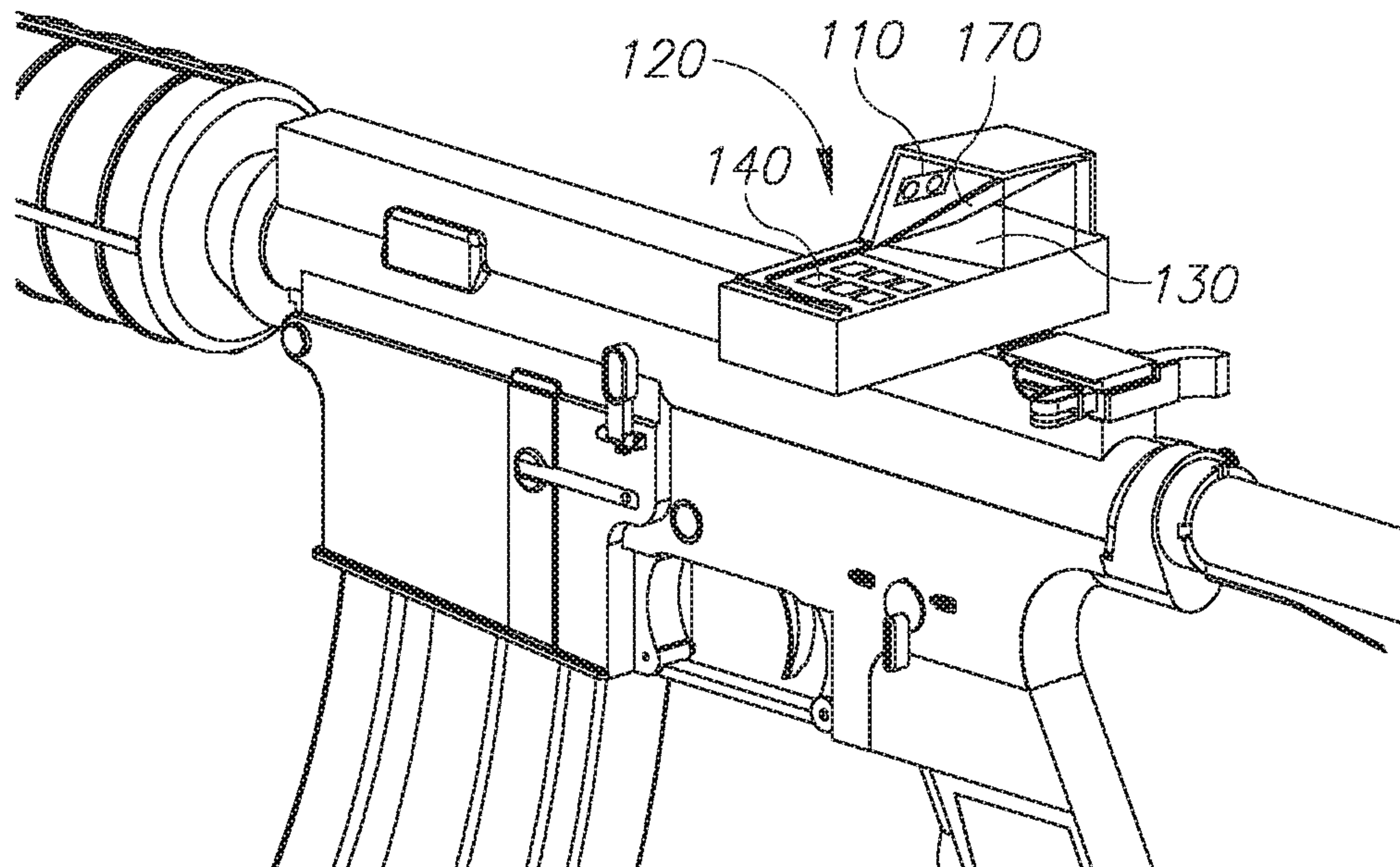


Figure 1B

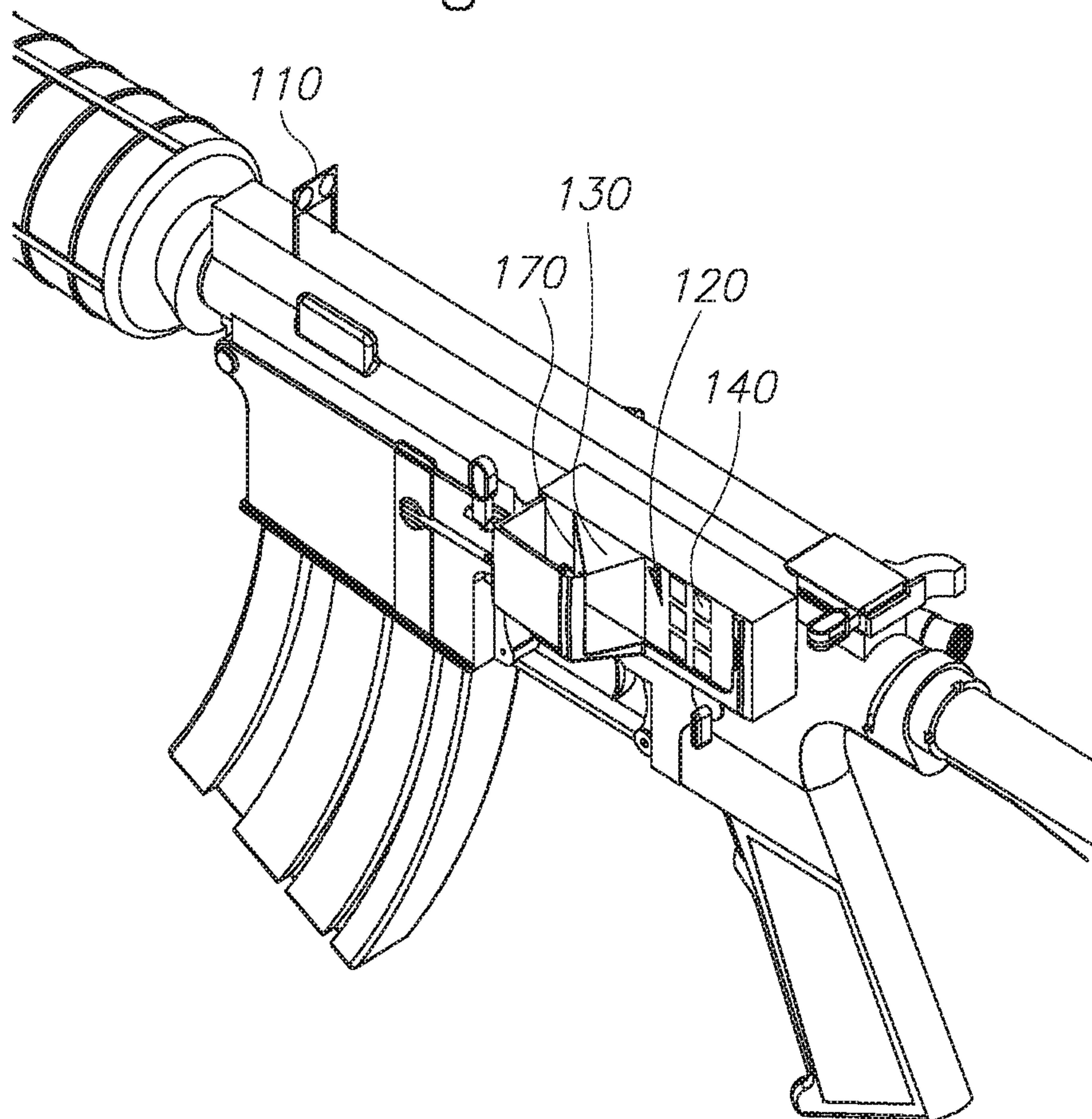


