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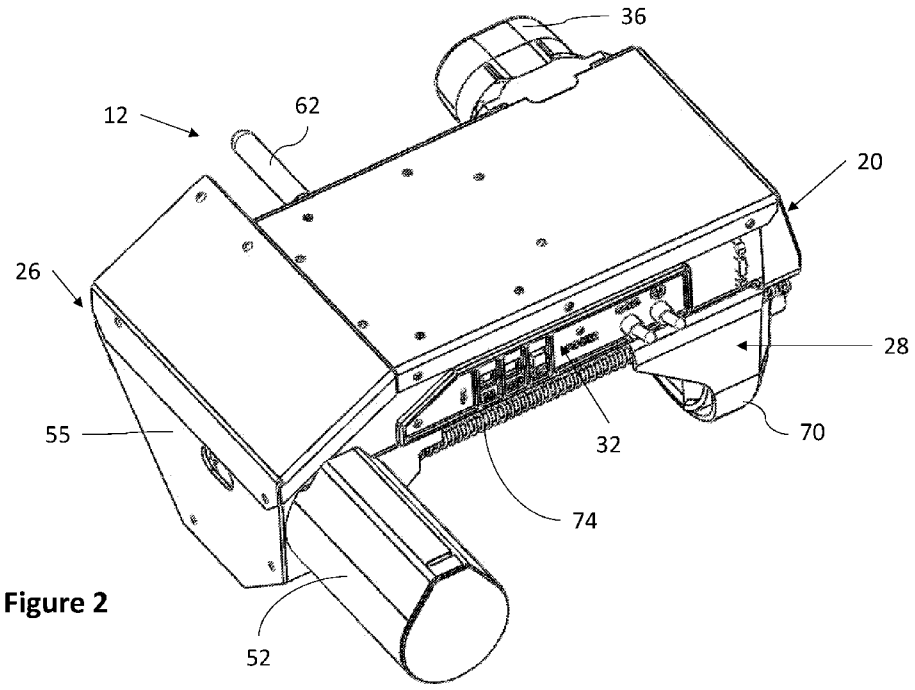



Figure 2

(57) Abstract: A system and a method for remotely activating and operating a grenade, the grenade including a grenade body, a grenade head, a safety pin accommodated in the grenade head and connected to a pull ring, and a safety lever. The method includes loading the grenade into a grenade-carrier such that the safety-pin is functionally associated with a pin extractor assembly of the grenade-carrier and the safety lever is fixed within the grenade-carrier. Using a remote-control unit, instructing the pin extractor assembly to automatically remove the safety pin from the head of the grenade. Following removal of the safety pin from the head of the grenade, using the remote-control unit, instructing the grenade-carrier to automatically release the grenade. Release of the grenade from the grenade-carrier frees the safety lever to pivot relative to the grenade head thereby to activate the grenade. The system may be modified for multiple munitions.

WO 2025/012733 A2

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# A SYSTEM AND A METHOD FOR SAFE AND REMOTE ACTIVATION OF A GRENADE

## FIELD OF THE INVENTION

The present invention relates to systems and methods for safe and remote activation of a grenade, and specifically to systems and methods which mechanically remove the safety pin of the grenade, without requiring operator exposure during removal of the safety pin.

## BACKGROUND OF THE INVENTION

Grenades have been used in warfare for many decades. Typically, hand grenades are activated by a human operator who removes the safety pin from the grenade, and are then thrown at the target. However, the need for the human operator to remove the safety pin also forms a risk to the human operator, who may be hurt by the grenade in case of a failure of if the grenade is not thrown on time, or not thrown far enough.

Various mechanisms for automated launching of grenades, such as launching grenades from a drone, have been described. However, the known mechanisms require the human operator to remove the safety pin from the grenade, and thus are subject to similar risks as those caused when throwing the grenade by hand.

There is thus a need in the art for a system and method for automatically and safely activating a grenade and launching the grenade, without requiring the human operator to pull the safety pin of the grenade or exposing the human operator to risk.

## SUMMARY OF THE INVENTION

The present invention relates to systems and methods for safe and remote activation of a grenade.

In accordance with an embodiment of the present invention, there is provided a system for remote activation of a grenade having a grenade body, a grenade head accommodating a safety pin connected to a pull ring, and a safety lever. The system includes a grenade-carrier and a remote-control unit.

The grenade-carrier includes a housing defining a grenade seat adapted to receive the grenade body and a grenade head bay adapted to receive the grenade head.

The grenade-carrier further includes a pin extractor assembly functionally associated with the grenade head bay, and adapted, in an active state, when the grenade head is disposed within the grenade head bay, and in response to receipt of a first input, to remove the safety pin from the grenade head.

The grenade-carrier further includes a grenade hold-and-release assembly adapted to secure the grenade within the housing, and, in response to receipt of a second input, to release the grenade from the housing. When the grenade is secured by the grenade hold-and-release assembly, the safety lever is prevented from pivoting relative to the grenade head even if the safety pin has been removed from the grenade.

The grenade-carrier further includes a communication interface and a controller, functionally associated with the pin extractor assembly, the grenade hold-and-release assembly, and the communication interface, for controlling activation thereof.

The grenade-carrier further includes a power supply powering the pin extractor assembly, the grenade hold-and-release assembly, and the controller.

The remote-control unit includes a controller, a user interface, a communication interface, and a power supply.

The remote-control unit is adapted to communicate with the grenade-carrier and to provide to the controller of the grenade-carrier the first input and the second input, provided by an operator using the user interface, for remote operation of the grenade-carrier, the first input being separate and distinct from the second input.

In some embodiments, the grenade hold-and-release assembly is adapted to release the grenade, in response to the second input, only following identification of complete extraction of the safety pin.

In some embodiments, following extraction of the safety pin from the grenade, release of the grenade from the hold-and-release assembly enables the safety lever to pivot relative to the grenade head.

In some embodiments, the system further includes a delivery vehicle onto which the grenade-carrier is mounted. The delivery vehicle is adapted to deliver the grenade-carrier and the grenade accommodated therein to a target location for activation of the grenade.

In some embodiments, the system further includes the grenade.

In some embodiments, the grenade is an explosive hand grenade. In some embodiments, the grenade is a flash bang grenade. In some embodiments, the grenade

is a smoke grenade. In some embodiments, the grenade is a gas grenade.

In some embodiments, the grenade seat and the grenade head bay are suitable for accommodating at least two of the following types of grenades: an explosive hand grenade; a flash bang grenade; a smoke grenade; and a gas grenade.

In some embodiments, the grenade seat and the grenade head bay are suitable for accommodating each of an explosive hand grenade; a flash bang grenade; a smoke grenade; and a gas grenade.

In some embodiments, the pin extractor assembly includes a motor, operable in response to receipt of the first input, and an extractor, adapted to engage a pull ring of the safety pin of the grenade, and to be moved, by operation of the motor, relative to the grenade head bay, so as to pull the safety pin out of the grenade.

In some embodiments, the extractor is connected to a slidable connector, the slidable connector being adapted to slide along a threaded rod, which threaded rod is adapted to be rotated by operation of the motor.

In some embodiments, the threaded rod extends out of the motor.

In some embodiments, the threaded rod is disposed in parallel to the motor, and rotation of the motor is transferred to the rod by at least two gears.

In some embodiments, the pin extractor assembly includes a pull-sensor adapted to provide a pull signal to the controller of the grenade-carrier when the extraction of the safety pin is complete.

In some embodiments, following receipt of the first input, if the pull signal was not received within a predetermined duration, the controller of the grenade-carrier is adapted to provide a warning signal to the remote-control unit.

In some embodiments, when the grenade is disposed within the grenade-carrier, the grenade hold-and-release assembly applies pressure to the grenade in an axial direction, such that when the safety pin is removed from the grenade, the pressure in the axial direction prevents the safety lever from pivoting relative to the grenade head, thereby maintaining the grenade un-actuated.

In some embodiments, the grenade hold-and-release assembly includes a clamp connected to at least one spring, the clamp being movable relative to the grenade head bay along a ratcheted rod, and adapted to secure the grenade within the grenade housing.

In some embodiments, the grenade hold-and-release assembly further includes a

rotating mechanism adapted, in response to receipt of the second input, to rotate the ratcheted rod thereby releasing the clamp to move away from the grenade head bay under the force of the at least one spring and releasing the grenade from the grenade housing.

In some embodiments, the clamp includes a tooth adapted to engage the ratcheted rod, and the grenade hold-and-release assembly further includes a pivoting arm associated with a pivoting actuator and with the ratcheted rod. In some embodiments, in response to receipt of the second input, the controller of the grenade-carrier is adapted to operate the pivoting actuator to cause pivoting of the arm causing the ratcheted rod to disengage the tooth of the clamp, thereby releasing the clamp to move away from the grenade head bay under the force of the at least one spring and releasing the grenade from the grenade housing.

In some embodiments, the grenade-carrier includes a sensor adapted to sense the presence of a grenade within the grenade-carrier, and to provide to the controller of the grenade-carrier a drop signal indicating when the grenade head is no longer present in the grenade-carrier.

In some embodiments, following receipt of the second input, if the drop signal was not received within a predetermined duration, the controller of the grenade-carrier is adapted to provide a warning signal.

In some embodiments, the system further includes a delivery vehicle, having the grenade-carrier mounted thereon. In some embodiments, the delivery vehicle includes an unmanned aerial vehicle.

In some embodiments, the grenade-carrier is adapted to carry a plurality of grenades, and the remote-control unit is adapted to control pin extraction and release of each of the plurality of grenades.

In some embodiments, when the grenade is disposed within the grenade-carrier, the safety lever of the grenade is exposed.

In accordance with an embodiment of the present invention, there is provided a method of remotely activating and operating a grenade, the grenade including a grenade body, a grenade head, a safety pin accommodated in the grenade head and connected to a pull ring, and a safety lever, the method including:

(a) loading the grenade into a grenade-carrier such that the safety-pin is functionally associated with a pin extractor assembly of the grenade-carrier and the safety lever is

fixed within the grenade-carrier;

(b) using a remote-control unit, providing a first input instructing the pin extractor assembly to automatically remove the safety pin from the head of the grenade;

(c) responsive to confirmation of complete removal of the safety pin from the head of the grenade, using the remote-control unit, providing a second input instructing the grenade-carrier to automatically release the grenade,

wherein release of the grenade from the grenade-carrier frees the safety lever to pivot relative to the grenade head thereby to activate the grenade.

In some embodiments, the loading of the grenade includes:

manually placing the grenade in a grenade seat of the grenade-carrier, such that the grenade head is in a grenade head bay of the grenade-carrier;

manually placing the pull ring of the grenade on a movable pin extractor of the pin extractor assembly; and

manually pushing a movable clamp toward the grenade head bay, thereby to secure the grenade within the grenade-carrier.

In some embodiments, loading of the grenade comprises manually placing the grenade in the grenade seat such that the safety lever of the grenade is exposed, and manually pushing the movable clamp such that the clamp applies pressure to the grenade in an axial direction, which pressure prevents the exposed safety lever from pivoting relative to the grenade head.

In some embodiments, the method further includes, prior to step (b), mounting the grenade-carrier on a delivery vehicle, and guiding the delivery vehicle with the grenade-carrier to a target location for release of the grenade.

In some embodiments, the method further includes, following step (b), upon receipt of a warning notification indicative of a failure in removal of the safety-pin, initiating safe disposal of the grenade.

In some embodiments, the method further includes, following step (c), upon receipt of a warning notification indicative of a failure in releasing of the grenade from the grenade-carrier, initiating safe disposal of the grenade.

In some embodiments, the method further includes, following step (c), retrieving the grenade-carrier for future use thereof.

BRIEF DESCRIPTION OF THE FIGURES

The foregoing discussion will be understood more readily from the following detailed description of the invention, when taken in conjunction with the accompanying Figures (1-11), in which:

Figure 1 is a block diagram of a system for safe and remote activation and launching of a grenade according to embodiments of the disclosed technology;

Figure 2 is a top front perspective illustration of a grenade-carrier of the system of Figure 1, according to an embodiment of the disclosed technology;

Figures 3A and 3B are bottom front perspective illustrations of the grenade-carrier of Figure 2, in empty and loaded operative states, respectively;

Figure 4 is a partly exploded top view perspective illustration of the grenade-carrier of Figures 2 to 3B, according to an embodiment of the disclosed technology;

Figure 5 is a cross-sectional illustration of the grenade-carrier of Figures 2 to 4, according to an embodiment of the disclosed technology;

Figures 6A and 6B are partially exploded illustrations of a pin extractor assembly forming part of the grenade-carrier of Figures 2 to 5, in various steps of operation thereof, according to an embodiment of the disclosed technology;

Figures 7A and 7B are schematic illustrations of a grenade hold-and-release assembly forming part of the grenade-carrier of Figures 2 to 5, in various steps of operation thereof, according to an embodiment of the disclosed technology;

Figure 8 is a top front perspective illustration of another grenade-carrier of the system of Figure 1, according to another embodiment of the disclosed technology;

Figures 9A and 9B are bottom front perspective illustrations of the grenade-carrier of Figure 8 according to an embodiment of the disclosed technology, in empty and loaded operative states, respectively;

Figures 10A and 10B are a fully exploded view and a partly exploded top view illustration of the grenade-carrier of Figures 8-9B, according to an embodiment of the disclosed technology;

Figure 11 is a cross-sectional illustration of the grenade-carrier of Figures 8 to 10B, according to an embodiment of the disclosed technology;

Figures 12A and 12B are illustrations of a pin extractor assembly forming part of the grenade-carrier of Figures 8 to 11, in various steps of operation thereof, according to an embodiment of the disclosed technology;

Figures 13A and 13B are sectional illustrations of the grenade-carrier of Figures 8 to 11, in various states thereof, according to an embodiment of the disclosed technology, the sectional illustrations taken along a first direction;

Figures 14A and 14B are sectional illustrations of the grenade-carrier of Figures 8 to 11, in various states thereof, according to an embodiment of the disclosed technology, the sectional illustrations taken along a second direction perpendicular to the first direction, the states corresponding to the states of Figures 13A and 13B;

Figure 15 is a schematic illustration of types of grenades that can be received in the grenade-carrier of Figures 2 to 7B or in the grenade carrier of Figures 8 to 14B, according to an embodiment of the disclosed technology;

Figure 16 is a schematic illustration of types of adaptors that can connect to the grenade-carrier of Figures 2 to 7B or to the grenade carrier of Figures 8 to 14B, according to an embodiment of the disclosed technology;

Figure 17 is a perspective view illustration of a remote-control unit forming part of the system of Figure 1, according to an embodiment of the disclosed technology;

Figure 18 is a flow chart of a method of activating and launching a grenade, by an operator, using the system of Figure 1, according to an embodiment of the disclosed technology; and

Figure 19 is a flow chart of a method of operation of the grenade-carrier of the system of Figure 1, according to an embodiment of the disclosed technology.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

The principles of the inventive system and method for safely and remotely activating and launching a grenade, may be better understood with reference to the drawings and the accompanying description.

Before explaining at least one embodiment of the invention 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 drawings. The invention is capable of 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.

For the purposes of the present disclosure, the term "substantially" is defined as "within 10% deviation of".

Reference is now made to Figure 1, which is a block diagram of a system **10** for safe and remote activation and launching of a grenade according to embodiments of the disclosed technology.

System **10** includes a grenade-carrier **12** and a remote-control unit **14**.

Grenade-carrier **12** includes a housing, defining a grenade seat **22** and a grenade head bay **24**. The housing is adapted to receive a grenade with the body of the grenade disposed in seat **22** and the head of the grenade being disposed in bay **24**, as explained in further detail hereinbelow.

A pin extractor assembly **26** is functionally associated with grenade head bay **24**, and is configured to automatically remove the safety pin from the grenade, as explained in further detail hereinbelow.

A grenade hold-and-release assembly **28** is functionally associated with grenade seat **22**, and is configured to hold the grenade within carrier **12**, and to release the grenade from carrier **12**, at appropriate times. As explained in further detail hereinbelow, grenade hold-and-release assembly **28** further ensures that the safety lever of the grenade remains tightly held until launching of the grenade, thus preventing premature detonation or activation of the grenade.

Pin extractor assembly **26** and grenade hold-and-release assembly **28** are functionally associated with a controller **30**, which is adapted to control operation of the pin extractor assembly and of the hold-and-release assembly.

The term "controller" as used herein means a computing device configured for monitoring, controlling, regulating and/or actuating one or more components, assemblies, stations, systems, or subsystems. A controller should be understood to include any or all of (and not exhaustively): one or more processors, one or more computer-readable media, e.g., transient and/or non-transient storage media, communications arrangements, a power source and/or a connection to a power source, and firmware and/or software. Controllers can be programmed in advance, e.g., by having program instructions stored in the computer-readable media for execution by one of more processors of the controller. Thus, a controller 'configured' to perform a function is equivalent herein to the controller being programmed, i.e., having access to stored program instructions for execution, to perform the function.

Controller **30** may also be functionally associated with a user interface **32**, for example including switches or buttons which can be activated or deactivated by a human operator of grenade-carrier **12**. Grenade-carrier **12** further includes a communication interface **34**, which may also be functionally associated with controller **30**. Communication interface **34** is adapted to communicate with remote-control unit **14**, for receipt of operation commands from an operator who is remote from the grenade-carrier **12**, and to send feedback to the remote-control unit to alert the operator to problems, as explained in further detail hereinbelow.

Typically, controller **30**, user interface **32**, and/or communication interface **34** are mounted on, or within, the housing of the grenade-carrier.

A battery, or another power source, **36**, powers all the electronic components of grenade-carrier **12**.

In some implementations, grenade-carrier **12** may be mounted onto a delivery vehicle **38**, which delivers the grenade-carrier to the target for activation and release of the grenade. For example, the delivery vehicle **38** may be an Unmanned Aerial Vehicle (UAV) also known as a drone, or a chassis of a car, to which grenade-carrier **12** is attached.

