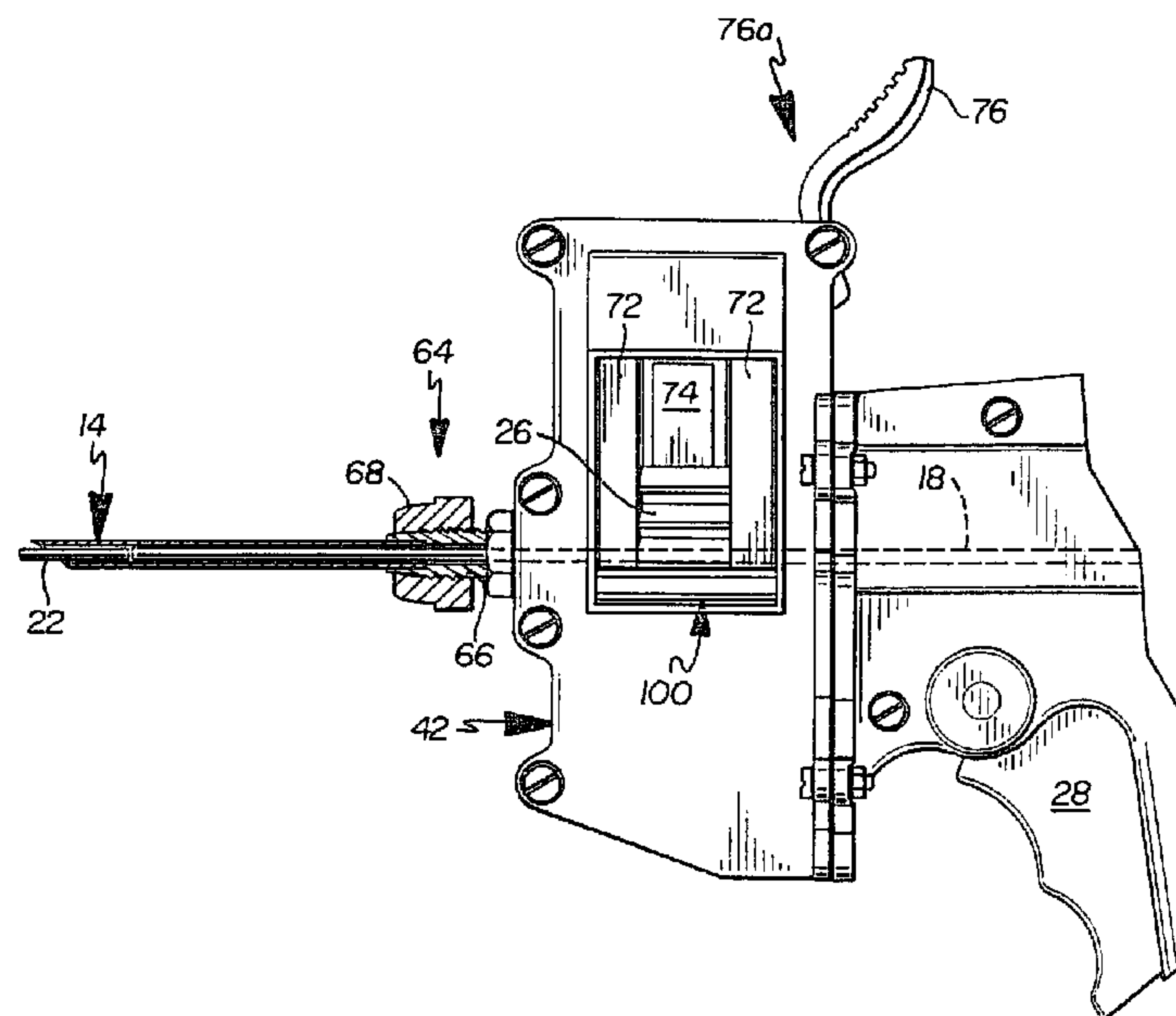




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(57) Abrégé/Abstract:

This invention is an implanter (10) comprising a housing (12), a hollow needle (14) connected to the housing (12), a drive pin (18) positioned within the housing (12); and aligned with the hollow needle (14), a trigger assembly (20) operably connected to both the housing (12), and the drive pin (18). The drive pin (18) has a distal end (22). Further it has a retracted position wherein the distal end (22) of the drive pin (18) is in the housing (12), and an extended position wherein the distal end (22) of the drive pin portion (18) extends out of the housing (12). A pellet (24) is positioned between the needle (14), and the distal end (22) of the drive pin (18) when the drive pin (18) is in the retracted position. The drive pin (18) expels the pellet (24) through the hollow needle (14) when moving from the retracted position to the extended position. The trigger assembly (20) includes a trigger (28) that has a relaxed position and an actuated position. The drive pin (18) moves from the retracted position to the extended position when the trigger (28) moves from the relaxed position to the actuated position. The invention further relates to a method for implanting an object (24) beneath a membrane, comprising the steps of positioning an object (24) to be implanted between a drive pin (18) and a hollow needle (14); positioning a plug (38) between the object (24) and the drive pin (18); inserting the needle (14) through the membrane; and moving the drive pin (18) from a retracted position to an extended position to expel the object (24) through the hollow needle (14), and stop the needle (14) with the plug (38).



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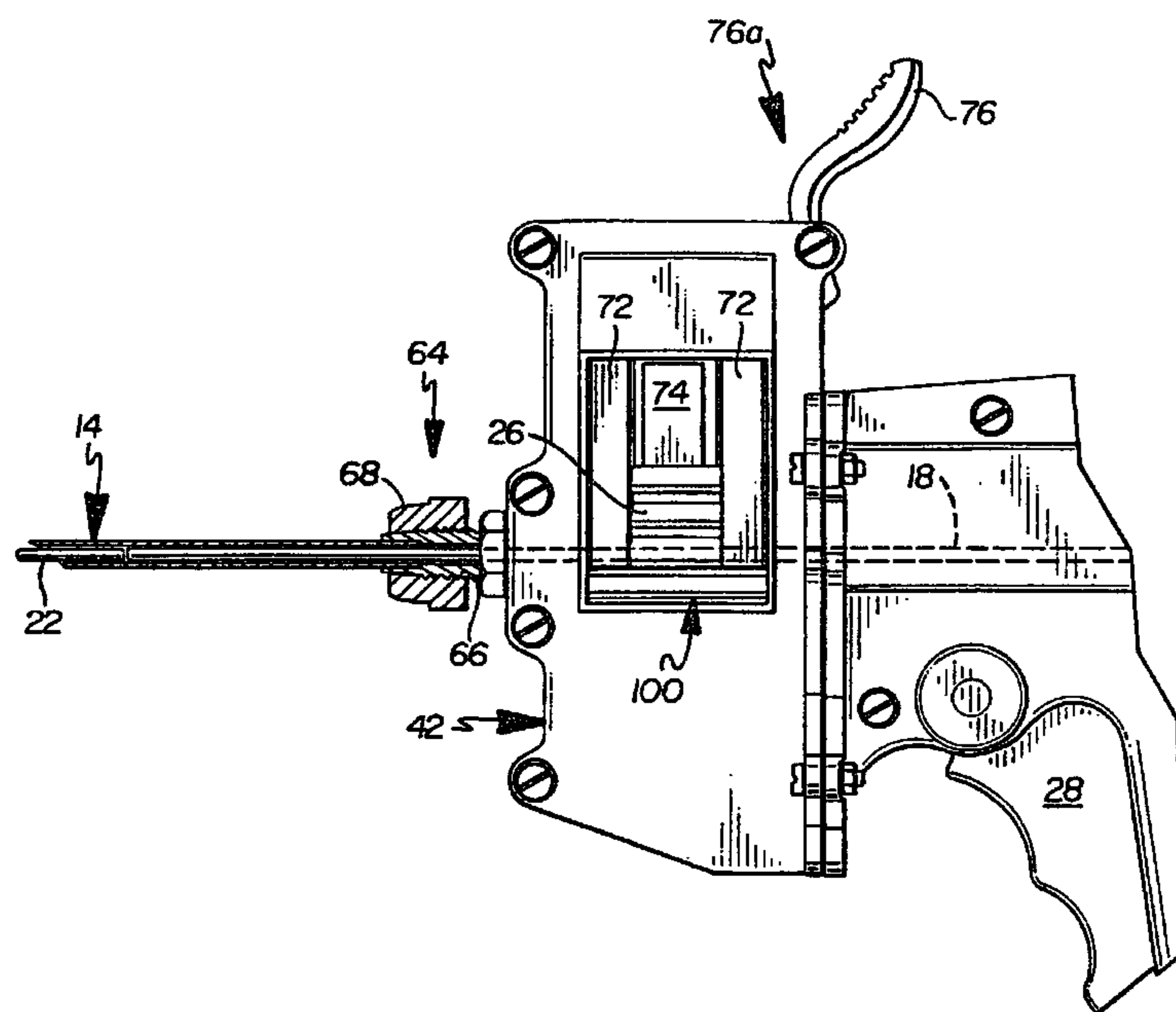
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(54) Title: IMPLANTER APPARATUS



(57) Abstract: This invention is an implanter (10) comprising a housing (12), a hollow needle (14) connected to the housing (12), a drive pin (18) positioned within the housing (12); and aligned with the hollow needle (14), a trigger assembly (20) operably connected to both the housing (12), and the drive pin (18). The drive pin (18) has a distal end (22). Further it has a retracted position wherein the distal end (22) of the drive pin (18) is in the housing (12), and an extended position wherein the distal end (22) of the drive pin portion (18) extends out of the housing (12). A pellet (24) is positioned between the needle (14), and the distal end (22) of the drive pin (18) when the drive pin (18) is in the retracted position. The drive pin (18) expels the pellet (24) through the hollow needle (14) when moving from the retracted position to the extended position. The trigger assembly (20) includes a trigger (28) that has a

relaxed position and an actuated position. The drive pin (18) moves from the retracted position to the extended position when the trigger (28) moves from the relaxed position to the actuated position. The invention further relates to a method for implanting an object (24) beneath a membrane, comprising the steps of positioning an object (24) to be implanted between a drive pin (18) and a hollow needle (14); positioning a plug (38) between the object (24) and the drive pin (18); inserting the needle (14) through the membrane; and moving the drive pin (18) from a retracted position to an extended position to expel the object (24) through the hollow needle (14), and stop the needle (14) with the plug (38).

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BACKGROUND OF THE INVENTION

IMPLANTER APPARATUS

1. Field of the Invention.

The present invention relates, generally, to apparatus and methods for
5 implanting objects beneath membranes. More particularly, the invention relates to
implanters for depositing electronic tracing devices, hormone pellets or other objects
or pellets beneath a membrane.

2. Background Information.

The state of the art in general includes various devices and methods for
10 implanting objects beneath a membrane using a device that has a rod which travels
through a hollow needle to deposit the object through the needle and beneath the
punctured membrane. For example, the objects or pellets may comprise electronic
tracing devices or transponders which are used to tag an animal, or the pellets may
comprise hormone pellets which are used in the domestic livestock fattening industry
15 to promote growth of the animal. The pellets are often injected into the ears of the
animals to prevent the pellets from entering food products for human or animal
consumption as the ears are commonly discarded in slaughtering. Typically, the ear is
grabbed with one hand while the other hand operates the implanter. The pellets
should be carefully, properly and accurately implanted to reduce the probability for
20 infection and increase the effectiveness of the deposited pellets. Further, because of
the movements of the animals, it is desirable for the pellets to be quickly implanted
into the animal.