Figure 1C

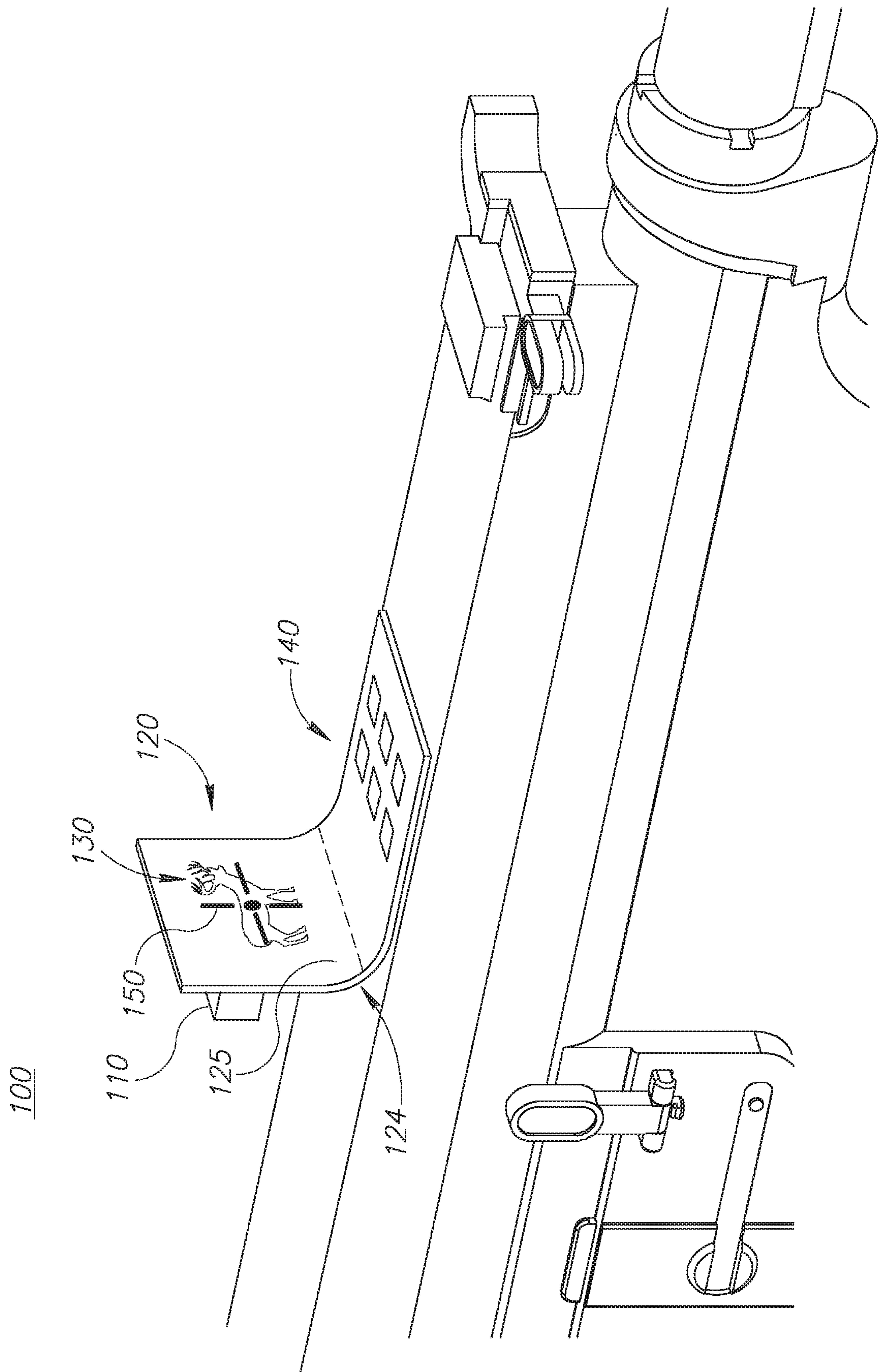


Figure 1D