Remote-control unit **14** includes a controller **40**, functionally associated with a user interface **42** and with a communication interface **44**. User interface **42** is adapted to receive user instructions for operation of grenade-carrier **12**, and communication interface **44** is adapted to transmit to the grenade-carrier, and specifically to communication interface **34** thereof, input corresponding to the received user instructions, as explained in further detail hereinbelow.

A battery, or another power source, **46**, powers all the electronic components of remote-control unit **14**.

Communication interfaces **34** and **44** may communicate with each other using any suitable protocol known in the art, such as via Bluetooth communication, Radio Frequency communication, Wi-Fi communication, and the like.

It is to be appreciated that system **10** of Figure 1 may be modified to carry and activate a plurality of grenades, as required. For example, the grenade-carrier may include multiple grenade seats each associated with a pin extractor assembly and a grenade hold-and-release assembly, which would operate based on corresponding instructions received from the remote-control unit. As another example, the grenade-

carrier may include a revolving grenade holder, adapted to bring each grenade into contact with the pin extractor assembly and with the grenade hold-and-release assembly.

Reference is now made to Figure 2, which is a top front perspective illustration of an exemplary grenade-carrier **12**, to Figures 3A and 3B, which are bottom front perspective illustrations of grenade-carrier **12** in empty and loaded operative states, respectively, to Figure 4, which is a partly exploded top view perspective illustration of grenade-carrier **12**, and to Figure 5, which is a cross-sectional illustration of the grenade-carrier **12**, according to an embodiment of the disclosed technology.

Grenade-carrier **12** includes housing **20**, having a cover **48** (seen clearly in Figure 4), the housing defining grenade seat **22** and grenade head bay **24** (both seen clearly in Figure 3A).

As seen in Figure 3B, a grenade **100** having a grenade body **102** and a grenade head **104** is adapted to be disposed within the housing, such that the grenade head is within grenade head bay **24** and the grenade body is within seat **22**. Grenade **100** additionally includes a safety pin **106** attached to a pull ring **108**, and a safety lever **110**. As shown in Figure 3B, the grenade is placed within housing **20** such that safety lever **110** faces away from seat **22**, and pull ring **108** is oriented toward a pin extractor of pin extractor assembly **26**, as explained hereinbelow.

Reference is now additionally made to Figures 6A and 6B, which are partially exploded illustrations of pin extractor assembly **26**, in two steps of operation thereof, according to an embodiment of the disclosed technology.

Pin extractor assembly **26** is disposed about grenade head bay **24**, and includes a slidable extractor **50**, slidable relative to the grenade head bay. Slidable extractor **50** is connected to a motor **52** via a rod **54**. Specifically, an arch **51** attached to slidable extractor **50** is disposed about rod **54**, and is movable therealong relative to motor **52**. An extractor housing **55** (see Figures 6A and 6B) covers the rod and the motor. When motor **52** is active, rotation of the motor actuates rotation of rod **54**, thereby driving motion of extractor **50** along the rod.

Typically, extractor **50** is mounted onto a sliding track **56**. Extractor **50** includes an indentation **58**, adapted to receive a pull-ring attached to the safety pin of the grenade, such that motion of extractor **50** relative to the grenade head bay causes pulling on the pull ring and extraction of the safety pin.

Figure 6A illustrates pin extractor assembly **26** when the pin is within the grenade. In this setting, arch **51** is adjacent motor **52**. When motor **52** is activated, arch **51** moves along rod **54** away from motor **52**, thereby drawing extractor **50** away from the motor and from the head of the grenade. Because the pull ring of the grenade is attached to indentation **58**, motion of extractor **50** away from the head of the grenade extracts the safety pin **106** from the grenade.

In some embodiments, pin extractor assembly **26** may further include a switch or sensor **60** (indicated in Figure 4) adapted to identify when extractor **50** has completed its motion relative to the grenade head bay, indicating that the safety pin **106** has been fully removed. For example, extractor **50** may have an arm portion **50'** extending into the extractor housing **55**, such that arm portion **50'** is adapted to engage switch **60** upon completion of the pin extraction. As explained in further detail hereinbelow, this sensor assists in maintaining the safe activation of the grenade.

As explained in further detail hereinbelow, extraction of the pin does not automatically activate grenade **100**, because safety lever **110** is held in place until release of the grenade by grenade hold-and-release assembly **28**.

As seen clearly in Figures 4 and 5, the processor **30**, communication interface **34**, and other electronic components, are disposed between cover **48** and grenade seat **22** of housing **20**. An antenna **62**, functionally associated with communication interface **34**, as well as battery **36**, extend out of one side of housing **20**, whereas user interface **32** can be disposed on an opposing side of housing **20**.

In some embodiments, user interface **32** includes various switches and buttons to activate operation of the grenade-carrier, as well as to test functionality of the various assemblies thereof. For example, user interface **32** may include any one or more of the following:

a pin-in/out switch allowing an operator to test operation of the pin extractor assembly **26**;

a release switch allowing an operator to test operation of the grenade hold-and-release assembly **28**;

an on/off switch; and

a communication on/off switch facilitating communication with remote-control unit **14**.

Reference is now additionally made to Figures 7A and 7B, which are schematic

illustrations of grenade hold-and-release assembly **28** in various steps of operation thereof, according to an embodiment of the disclosed technology.

Grenade hold-and-release assembly **28** includes a clamp **70**, seen clearly in Figures 3A and 5, the clamp being disposed distally to grenade head bay **24**. Clamp **70** is slidable relative to grenade seat **22**, as indicated by an arrow in Figure 5, and is adapted to engage a bottom end of grenade **100**, so as to trap the grenade within housing **20**. Clamp **70** is movable toward grenade head bay **24** along a ratcheted rod **72**, seen in Figure 3A and 7A, by engagement of a tooth (not explicitly shown) on the clamp with the ratchets in the rod. Clamp **70** is further associated with a pair of springs **74**, one end of which is seated against clamp **70**, and the opposing end of which is seated against the distal end of the grenade head bay **24**.

In some embodiments, grenade hold-and-release assembly **28** may further include a switch or sensor **75** (indicated in Figure 3A) adapted to identify grenade **100** has been removed from carrier **12**, or when the grenade is placed therein. As explained in further detail hereinbelow, this sensor assists in maintaining the safe activation of the grenade.

Grenade hold-and-release assembly **28** further includes an actuation mechanism **76** (indicated in Figure 5), adapted, upon receipt of a suitable command from controller **30**, to cause a rotating mechanism **77** rotate ratcheted rod **72** relative to grenade seat **22**. As seen in Figure 7B, when rod **72** is rotated, the tooth of clamp **70** is released from the ratchets in the rod, and the clamp is pushed away from grenade head bay **24** by the force of springs **74**. This releases the grenade from seat **22** allowing the grenade to drop. If safety pin **106** has been removed prior to release of clamp **70**, dropping of the grenade results in pivoting of safety lever **110** relative to the grenade head and activation of the grenade, as is known in the art.

Reference is now made to Figure 8, which is a top front perspective illustration of another exemplary grenade-carrier **112**. Reference is additionally made to Figures 9A and 9B, which are bottom front perspective illustrations of grenade-carrier **112** in empty and loaded operative states, respectively, to Figures 10A and 10B, which are a fully exploded view and a partly exploded top view illustration of grenade-carrier **112**, and to Figure 11, which is a cross-sectional illustration of grenade-carrier **112**.

Grenade-carrier **112** is another implementation of the grenade-carrier described hereinabove with respect to Figure 1, and is similar in structure to grenade-carrier **12** of

Figures 2 to 5. Differences between grenade-carrier **12** of Figures 2 to 5 and grenade-carrier **112** are described hereinbelow. Corresponding elements of grenade-carriers **12** and **112** are assigned corresponding numbers, and, where no explicit description is provided for an element of grenade-carrier **112**, it is assumed that the description of the corresponding element of grenade-carrier **12** remains applicable also in grenade-carrier **112**.

Grenade-carrier **112** includes housing **120**, having a cover **148** (seen clearly in Figures 10A and 10B), the housing defining grenade seat **122** and grenade head bay **124** (both seen clearly in Figure 9A).

As seen in Figure 9B, grenade **100** is adapted to be disposed within the housing, such that the grenade head is within grenade head bay **124** and the grenade body is within seat **122**, in a similar manner to that described hereinabove with respect to Figure 3B.

As seen clearly in Figures 10A, 10B, and 11, a processor **130**, a communication interface **134**, and other electronic components, are disposed between cover **148** and grenade seat **122** of housing **120**. An antenna **162**, functionally associated with communication interface **134**, extends out of a side of housing **20**. A user interface **132** is disposed on a side of housing **120**, in some embodiments continuously to antenna **162**. A battery **136** extends slightly out of housing **120**, such that a majority of the length and of the volume of the battery is enclosed within the housing.

User interface **132** is substantially similar to user interface **32** described hereinabove, and includes corresponding switches, such as a pin-in/out switch allowing an operator to test operation of a pin extractor assembly **126**; a release switch allowing an operator to test operation of a grenade hold-and-release assembly **128**; an on/off switch; and a communication on/off switch facilitating communication with remote-control unit **14** (shown clearly in Figure 1).

Figure 10A clearly illustrates housing **120** and cover **148**. Disposed between cover **148** and housing **120** are a circuitry board **131** accommodating processor **130** and communication interface **134**. Circuitry board is functionally associated with a motor, or actuation mechanism **176**, forming part of grenade hold-and-release assembly **128**, described in further detail hereinbelow. Additional components of grenade hold-and-release assembly **128** are also disposed between cover **148** and housing **120**, e.g. between circuitry board **131** and the housing. These may include a ratcheted rod and a

rotating mechanism, as described in further detail hereinbelow.

Battery **136** is adapted to be accommodated in a suitable cavity **137** in housing **120**, shown in Figure 10A as being disposed on the right side of the housing, and a motor **152** forming part of a pin extractor assembly **126** is adapted to be disposed on the opposing side of the housing, and to be enclosed between the housing and the cover **148**.

A clamp **177**, forming part of grenade hold-and-release assembly **128** is adapted to be disposed beneath housing **120**, and to assist in securing grenade **100** therein, as described in further detail hereinbelow.

Reference is now additionally made to Figures 12A and 12B, which are illustrations of pin extractor assembly **126**, in two steps of operation thereof, according to an embodiment of the disclosed technology.

As seen clearly in Figure 9A, pin extractor assembly **126** is disposed about grenade head bay **124**. As shown in Figures 12A and 12B, pin extractor assembly **126** includes a slidable extractor **150**, which is slidable relative to the grenade head bay. Slidable extractor **150** is connected to a motor **152** via a threaded rod **154** and via a plurality of gears **153**, which convert the rotational motion of motor **152** to rotational motion of the threaded rod. Specifically, an engagement portion **151** of slidable extractor **150** is disposed about threaded rod **154**, and is movable therealong. When motor **152** is active, rotation of the motor actuates rotation of rod **154**, thereby driving motion of extractor **150** along the rod.

Typically, extractor **150** moves relative to a sliding track **156**. Extractor **150** includes an indentation **158**, adapted to receive the pull-ring attached to the safety pin of the grenade, such that motion of extractor **150** relative to the grenade head bay causes pulling on the pull ring and extraction of the safety pin.

Figure 12A illustrates the arrangement pin extractor assembly **126** when the pin is within the grenade. In this setting, engagement portion **151** is closer to gears **153**. When motor **152** is activated, engagement portion **151** moves along rod **154** away from gears **153**, thereby drawing extractor **150** away from the head of the grenade. Because the pull ring of the grenade is attached to indentation **158**, motion of extractor **150** away from the head of the grenade extracts the safety pin **106** from the grenade.

In some embodiments, pin extractor assembly **126** may further include a switch or sensor **160** (indicated in Figure 10B) adapted to identify when extractor **150** has

completed its motion relative to the grenade head bay, indicating that the safety pin **106** has been fully removed. As explained in further detail hereinbelow, this sensor assists in maintaining the safe activation of the grenade.

As explained in further detail hereinbelow, extraction of the pin does not automatically activate grenade **100**, because safety lever **110** is held in place until release of the grenade by grenade hold-and-release assembly **128**.

Reference is now made to Figures 13A and 13B, which are sectional illustrations of grenade-carrier 112, the sectional illustrations taking along a first direction perpendicular to a longitudinal axis of the grenade-carrier, and to Figures 14A and 14B, which are sectional illustrations of grenade-carrier **112**, taken along a second direction perpendicular to the first direction. Figures 13A and 14A are taken in a first state of grenade hold-and-release assembly **128**, and Figures 13B and 14B are taken in a second state of grenade hold-and-release assembly **128.**

Grenade hold-and-release assembly **128** includes a clamp **170**, seen clearly in Figures 9A and 11, the clamp being disposed distally to grenade head bay **124**. Clamp **170** is slidable relative to grenade seat **22**, as indicated by an arrow in Figure 11, and is adapted to engage a bottom end of grenade **100**, so as to trap the grenade within housing **120**. Clamp **170** is movable toward grenade head bay **124** along a ratcheted rod **172**, seen clearly in Figures 14A and 14B, by engagement of teeth **173** on the clamp with the ratchets in the rod. Clamp **170** is further associated with a pair of springs **174**, as described hereinabove.

In some embodiments, grenade hold-and-release assembly **128** may further include a switch or sensor **175** (indicated in Figures 9A and 11) adapted to identify when the grenade head of grenade **100** is absent from grenade head bay **124**, or when the grenade is placed therein. As explained in further detail hereinbelow, this sensor assists in maintaining the safe activation of the grenade.

Grenade hold-and-release assembly **128** further includes an actuation mechanism **176**, typically in the form of a servomotor, shown clearly in Figures 10A, 13A, and 13B. Actuation mechanism **176** is functionally associated with a pivoting arm **177**, which is fixed to ratcheted rod **172**, as seen in Figures 13A and 13B. Upon receipt of a suitable command from controller **130**, actuation mechanism **176** is adapted to push an end of pivoting arm **177**, thereby to cause the pivoting arm to pivot relative to clamp **170** and to housing **120**. This pivoting causes slight pivoting of ratcheted rod **172**

relative to the clamp. As seen in Figures 13B and 14B, when rod **172** is pivoted, teeth **173** of clamp **170** disengage from the ratchets in the rod forming a gap **178** between the teeth and the rod and allowing the clamp to be pushed away from grenade head bay **124** by the force of springs **174**. This releases the grenade from seat **122** allowing the grenade to drop. If safety pin **106** has been removed prior to release of clamp **170**, dropping of the grenade results in pivoting of safety lever **110** relative to the grenade head and activation of the grenade, as is known in the art.

Reference is now made to Figure 15, which is a schematic illustration of types of grenades **100** that can be received in the grenade-carrier **12** of Figures 2 to 7B or in grenade-carrier 112 of Figures 8 to 14B, according to an embodiment of the disclosed technology.

As seen in Figure 15, a hand grenade **100a** has an ovoid body **102a**, a flash bang grenade **100b** has a narrow cylindrical body **102b**, a gas grenade **100c** has a substantially ball shaped body **102c**, and a smoke grenade **100d** has a wider cylindrical body **102d**. Additionally, the shape of the safety levers **110a**, **110b**, **110c**, and **110d** of grenades **100a**, **100b**, **100c**, and **100d**, respectively, are different from each other.

However, grenade heads typically have a standardized structure, and therefore the grenade heads **104** of grenades **100a**, **100b**, **100c**, and **100d** share the same geometrical structure and dimensions. As a result, grenade head bays **24** or **124** of respective grenade-carriers **12** or **112** can receive any of grenades **100a**, **100b**, **100c**, and **100d**. The width of housing **20** or **120**, and specifically of grenade seat **22** or **122**, is sufficiently wide to accommodate any of grenades **100a**, **100b**, **100c**, and **100d**.

The difference in the lengths of the different grenades is accommodated for by the movability of clamps **70** or **170** relative to the grenade head bay, allowing the clamp to be moved as close as necessary to the grenade head bay to hold each type of grenade snugly within the grenade seat, and to ensure that the safety lever cannot move until the clamp retracts.

In some applications, and as shown for example in Figure 5, a side of clamp **70** which faces grenade head bay **24** includes a plurality of contours, or indentations, **78**, **79**, and **80**, which are configured to engage the bottom ends (i.e. ends distal to the grenade head **104**) of grenade bodies **102a**, **102b**, **102c**, and **102d**. Such contours may assist in holding the grenade more snugly and conveniently within grenade-carrier **12**, but are not necessary for operation of the grenade-carrier.

It is to be appreciated that grenade-carriers **12** and/or **112** would be able to accommodate any type of grenade, including grenades not shown herein, provided that the grenade head has a shape corresponding to that of the grenade heads shown herein. It is further appreciated that the grenade-carriers **12** and/or **112** could be modified to carry grenades having a different shaped grenade head. As such, it is to be appreciated that grenade-carriers **12** and/or **112**, and system **10** in general, can be used to turn any hand-operated grenade into a launchable-munition, and can be operated safely and remotely from a point of impact.

It is to be appreciated that a grenade-carriers **12** and/or **112** may be formed with a different grenade head bay shape to accommodate each specific grenade head shape, and would be able to accommodate any grenade having that specific grenade head shape, regardless of the other dimensions of the grenade.

Reference is now made to Figure 16, which is a schematic illustration of types of adaptors that can connect to the grenade-carrier of Figures 2 to 7B or to the grenade carrier of Figures 8 to 14B, according to an embodiment of the disclosed technology.

As seen, adaptors **180a**, **180b**, and **180c**, are each suitable for connection to a different type of drone or delivery vehicle, such as delivery vehicle **38** of Figure 1. However, cover **148** of grenade-carrier **112** includes four bores **182**, adapted to connect, via suitable fasteners indicated by arrows **184**, to each of adaptors **180a**, **180b**, and **180c**. The position of bores **182** are standardized, such that despite their different structures, each of adaptors **180a**, **180b**, and **180c** can connect to the grenade carrier at the same positions. Figure 17 is a perspective view of remote-control unit **14** of system **10**, according to an embodiment of the disclosed technology.