These devices and methods are believed to have significant limitations and
shortcomings. One of the shortcomings is that implanter devices may spread blood-

borne diseases among the animals if the needle is not replaced for each animal. In recognition of this problem, Turley (U.S. Patent No. 5,279,554) disclosed a device that uses a shroud or covering that moves and locks in an extended position to partially cover the needle, and thus encourages a user to replace the needle after each use. Another shortcoming of the known art is the inability to automatically, quickly, consistently and powerfully implant multiple pellets. Turley (U.S. Patent No. 4,154,239) disclosed that the link between the drive pin and the trigger / actuator in the known art devices tended to buckle, and further disclosed that the speed or velocity of the drive pin was limited because the known art devices employed a 1:1 ratio between the drive pin and the trigger / actuator. In recognition of these problems, Turley ('231) disclosed a device that uses a flexible belt or link to achieve a velocity ratio other than 1:1. Other devices have achieved a velocity ratio other than 1:1 by attaching spur gears to the trigger and a rack gear to the drive pin.

Applicants' invention provide an implanter apparatus which is believed to constitute an improvement over existing technology.

BRIEF SUMMARY OF THE INVENTION

The present invention provides an implanter which generally comprises a housing or housing assembly, a hollow needle connected to the housing assembly through a quick attachment mechanism, a drive pin positioned within the housing assembly and aligned with the hollow needle, and a trigger assembly operably connected to both the housing assembly and the drive pin. The drive pin has a distal end, and further has a retracted position in which the distal end of the drive pin is in the housing assembly and an extended position in which the distal end of the drive pin extends out of the housing assembly. A pellet is positioned between the needle and the distal end of the drive pin when the drive pin is in the retracted position. The drive pin expels the pellet through the hollow needle as it moves from the retracted position to the extended position.

The trigger assembly includes a trigger that has a relaxed position and an actuated position. The drive pin moves from the retracted position to the extended position to expel the pellet when the trigger moves from the relaxed position to the actuated position. The trigger assembly is adapted to provide a mechanical advantage for increasing the velocity of the drive pin with respect to the velocity of the trigger. The trigger assembly includes a trigger lever having a fulcrum point, a trigger end operably contacting the trigger, and a shuttle end operably connected to a drive pin shuttle that slides along at least one shuttle guide groove to move the drive pin between the retracted position and the extended position. The fulcrum point is preferably closer to the trigger end than to the shuttle end to provide the mechanical

advantage for increasing the velocity ratio between the drive pin and the trigger assembly.

The housing assembly includes a magazine housing attached to a body housing. The magazine housing has a magazine passage sized to receive a pellet magazine and contains a magazine advancement mechanism. The magazine advancement mechanism indexes the pellet magazine through a number of predetermined index positions within the magazine passage. The drive pin is adapted to extend through the pellet magazine, *i.e.* one of the plurality of tubes, and into the hollow needle at each one of the predetermined index positions. The magazine advancement mechanism preferably has an opening or window for viewing the index positions of the pellet magazine. The magazine advancement mechanism has at least one fixed clip for engaging one side of the pellet magazine, at least one movable clip for engaging the other side of the pellet magazine, and an index actuator for indexing the at least one movable clip within the magazine passage. The clips are adapted to prevent the pellet magazine from moving in a first direction within the magazine passage and to allow the pellet magazine to move in a second direction upon the application of an index force, which moves the movable clip in an index motion. The movable clip has a bias spring to move the movable clip from one groove, over a ridge, and to an adjacent groove upon release of an index force.

In a manual index actuator embodiment, the index force is manually applied to the index actuator to index the movable clip within the magazine passage. A bias spring provides the return motion. In an automatic index actuator embodiment, the index force is generated by an actuation force applied to the trigger. The automatic index actuator includes a cam lever pivotally attached at a fulcrum point to the

housing assembly. The cam lever has a cam end in operable contact with a cam follower mounted on the drive pin shuttle. The cam lever further has a magazine advancement mechanism end in operable contact with the at least one movable clip. The magazine advancement end has an index motion and a return motion. The cam lever pivots and moves the magazine advancement end in an index motion to index the pellet magazine when the cam follower moves with the drive pin into the retracted position, and the cam lever pivots and moves the magazine advancement end in a return motion as the cam follower moves with the drive pin from the retracted position toward the extended position. A latch mechanism prevents the magazine advancement end from undergoing an index motion until the drive pin is fully retracted out of the magazine.

Each one of the tubes in the pellet magazine may include both a pellet and a plug. The pellet is positioned in front of the plug. When the drive pin extends, the pellet is expelled from the needle and the plug remains in the needle to discourage the use of the needle in another animal. The quick attachment mechanism allows the needle to be quickly replaced. Preferably, the quick attachment mechanism includes a threaded collet. The hollow needle extends through the threaded collet, and a threaded nut screws around the collet to quickly attach and detach the hollow needle from the housing assembly. The collet preferably has two or more circumferentially spaced slots that enable the collet to securely tighten around a range of needle diameters.

The features, benefits and objects of this invention will become clear to those skilled in the art by reference to the following description, claims and drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

Figure 1 is a perspective view of an embodiment of the implanter of the
5 present invention.

Figure 2 is a rear plan view of the implanter of Figure 1.

Figure 3 is a partially exploded view of a quick attachment mechanism for a
10 needle, a magazine housing, and of a pellet magazine having a tube loaded with both a
pellet and a plug.

Figure 4 is a perspective view of a pellet magazine.

15 Figure 5 is a plan view, partially in cross section, of a drive pin extending
through a pellet magazine and a needle.

Figure 6 is a plan view of a magazine advancement mechanism illustrating a
manual index actuator.

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Figure 7 is a plan view of a partially assembled housing assembly illustrating
the relationship between a trigger assembly, a drive pin and a drive pin shuttle when
the drive pin is in a retracted position.

Figure 8 is a plan view of partially assembled housing assembly illustrating the relationship between a trigger assembly, a drive pin and a drive pin shuttle when the drive pin is partially extended.

5 Figure 9 is a rear view of a magazine advancement mechanism illustrating a manual index actuator.

Figure 10 is an end view illustrating the relationship between a pellet magazine and a magazine advancement mechanism.

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Figure 11 is a perspective view of another embodiment of the implanter gun of the present invention.

Figure 12 is a plan view of a partially assembled housing assembly illustrating
15 an automatic index actuator and a latched cam actuated lever.

Figure 13 is a plan view illustrating the placement of a pellet magazine within a magazine passage of a magazine advancement mechanism.

20 Figure 14 is a plan view of a partially assembled housing assembly illustrating an automatic index actuator and a released cam actuated lever.

Figure 15 is a rear plan view of the automatic index actuator of Figure 14 and the latched cam actuated lever.

Figure 16 is a rear plan view of the automatic index actuator of Figure 14 and a released cam actuated lever.

5

DETAILED DESCRIPTION

Figures 1-16 illustrate preferred embodiments of the present invention, which is generally indicated by the reference numeral 10. The implanter 10 is described below first in terms of its major structural elements and then in terms of its secondary structural and/or functional elements which cooperate to implant an object beneath a membrane, *i.e.* to inject a transponder or hormone into an animal or to deposit a reactant through a stretched covering into a reaction vessel, among others.

Referring to **Figures 1, 3, 5, 7 and 8**, the implanter 10 generally comprises a housing assembly 12, a hollow needle 14 connected to the housing assembly 12, a drive pin assembly 16 including a drive pin 18 positioned within the housing assembly 12 and aligned with the hollow needle 14, and a trigger assembly 20 operably connected to both the housing assembly 12 and the drive pin 18. The drive pin 18 has a distal end 22, and further has a retracted position in which the distal end 22 of the drive pin 18 is in the housing assembly 12 and an extended position in which the distal end 22 of the drive pin 18 extends out of the housing assembly 12 and through the hollow needle 14.

Referring to **Figures 3 and 5** in particular, a pellet 24 is positioned, preferably using a pellet magazine 26, between the needle 14 and the distal end 22 of the drive

pin 18 when the drive pin 18 is in the retracted position. The drive pin 18 expels the pellet 24 through the hollow needle 14 as it moves from the retracted position to the extended position. The trigger assembly 20 includes a trigger 28 that has a relaxed position shown in **Figure 7**, and an actuated position shown in **Figure 8**. The drive
5 pin 18 moves from the retracted position to the extended position as the trigger 28 moves from the relaxed position to the actuated position. The trigger assembly 20 is adapted to provide a mechanical advantage for increasing a drive pin velocity with respect to a trigger velocity, which provides the implanter 10 with the capability of quickly depositing an object or pellet 24. The embodiments illustrated in the figures
10 incorporate a first class lever as a trigger lever 30 to provide the mechanical advantage that increases the drive pin velocity.

The pellet magazine 26 has a plurality of tubes 32 for holding and retaining pellets 24. The housing assembly 12 includes a magazine passage 34 sized to receive the pellet magazine 26 and contains a magazine advancement mechanism 36 for
15 indexing the pellet magazine 26 through a number of predetermined index positions within the magazine passage 34. The drive pin 18 is adapted to extend through the pellet magazine 26 and into the hollow needle 14 when the pellet magazine 26 is at each one of the predetermined index positions. A pellet 24 may be loaded in front of a plug 38 in each one of the tubes 32 in the pellet magazine 26. The pellet 24 is
20 positioned and adapted to be expelled from the needle 14, and the plug 38 has a shape and size to remain in the needle 14 when the drive pin 18 is extended. By remaining in the needle 14, the plug 38 discourages, and effectively prevents, the hollow needle 14 from being used again in another animal. The plug 38 may be formed from a variety of materials. In the embodiment shown in the figures, the plug 38 is a plastic

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object having a generally cylindrical shape. The plug 38 has a circumferential rib 39 that causes the plug 38 to be stuck in the needle 14.

The elements of the implanter 10 are hereafter described in more detail. Many of these elements or components are constructed from molded plastic in order to

5 provide an economical implanter 10 that is light and durable. Referring again to **Figure 1**, the housing assembly 12 generally includes a body housing 40 attached to a magazine housing 42. In the embodiments shown, the body housing 40 is formed by fastening a first side 40a to a second side 40b, and the magazine housing 42 is formed by fastening together a first side 42a to a second side 42b. The body housing 40 is

10 shaped generally like a pistol, which provides a user the ability to operate the device and accurately deposit the pellet with one hand. The body housing 40 comprises a hand grip portion 44 and a drive pin portion 46. The trigger assembly 20, and in particular the trigger 28, is positioned adjacent to the hand grip portion 44. Referring to **Figure 7** and **8**, the drive pin portion 46 is formed to include a drive pin passage 48

15 and a shuttle guide, which is formed by shuttle guide grooves 50 in the first and second sides 40a and 40b of the body portion 40. A drive pin shuttle 90 is connected to the proximal end of the drive pin 18, and slides along the shuttle guide. The shuttle guide and the drive pin passage 48 cooperate to accurately extend the drive pin 18 through the pellet magazine 26 and the hollow needle 14.

20 The first and second sides 42a and 42b of the magazine housing 42 form the magazine passage 34, which is sized and configured to receive the pellet magazine 26 shown in **Figure 4**. The pellet magazine 26 comprises a plurality of adjacent tubes 32 formed together as a unitary body. The longitudinal axes of these tubes are parallel to each other and are generally aligned in the same plane. The pellet magazine 26 has

two exterior sides 52a and 52b, each of which have a set of parallel ridges 54 and corresponding grooves. The pellet magazine 26 further has a proximal end 56 and a distal end 58. An alignment flange 60, having a generally rectangular plate-like shape, is formed at the proximal end 56 and serves as a means for properly aligning and orientating the pellet magazine 26 in the magazine passage 34. A lip having circumferential cuts is formed around the circumference of each tube 32 at the distal end 58. The lip prevents the pellets 24 from falling out of the pellet magazine 26, but allows the drive pin 18 to easily force a pellet 24 through the lip. As illustrated in **Figure 13**, the alignment flange 60 of the pellet magazine 26 corresponds to alignment grooves 62 formed in each side of the magazine housing 42 and causes the pellet magazine 26 to fit within the magazine passage 34 only in the predetermined manner.

