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(54) Title: FASTENER TOOL

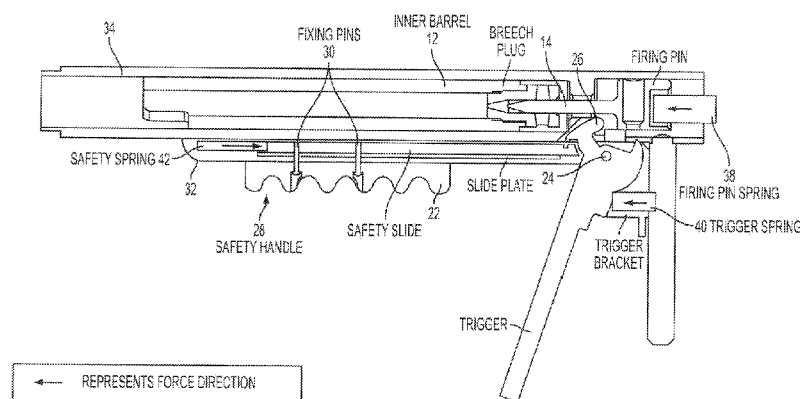


FIG. 2

(57) Abstract: A fastener tool including a barrel for passage of a fastener in response to explosion of a charge, a firing pin biased for actuating the charge, a retainer for retaining the firing pin in a cocked position, a trigger movable in a first direction to drive the firing pin into the cocked position and movable in a second direction to operate the retainer so as to release the firing pin from the cocked position, a catch for restricting movement of the trigger in said second direction so as to prevent release of the firing pin from the cocked position, and an actuator which is operable to disengage the catch to allow the trigger to be moved in the second direction to release the firing pin from the cocked position.



FASTENER TOOL

Field of the Invention

5 The invention relates to a fastener tool having a safety mechanism to prevent accidental actuation of the fastener tool, and, more particularly, but not exclusively, to a fastener tool suitable for use underwater having a safety mechanism to prevent accidental actuation of the fastener tool.

10 **Background of the Invention**

 It has been previously proposed to provide a fastener tool for driving fasteners into a substrate. Fastener tools may be specially designed to be operable under water as well as in normal (non-underwater) applications. Such fastener tools may be direct acting powder-
15 actuated tools, and may fire fasteners at speeds in the order of 1,000 to 1,500 kilometres per hour.

 The applicant has identified that fasteners fired at these speeds may pose a danger to the operator of the tool and to others in the vicinity, particularly where the fastener tool
20 is used under water owing to the lack of visibility under water, particularly if the water is murky. The applicant has identified that it would be advantageous to provide a fastener tool which is less prone to accidental firing than existing fastener tools that typically have operational steps able to be completed in more than one order. In particular, the applicant has determined that it may be beneficial for a fastener tool to require two-handed firing
25 operation, for the operators' two hands to necessarily be in a certain location on the tool for firing, and with operational firing steps to necessarily be undertaken in a set sequence.

 Examples of the invention seek to provide an improved fastener tool which overcomes or at least alleviates disadvantages associated with existing fastener tools.
30

Summary of the Invention

In accordance with the present invention, there is provided a fastener tool including a barrel for passage of a fastener in response to explosion of a charge, a firing pin biased for actuating the charge, a retainer for retaining the firing pin in a cocked position, a trigger movable in a first direction to drive the firing pin into the cocked position and
5 movable in a second direction to operate the retainer so as to release the firing pin from the cocked position, a catch for restricting movement of the trigger in said second direction so as to prevent release of the firing pin from the cocked position, and an actuator which is operable to disengage the catch to allow the trigger to be moved in the second direction to release the firing pin from the cocked position.

10

Preferably, the catch is arranged such that when in a restricting condition the catch supports the trigger in an obstructing position in which the trigger obstructs a path of the firing pin such that even if the firing pin is released from the cocked position the firing pin would be obstructed by the trigger against contacting the charge to prevent actuation
15 of the charge.

15

Preferably, the actuator is in the form of a sliding handle which is able to be slid forwardly relative to the trigger in a direction parallel to an axis of the barrel to disengage the catch. It is advantageous that the sliding handle operates in line with the intended
20 application of the closing force, that is forward of the trigger towards the muzzle of the tool. In another form, the actuator may include a link arm or other mechanical assembly to allow a force to be applied in a direction other than forward in a direction parallel to an axis of the barrel to disengage the catch. For example, a link could be used to allow a force to be applied in a direction perpendicular (or more generally at a different direction)
25 to the direction of application of the closing force.

25

In a preferred form, the barrel is movable from an extended position in which the firing pin is prevented from contacting the charge and a contracted position in which the firing pin is enabled to contact the charge.

30

Preferably, the second direction is opposite to the first direction.

It is preferred that the fastener tool has a handle, said first direction is movement of the trigger away from the handle, and the second direction is movement of the trigger toward the handle.

5 Preferably, the firing pin is biased forwardly toward the charge by a firing pin spring

Preferably, the trigger is biased against movement in the second direction by a trigger spring.

10

In a preferred form, the catch is biased toward the restricting condition by a catch spring.

15 Preferably, the catch has a recess for engaging a protrusion of the trigger to prevent sliding movement of the catch from the restricting condition to the disengaged condition when the firing pin is uncocked. More preferably, the catch and the trigger are arranged such that after firing of the fastener tool the catch and the trigger automatically return to a position wherein the protrusion of the trigger engages with the recess of the catch. Even more preferably, after firing of the fastener tool, the catch and the trigger automatically
20 return to said position wherein the protrusion of the trigger engages with the recess of the catch by virtue of the catch spring, the firing pin spring and interengaging surfaces formed on the catch and trigger.

25 In a preferred form, when the firing pin is uncocked, the firing pin spring biases the protrusion of the trigger into the recess such that the force from the firing pin spring must be opposed to disengage the trigger from the catch. More preferably, when the firing pin is cocked, the trigger spring biases the trigger to clear sliding movement of the catch thereby preventing engagement of the protrusion with the recess.

30 **Brief Description of the Drawings**

The invention is described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a fastener tool in accordance with an example of the present invention;

5 Figure 2 shows a sectional view of the fastener tool;

Figure 3 shows a detailed sectional view of the fastener tool with a firing pin of the fastener tool in an uncocked condition;

10 Figure 4 shows a detailed sectional view of the fastener tool with a trigger of the tool being used to drive the firing pin into the cocked position;

Figure 5 shows a sectional view of part of the fastener tool in the cocked position, with a catch of the tool in a restricting position;

15 Figure 6 is a detailed sectional view of the fastener tool, in the cocked condition with the catch in the restricting condition;

Figure 7 shows the catch being slid forwardly from the restricting condition to a
20 disengaged condition;

Figure 8 shows a detailed sectional view of the fastener tool with the catch in the disengaged condition and the trigger being operated to release the firing pin from the cocked position;

25 Figure 9 shows a detailed sectional view of the fastener tool with the trigger brought into a position which releases the firing pin from the cocked position;

Figure 10 shows a detailed sectional view of the fastener tool with the firing pin
30 having actuated a charge; and

Figure 11 shows a detailed sectional view of the fastener tool automatically being returned to a safe condition after firing.