As seen, remote-control unit **14** includes a housing **90** housing the controller **40** and communication interface **44** (see Figure 1). An antenna **92**, functionally associated with communication interface **44**, extend out of an end of remote-control unit **14**. Battery **46** is also mounted within housing **90**.

User interface **42** of remote-control unit **14** includes a display **94**, an arm switch **95**, a pull button **96**, a drop button **97**, and an on/off switch **98**. As explained in further detail hereinbelow, arm switch **95** is adapted to arm the system and establish a communication link between remote-control unit **14** and grenade-carrier **12**, pull button **96** is adapted to initiate extraction of the safety pin from the grenade, and drop button **97** is adapted to initiate retraction of clamp **70** leading to dropping of the grenade from

the carrier.

In some embodiments, user interface **42** may further include an audio speaker (not explicitly shown) and/or a vibration motor (not explicitly shown) for providing audio warnings and/or tactile warnings to the operator in case of a malfunction of the system or a problem with removal of the safety pin or with dropping of the grenade, as explained in further detail hereinbelow.

It is to be appreciated that the remote-control unit of Figure 17 is suitable for controlling operation of grenade-carrier **12** of Figures 2 to 7B and for controlling operation of grenade carrier **112** of Figures 8 to 14B, according to embodiments of the disclosed technology.

Figure 18 is a flow chart of a method of activating and launching grenade **100** using system **10** of Figure 1, according to an embodiment of the disclosed technology. The description of Figure 18 is provided with respect to grenade-carrier **12**, but is equally applicable to grenade-carrier **112** described hereinabove, and to any other grenade carrier in accordance with the teachings herein.

At an initial step **S200**, the operator activates grenade-carrier **12**. In some embodiments, in optional steps **S202** and **S204**, the operator may test the functionality of pin extractor assembly **26** grenade hold-and-release assembly **28**, for example by activating them directly from user interface **32** of the grenade-carrier.

At step **S206**, the operator removes pull ring **106** from its clip on the side of grenade **100**, making the pull ring accessible for use.

At step **S208**, the operator places grenade **100** in grenade-carrier **12**, such that grenade body **102** is within grenade seat **22** and grenade head **104** is within grenade head bay **24**. The user then places pull ring **106** of grenade **100** within indentation **58** of extractor **50** at step **S210**, so that motion of the extractor will result in motion of the pull ring and of the safety pin. The user completes loading of grenade **100** by pushing clamp **70** toward grenade head bay **24**, until clamp **70** holds the grenade firmly in place, at step **S212**.

At step **S214**, the operator activates communication interface **34** of grenade-carrier **12**, for example by operating a switch forming part of user interface **32**. The operator then determines whether a confirmation message indicating that communication is ok was received, at step **S216**. If no such message was received, the system is faulty, and the flow terminates at step **S217**.

Otherwise, if a confirmation message was received, at step **S218** the user activates remote-control unit **14**, and arms the system by flipping arm switch **95**. The operator then determines whether a confirmation message indicating that communication is ok was received, at step **S220**. If no such message was received, the system is faulty, and the flow terminates at step **S217**. Otherwise, proper communication has been established between grenade-carrier **12** and remote-control unit **14**, and the operator can deliver grenade-carrier to a target location at step **S222**.

At step **S224**, the operator presses pull button **96** on remote-control unit **14** in order to initiate pulling of safety pin **106** out of grenade **100**. The operator then waits a predetermined duration (e.g. 5 seconds) to see whether a warning signal is received, at step **S226**. The warning signal may be in the form of a sound emanating from remote-control unit **14**, a visual message on the remote-control unit, vibration of the remote-control unit, or by any other suitable method.

If a warning signal is received, at step **S228** the operator initiates a safe disposal procedure, for example involving a bomb squad to actively and safely detonate the grenade.

Otherwise, if no warning signal is received, in some embodiments, the operator may wait for confirmation that the pin was properly extracted from the grenade. If no such confirmation is received, the flow may return to step **S228**. Otherwise, if the confirmation is received, or if the operator does not wait for a positive confirmation and operates only based on the absence of a negative message, when the time is right, at step **S230** the operator presses drop button **97** on remote-control unit **14** in order to initiate dropping of grenade **100** out of grenade-carrier **12**.

The operator then waits a predetermined duration (e.g. 5 seconds) to see whether a warning signal is received, at step **S232**. The warning signal may be in the form of a sound emanating from the remote-control unit, a visual message on the remote-control unit, vibration of the remote-control unit, or by any other suitable method.

If a warning signal is received, flow returns to step **S228** and the operator initiates the safe retrieval procedure. Otherwise, in some embodiments, the operator may wait for positive confirmation that the grenade was dropped. If no such confirmation is received, the flow may return to step **S228**. Otherwise, if the confirmation is received, or if the operator does not wait for a positive confirmation and

operates only based on the absence of a negative message, the mission is complete and at step **S234** the operator retrieves grenade-carrier **12** for re-loading thereof.

Reference is now made to Figure 19, which is a flow chart of a method of operation of grenade-carrier **12** of system **10**, according to an embodiment of the disclosed technology. The method of Figure 19 is typically carried out by the controller of the grenade-carrier. The description of Figure 19 is provided with respect to grenade-carrier **12**, but is equally applicable to grenade-carrier **112** described hereinabove, and to any other grenade carrier in accordance with the teachings herein.

At an initial step **S250**, controller **30** evaluates whether it is armed. If it is armed, and communication is correct, processor **30** causes user interface **32** to display a communication confirmation at step **S252**.

Controller **30** then waits until it receives, from remote-control unit **14**, via communication interface **34**, an instruction to pull the safety pin out of the grenade, at step **S254**. In some embodiments, controller **30** then validates whether a grenade is present within the grenade-carrier, at step **S256**. If no grenade is present, an error message is provided at step **S258**. In some embodiments, the error message may be transmitted from carrier **12** to remote-control unit **14**, to be displayed thereon. In some embodiments, the error message may be displayed on a display forming part of user interface **32** on grenade-carrier **12**.

Otherwise, if the grenade is present, at step **S260** controller **30** operates pin extractor assembly **26** to trigger extraction of the safety pin from the grenade. For example, controller **30** may trigger initiation of operation of motor **52**, to drive extractor **50** away from the grenade head, thereby the extract the pin, as explained hereinabove.

Controller **30** determines, at step **S262**, whether it received an input confirming completion of the pin removal. For example, such an input may be received from sensor or switch **60**. If no such input was received, a warning signal is provided at step **S264**. In some embodiments, the warning signal may be transmitted from carrier **12** to remote-control unit **14**, to be displayed thereon or otherwise indicated to the operator (e.g. audibly or tactilely). In some embodiments, the warning signal may be displayed on a display forming part of user interface **32** on grenade-carrier **12**.

If an input confirming that the pin was properly extracted is received, in some embodiments, a pull-confirmation may be provided at step **S265**. In some embodiments, the pull confirmation may be transmitted from carrier **12** to remote-

control unit **14**, to be displayed thereon or otherwise indicated to the operator (e.g. audibly or tactilely).

Controller **30** then waits until it receives, from remote-control unit **14**, via communication interface **34**, an instruction to drop the grenade, at step **S266**. At step **S268** controller **30** operates grenade hold-and-release assembly **28** to trigger dropping of the grenade from the carrier. For example, controller **30** may trigger rotation of ratcheted rod **72** and motion of clamp **70** away from the grenade head, thereby to allow the grenade to drop out of grenade seat **22** in the grenade-carrier, as explained hereinabove.

It is to be appreciated that once the grenade is removed from the grenade-carrier, since the safety pin has already been removed at step **S262**, the safety lever can pivot relative to the grenade head triggering activation of the grenade.

Controller **30** determines, at step **S270**, whether it received an input confirming removal of the grenade from the grenade-carrier. For example, such an input may be received from sensor or switch **75** indicating that there has been a change in the status of the presence of a grenade. If no input confirming the drop of the grenade was received, the flow returns to step **S264** and a warning signal is provided, substantially as described hereinabove.

Otherwise, the grenade has been safely dropped, and at step **S272** a completion signal is provided. In some embodiments, the completion signal may be transmitted from carrier **12** to remote-control unit **14**, to be displayed thereon or otherwise indicated to the operator (e.g. audibly or tactilely). In some embodiments, the completion signal may be displayed on a display forming part of user interface **32** on grenade-carrier **12**. In some applications, controller **30** may await resetting thereof with respect to a new grenade.

It is to be appreciated that the methods of Figures 10 and 11 can be used with any type of hand-operated grenade (possibly modifying the shape of the grenade seat and/or of the grenade head bay), to turn the grenade into a safely operated launchable munition or projectile.

It is to be appreciated that grenade-carrier **12** may be modified to carry multiple grenades, and similarly remote-control unit **14** may be modified to control activation of those multiple grenades. In such embodiments, the methods of Figures 18 and 19 would also be modified, for example to operate iteratively to control activation and launching

of multiple grenades.

It will be appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination. Similarly, the content of a claim depending from one or more particular claims may generally depend from the other, unspecified claims, or be combined with the content thereof, absent any specific, manifest incompatibility therebetween.

Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

WHAT IS CLAIMED IS:

1. A system for remote activation of a grenade having a grenade body, a grenade head accommodating a safety pin connected to a pull ring, and a safety lever, the system comprising:

(a) a grenade-carrier, comprising:

(i) a housing defining a grenade seat adapted to receive the grenade body and a grenade head bay adapted to receive the grenade head;

(ii) a pin extractor assembly functionally associated with the grenade head bay, and adapted, in an active state, when the grenade head is disposed within the grenade head bay, and in response to receipt of a first input, to remove the safety pin from the grenade head;

(iii) a grenade hold-and-release assembly adapted to secure the grenade within the housing, and, in response to receipt of a second input, to release the grenade from the housing,

wherein when the grenade is secured by the grenade hold-and-release assembly, the safety lever is prevented from pivoting relative to the grenade head even if the safety pin has been removed from the grenade;

(iv) a communication interface;

(v) a controller, functionally associated with the pin extractor assembly, the grenade hold-and-release assembly, and the communication interface, for controlling activation thereof; and

(vi) a power supply powering the pin extractor assembly, the grenade hold-and-release assembly, and the controller; and

(b) a remote-control unit comprising:

(i) a controller;

(ii) a user interface;

(iii) a communication interface; and

(iv) a power supply,

wherein the remote-control unit is adapted to communicate with the grenade-carrier and to provide to the controller of the grenade-carrier the first input and the second input, provided by an operator using the user interface, for remote operation of the grenade-carrier, the first input being separate and distinct from the second input.

2. The system of claim 1, wherein the grenade hold-and-release assembly is adapted to release the grenade, in response to the second input, only following identification of complete extraction of the safety pin.

3. The system of claim 1 or claim 2, wherein, following extraction of the safety pin from the grenade, release of the grenade from the hold-and-release assembly enables the safety lever to pivot relative to the grenade head.

4. The system of any one of claims 1 to 3, further comprising a delivery vehicle onto which the grenade-carrier is mounted, the delivery vehicle adapted to deliver the grenade-carrier and the grenade accommodated therein to a target location for activation of the grenade.

5. The system of any one of claims 1 to 4, further comprising the grenade.

6. The system of claim 5, wherein the grenade is an explosive hand grenade.

7. The system of claim 5, wherein the grenade is a flash bang grenade.

8. The system of claim 5, wherein the grenade is a smoke grenade.

9. The system of claim 5, wherein the grenade is a gas grenade.

10. The system of any one of claims 1 to 5, wherein the grenade seat and the grenade head bay are suitable for accommodating at least two of the following types of grenades:

an explosive hand grenade;
a flash bang grenade;
a smoke grenade; and
a gas grenade.

11. The system of any one of claims 1 to 5, wherein the grenade seat and the

grenade head bay are suitable for accommodating each of the following types of grenades:

an explosive hand grenade;

a flash bang grenade;

a smoke grenade; and

a gas grenade.

12. The system of any one of claims 1 to 11, wherein the pin extractor assembly includes:

a motor, operable in response to receipt of the first input;

an extractor, adapted to engage a pull ring of the safety pin of the grenade, and to be moved, by operation of the motor, relative to the grenade head bay, so as to pull the safety pin out of the grenade.

13. The system of claim 12, wherein the extractor is connected to a slidable connector, the slidable connector being adapted to slide along a threaded rod, which threaded rod is adapted to be rotated by operation of the motor.

14. The system of claim 13, wherein the threaded rod extends out of the motor.

15. The system of claim 13, wherein the threaded rod is disposed in parallel to the motor, and rotation of the motor is transferred to the rod by at least two gears.

16. The system of any one of claims 12 to 15, wherein said pin extractor assembly includes a pull-sensor adapted to provide a pull signal to the controller of the grenade-carrier when the extraction of the safety pin is complete.

17. The system of claim 16, wherein, following receipt of the first input, if the pull signal was not received within a predetermined duration, the controller of the grenade-carrier is adapted to provide a warning signal to the remote-control unit.

18. The system of any one of claims 1 to 17 wherein, when the grenade is disposed within the grenade-carrier, the grenade hold-and-release assembly applies pressure to

the grenade in an axial direction, such that when the safety pin is removed from the grenade, the pressure in the axial direction prevents the safety lever from pivoting relative to the grenade head, thereby maintaining the grenade un-actuated.

19. The system of any one of claims 1 to 18, wherein the grenade hold-and-release assembly comprises a clamp connected to at least one spring, the clamp being movable relative to the grenade head bay along a ratcheted rod, and adapted to secure the grenade within the grenade housing.

20. The system of claim 19, wherein the grenade hold-and-release assembly further includes a rotating mechanism adapted, in response to receipt of the second input, to rotate the ratcheted rod thereby releasing the clamp to move away from the grenade head bay under the force of the at least one spring and releasing the grenade from the grenade housing.

21. The system of claim 19, wherein the clamp includes a tooth adapted to engage the ratcheted rod, and wherein the grenade hold-and-release assembly further includes a pivoting arm associated with a pivoting actuator and with the ratcheted rod,

wherein, in response to receipt of the second input, the controller of the grenade-carrier is adapted to operate the pivoting actuator to cause pivoting of the arm causing the ratcheted rod to disengage the tooth of the clamp, thereby releasing the clamp to move away from the grenade head bay under the force of the at least one spring and releasing the grenade from the grenade housing.

22. The system of any one of claims 1 to 21, wherein the grenade-carrier includes a sensor adapted to sense the presence of a grenade within the grenade-carrier, and to provide to the controller of the grenade-carrier a drop signal indicating when the grenade head is no longer present in the grenade-carrier.

23. The system of claim 22, wherein, following receipt of the second input, if the drop signal was not received within a predetermined duration, the controller of the grenade-carrier is adapted to provide a warning signal.

24. The system of any one of claims 4 to 23, wherein the delivery vehicle comprises an unmanned aerial vehicle.

25. The system of any one of claims 1 to 24, wherein the grenade-carrier is adapted to carry a plurality of grenades, and the remote-control unit is adapted to control pin extraction and release of each of the plurality of grenades.

26. The system of any one of claims 5 to 25, wherein, when the grenade is disposed within the grenade-carrier, the safety lever of the grenade is exposed.

27. A method of remotely activating and operating a grenade, the grenade including a grenade body, a grenade head, a safety pin accommodated in the grenade head and connected to a pull ring, and a safety lever, the method comprising:

(a) loading the grenade into a grenade-carrier such that the safety-pin is functionally associated with a pin extractor assembly of the grenade-carrier and the safety lever is fixed within the grenade-carrier;

(b) using a remote-control unit, providing a first input instructing the pin extractor assembly to automatically remove the safety pin from the head of the grenade;

(c) responsive to confirmation of complete removal of the safety pin from the head of the grenade, using the remote-control unit, providing a second input instructing the grenade-carrier to automatically release the grenade,

wherein release of the grenade from the grenade-carrier frees the safety lever to pivot relative to the grenade head thereby to activate the grenade.

28. The method of claim 27, wherein the loading of the grenade comprises:

manually placing the grenade in a grenade seat of the grenade-carrier, such that the grenade head is in a grenade head bay of the grenade-carrier;

manually placing the pull ring of the grenade on a movable pin extractor of the pin extractor assembly; and

manually pushing a movable clamp toward the grenade head bay, thereby to secure the grenade within the grenade-carrier.

29. The method of claim 27 or claim 28, wherein the loading of the grenade

comprises manually placing the grenade in the grenade seat such that the safety lever of the grenade is exposed, and manually pushing the movable clamp such that the clamp applies pressure to the grenade in an axial direction, which pressure prevents the exposed safety lever from pivoting relative to the grenade head.

30. The method of any one of claims 27 to 29, further comprising, prior to step (b), mounting the grenade-carrier on a delivery vehicle, and guiding the delivery vehicle with the grenade-carrier to a target location for release of the grenade.

31. The method of any one of claims 27 to 30, further comprising, following (b), upon receipt of a warning notification indicative of a failure in removal of the safety-pin, initiating safe disposal of the grenade.

32. The method of any one of claims 27 to 31, further comprising, following (c), upon receipt of a warning notification indicative of a failure in releasing of the grenade from the grenade-carrier, initiating safe disposal of the grenade.

33. The method of any one of claims 27 to 32, further comprising, following (c), retrieving the grenade-carrier for future use thereof.