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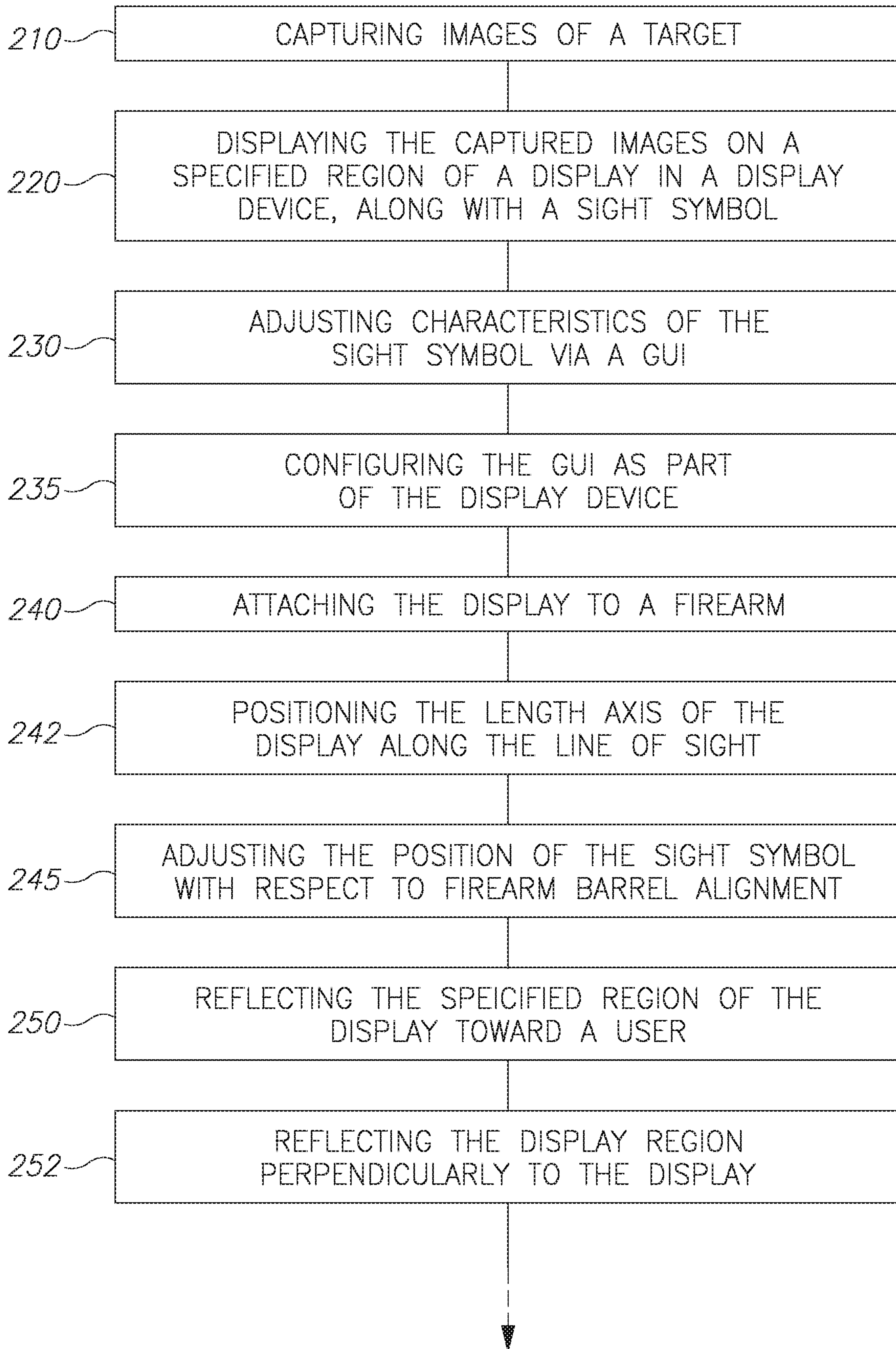
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Figure 2