Detailed Description

With reference to Figures 1 to 11, there is shown a fastener tool 10 which may be
5 used underwater, and also outside of water. Advantageously, the fastener tool 10 includes
a safety mechanism which prevents accidental firing of the fastener tool 10.

The particular example shown in the drawings has a safety mechanism which
requires several operational steps to be performed in a certain sequence in order to fire the
10 fastener tool 10, using both hands of an operator located at certain positions on the fastener
tool 10.

More specifically, there is provided a fastener tool 10 including a barrel 12 for
passage of a fastener (not shown) in response to explosion of a charge (not shown). The
15 fastener tool 10 includes a firing pin 14 biased for actuating the charge, a retainer 16 for
retaining the firing pin 14 in a cocked position, and a trigger 18 movable in a first direction
to drive the firing pin 14 into the cocked position and movable in a second direction to
operate the retainer 16 so as to release the firing pin 14 from the cocked position. Also
included is a catch 20 for restricting movement of the trigger 18 in said second direction so
20 as to prevent release of the firing pin 14 from the cocked position, and an actuator 22
which is operable to disengage the catch 20 to allow the trigger 18 to be moved in the
second direction to release the firing pin 14 from the cocked position.

Advantageously, the example shown in the drawings may retain features from
25 existing underwater tools so as to retain the same method of loading firing tubes, moving
the barrel 12 into the firing position, and actual firing.

The catch 20 may be arranged such that when in a restricting condition (see Figure
3) the catch 20 supports the trigger 18 in an obstructing position in which the trigger 18
30 obstructs a path of the firing pin 14 such that even if the firing pin 14 is released from the
cocked position (the firing pin 14 has been released from the cocked position in Figure 3)
the firing pin 14 is obstructed by the trigger 18 against contacting the charge to prevent
actuation of the charge. With reference to Figure 3, the catch 20 prevents the trigger 18

from rotating in an anti-clockwise direction about an axis 24 such that a cocking arm 26 of the trigger abuts with the firing pin 14 to prevent a tip of the firing pin 14 from contacting the charge.

5 With reference to Figures 1 and 2, the actuator 22 may be in the form of a sliding handle 28 which is able to be slid forwardly relative to the trigger 18 in a direction parallel to a longitudinal axis of the barrel 12 to disengage the catch 20. More specifically, as shown in the sectional view of Figure 2, the sliding handle 28 may be coupled to the catch 20 by way of pins 30 so that forward movement of the sliding handle 28 results in forward
10 movement of the catch 20 within a housing 32 of the fastener tool 10.

The barrel 12 is movable within an outer barrel 34 (see Figures 1 and 2) from an extended position in which the firing pin 14 is prevented from contacting the charge to a contracted position in which the firing pin 14 is enabled to contact the charge. However,
15 owing to the aforementioned cocking arm 26 of the trigger 18, when the catch 20 is in the restricting condition, the firing pin 14 cannot reach the cartridge even when the barrel 12 is in the contracted position, as depicted in Figure 3. Also, in the idle position shown in Figure 3, the trigger 18 is locked relative to the catch 20 such that the sliding handle 28 is not able to be slid forwards until the fastener tool 10 has been cocked, as the bias of the
20 firing pin 14 retains the trigger 18 in engagement with the catch 20.

In the example fastener tool 10 depicted in the drawings, the second direction is opposite to the first direction, as the first direction is clockwise movement of the trigger 18 about the axis 24 whereas the second direction is anti-clockwise movement of the trigger
25 18 about the axis 24. More specifically, the fastener tool 10 has a fixed handle 36, the first direction corresponds with movement of the trigger 18 away from the fixed handle 36, and the second direction corresponds with movement of the trigger 18 towards the fixed handle 36.

30 Various springs are used to allow the safety mechanisms of the fastener tool 10 to function. More specifically, the firing pin 14 is biased forwardly toward the charge by a pin spring 38 which acts between a rear part of the firing pin 14 and the outer barrel 34. With reference to Figure 2, the trigger 18 is biased against movement in the second

direction by a trigger spring 40. Also, the catch 20 is biased toward the restricting condition by a catch spring 42.

The catch 20 has a recess 44 for engaging a protrusion 46 of the trigger 18 to prevent sliding movement of the catch 20 from the restricting condition (see Figure 6) to the disengaged condition (see Figure 7) when the firing pin 14 is uncocked. The catch 20 and the trigger 18 are arranged such that after firing of the fastener tool 10, the catch 20 and trigger 18 automatically return to a position (see Figure 11) wherein the protrusion 46 of the trigger 18 engages with the recess 44 of the catch 20. More specifically, the catch 20 and the trigger 18 automatically return to said position in which the protrusion 46 of the trigger 18 engages with the recess 44 of the catch 20 by virtue of the catch spring 42 the firing pin spring 38 and interengaging surfaces 48, 50 formed on the catch 20 and trigger 18, acting as cams/ramps such that the fastener tool 10 resets and pushes the firing pin 14 rearwardly until the protrusion 46 locks back in place in the recess 44. In particular, the catch has a ramp formed on its end which is angled so as to rotate the trigger 18 clockwise under the bias of the catch spring 42 until the protrusion 46 can ride up and over the catch 20 to the recess 44.

When the firing pin 14 is uncocked (see Figure 11), the firing pin spring 38 biases the protrusion 46 of the trigger 18 into the recess 44 such that the force from the firing pin spring 38 must be opposed to disengage the trigger 18 from the catch 20. When the firing pin 14 is cocked, the trigger spring 40 biases the trigger 18 to clear sliding movement of the catch 20 (see Figure 8), thereby preventing engagement of the protrusion 46 with the recess 44.

25

A full cycle of the fastener tool 10 is shown consecutively from Figure 3 to Figure 11. More specifically, as shown in Figure 3, the trigger 18 is engaged with the catch 20 under the biasing force of the firing pin spring 38. The firing pin 14 rests on the cocking arm 26 of the trigger 18 which applies force from the firing pin spring 38 to the catch 20. The barrel 12 cooperates with a breech plug 52 to control relative positioning of the charge and the outer barrel 34, however while the trigger 18 is engaged with the catch 20 the firing pin 14 cannot reach the charge even when the barrel 12 is in its most rearward position.

With reference to Figure 4, the user manually cocks the tool 10 by moving the trigger 18 forward with their second end to move the firing pin 14 backwards to allow a pawl to drop from the firing pin 14 behind a sear block 54 to retain the firing pin 14 in the
5 cocked position. In this way, the pawl and sear block 54 act as the retainer.

With reference to Figure 5, once the tool 10 is cocked, the catch spring 42 maintains the catch 20 in place so that an accidental firing event (e.g. dropping the tool 10) results in the trigger 18 falling back into the recess 44 on the catch 20, therefore not
10 allowing the firing pin 14 to contact the charge.

As shown in Figure 6, with the tool cocked, the trigger spring 40 levers the trigger 18 out of the recess 44 clearing the path for movement of the catch 20 so that the catch 20 can be moved out of the way of the trigger 18 to allow firing.