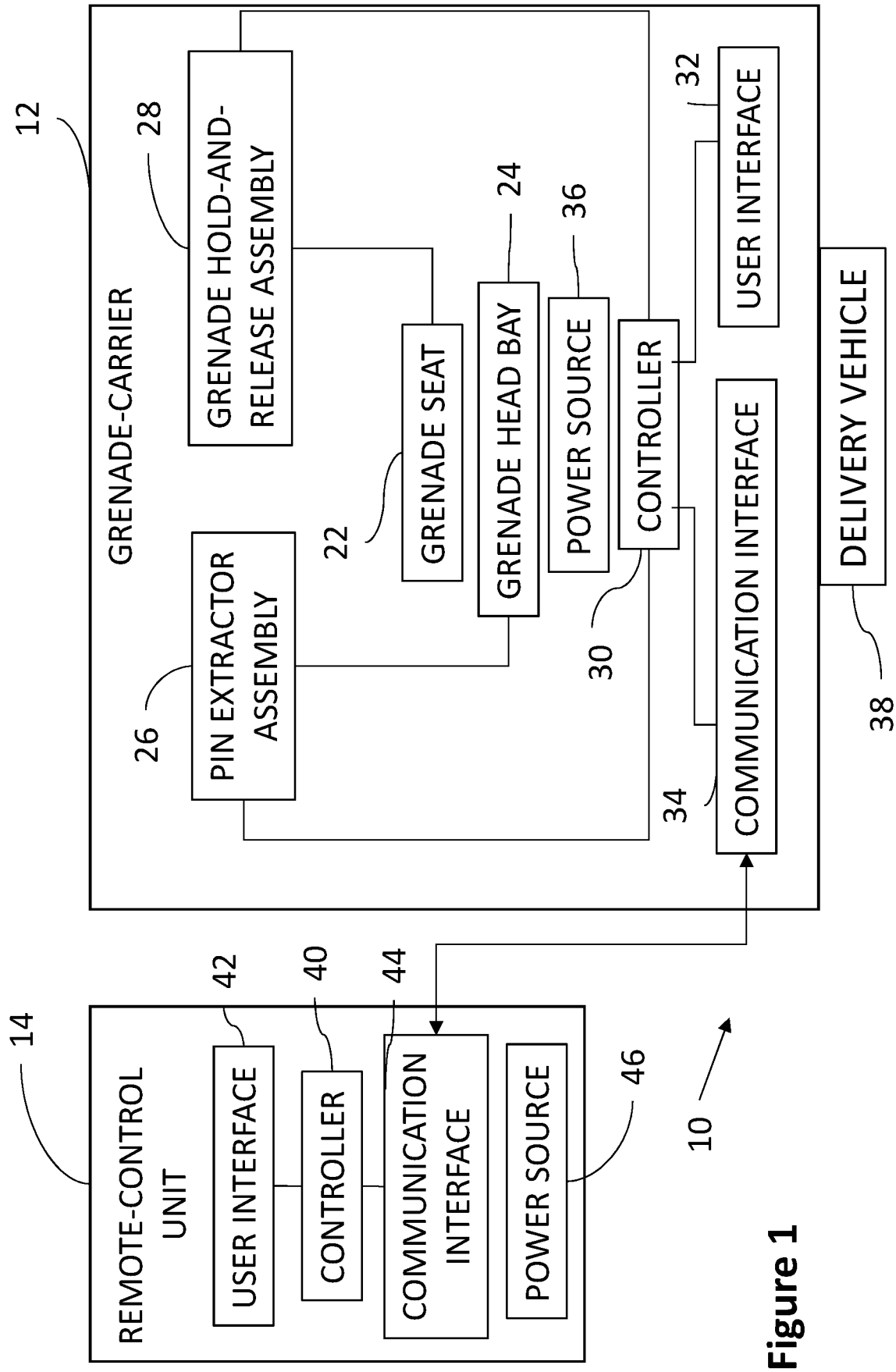

12
GRENADE-CARRIER
28
GRENADE HOLD-AND-RELEASE ASSEMBLY
22
GRENADE SEAT
24
GRENADE HEAD BAY
36
POWER SOURCE
CONTROLLER
30
32
USER INTERFACE
COMMUNICATION INTERFACE
34
26
PIN EXTRACTOR ASSEMBLY
DELIVERY VEHICLE
38
14
REMOTE-CONTROL UNIT
42
USER INTERFACE
40
CONTROLLER
44
COMMUNICATION INTERFACE
POWER SOURCE
46
10