A quick attachment mechanism 64 for a needle 14 is mounted on the distal side of the magazine housing 42. As illustrated in **Figures 1 and 6**, the quick attachment mechanism 64 preferably includes a threaded collet 66 or slotted sleeve. The hollow needle 14 extends through the threaded collet 66, and a threaded nut 68 screws around the collet 66 to quickly attach and detach the hollow needle 14 from the housing assembly 12. The collet 66 preferably has two or more circumferentially spaced slots 70 that enable the collet 66 to securely tighten around a large range of needle diameters. The collet 66 shown in the figures, for example, has six circumferentially spaced slots 70. The collet 66 is mounted to the magazine housing 42 by sandwiching the housing wall between two nuts.

The magazine housing 42 contains the magazine advancement mechanism 36 for indexing the pellet magazine 26. The magazine advancement mechanism 36

includes: at least one and preferably two fixed clips 72 for engaging one side of the pellet magazine; at least one and preferably one movable clip 74 for engaging the other side of the pellet magazine; and an index actuator 76 for indexing the movable clip 74 within the magazine passage 34. The clips 72 and 74 are attached to the magazine housing 42 within the magazine passage 34. As illustrated in **Figure 10**, the clips 72 and 74 are adapted to prevent the pellet magazine 26 from moving in a first direction and to allow the pellet magazine 26 to move in a second direction upon the application of an index force by securely engaging the ridges 54 in the side walls of the pellet magazine 26. The movable clip 74 has a bias spring 78 and a latch spring 80 to move the movable clip 74 from one groove over a ridge 54 to another adjacent groove upon release of the index force.

In manual index actuator embodiment 76a illustrated in **Figures 1, 2, 6, and 9**, the index force is manually applied to the index actuator 76 to index the movable clip 74 within the magazine passage 34. The bias spring 78 provides the return motion. In an automatic index actuator embodiment 76b illustrated in **Figures 11-15**, the index force is generated by an actuation force applied to the trigger 28. The automatic index actuator 76b includes a cam lever 82 pivotally attached at a fulcrum point 84 to the body housing 40b. The cam lever 82 has a cam end 86 in operable contact with a cam follower 88 mounted on a drive pin shuttle 90, which is attached to the drive pin 18. The cam lever 82 further has a magazine index end 92 in operable contact with the movable clip 74. The magazine index end 92 has an index motion and a return motion. As illustrated in **Figures 12 and 15**, the cam lever 82 pivots and moves the magazine index end 92 in a return motion as the cam follower 88 moves with the drive pin 18 from the retracted position toward the extended position. As illustrated

in **Figures 14 and 16**, the cam lever 82 pivots and moves the magazine index end 92 in an index motion when the cam follower 88 moves with the drive pin shuttle 90 and drive pin 18 into the retracted position. A latch mechanism 94, comprising a latch member 96 pivotally mounted to the body housing 40 and a latch spring 98 for biasing
5 the latch member 96 in a latch position, prevents the magazine index end 92 from undergoing an index motion until the drive pin shuttle 90 contacts the latch member 96, presses against the latch spring 98, and pushes the latch member 96 to a release position. The drive pin 18 is fully retracted out of the magazine 26 when the drive pin shuttle 90 contacts the latch member 96. The latch member 96 releases a pair of bias
10 springs 78, shown in **Figure 16**, which provide an index force to index the pellet magazine 26. The drive pin 18 is securely attached to the drive pin shuttle 90, and together form the drive pin assembly 16 that cooperates with the drive pin passage 48 and shuttle guide in the body housing 40 to consistently and accurately extend and retract the drive pin 18 along a line extending through the pellet magazine tubes 32,
15 the collet 66, and the hollow needle 14. The index position of the pellet magazine 26 is seen through an opening or window 100 in the magazine housing 42.

The trigger assembly 20 is adapted to provide a mechanical advantage for increasing a drive pin velocity with respect to a trigger velocity, and thus allow the implanter 10 to quickly deposit the pellet. The embodiments illustrated in **Figures 7,**
20 **8, 12 and 14** incorporate a first class lever 30, wherein the effort or actuation force is applied at the trigger 28 and the load is applied at the drive pin shuttle 90, to provide the mechanical advantage to increase the drive pin velocity. The trigger assembly 20 includes the trigger lever 30 which has a fulcrum point 102, a trigger end 104 operably contacting or connected to the trigger 28, and a shuttle end 106 operably

connected. through a trigger linkage 118, to the drive pin shuttle 90 that slides along the shuttle guide grooves 50 to move the drive pin 18 between the retracted position and the extended position. The fulcrum point 102 is preferably closer to the trigger end 104 than to the shuttle end 106 to provide the mechanical advantage to increase the velocity ratio between the drive pin 18 and the trigger 28. A cam follower 108 is connected at the trigger end 104 of the trigger lever 30 and a cam surface 110 is formed in the interior of the trigger 28. The trigger 28 is attached to the body housing 40 at a pivot point 112. The trigger 28 pivots about this point 112 upon the application of an actuation force. The cam surface 110 within the trigger 28 is formed to cause the cam follower 108 and the trigger end 104 to pivot back toward the hand grip portion 44, which causes the shuttle end 106 to pivot forward to extend the drive pin 18. A trigger bias spring 114 is attached between the trigger lever 30 and a spigot 116 in the hand grip portion 44 of the body housing 40 to bias the shuttle end 106 and the drive pin shuttle 90 in the retracted position. The force of the trigger bias spring 114 is sufficient to overcome the force of the latch spring 98.

The implanter 10 described above is used to implant an object 24 beneath a membrane. The method for implanting an object 24 beneath a membrane generally comprises the steps of positioning an object 24 to be implanted between a drive pin 18 and a hollow needle 14, positioning a plug 38 between the object 24 and the drive pin 18, inserting the needle 14 through the membrane, and moving the drive pin 18 from a retracted position to an extended position to expel the object 24 through the hollow needle 14 and to stop the needle 14 with the plug 38. This method has advantages related to preventing blood borne diseases when the object is implanted in an animal. The stopped needle is replaced with an unstopped needle before implanting another

object in another animal. Replacing the needles is quick and easy using the quick attachment mechanism 64, and generally requires the steps of unscrewing the nut 68 off of the threaded collet 66, removing the stopped needle from the collet 66, placing an unstopped needle in the collet 66, and screwing the nut 68 onto the collet 66.

- 5 Furthermore, the steps of positioning an object 24 to be implanted between a drive pin 18 and a hollow needle 14 and positioning the plug 38 between the object 24 and the drive pin 18 is quickly and easily accomplished by pre-loading a plurality of objects 24 and plugs 38 in a magazine 26 of tubes and indexing the magazine 26 to position each object 24 and plug 38 between the drive pin 18 and the needle 14. Additionally,
- 10 the step of moving the drive pin 18 from a retracted position to an extended position to expel the object 24 through the hollow needle 14 and to stop the needle 14 with the plug 38 is quickly and easily accomplished by actuating a trigger 28, and the step of indexing the magazine 26 to position each object 24 and plug 38 between the drive pin 18 and the needle 14 is quickly and easily accomplished by releasing the trigger
- 15 28.

The descriptions above and the accompanying drawings should be interpreted in the illustrative and not the limited sense. While the invention has been disclosed in connection with the preferred embodiment or embodiments thereof, it should be understood that there may be other embodiments which fall within the scope of the

20 invention as defined by the following claims. Where a claim, if any, is expressed as a means or step for performing a specified function it is intended that such claim be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof, including both structural equivalents and

equivalent structures, material-based equivalents and equivalent materials, and act-based equivalents and equivalent acts.

CLAIMS

What is claimed is:

1. An implanter, comprising:
 - 5 (a) a housing;
 - (b) a hollow needle connected to said housing;
 - (c) a drive pin positioned within said housing and aligned with said hollow
needle, said drive pin having a distal end, said drive pin further having a
retracted position wherein said distal end of said drive pin is in said housing
10 and an extended position wherein said distal end of said drive pin portion
extends out of said housing; and
 - (d) a trigger operably connected to both said housing and said drive pin, said
trigger having a relaxed position and an actuated position, said drive pin
moving from said retracted position to said extended position when said
15 trigger moves from said relaxed position to said actuated position.
2. The implanter of claim 1, wherein said housing is a housing assembly
and includes a first side fastened to a second side, said first side and said second side
forming a drive pin passage adapted to receive said drive pin, said drive pin passage
20 being aligned with said hollow needle.
3. The implanter of claim 1, further including a quick attachment
mechanism attached to said housing, said quick attachment mechanism being adapted
to quickly connect and disconnect said hollow needle.

4. The implanter of claim 3, wherein said quick attachment mechanism includes a threaded collet and a threaded nut that screws around said threaded collet to fasten said hollow needle to said housing.

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5. The implanter of claim 4, wherein said collet has at least two slots to enable said collet to securely hold different sized needles.

6. The implanter of claim 1, wherein said drive pin is attached to a drive
10 pin shuttle and said housing has a shuttle guide, said drive pin shuttle sliding along said shuttle guide as said drive pin moves between said retracted position and said extended position, said drive pin shuttle being operably connected to said trigger assembly.

15 7. The implanter of claim 1, wherein said trigger is a trigger assembly and is adapted to provide a mechanical advantage for increasing a drive pin velocity with respect to a trigger velocity.

8. The implanter of claim 7, wherein said trigger is pivotally attached to
20 said housing, said trigger assembly further including a trigger lever operably connected to said trigger, said trigger lever having a fulcrum point, a trigger end, and a shuttle end, said fulcrum point being closer to said trigger end than to said shuttle end to provide said mechanical advantage for increasing said drive pin velocity with respect to said trigger velocity.

9. The implanter of claim 8, further including a trigger linkage pivotally attached to said shuttle end of said trigger lever and to said drive pin.

5 10. The implanter of claim 9, further including a trigger cam follower attached to said trigger end of said trigger lever, said trigger having a cam surface, said trigger cam follower being in movable contact with said cam surface causing said trigger lever to pivot about said fulcrum point and extend said drive pin when said trigger moves from said relaxed position to said actuated position.

10 11. The implanter of claim 8, further comprising a trigger bias spring for biasing said trigger assembly in said relaxed position.

12. The implanter of claim 11, further comprising a pellet magazine, said
15 pellet magazine having at least one tube for retaining said pellet, said housing including a magazine housing attached to a body housing, said magazine housing including a magazine passage sized to receive said pellet magazine and containing a magazine advancement mechanism for indexing said pellet magazine through a
20 number of predetermined index positions within said magazine passage, one end of said magazine housing being attached to said body housing and said hollow needle being attached to an opposing end of said magazine housing, said drive pin being adapted to extend through one of said plurality of tubes and into said hollow needle at each one of said predetermined index positions.

13. The implanter of claim 12, wherein at least one tube contains a plug with said pellet, said pellet being adapted to be expelled through said needle, said plug being adapted to remain in said needle to discourage said needle from being used again.

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14. The implanter of claim 12, wherein said at least one tube is a plurality of tubes having a longitudinal axis, each of said longitudinal axes being parallel with respect to each other, one end of said pellet magazine further including an alignment flange positioned perpendicular to said longitudinal axes, each of said plurality of tubes having a lip with a plurality of cuts at an opposing end of said pellet magazine adapted to prevent pellets from falling out of said tubes and to allow said pellets to be expelled from said tubes by an actuation force, said magazine housing having corresponding alignment grooves adjacent to said magazine passage, whereby said alignment grooves and said alignment flange properly align said pellet magazine within said magazine housing.

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15. The implanter of claim 12, wherein said magazine housing has an opening for viewing said index positions of said pellet magazine.

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16. The implanter of claim 12, wherein said magazine housing has a first and a second side that form said magazine passage, said first side being attached to said second side, and said first and second sides being attached to said housing body.