15

With reference to Figure 7, the user actuates the sliding handle 28 forward (away from the trigger 18) with their first hand, pushing against the resistance of the catch spring 42 and moving the catch 20 out of the path of the trigger 18.

Figure 8 shows that the trigger 18 has a clear path to allow it to push the pawl completely above the sear block 54, allowing the tool 10 to be fired. The existing firing process may continue with the user actuating the trigger 18 with their second hand, releasing the pawl from behind the sear block 54 and allowing the firing pin 14 to reach the charge. In particular, the trigger 18 features a finger 56 which serves to push the pawl
20 back into the firing pin 14.
25

Turning to Figure 9, the trigger 18 is shown with the finger 56 having pushed the pawl back into the firing pin 14 such that the firing pin 14 is able to move forwardly under the force of the firing pin spring 38 toward the charge.

30

Figure 10 shows the firing pin 14 at the end of its stroke, having not been obstructed by the cocking arm 26 by virtue of the catch 20 being in its disengaged position.

Finally, with reference to Figure 11, the force of the trigger spring 40 and the catch spring 42 cooperate with the interengaging surfaces 48, 50 such that the fastener tool 10 resets and pushes the firing pin 14 rearward until the protrusion 46 locks back in place in the recess 44 in the idle position.

5

While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

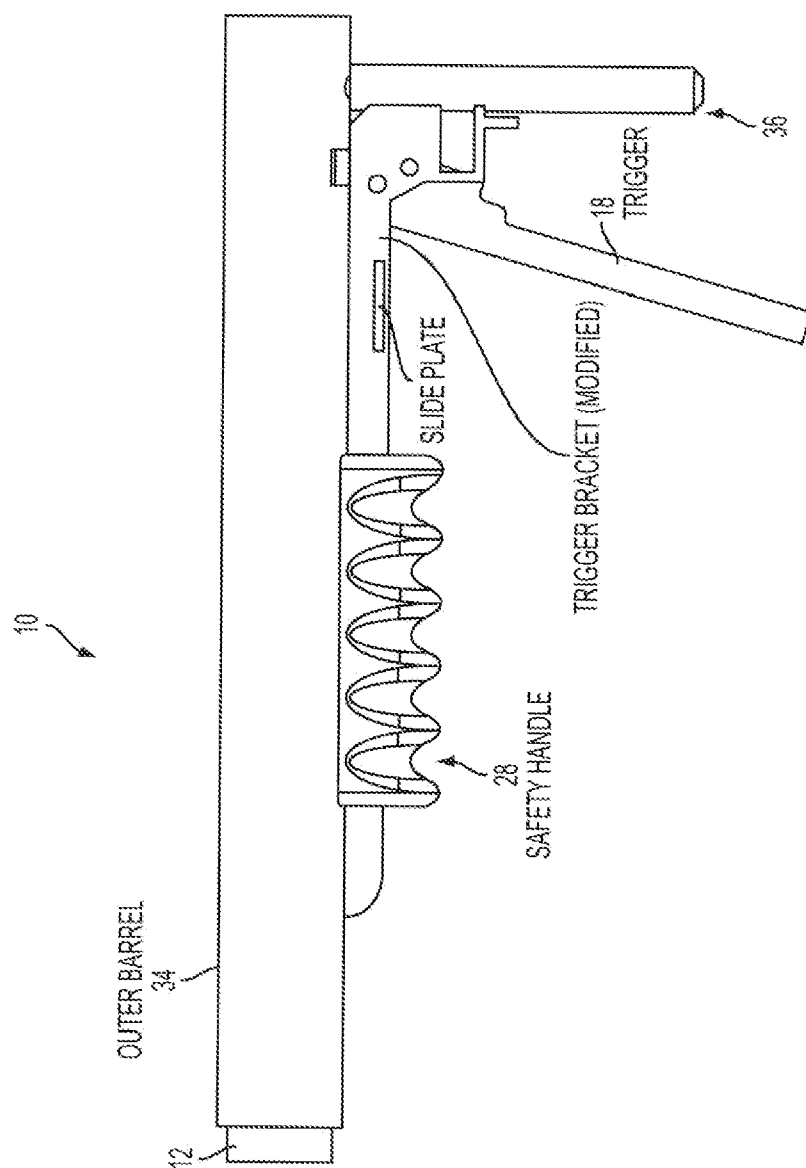
Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A fastener tool including a barrel for passage of a fastener in response to explosion of a charge, a firing pin biased for actuating the charge, a retainer for retaining the firing pin in a cocked position, a trigger movable in a first direction to drive the firing pin into the cocked position and movable in a second direction to operate the retainer so as to release the firing pin from the cocked position, a catch for restricting movement of the trigger in said second direction so as to prevent release of the firing pin from the cocked position, and an actuator which is operable to disengage the catch to allow the trigger to be moved in the second direction to release the firing pin from the cocked position.
2. A fastener tool as claimed in claim 1, wherein the catch is arranged such that when in a restricting condition the catch supports the trigger in an obstructing position in which the trigger obstructs a path of the firing pin such that even if the firing pin is released from the cocked position the firing pin would be obstructed by the trigger against contacting the charge to prevent actuation of the charge.
3. A fastener tool as claimed in claim 1 or claim 2, wherein the actuator is in the form of a sliding handle which is able to be slid forwardly relative to the trigger in a direction parallel to an axis of the barrel to disengage the catch.
4. A fastener tool as claimed in any one of claims 1 to 3, wherein the barrel is movable from an extended position in which the firing pin is prevented from contacting the charge and a contracted position in which the firing pin is enabled to contact the charge.
5. A fastener tool as claimed in any one of claims 1 to 4, wherein the second direction is opposite to the first direction.
6. A fastener tool as claimed in any one of claims 1 to 5, wherein the fastener tool has a handle, said first direction is movement of the trigger away from the handle, and the second direction is movement of the trigger toward the handle.

7. A fastener tool as claimed in any one of claims 1 to 6, wherein the firing pin is biased forwardly toward the charge by a pin spring
- 5 8. A fastener tool as claimed in any one of claims 1 to 7, wherein the trigger is biased against movement in the second direction by a trigger spring.
9. A fastener tool as claimed in any one of claims 1 to 8, wherein the catch is biased toward the restricting condition by a catch spring.
- 10 10. A fastener tool as claimed in any one of claims 1 to 9, wherein the catch has a recess for engaging a protrusion of the trigger to prevent sliding movement of the catch from the restricting condition to the disengaged condition when the firing pin is uncocked.
- 15 11. A fastener tool as claimed in claim 10, wherein the catch and the trigger are arranged such that after firing of the fastener tool the catch and the trigger automatically return to a position wherein the protrusion of the trigger engages with the recess of the catch.
- 20 12. A fastener tool as claimed in claim 11, wherein after firing of the fastener tool the catch and the trigger automatically return to said position wherein the protrusion of the trigger engages with the recess of the catch by virtue of the catch spring, the firing pin spring and interengaging surfaces formed on the catch and trigger.
- 25 13. A fastener tool as claimed in any one of claims 10 to 12, wherein when the firing pin is uncocked, the firing pin spring biases the protrusion of the trigger into the recess such that the force from the firing pin spring must be opposed to disengage the trigger from the catch.
- 30 14. A fastener tool as claimed in claim 13, wherein when the firing pin is cocked, the trigger spring biases the trigger to prevent engagement of the protrusion with the recess.