Figure 1

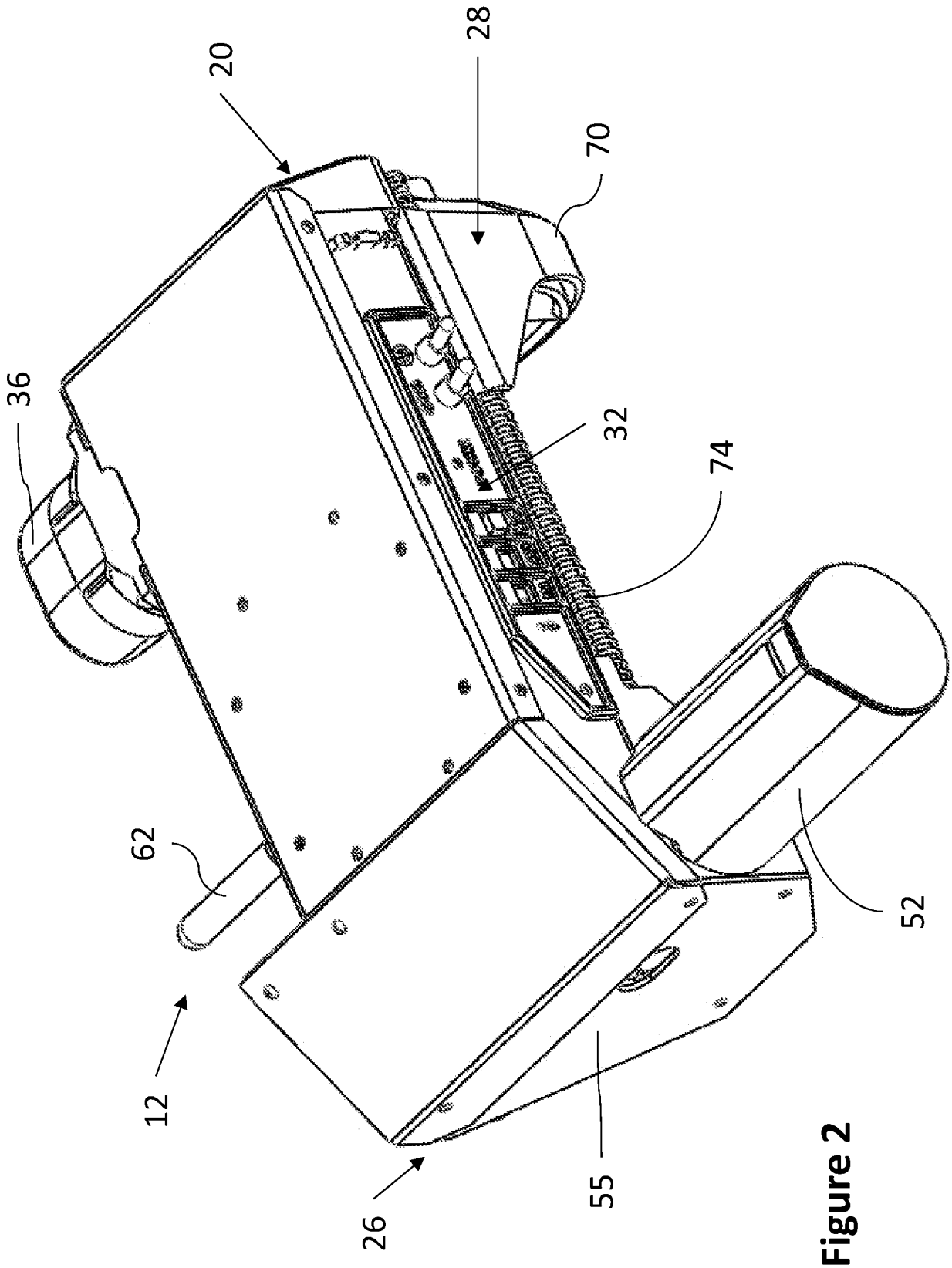



Figure 2

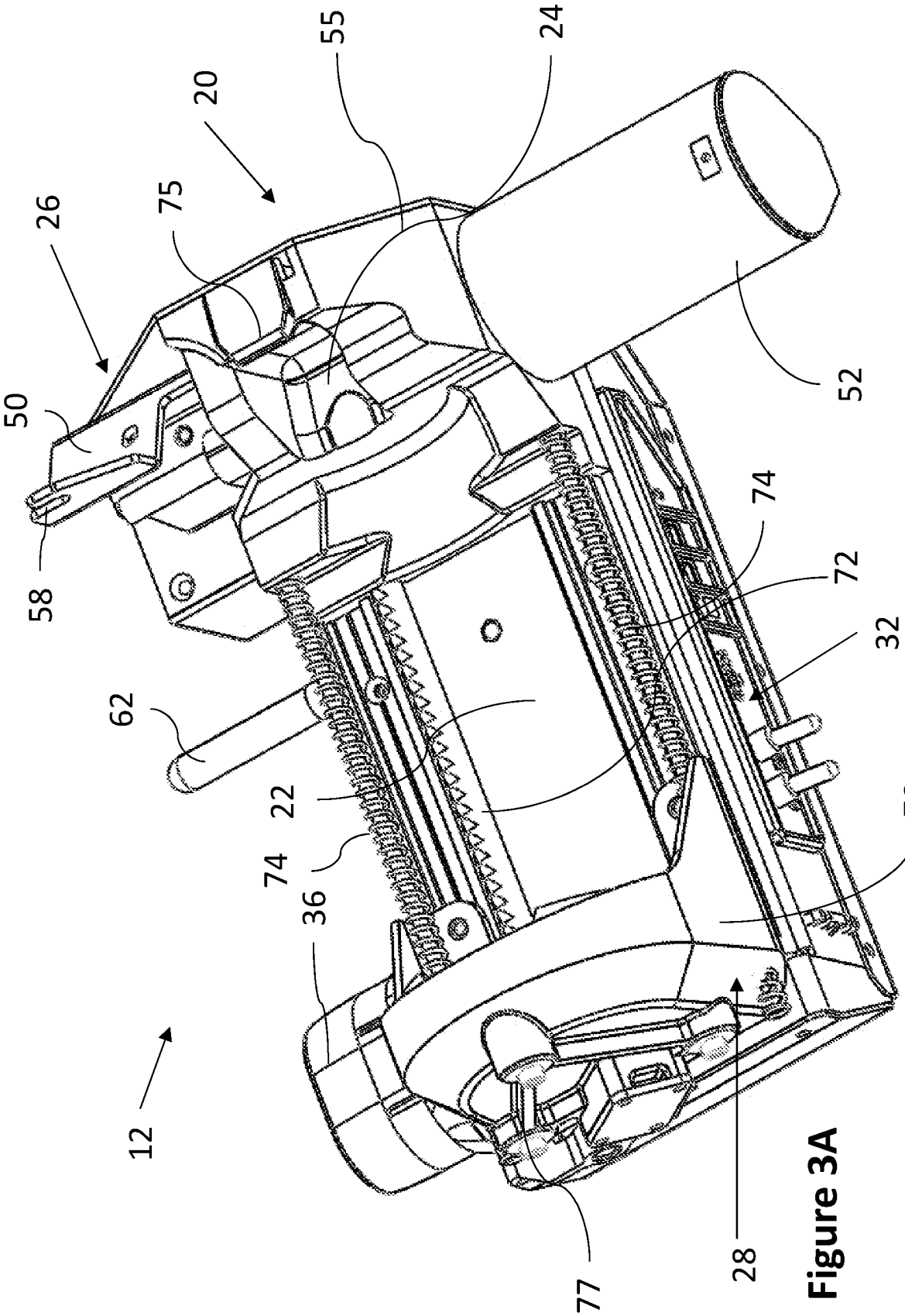



Figure 3A

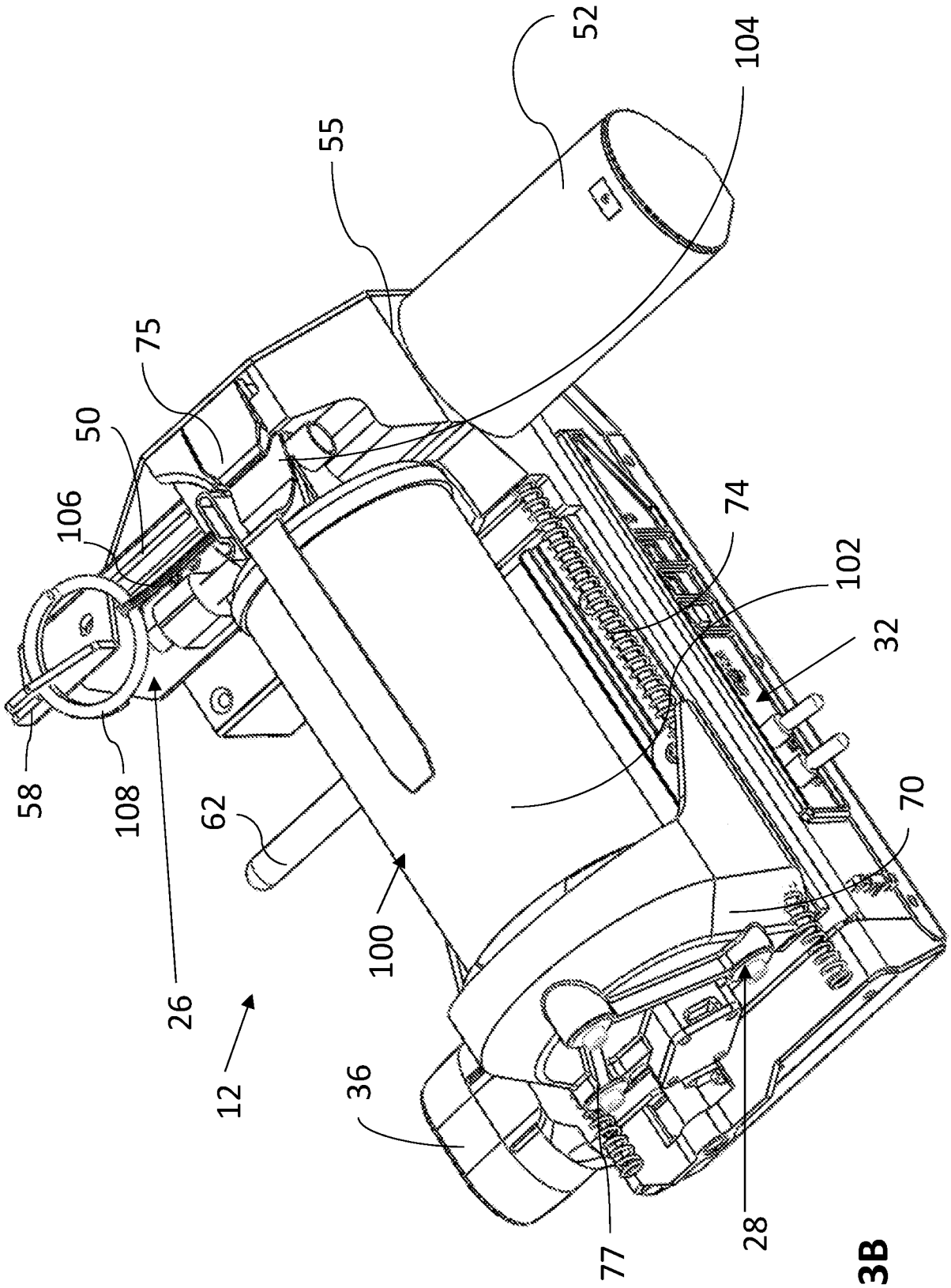



Figure 3B

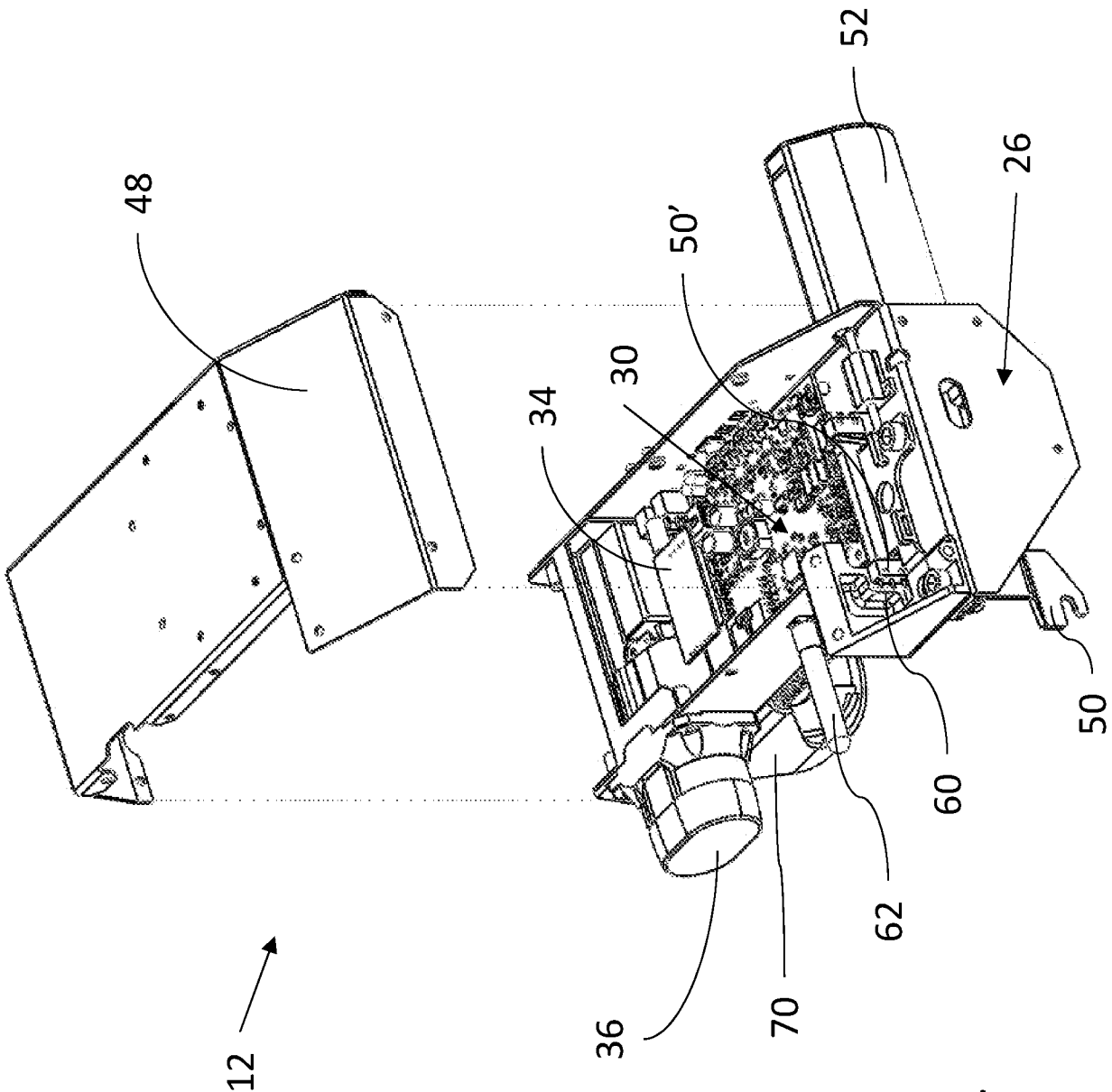



Figure 4

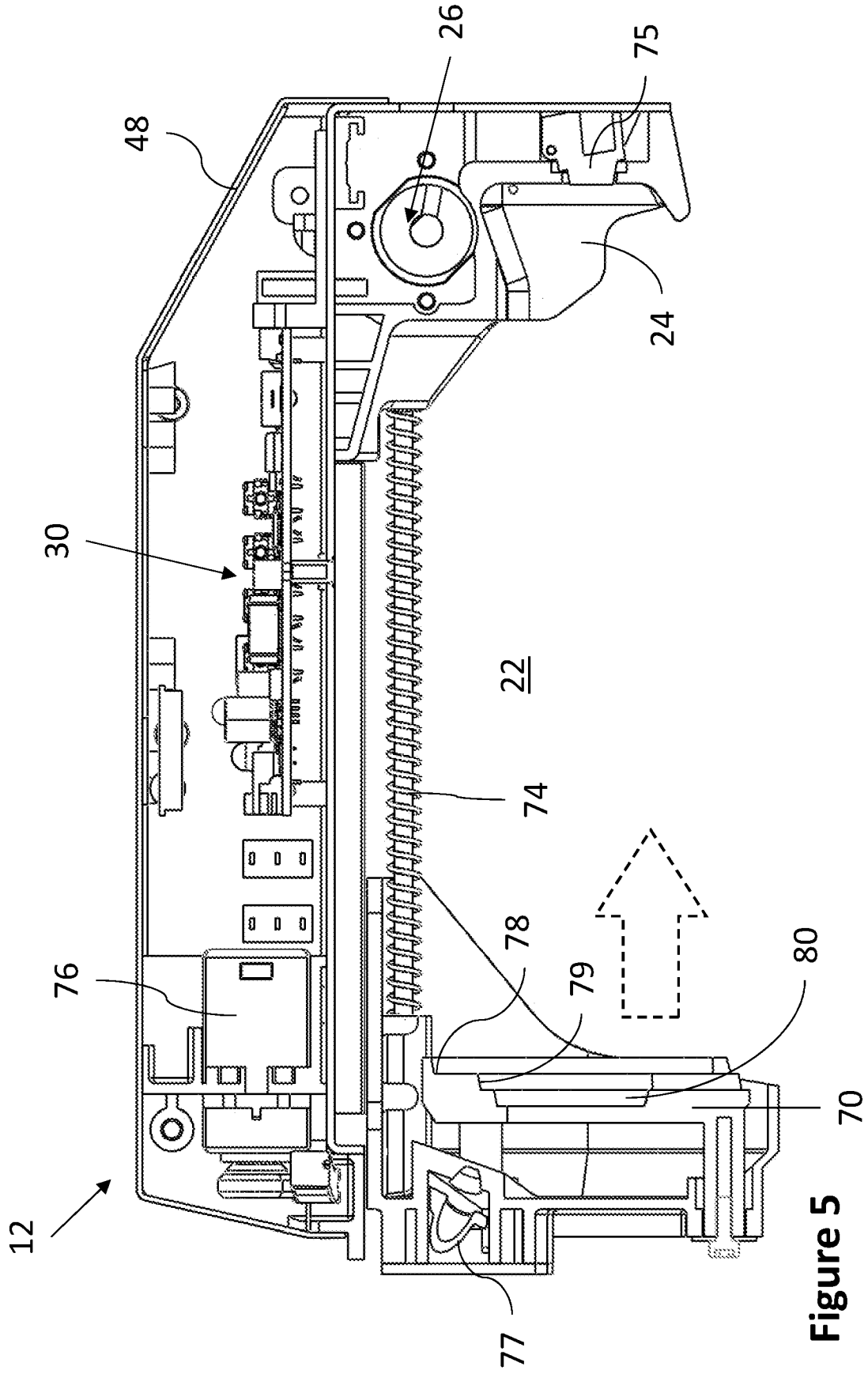



Figure 5

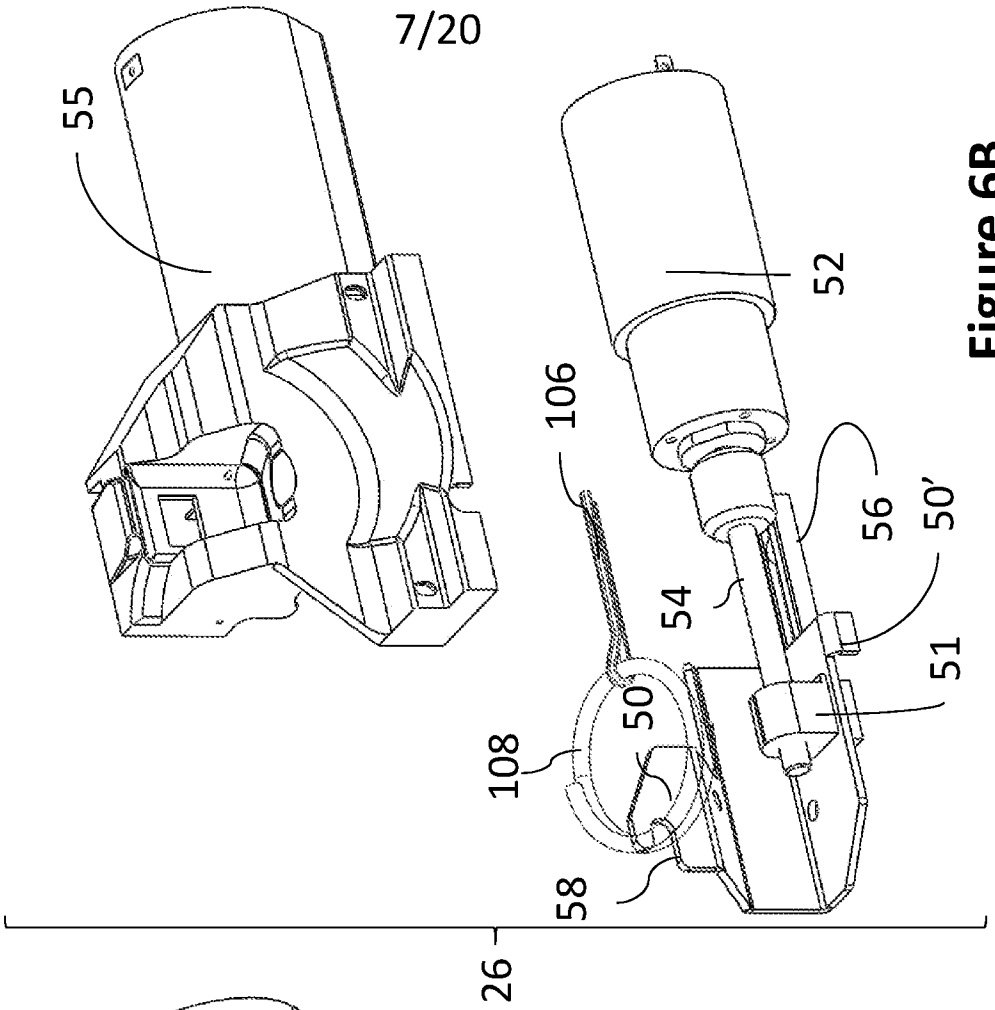



Figure 6B

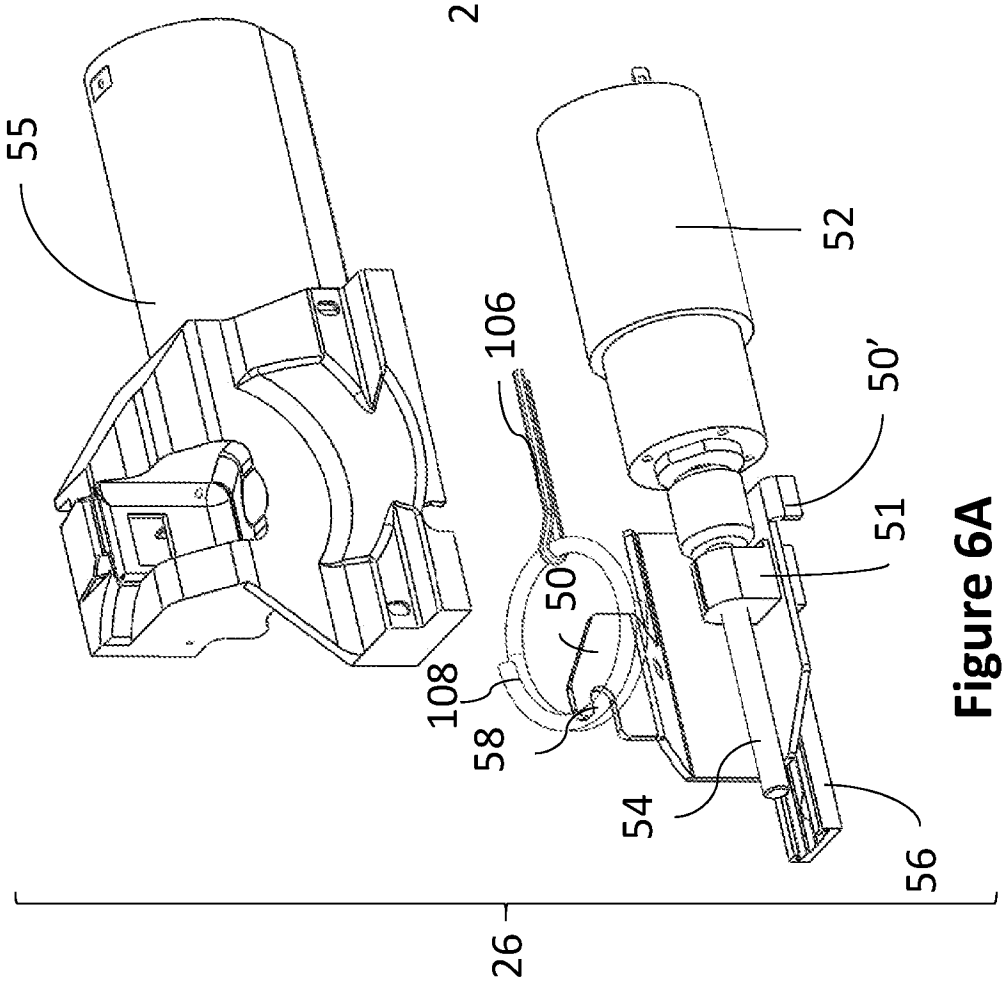