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17. The implanter of claim 12, wherein said pellet magazine has two opposing exterior side walls, said exterior side walls having a plurality of grooves, said magazine advancement mechanism having at least one fixed clip, at least one movable clip, and an index actuator for indexing said at least one movable clip, said at
5 least one fixed clip being adapted to engage said grooves in one of said exterior side walls and said at least one movable clip being adapted to engage said grooves in the other one of said exterior side walls, said clips preventing said pellet magazine from moving in a first direction and allowing said pellet magazine to move in a second direction.

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18. The implanter of claim 17, wherein said at least one movable clip is biased in an extended position by a latch spring, said at least one movable clip being adapted to engage one of said plurality of grooves and index said pellet magazine from a first tube to an adjacent second tube upon an index motion, said latch spring
15 compressing to allow said at least one movable clip to move to an adjacent one of said plurality of grooves upon a return motion.

19. The implanter of claim 17, wherein said at least one movable clip has a bias spring for moving said at least one movable clip.

20

20. The implanter of claim 17, wherein said index actuator is a manual actuator and an index force is manually applied to said index actuator to index said at least one movable clip.

21. The implanter of claim 17, wherein said index actuator is an automatic actuator and an index force is generated by an actuation force applied to said trigger.

22. The implanter of claim 21, further comprising a cam lever pivotally
5 attached at a fulcrum point to said housing, said cam lever having a cam end in operable contact with a cam follower mounted on a drive pin shuttle attached to said drive pin. said cam lever further having a magazine index end in operable contact with said at least one movable clip, said magazine index end having an index motion and a return motion. said magazine index end moving in said index motion when said cam
10 follower moves with said drive pin into said retracted position, said magazine index end moving in said return motion when said cam follower moves with said drive pin into said extended position.

23. The implanter of claim 21, further comprising a latch mechanism for
15 preventing said magazine end from undergoing an index motion until said drive pin is fully retracted out of said magazine.

24. An implanter for depositing an object beneath a membrane,
comprising:
20 (a) a housing assembly having a shuttle guide, said housing assembly including a magazine housing attached to a body housing, said magazine housing having a magazine passage sized to receive a pellet magazine, said pellet magazine having at least one tube for retaining a pellet, said magazine housing containing a magazine advancement mechanism for indexing said pellet

magazine through a number of predetermined index positions within said magazine passage;

(b) a hollow needle connected to said magazine housing;

(c) a drive pin assembly positioned within said housing assembly, said drive pin

5 assembly including a drive pin aligned with said hollow needle and a drive pin shuttle attached to said drive pin, said drive pin having a distal end, said drive pin further having a retracted position wherein said distal end of said drive pin is in said housing assembly and an extended position wherein said distal end of said drive pin portion extends out of said housing assembly, wherein said
10 pellet is positioned between said needle and said distal end of said drive pin when said drive pin is in said retracted position and said drive pin expels said pellet through said hollow needle when moving from said retracted position to said extended position, said drive pin shuttle sliding along said shuttle guide as said drive pin moves between said retracted position and said extended
15 position, said drive pin being adapted to extend through said pellet magazine at each one of said predetermined index positions; and

(d) a trigger assembly operably connected to both said housing assembly and said drive pin, said trigger assembly including:

(i) a trigger having a relaxed position and an actuated position, said drive
20 pin moving from said retracted position to said extended position when said trigger moves from said relaxed position to said actuated position, said trigger being pivotally attached to said housing assembly; and
(ii) a trigger lever operably connected to said trigger, said trigger lever having a fulcrum point, a trigger end, and a shuttle end operably

connected to said drive pin shuttle, said fulcrum point being closer to said trigger end than to said shuttle end to provide a mechanical advantage for increasing a drive pin velocity with respect to a trigger velocity.

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25. An implanter for depositing an object beneath a membrane, comprising:

- 10 (a) a housing assembly having a shuttle guide, said housing assembly including a magazine housing attached to a body housing, said magazine housing having a quick attachment mechanism, said magazine housing having a magazine passage sized to receive a pellet magazine, said pellet magazine having at least one tube for retaining a pellet and a plug, said magazine housing containing a magazine advancement mechanism for indexing said pellet magazine through a number of predetermined index positions within said magazine passage;
- 15 (b) a hollow needle connected to said magazine housing through said quick attachment mechanism, said quick attachment mechanism being adapted to quickly connect and disconnect said hollow needle from said magazine housing;
- 20 (c) a drive pin assembly positioned within said housing assembly, said drive pin assembly including a drive pin aligned with said hollow needle and a drive pin shuttle attached to said drive pin, said drive pin having a distal end, said drive pin further having a retracted position wherein said distal end of said drive pin is in said housing assembly and an extended position wherein said distal end of said drive pin portion extends out of said housing assembly, wherein said

pellet and said plug are positioned between said needle and said distal end of said drive pin when said drive pin is in said retracted position and said drive pin expels said pellet through said hollow needle when moving from said retracted position to said extended position, said plug being adapted to remain in said needle to discourage said needle from being used again, said drive pin shuttle sliding along said shuttle guide as said drive pin moves between said retracted position and said extended position; and

(d) a trigger assembly operably connected to both said housing assembly and said drive pin shuttle, said trigger assembly including a trigger that has a relaxed position and an actuated position, said drive pin moving from said retracted position to said extended position when said trigger moves from said relaxed position to said actuated position.

26. An implanter for depositing an object beneath a membrane, comprising:

(a) a housing assembly, said housing assembly including a magazine housing attached to a body housing, said magazine housing having a magazine passage sized to receive a pellet magazine, said pellet magazine having at least one tube for retaining a pellet, said magazine housing containing a magazine advancement mechanism for indexing said pellet magazine through a number of predetermined index positions within said magazine passage, said pellet magazine having a first exterior side wall and an opposing second exterior side wall, said exterior side walls having a plurality of grooves, said magazine advancement mechanism including:

- (i) at least one fixed clip adapted to engage said grooves in said first exterior side wall;
- (ii) at least one movable clip adapted to engage said grooves in said second exterior side wall, said clips preventing said pellet magazine from moving in a first direction and allowing said pellet magazine to move in a second direction;
- (iii) an automatic index actuator for indexing said at least one movable clip, said automatic index actuator including a cam lever pivotally attached at a fulcrum point to said housing assembly, said cam lever having a cam end in operable contact with a cam follower, said cam lever further having a magazine index end in operable contact with said at least one movable clip, said magazine index end having an index motion and a return motion, said magazine index end moving in said index motion when said cam follower moves into a retracted position, said magazine advancement end moving in said return motion when said cam follower moves into an extended position; and
- (iv) a latch mechanism; and
- (b) a hollow needle connected to said housing assembly;
- (c) a drive pin positioned within said housing assembly and aligned with said hollow needle, said drive pin having a distal end, said drive pin further having a retracted position wherein said distal end of said drive pin is in said housing assembly and an extended position wherein said distal end of said drive pin portion extends out of said housing assembly, wherein a pellet is positioned between said needle and said distal end of said drive pin when said drive pin is

in said retracted position and said drive pin expels said pellet through said hollow needle when moving from said retracted position to said extended position, said drive pin being connected to said cam follower, said latch mechanism preventing said magazine index end of said cam lever from
5 undergoing said index motion until said drive pin is in said retracted position; and

(d) a trigger assembly operably connected to both said housing assembly and said drive pin, said trigger assembly including a trigger that has a relaxed position and an actuated position, said drive pin moving from said retracted position to
10 said extended position when said trigger moves from said relaxed position to said actuated position.

27. A method for implanting an object beneath a membrane, comprising the steps of:

- 15 (a) positioning an object to be implanted between a drive pin and a hollow needle;
(b) positioning a plug between the object and the drive pin;
(c) inserting the needle through the membrane; and
(d) moving the drive pin from a retracted position to an extended position to expel
the object through the hollow needle and stop the needle with the plug.

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28. The method for implanting an object beneath a membrane of claim 27, further comprising the step of replacing the stopped needle after implanting the object into a first animal with an unstopped needle before implanting the object into a second animal.

29. The method of implanting an object beneath a membrane of claim 28, wherein the step of replacing the stopped needle with an unstopped needle includes the steps of unscrewing a nut off of a threaded collet, removing the stopped needle
5 from the collet, placing the unstopped needle in the collet, and screwing on the nut onto the collet.

30. The method for implanting an object beneath a membrane of claim 27, wherein the steps of positioning an object to be implanted between a drive pin and a
10 hollow needle and positioning the plug between the object and the drive pin includes the steps of pre-loading a plurality of objects and plugs in a magazine of tubes and indexing the magazine through a number of predetermined index positions to position each object and plug between the drive pin and the needle.

15 31. The method for implanting an object beneath a membrane of claim 30, wherein the step of moving the drive pin from a retracted position to an extended position to expel the object through the hollow needle and to stop the needle with the plug includes the step of actuating a trigger and the step of indexing the magazine to
20 position each object and plug between the drive pin and the needle includes the step of releasing the trigger.