15. A fastener tool as claimed in claim 1 or claim 2, wherein the actuator includes a link arm or other mechanical assembly to allow a force to be applied in a direction other than forward in a direction parallel to an axis of the barrel to disengage the catch.
- 5
16. A fastener tool substantially as hereinbefore described with reference to the accompanying drawings.
- 10





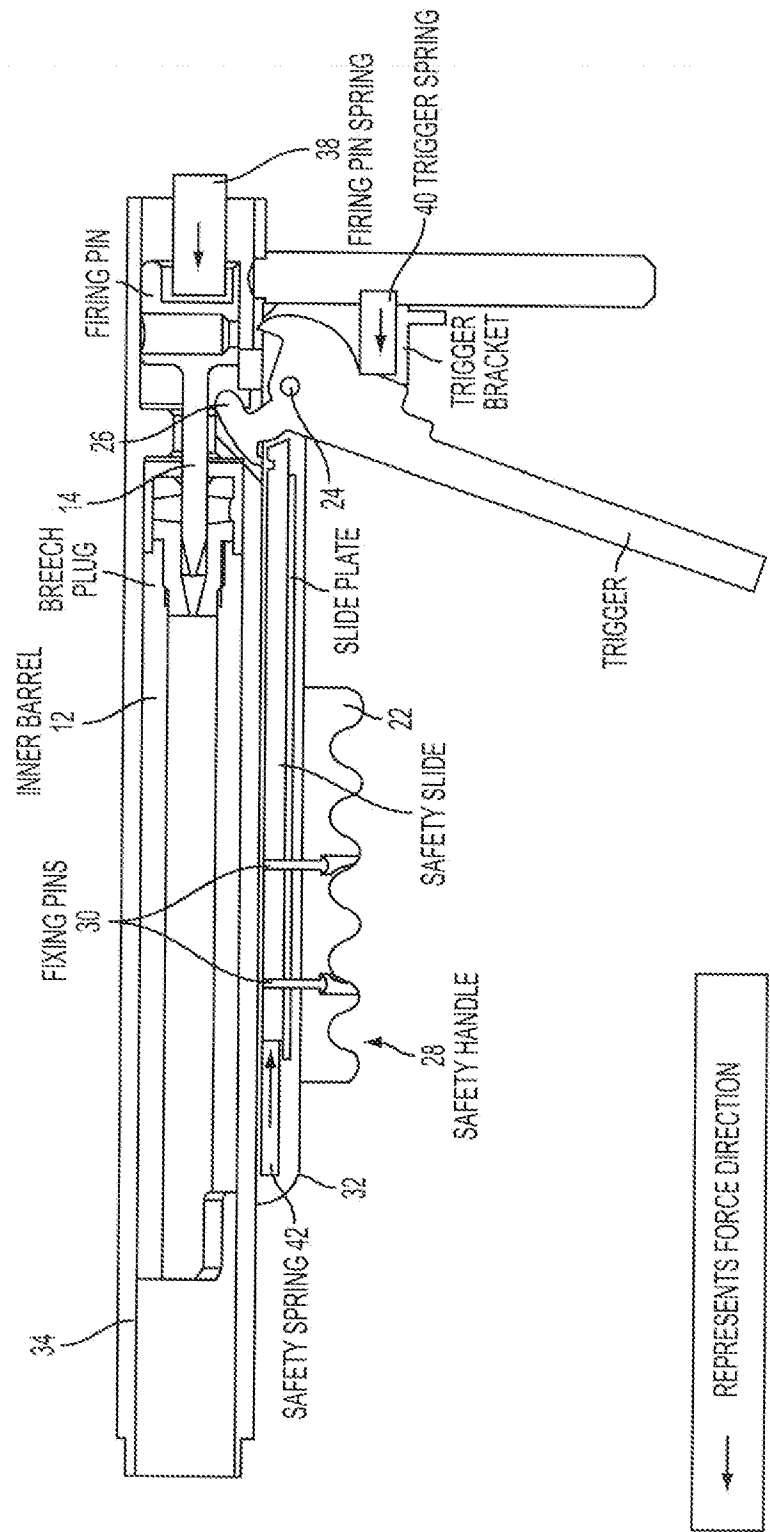
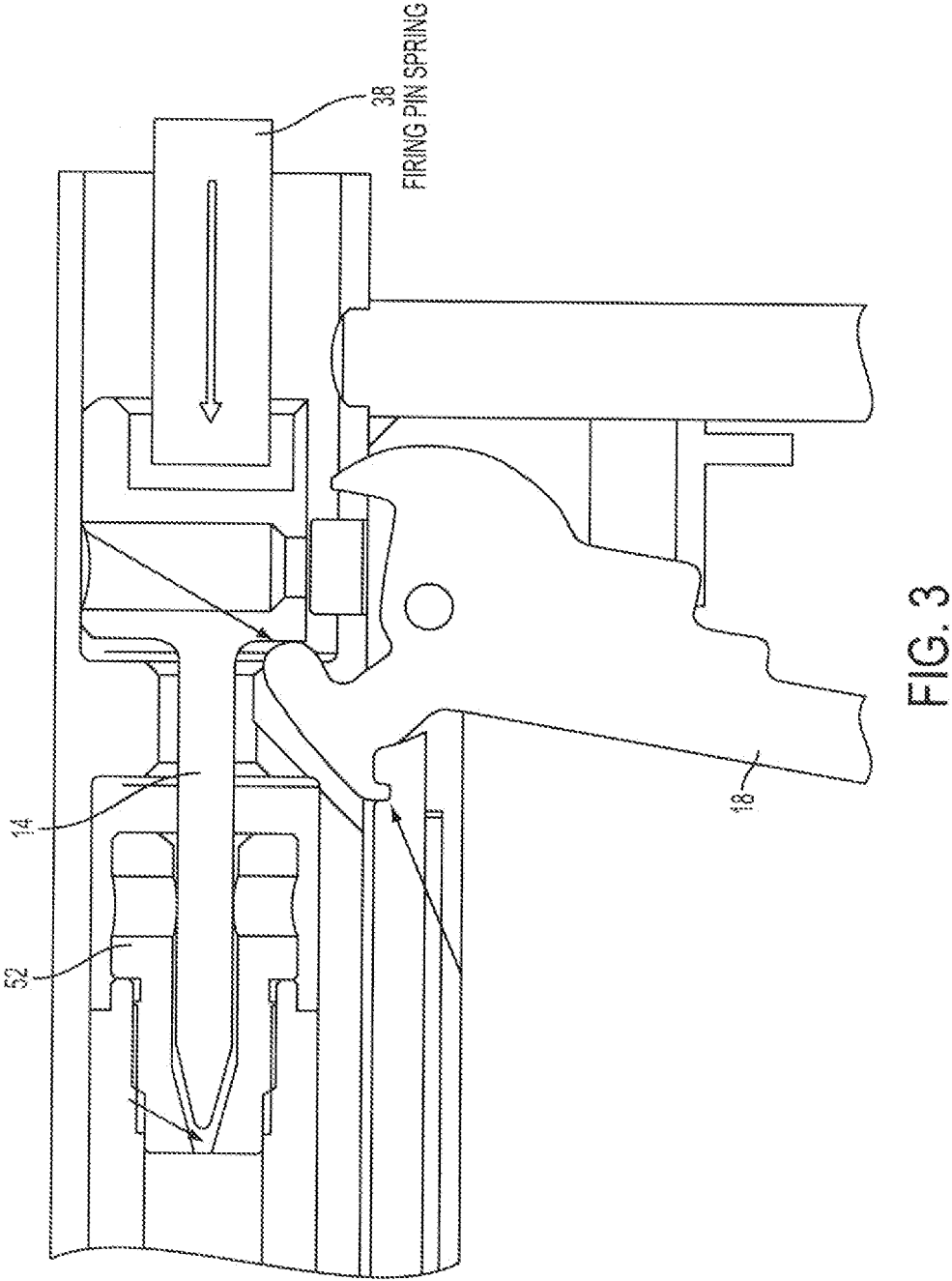
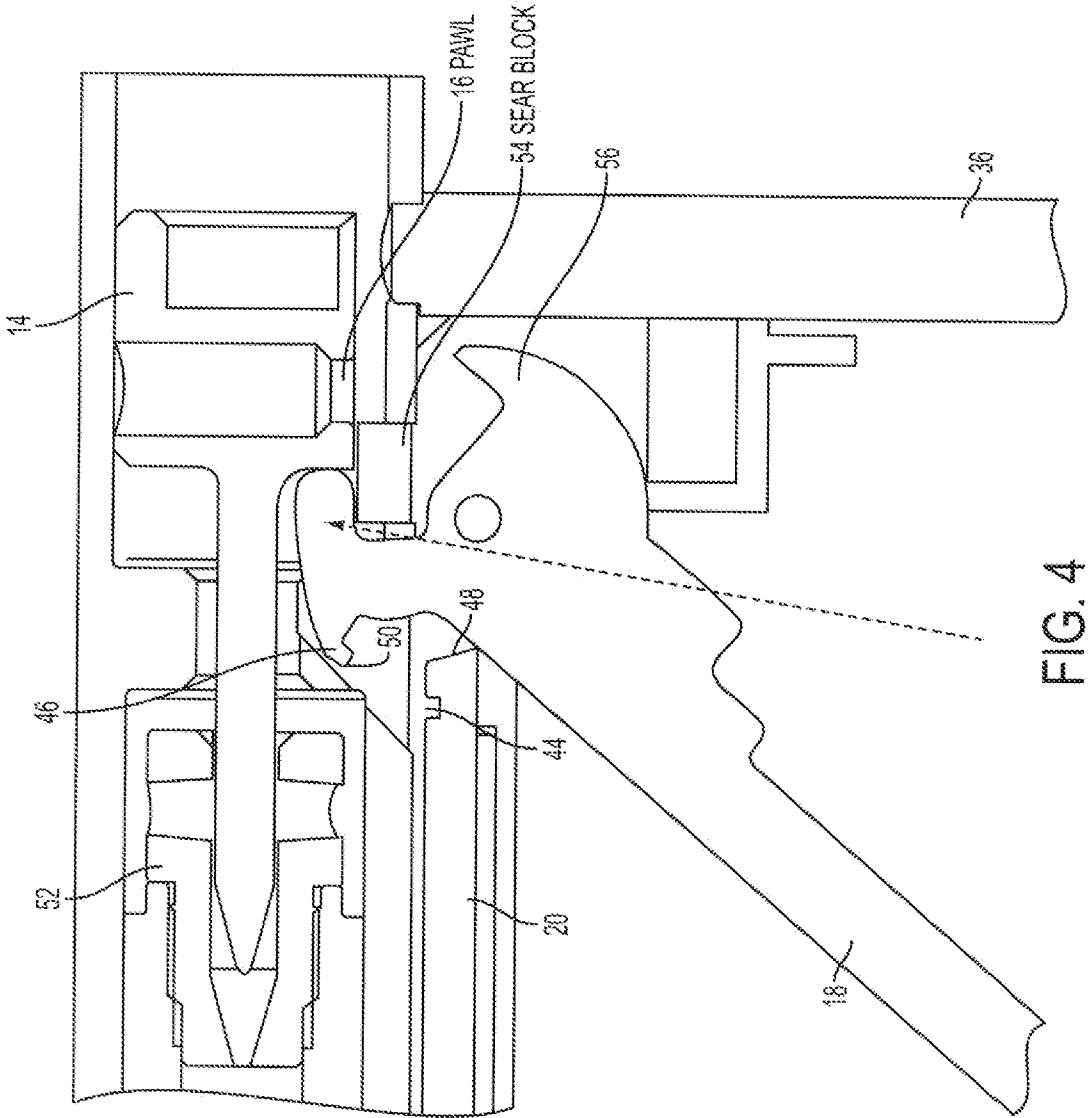