Figure 6A

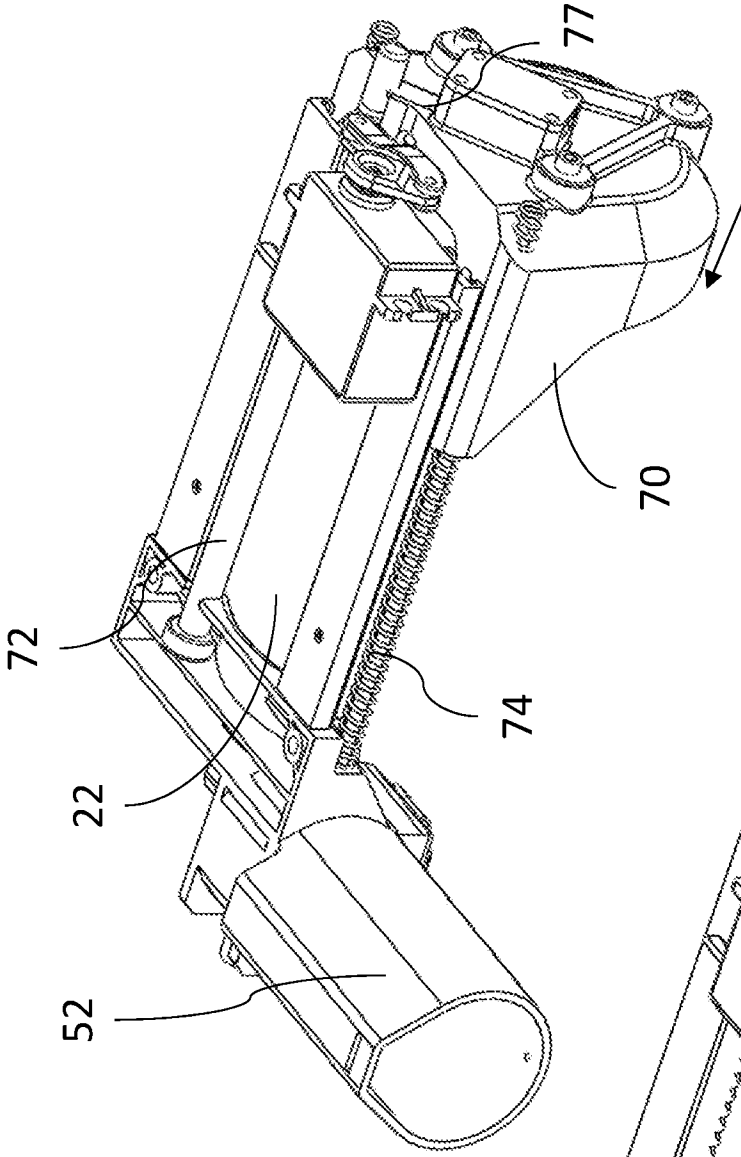



Figure 7B

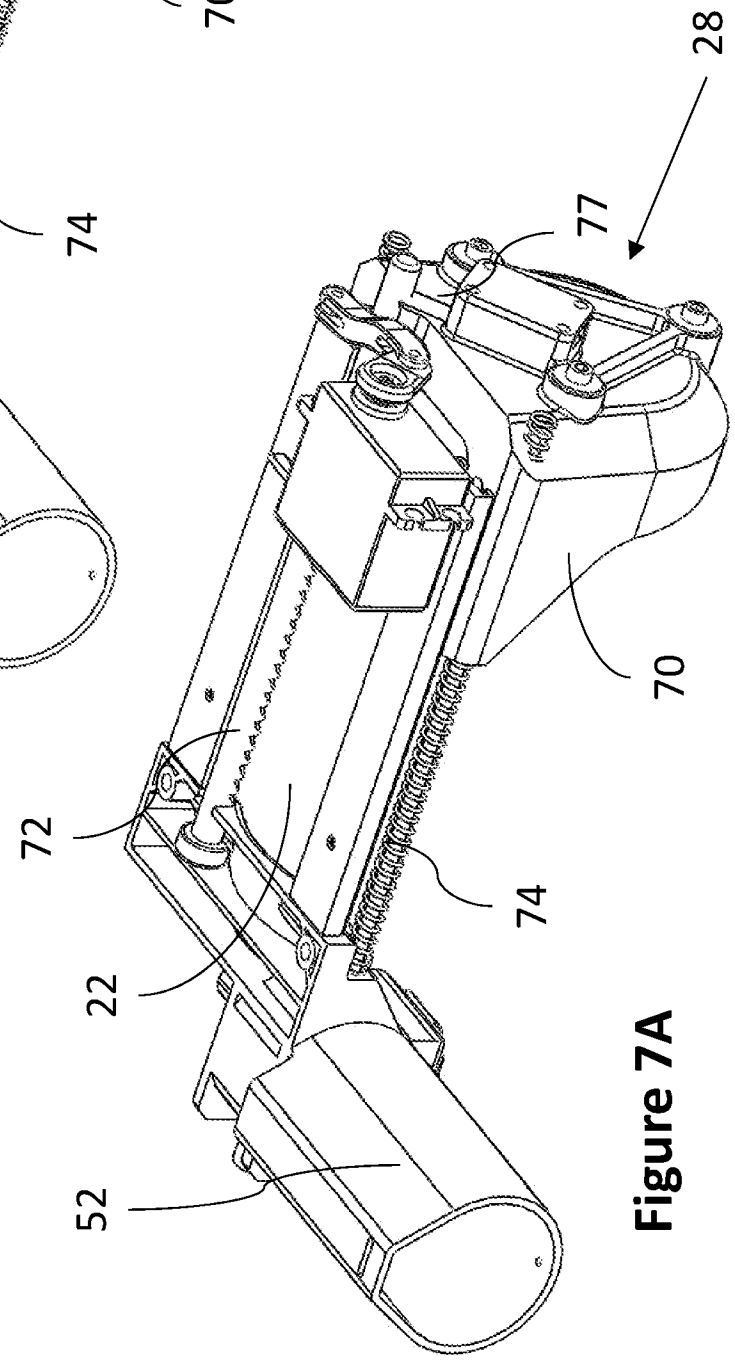



Figure 7A

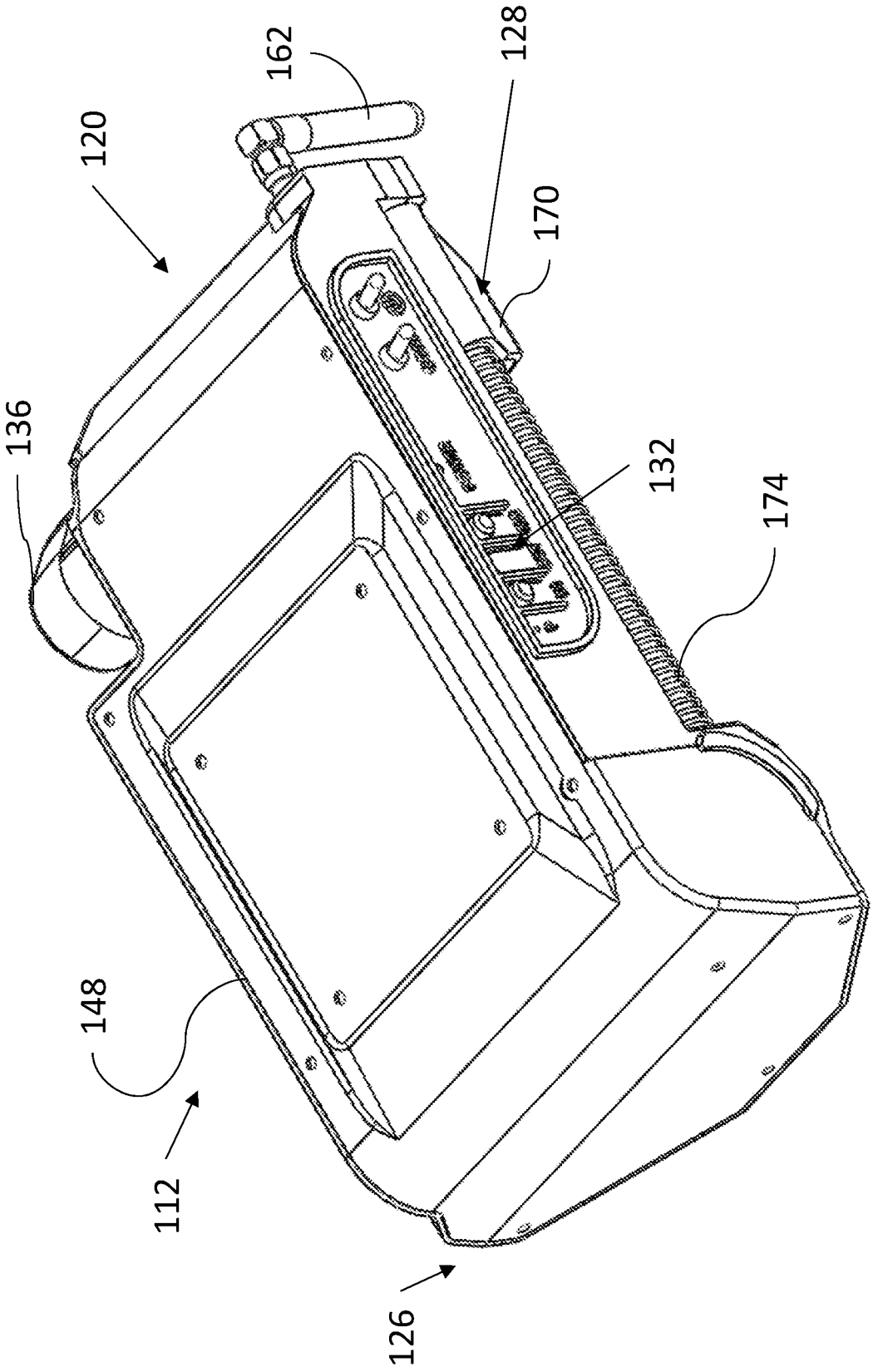



Figure 8

Figure 9B

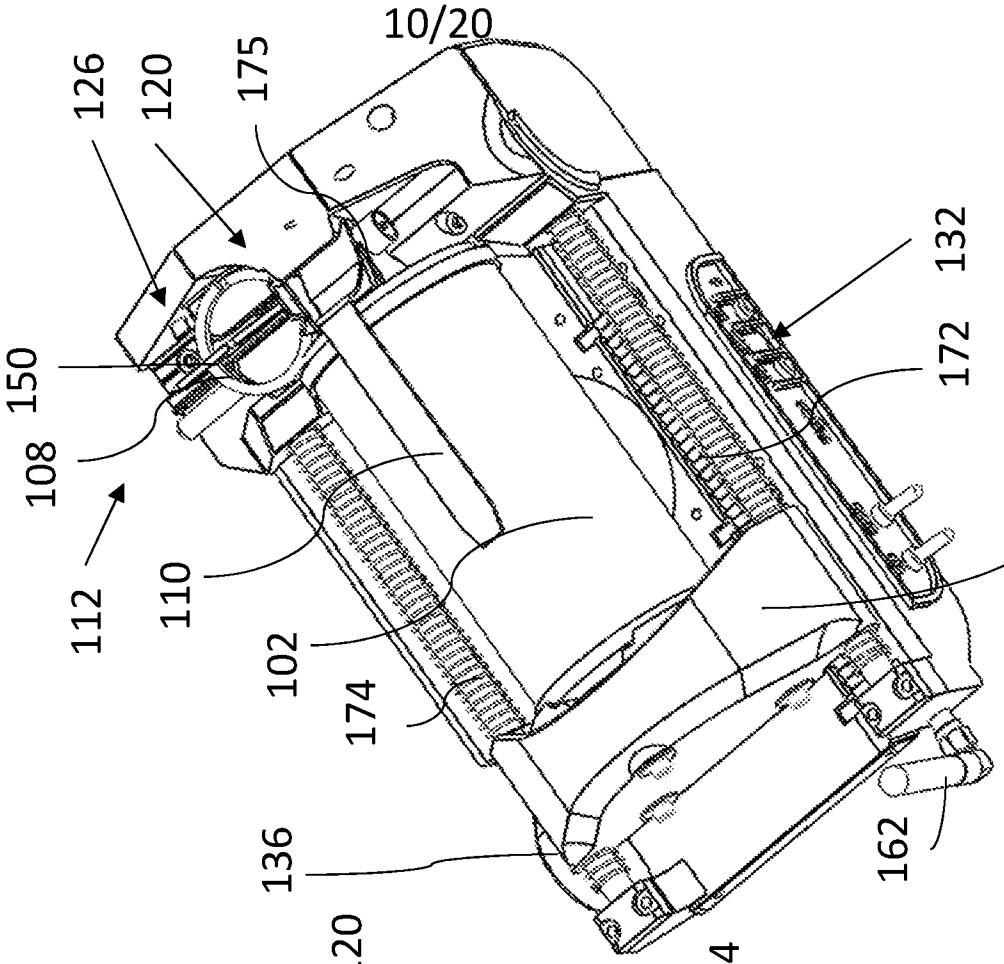



Figure 9A

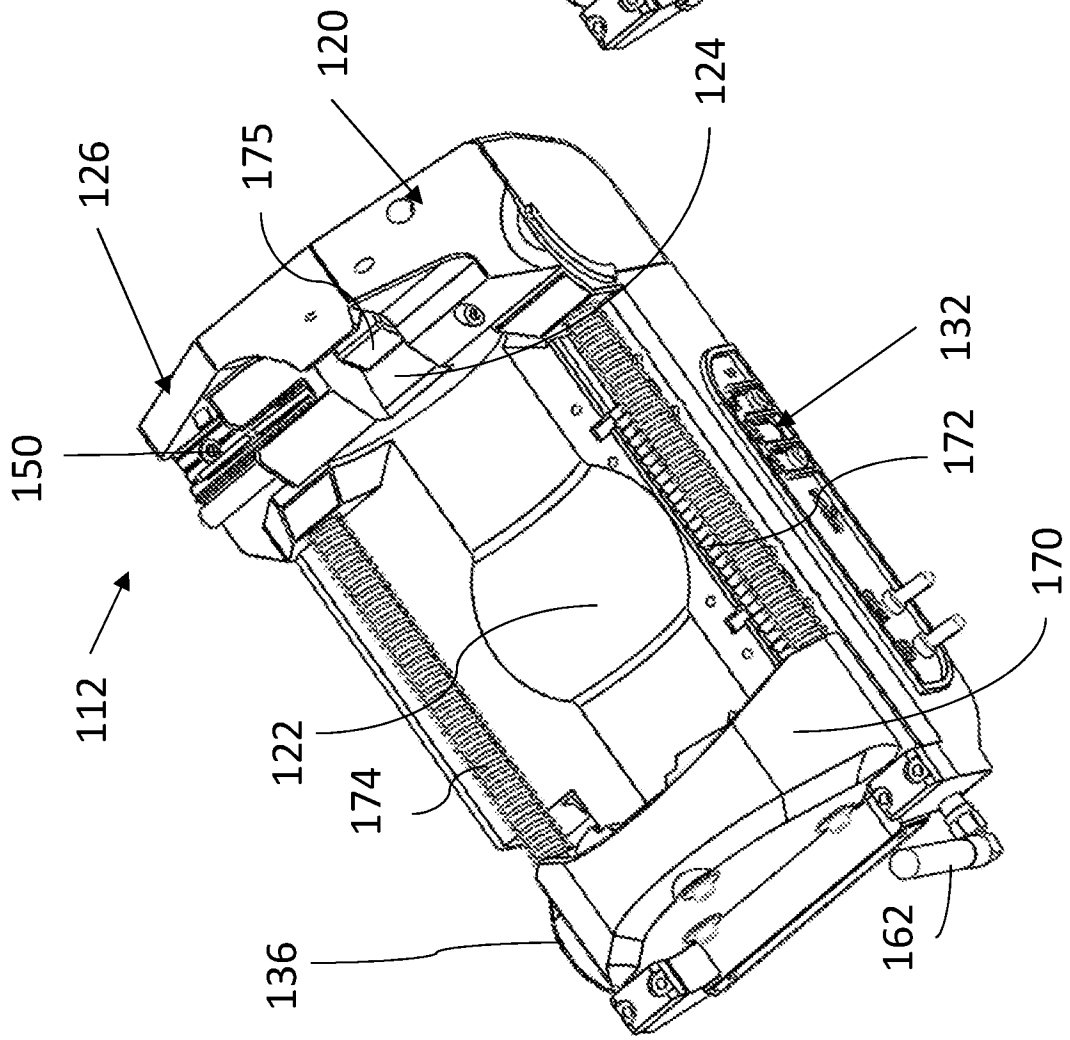


Figure 10B

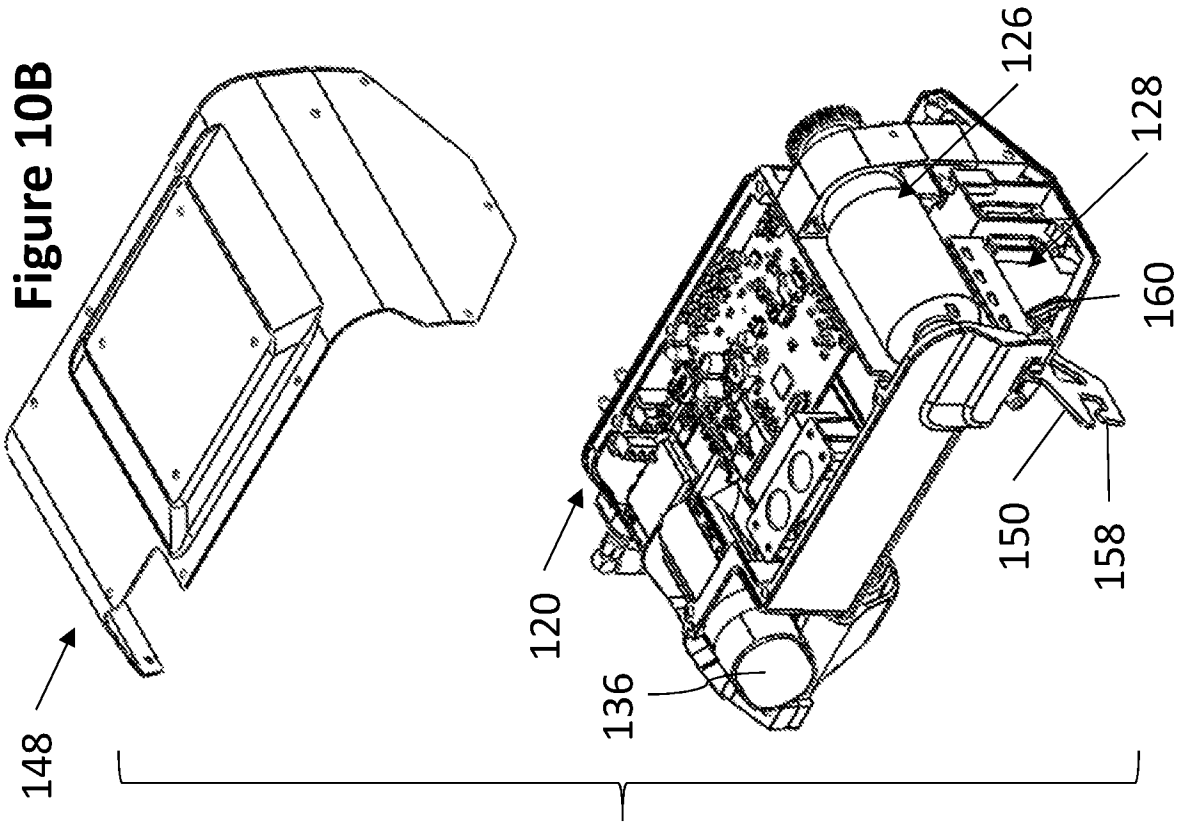
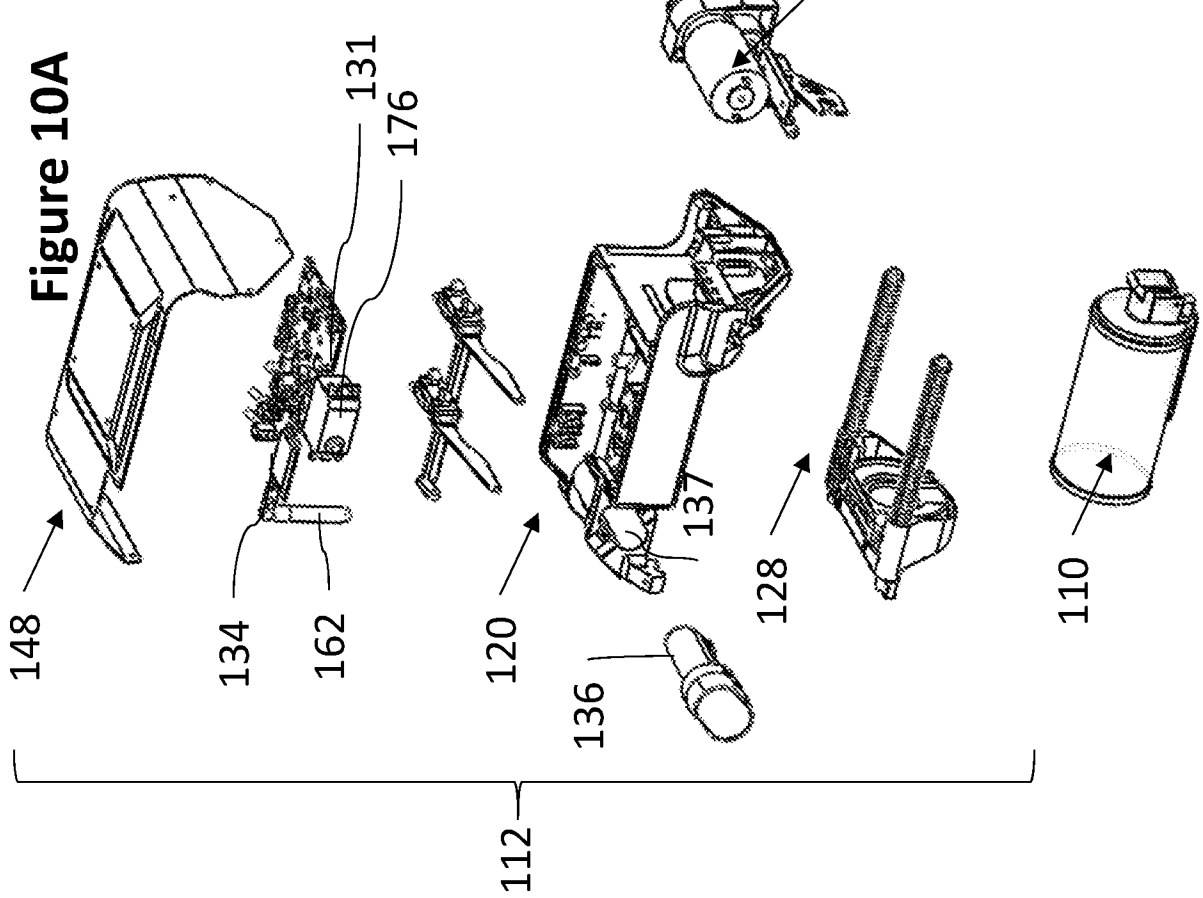