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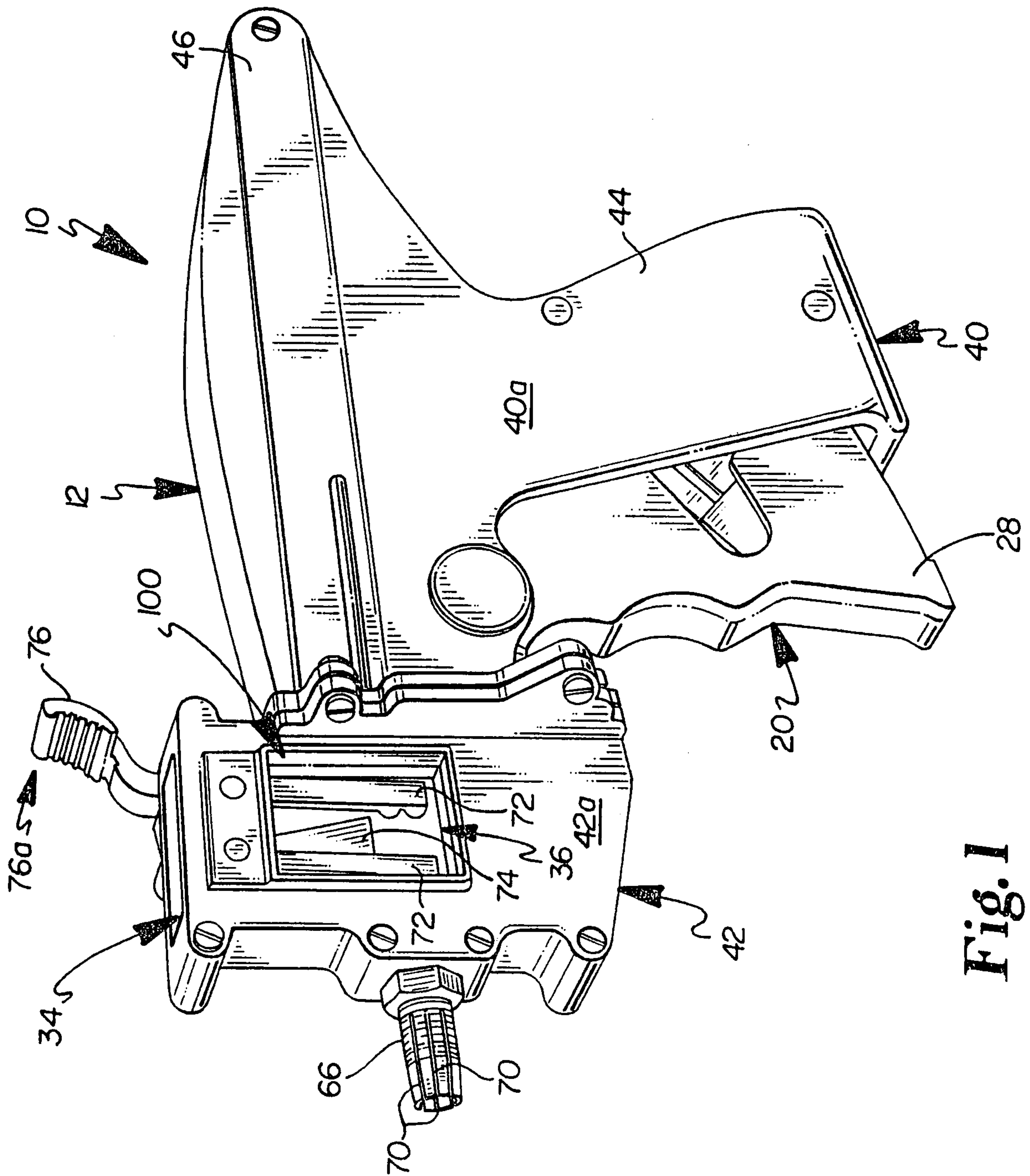
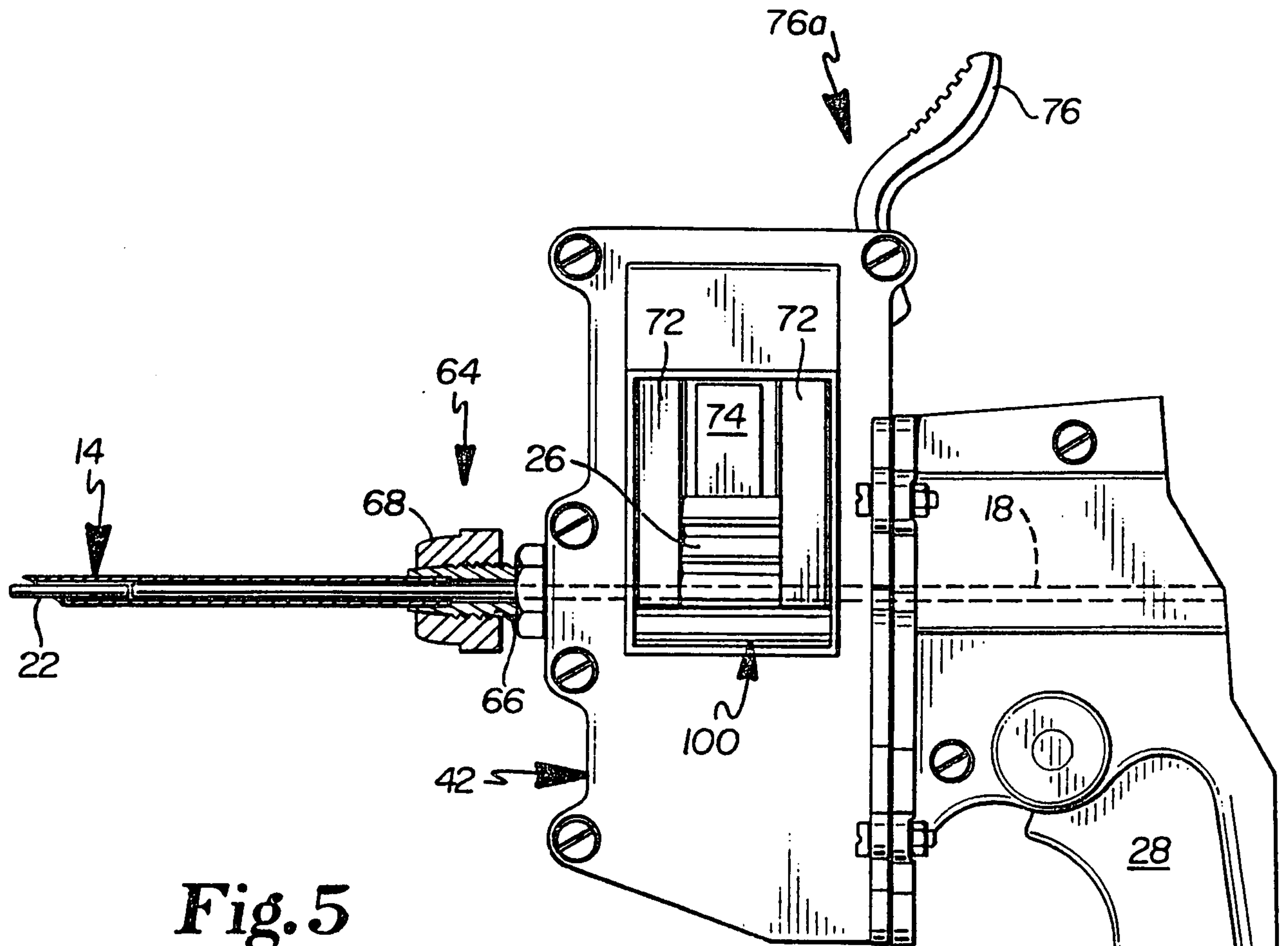
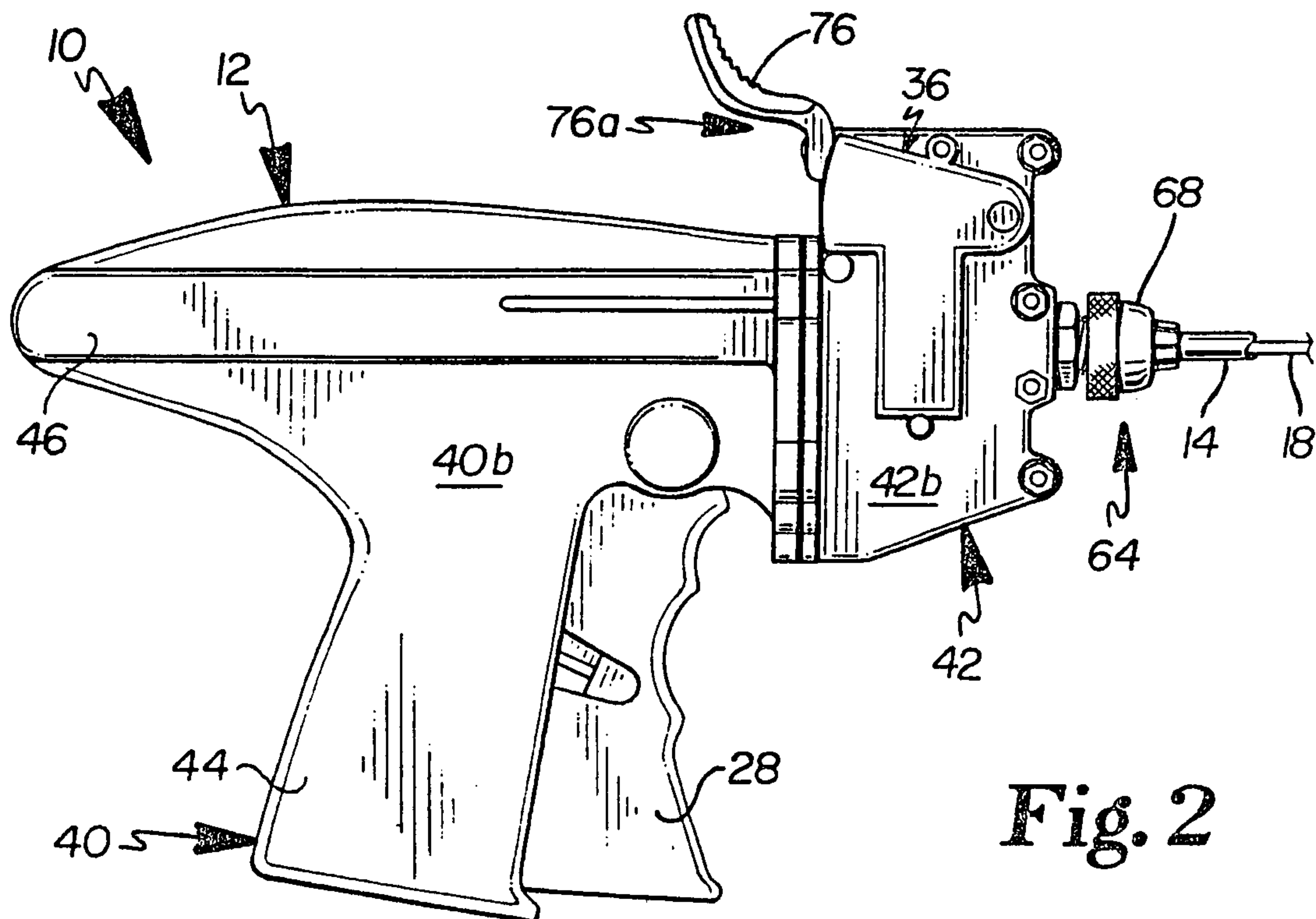
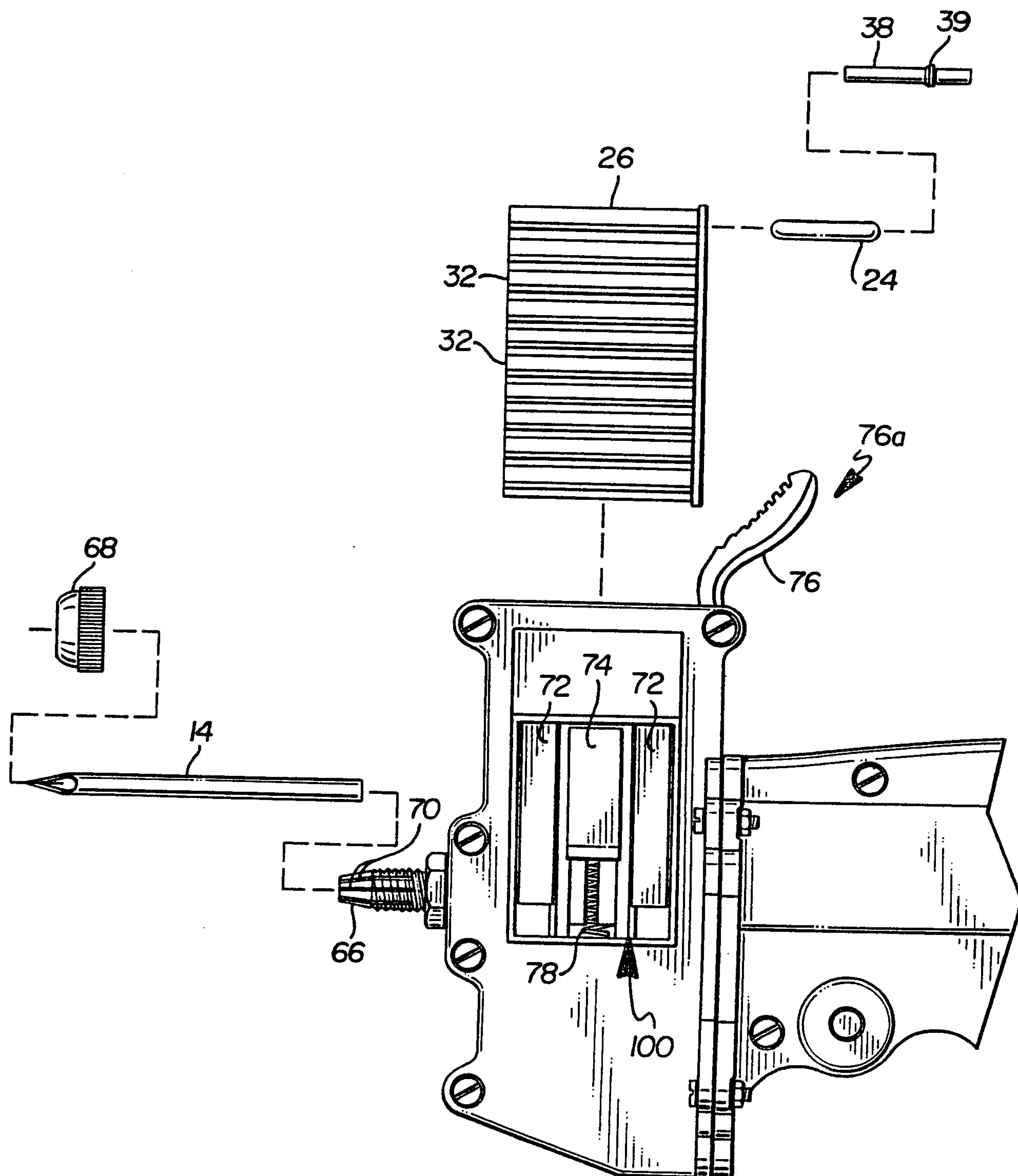