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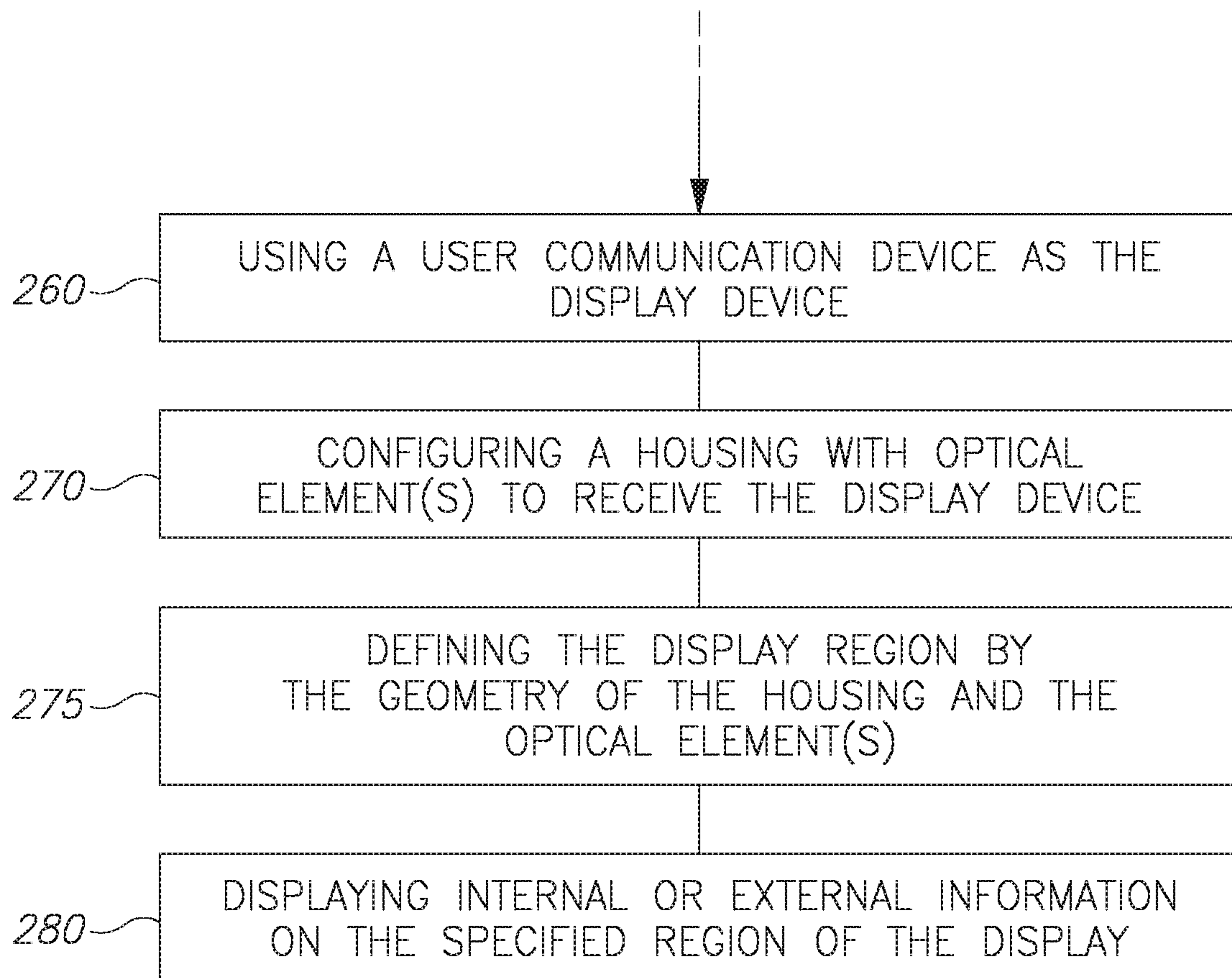


Figure 2 (cont. 1)

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