Figure 10A



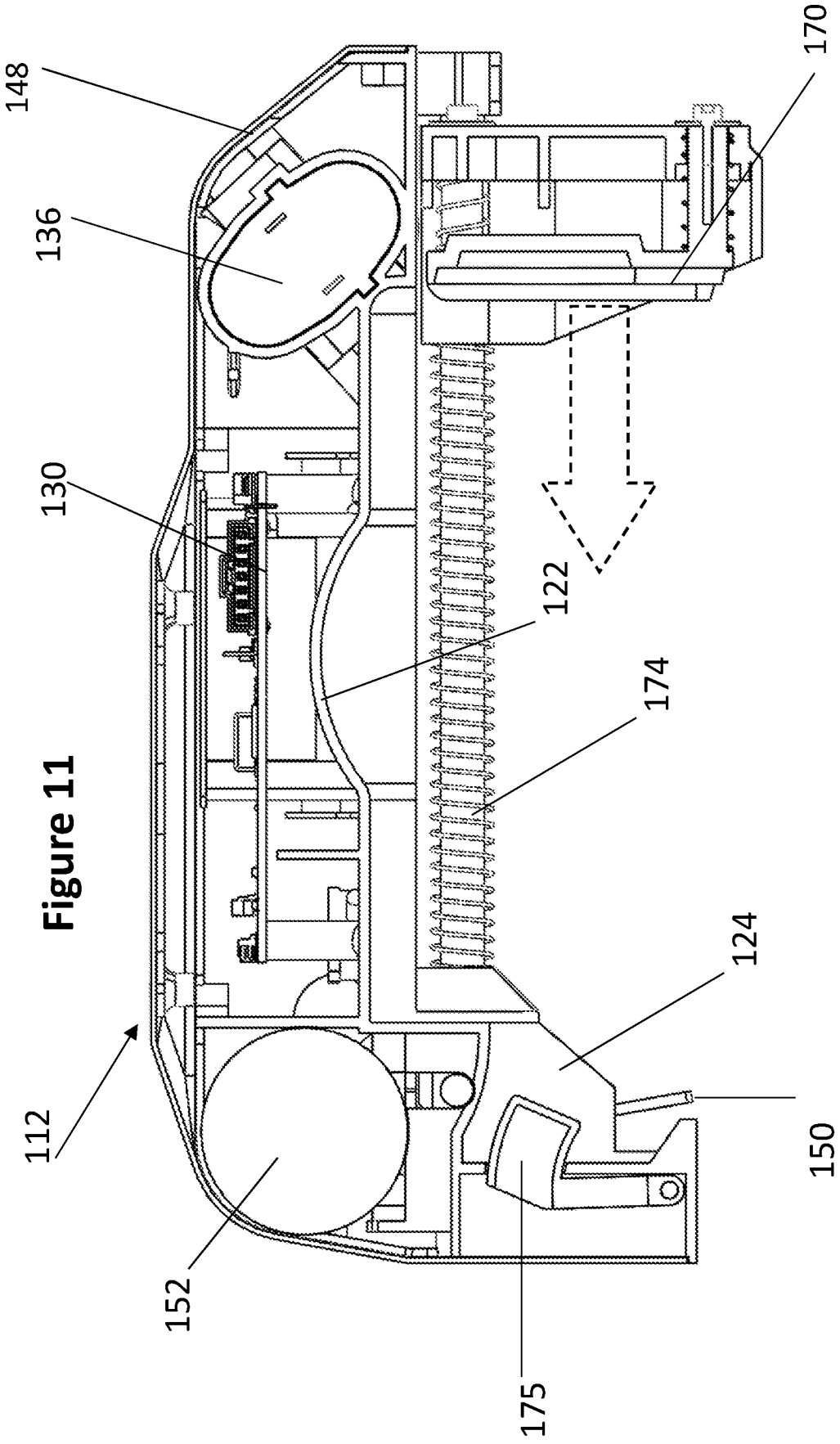



Figure 11

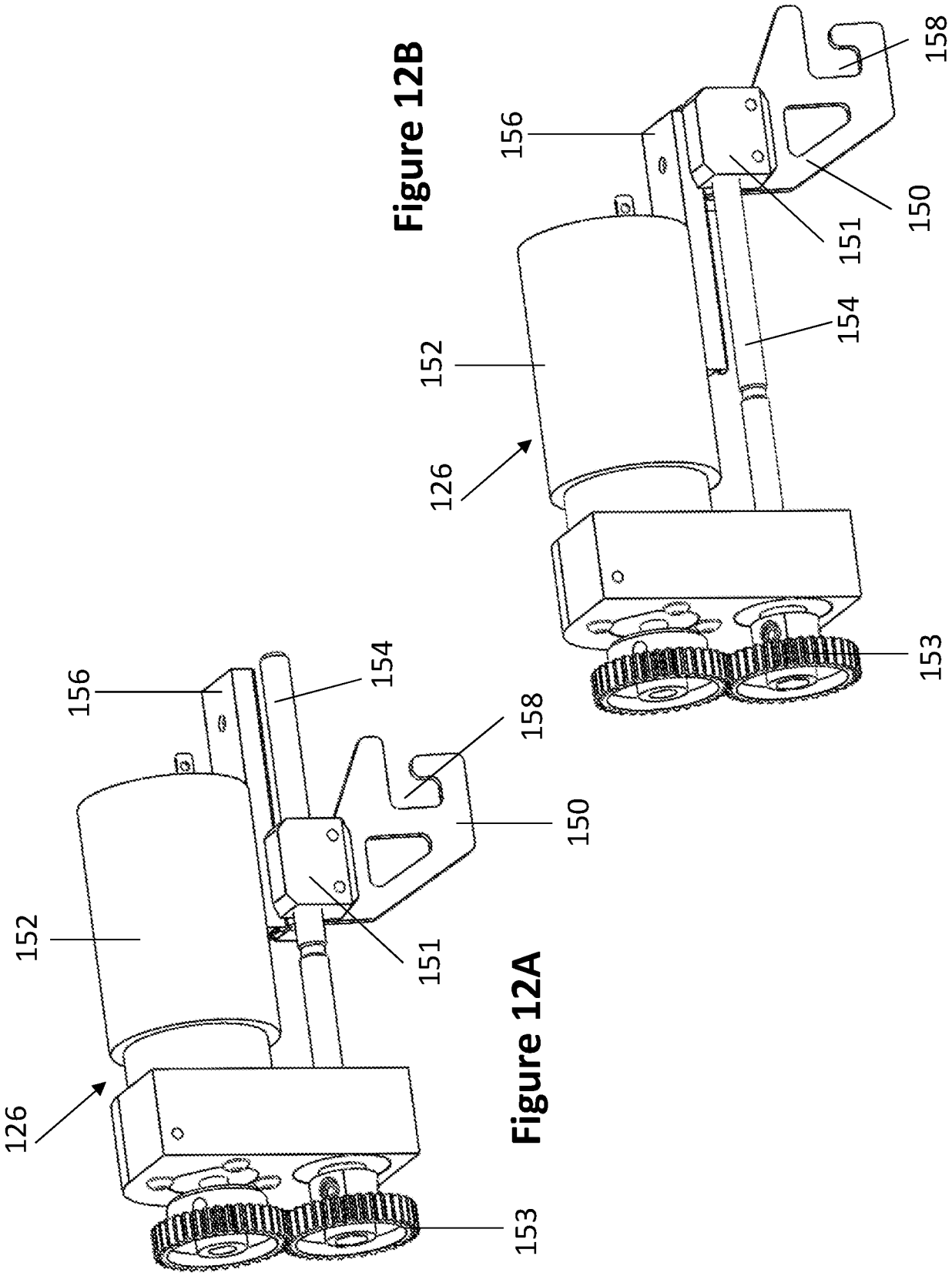



Figure 12A




Figure 12B

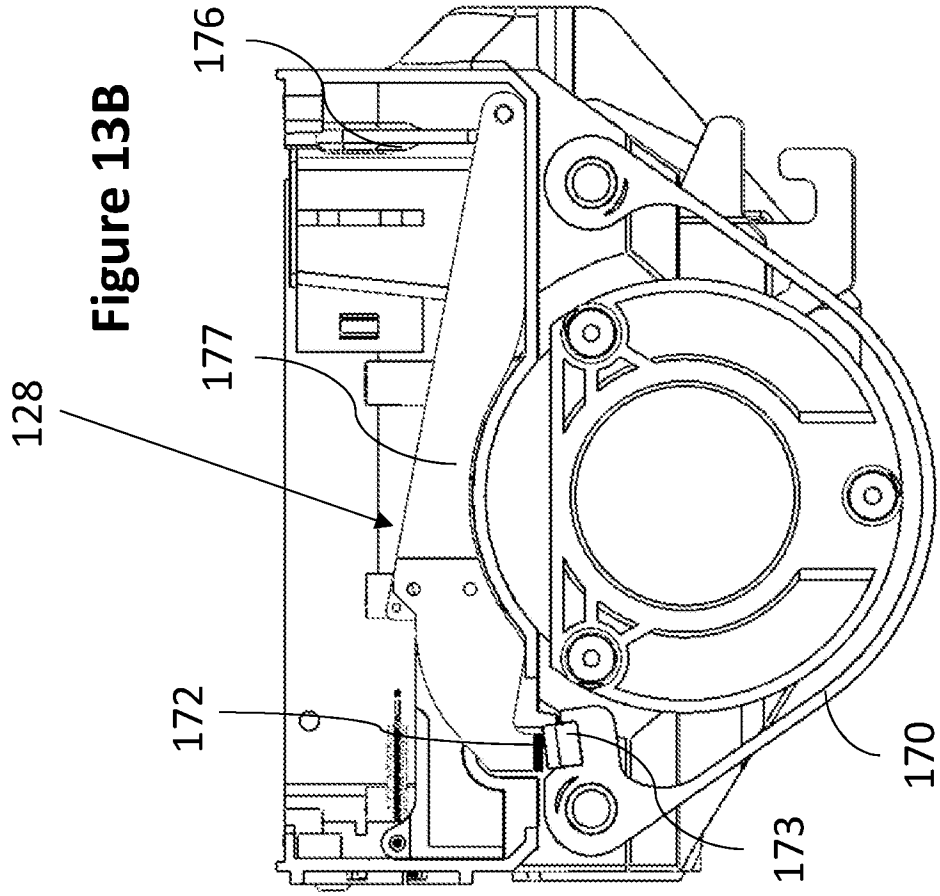



Figure 13B

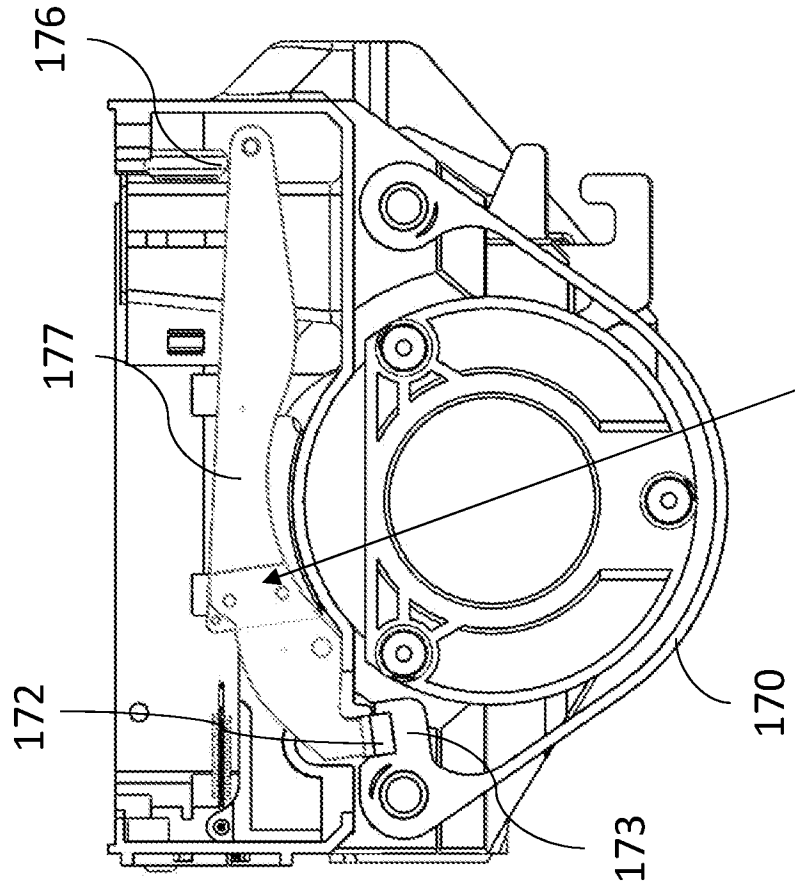



Figure 13A

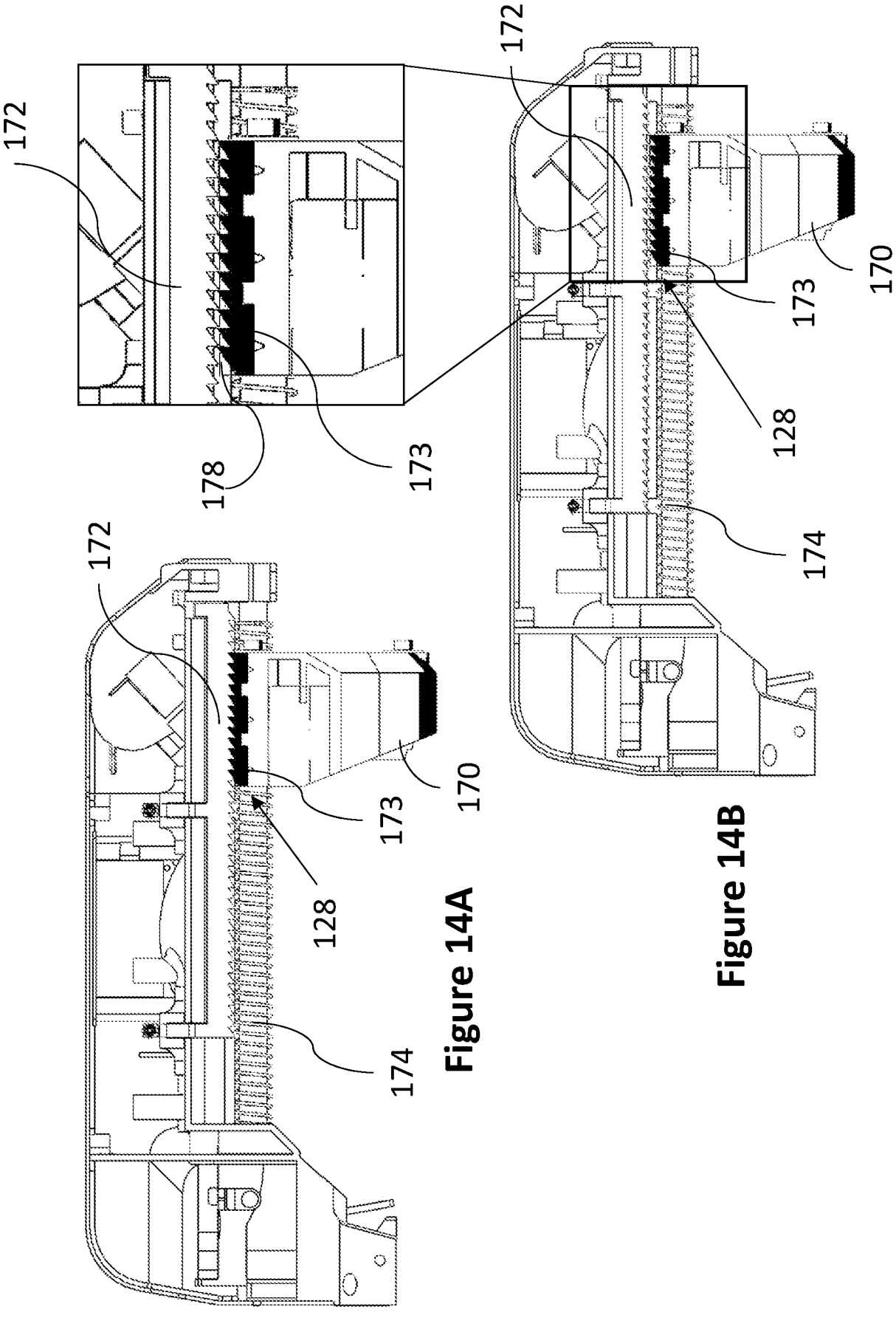



Figure 14A

Figure 14B

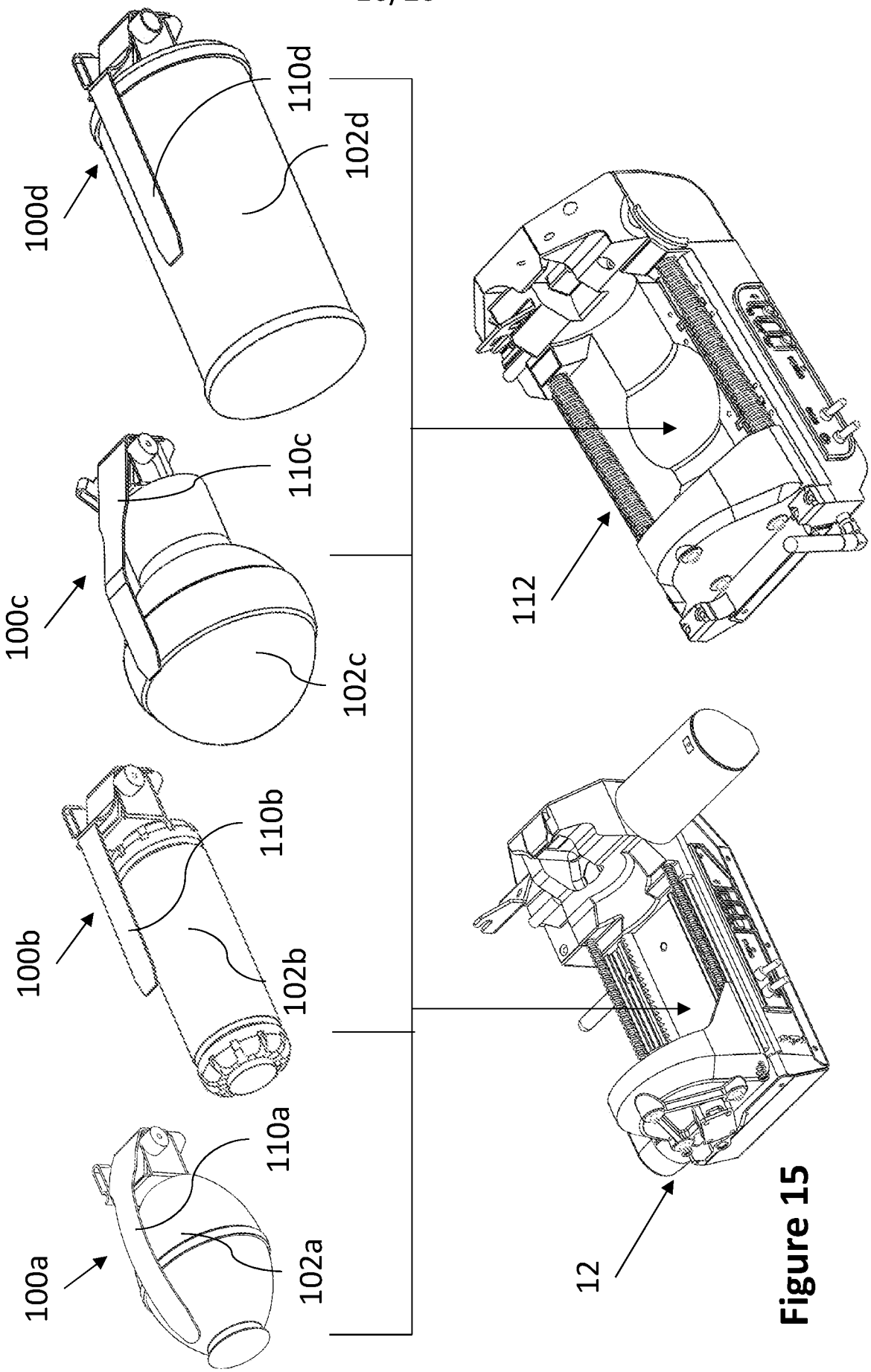

100d
110d
102d
100c
110c
102c
100b
110b
102b
100a
110a
102a
112
12

Figure 15

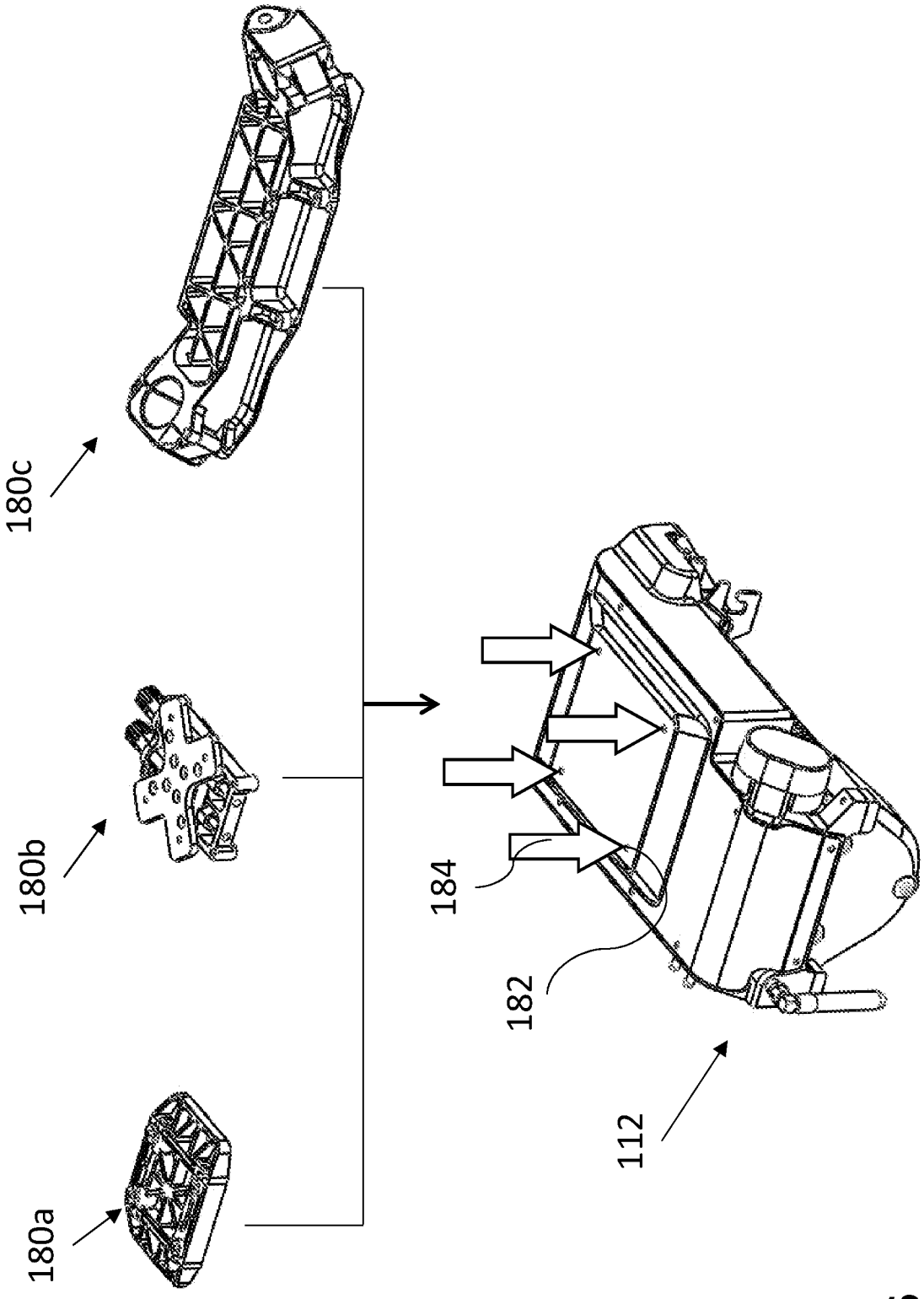



Figure 16

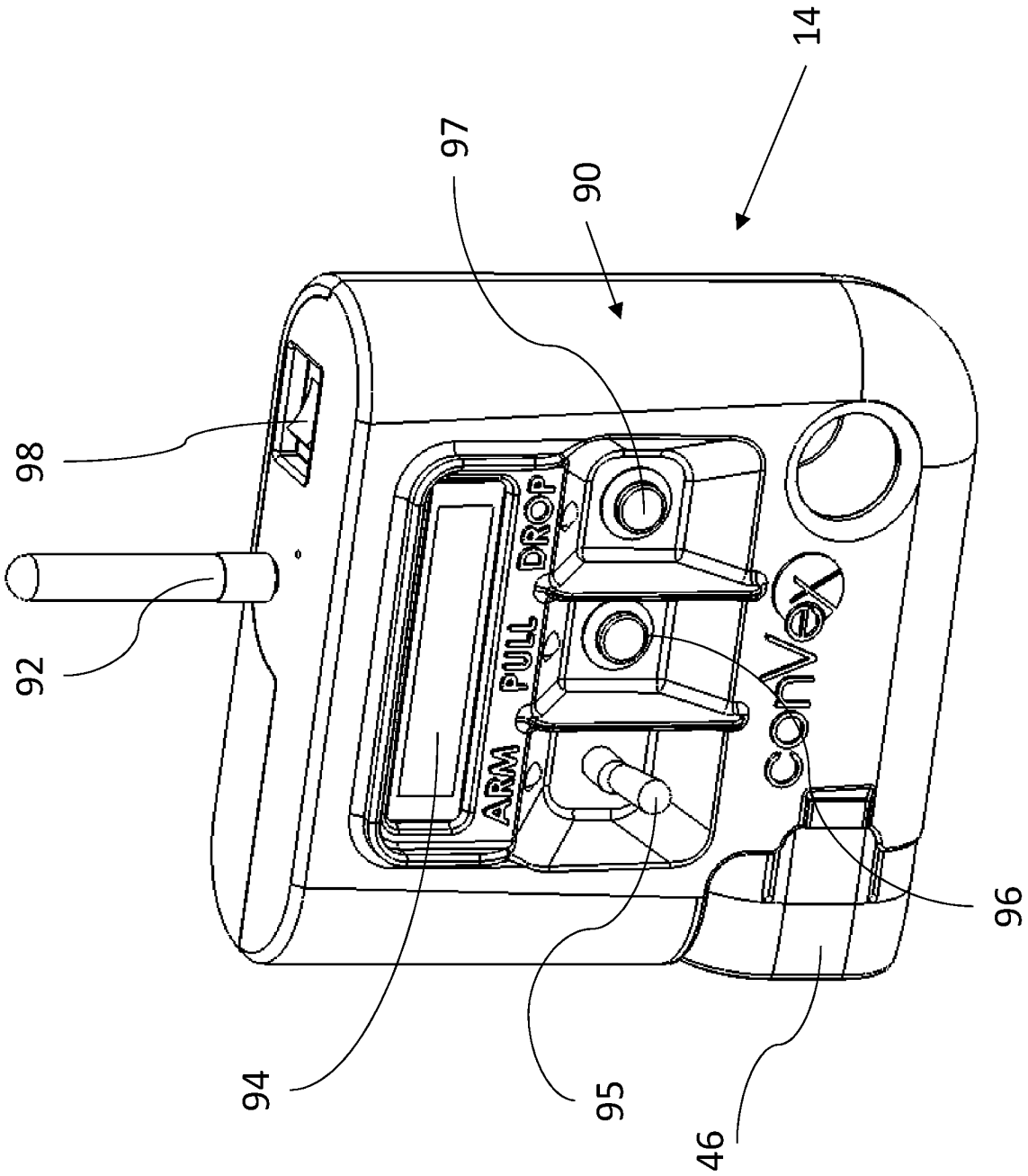



Figure 17

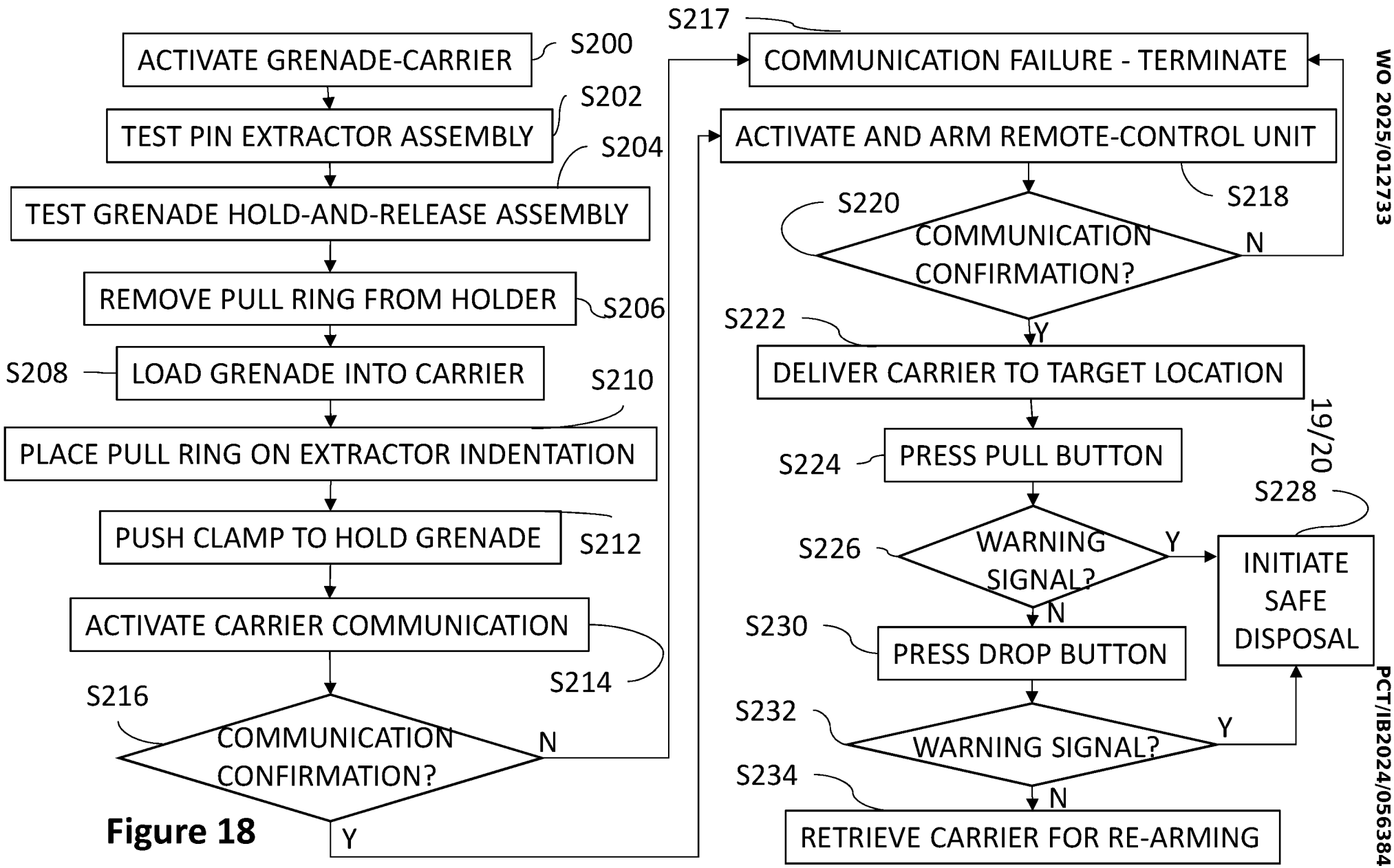

ACTIVATE GRENADE-CARRIER
S200
TEST PIN EXTRACTOR ASSEMBLY
S202
TEST GRENADE HOLD-AND-RELEASE ASSEMBLY
S204
REMOVE PULL RING FROM HOLDER
S206
S208
LOAD GRENADE INTO CARRIER
S210
PLACE PULL RING ON EXTRACTOR INDENTATION
PUSH CLAMP TO HOLD GRENADE
S212
ACTIVATE CARRIER COMMUNICATION
S214
S216
COMMUNICATION CONFIRMATION?
N
Y
S217