Fig. 1

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**Fig. 5****Fig. 2**

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**Fig. 3**

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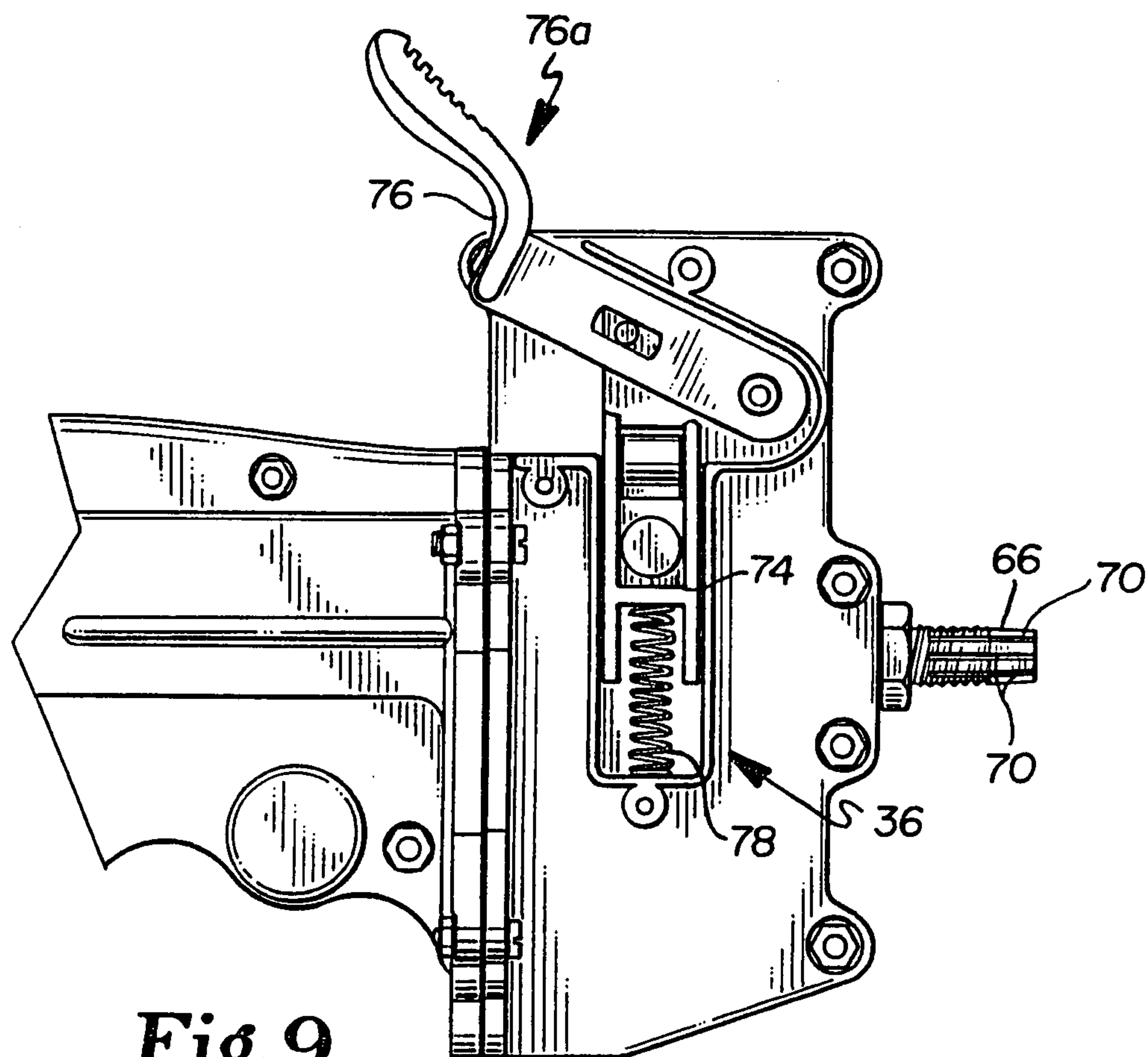


Fig. 9

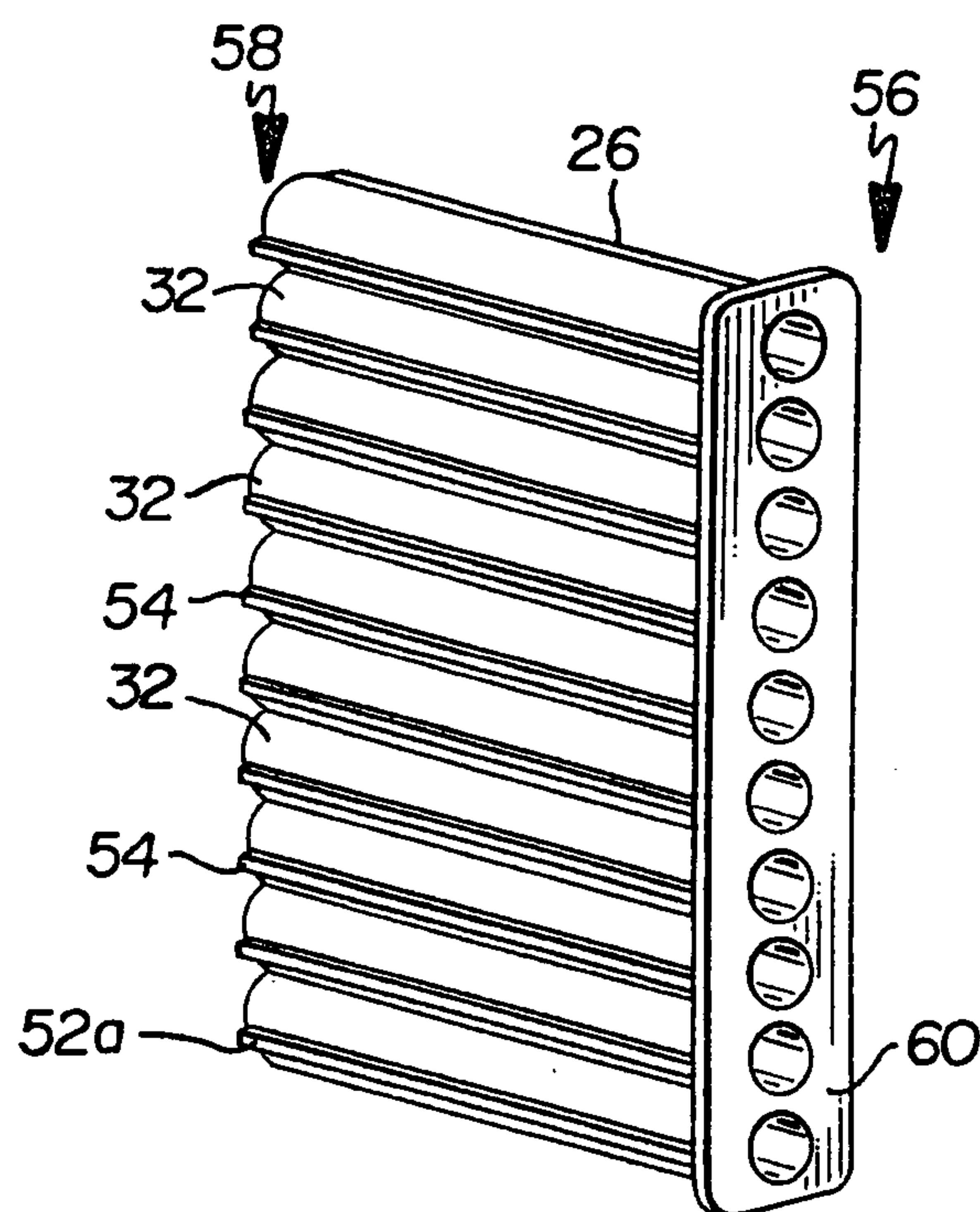
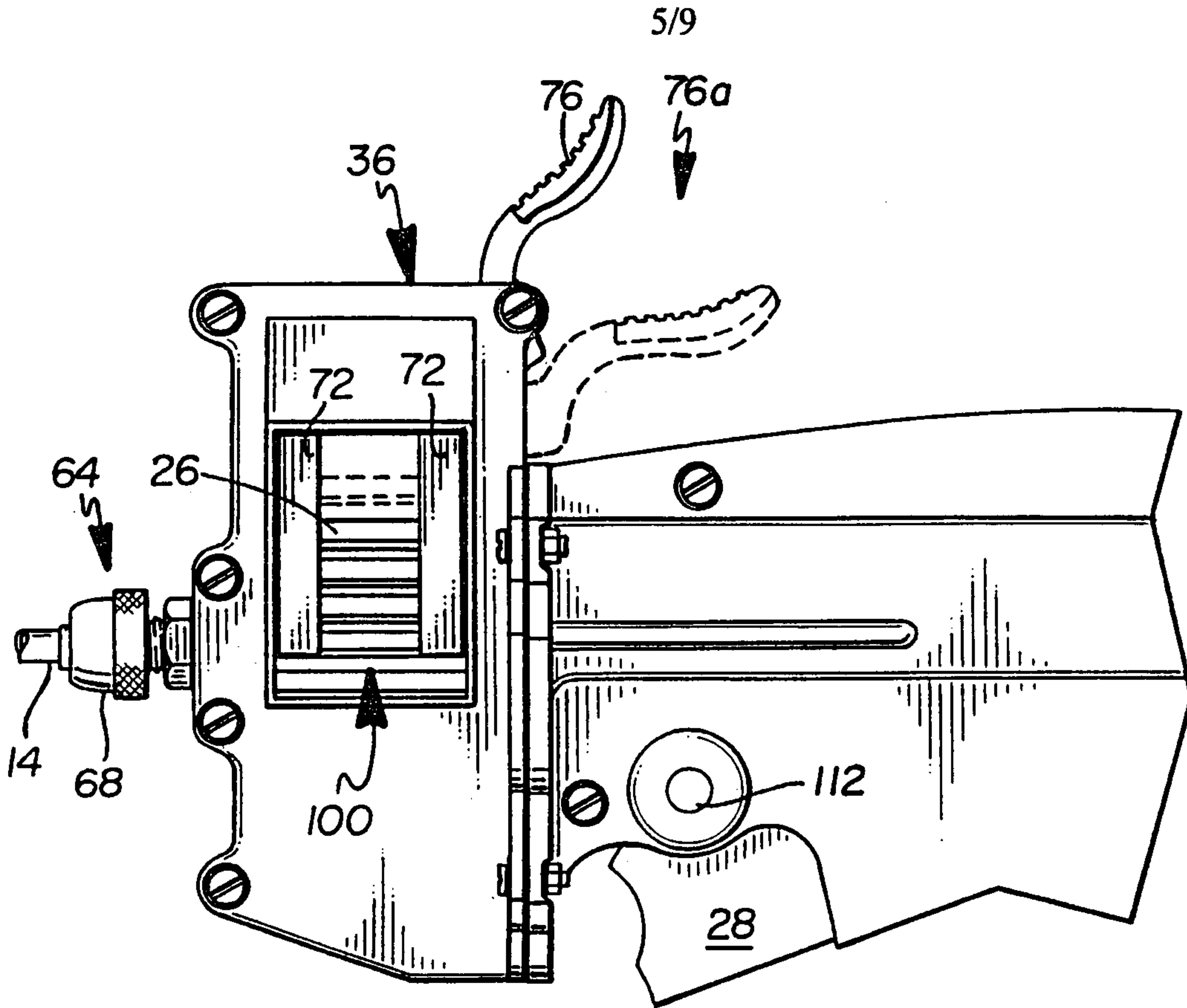
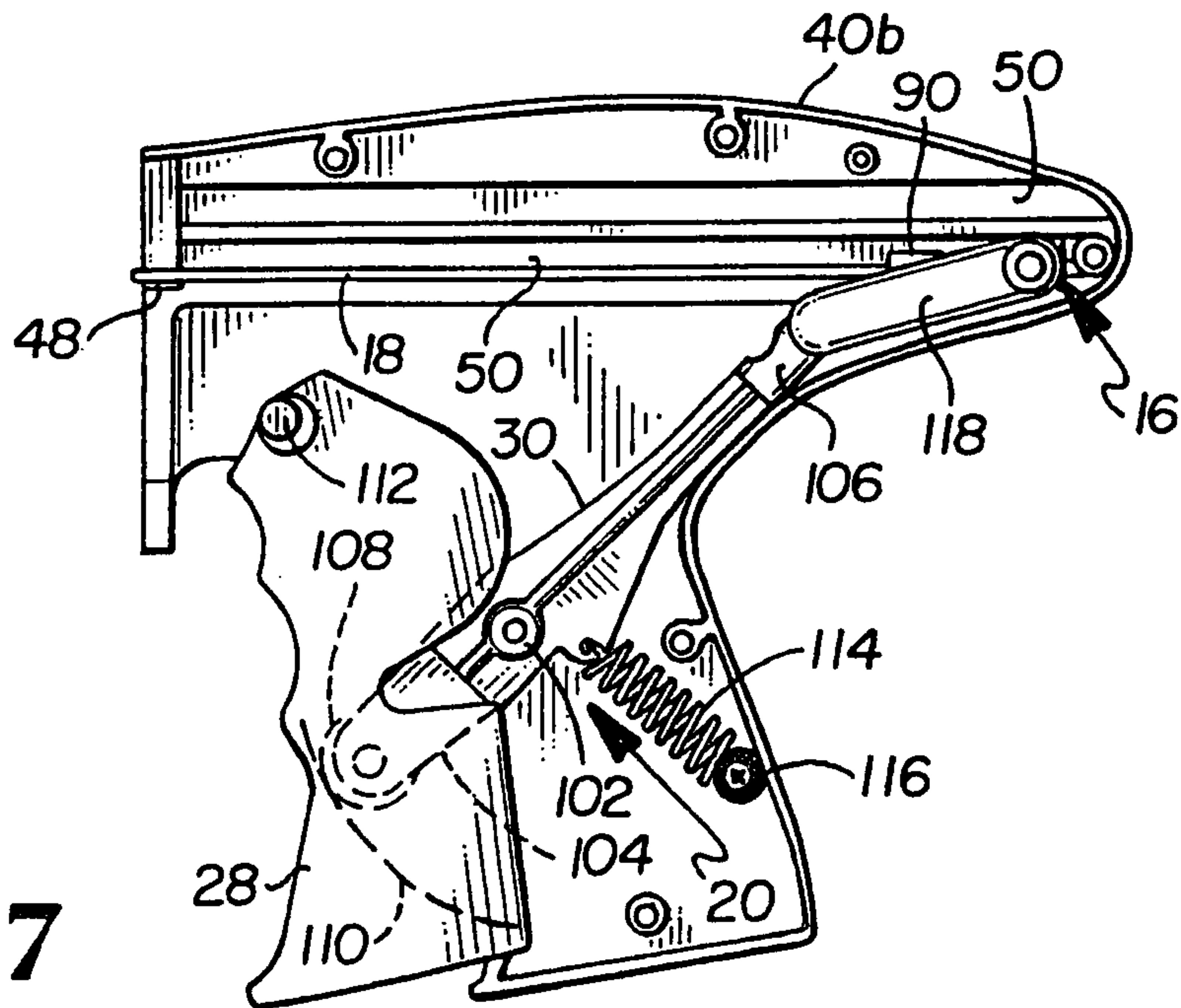