FIG. 2





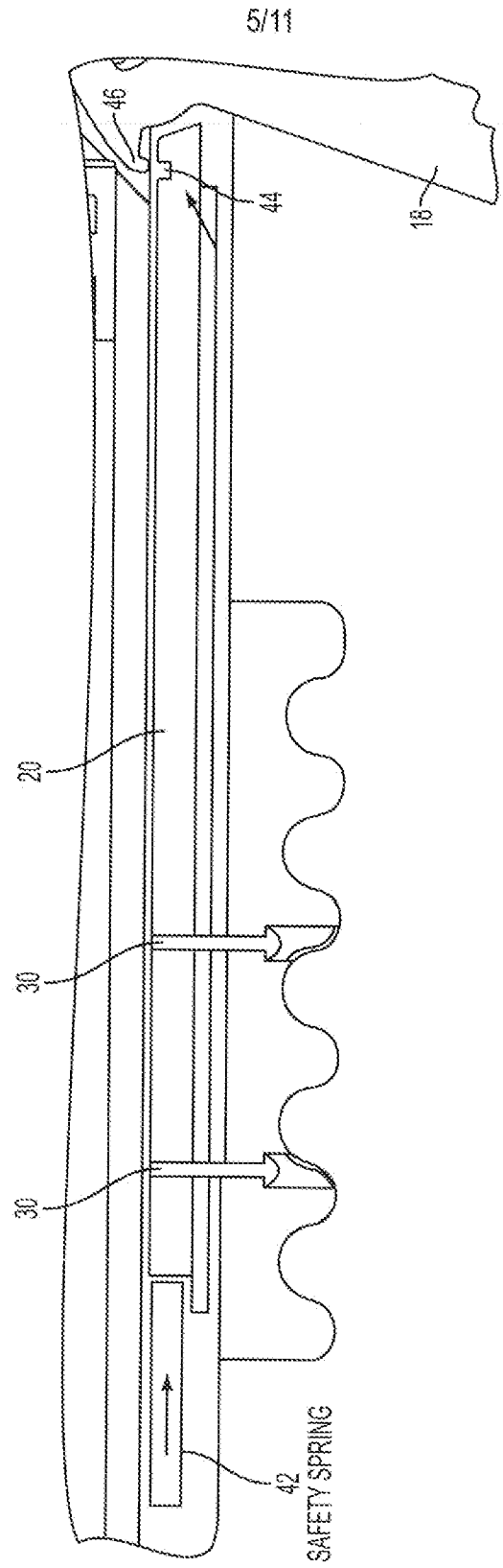


FIG. 5

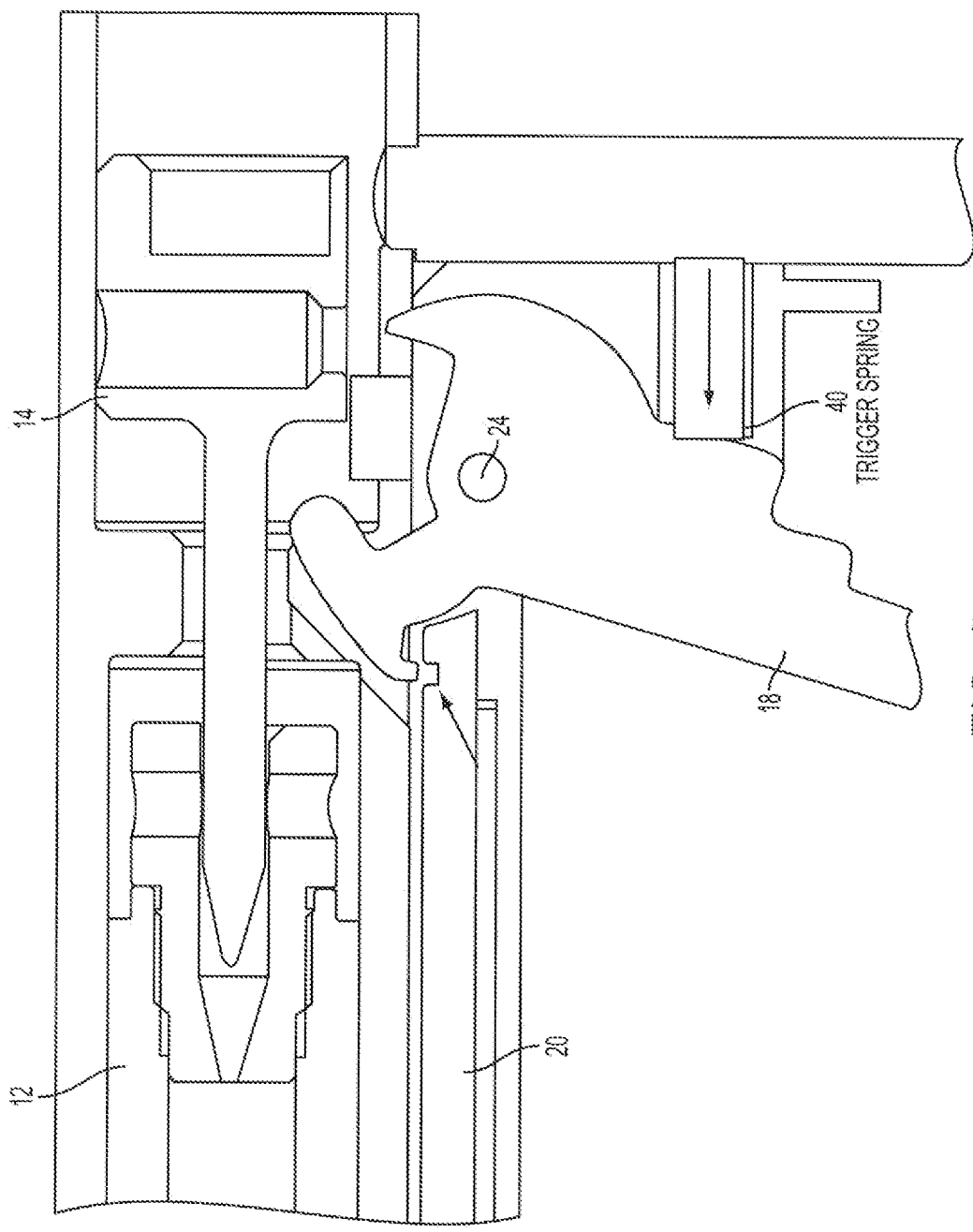


FIG. 6

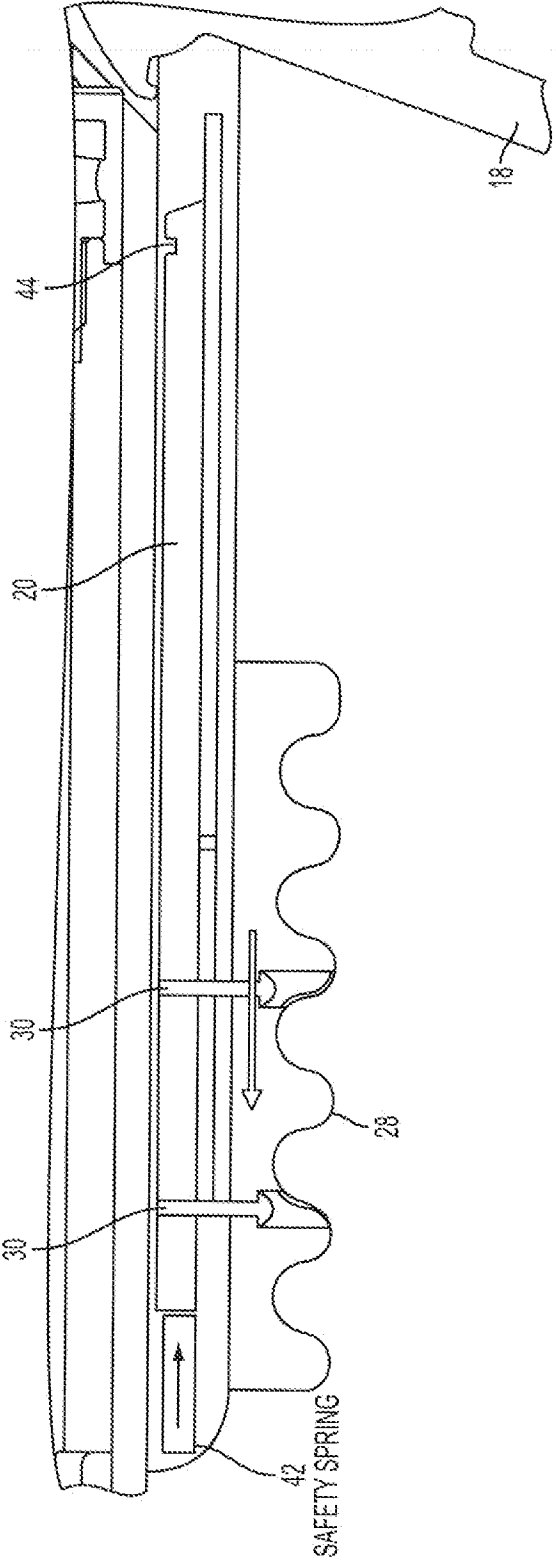


FIG. 7

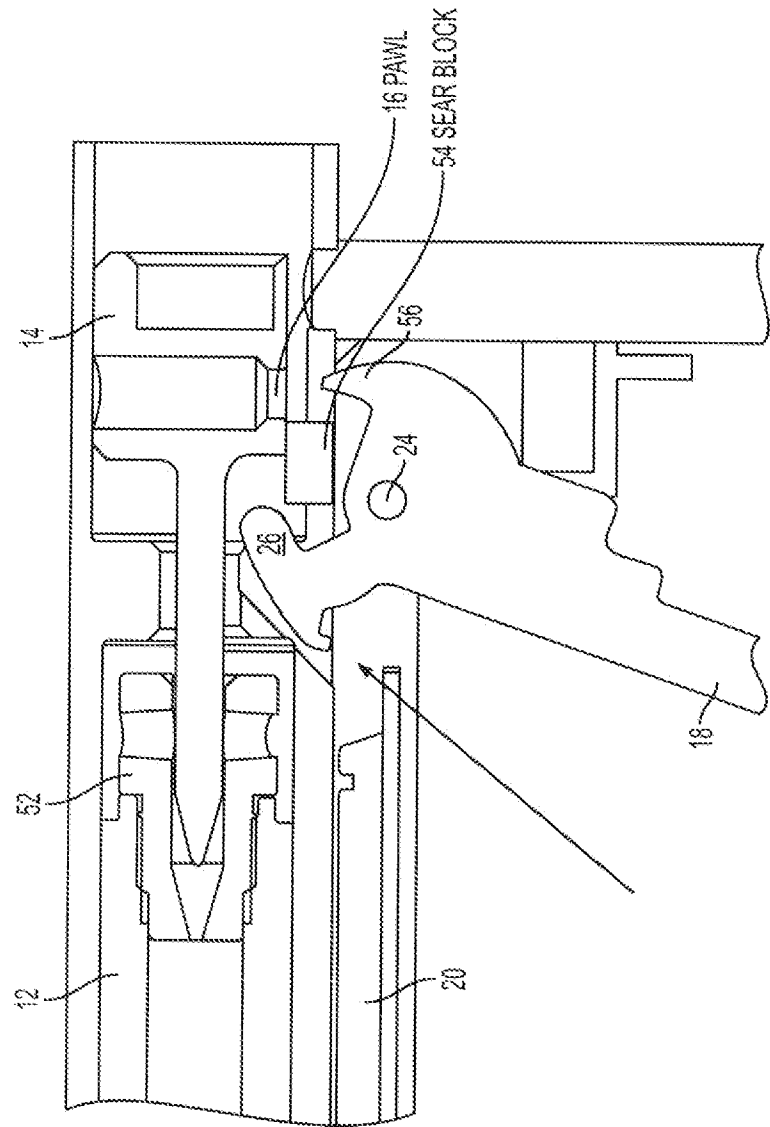


FIG. 8

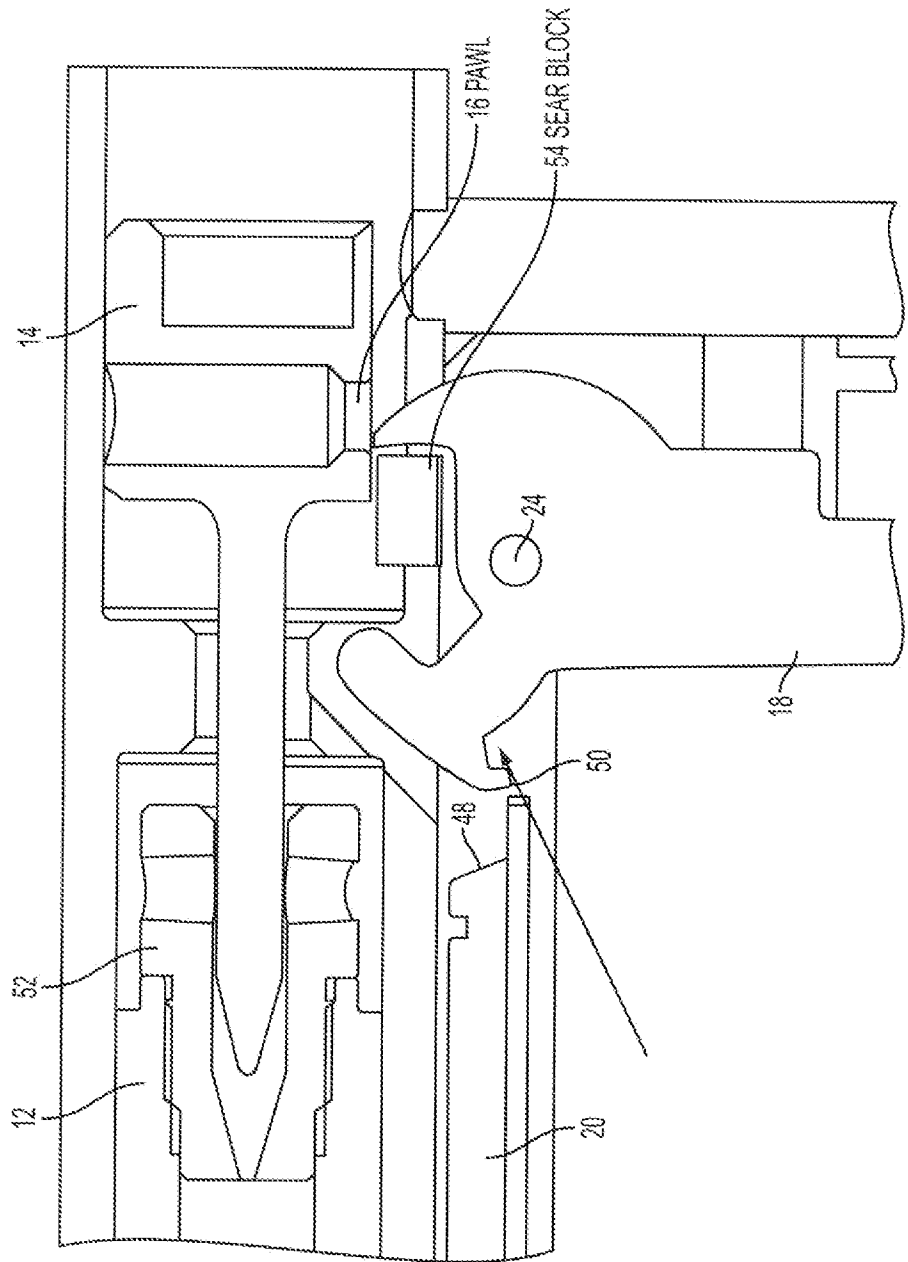


FIG. 9

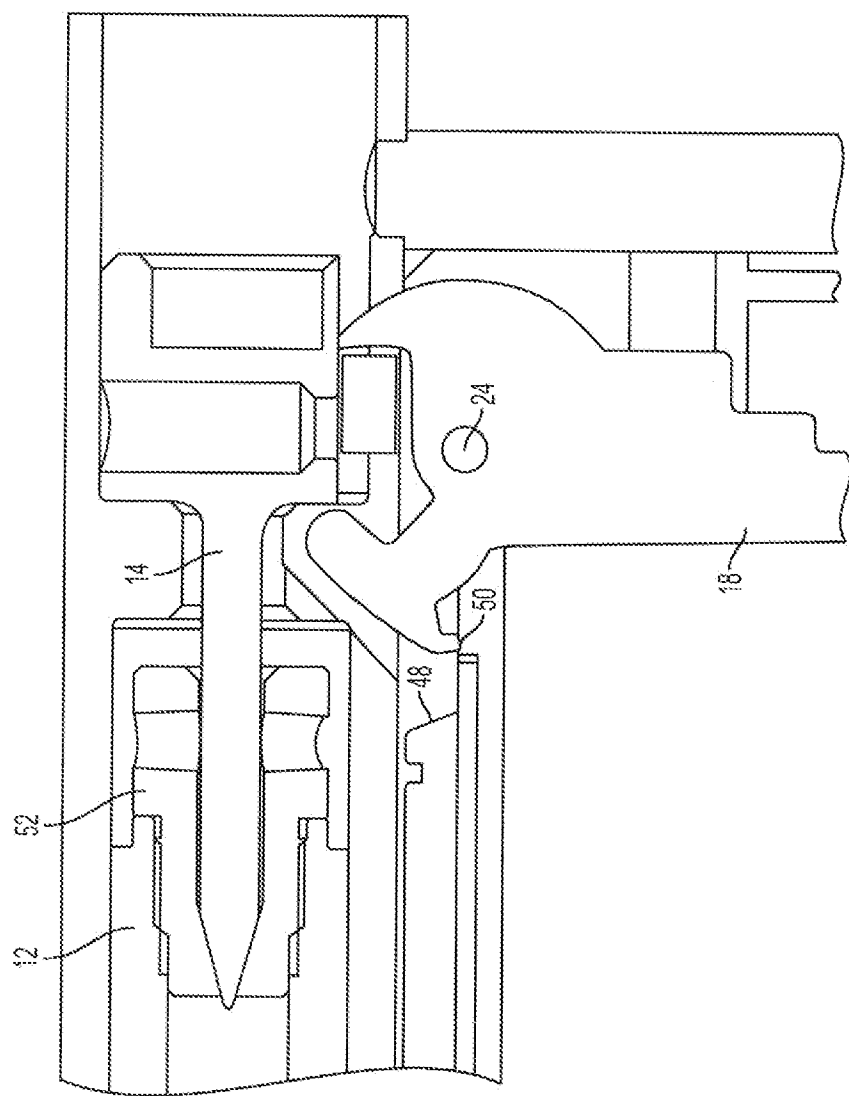


FIG. 10

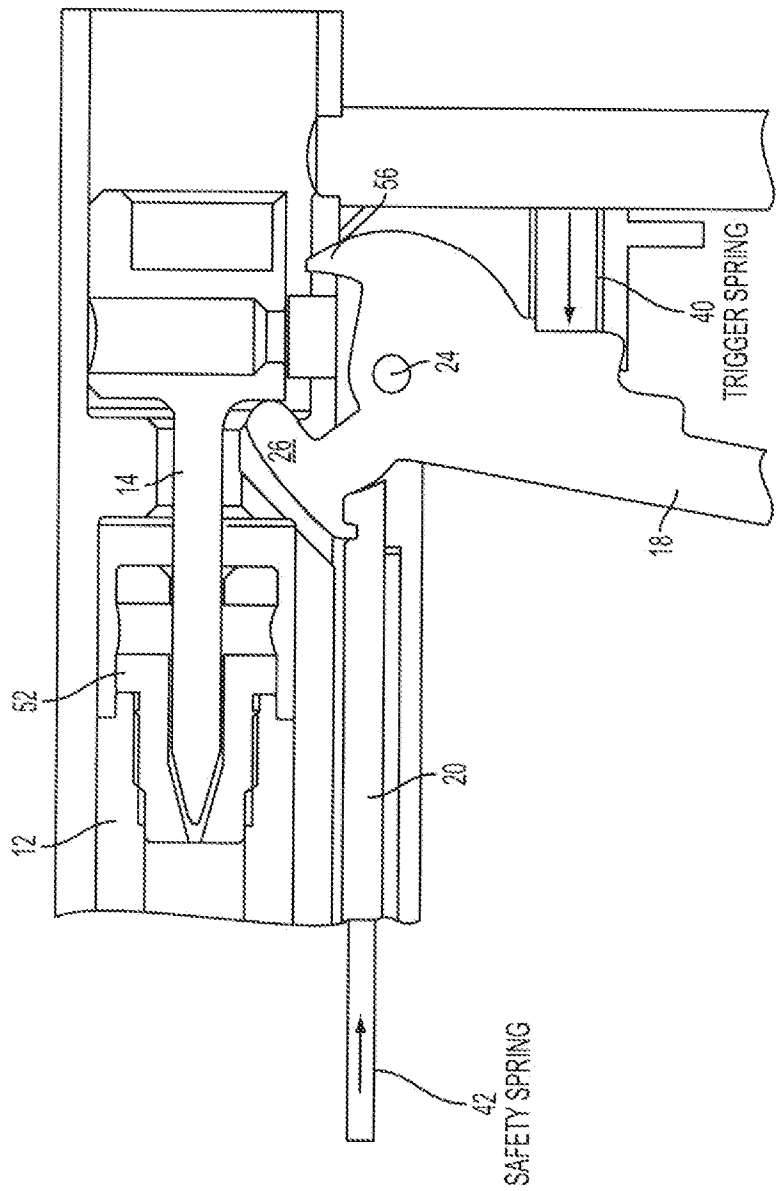


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/031736

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 16
because they relate to subject matter not required to be searched by this Authority, namely:
Claim 16 contains a reference to the description and/or the drawings.
According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/031736

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B25C1/08
 ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 B25C

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 565 312 A (BERRY BRIAN E [US]) 21 January 1986 (1986-01-21)	1-9,15
A	the whole document	10-14
X	US 5 273 198 A (POPOVICH MICHAEL S [US] ET AL) 28 December 1993 (1993-12-28)	1
A	FR 2 945 975 A1 (SUPRAMECA [FR]) 3 December 2010 (2010-12-03)	1
A	EP 0 308 321 A1 (PROSPECTION & INVENTIONS [FR]) 22 March 1989 (1989-03-22)	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

4 August 2014

Date of mailing of the international search report

11/08/2014

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Authorized officer

Dewaele, Karl

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/031736

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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