COMMUNICATION FAILURE - TERMINATE
ACTIVATE AND ARM REMOTE-CONTROL UNIT
S218
S220
COMMUNICATION CONFIRMATION?
N
Y
S222
DELIVER CARRIER TO TARGET LOCATION
S224
PRESS PULL BUTTON
S226
WARNING SIGNAL?
Y
N
S228
INITIATE SAFE DISPOSAL
S230
PRESS DROP BUTTON
S232
WARNING SIGNAL?
Y
N
S234
RETRIEVE CARRIER FOR RE-ARMING

**Figure 18**

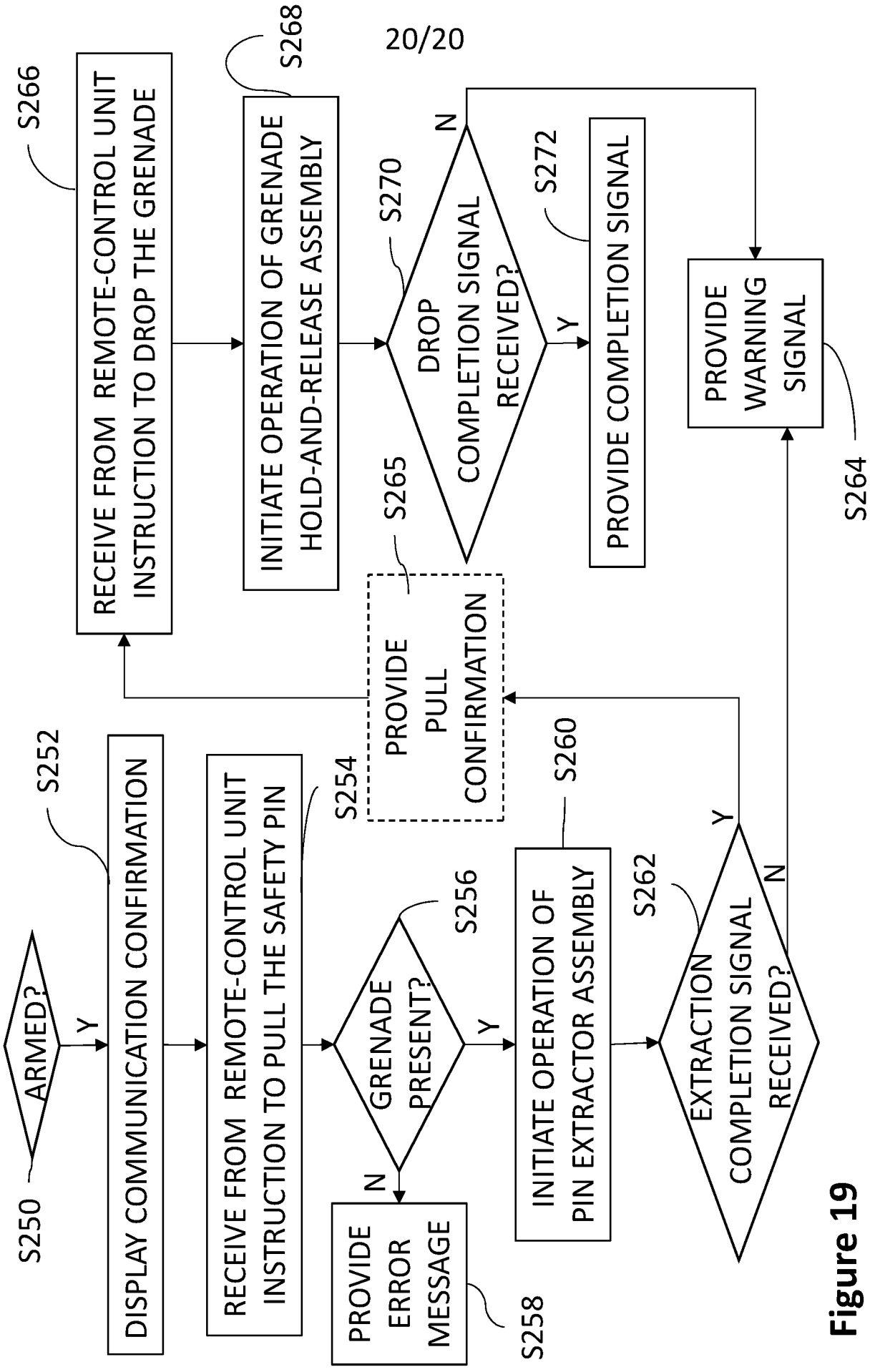

S250
ARMED?
Y
S252
DISPLAY COMMUNICATION CONFIRMATION
RECEIVE FROM REMOTE-CONTROL UNIT INSTRUCTION TO PULL THE SAFETY PIN
S254
PROVIDE PULL CONFIRMATION
S256
GRENADE PRESENT?
N
PROVIDE ERROR MESSAGE
S258
Y
S260
INITIATE OPERATION OF PIN EXTRACTOR ASSEMBLY
S262
EXTRACTION COMPLETION SIGNAL RECEIVED?
N
Y
PROVIDE WARNING SIGNAL
S264
S265
DROP COMPLETION SIGNAL RECEIVED?
N
Y
S266
RECEIVE FROM REMOTE-CONTROL UNIT INSTRUCTION TO DROP THE GRENADE
S268
INITIATE OPERATION OF GRENADE HOLD-AND-RELEASE ASSEMBLY
S270
S272
PROVIDE COMPLETION SIGNAL

**Figure 19**