Fig. 4

**Fig. 6****Fig. 7**

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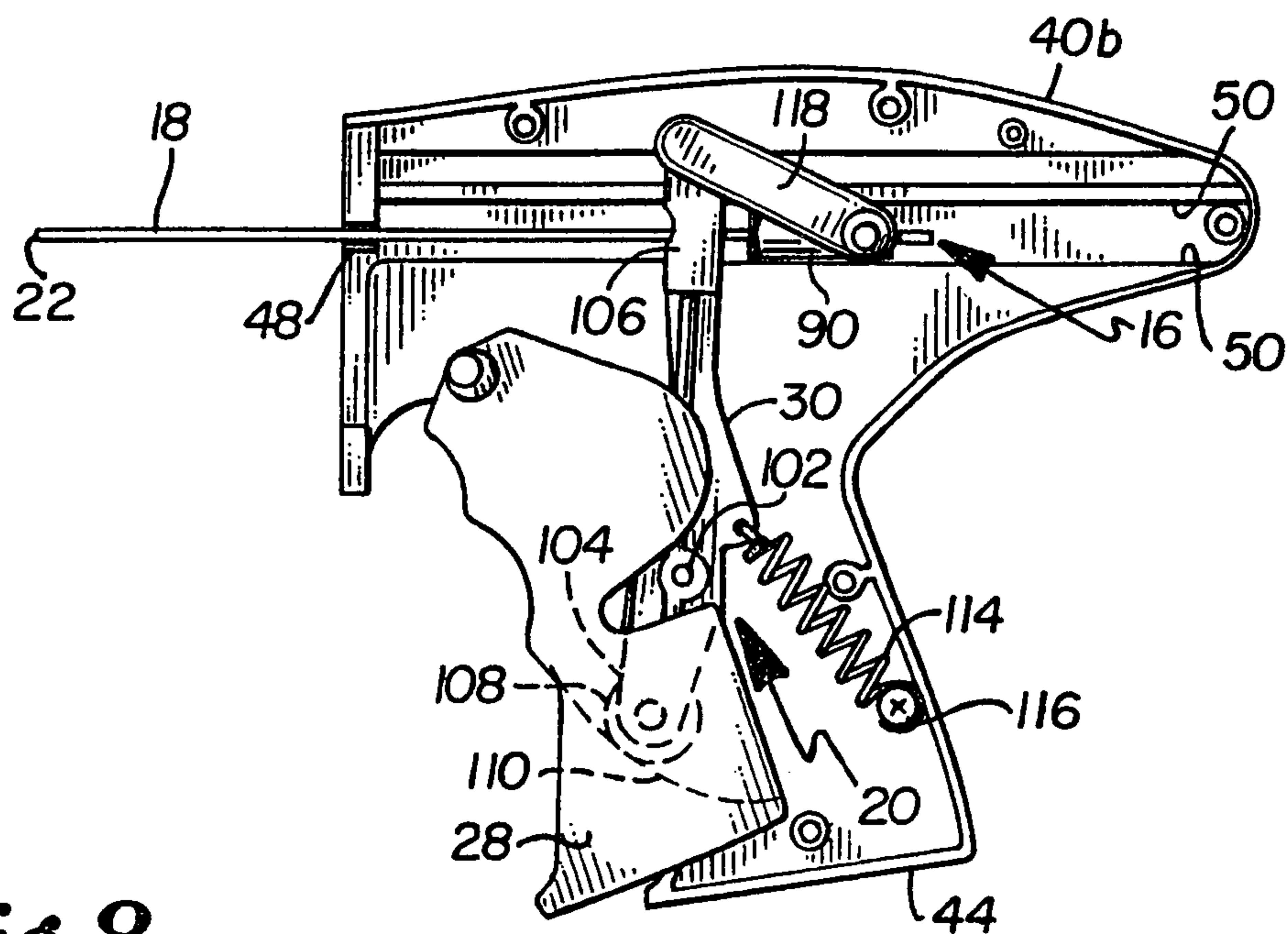


Fig.8

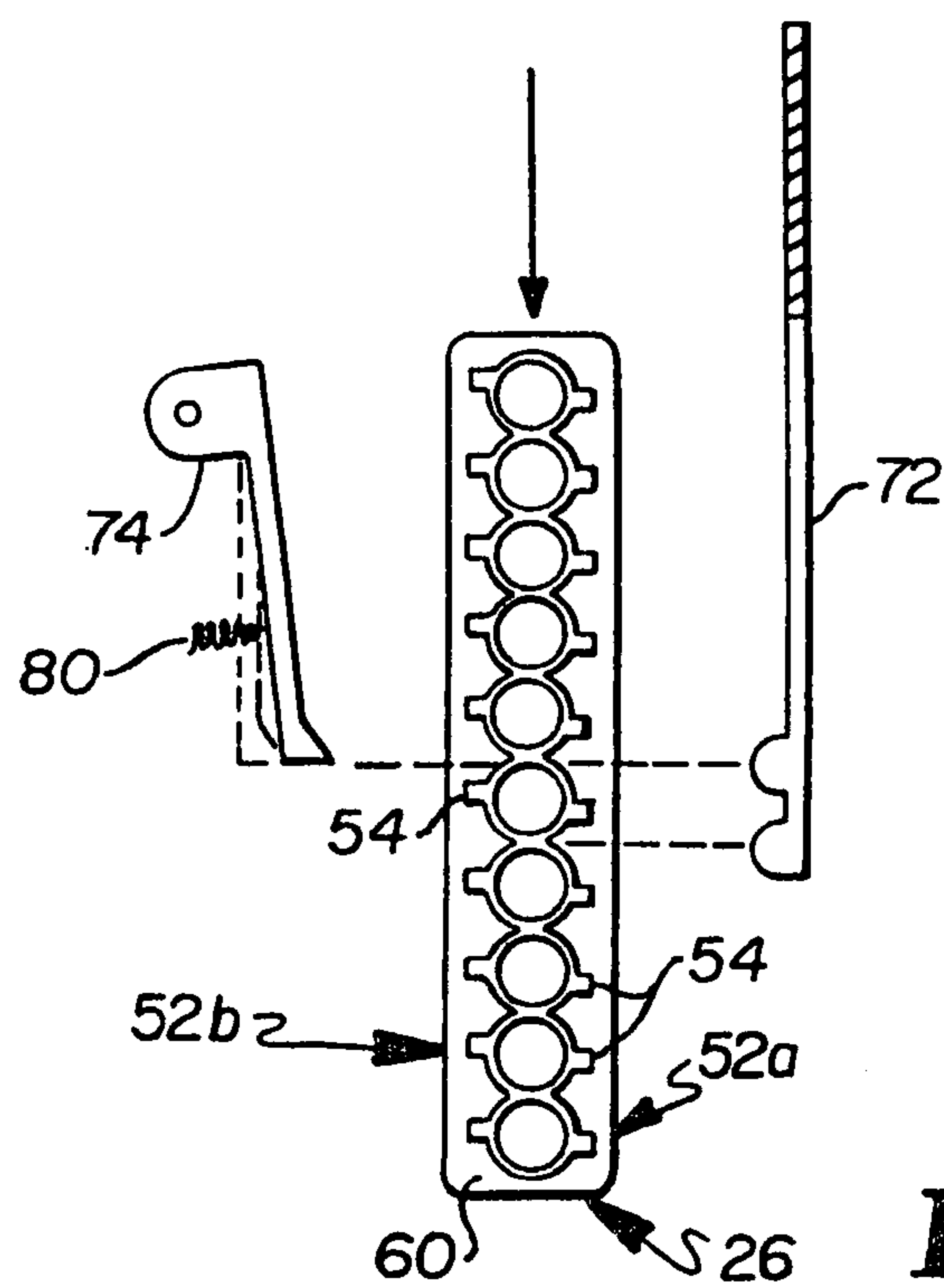


Fig. 10

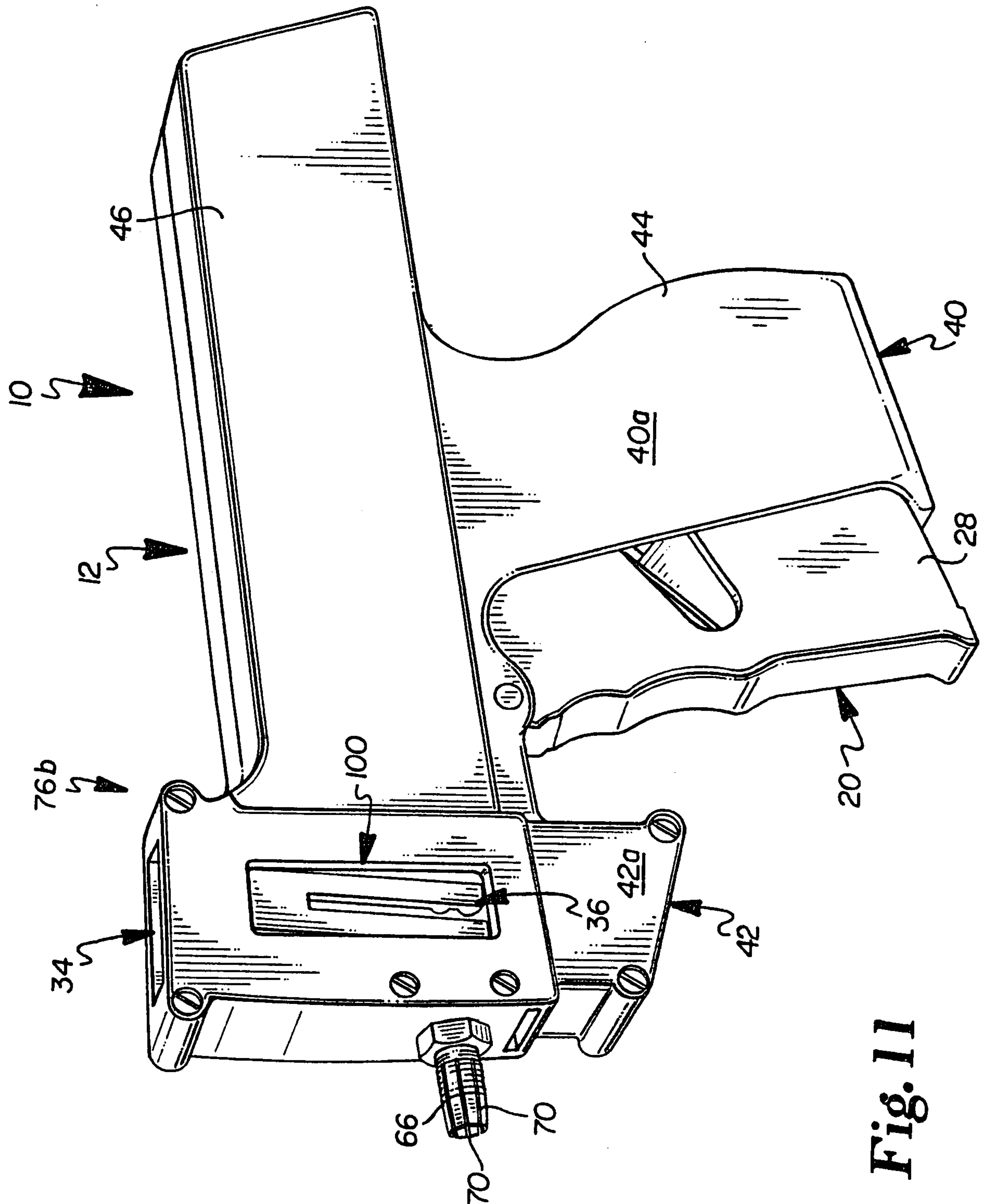


Fig. 11

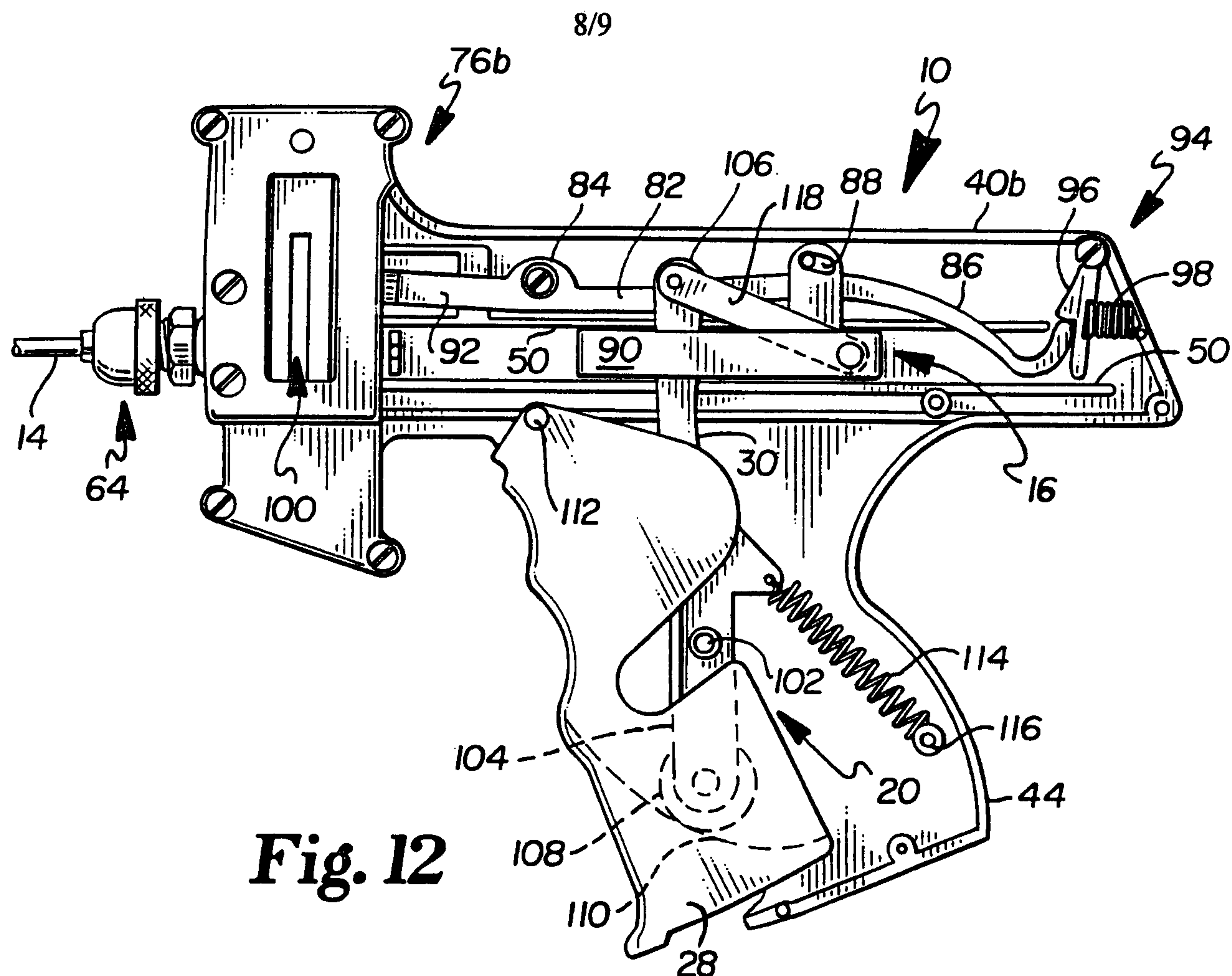


Fig. 12

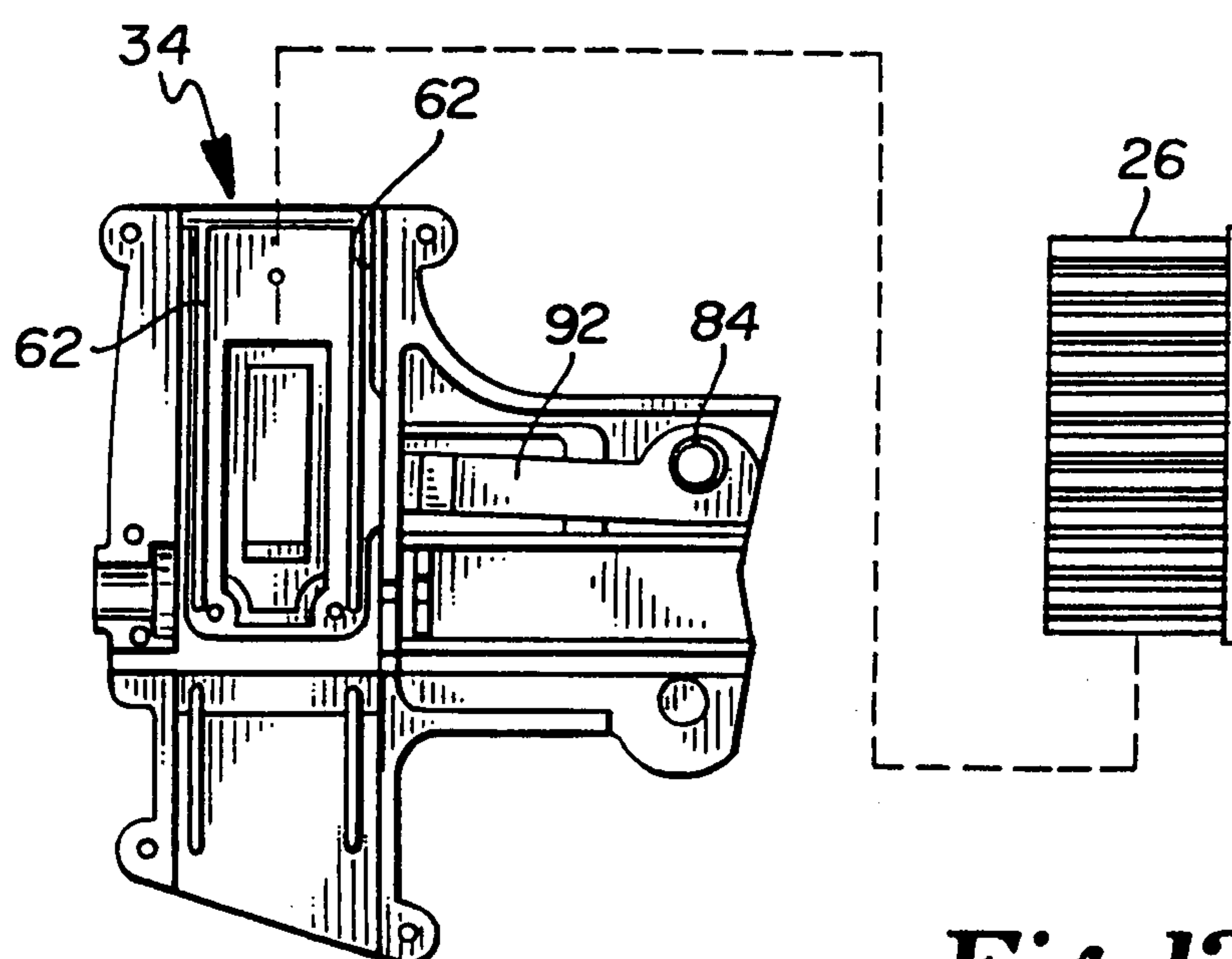


Fig. 13

