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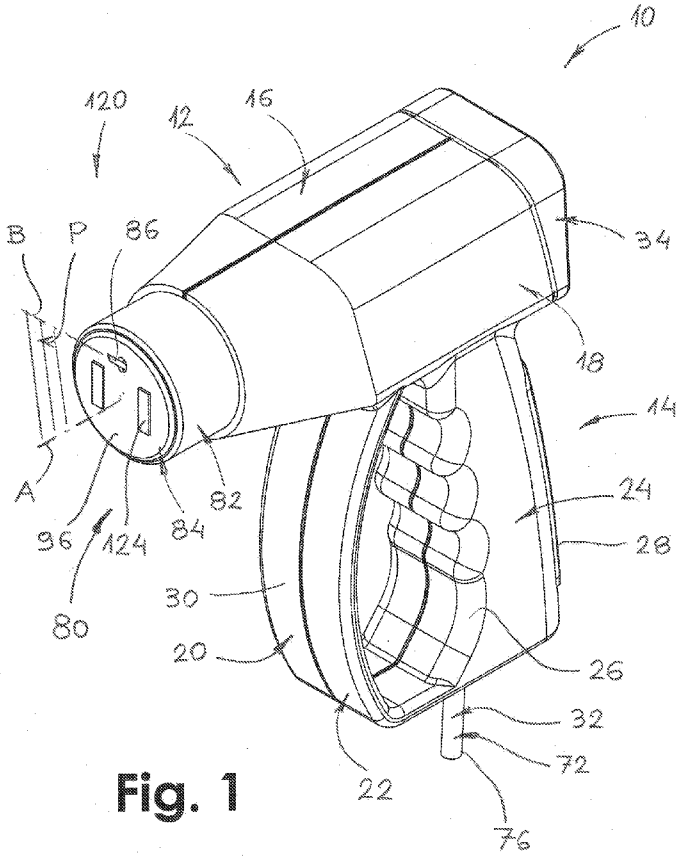

Fig. 1

[Continued on next page]

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(57) Abstract: An injection apparatus for injecting a medicament into a patient, the injection apparatus has a stationary head and a movable head that is movable with respect to the stationary head. A needle is attached to a needle holder that is held by the movable head and by the stationary head. When the movable head is urged rearwardly, a front edge of the needle moves forwardly with respect to a front face of the movable head.

INJECTION APPARATUS

FIELD OF THE INVENTION

The present invention relates to the field of injectors for injecting animals, and more particularly to the field of automatic injectors for injecting a large number of animals, for example, poultry or fish.

BACKGROUND OF THE INVENTION

In the field of animal treatment it is often required to inject to the animal a large variety of medicaments, in a liquid substance form, that may include, e.g., medicines, vaccines, hormones, food supplements and the like. For a matter of convenience, the above described substances that have to be injected will hereinafter be called "medicament".

When it is required to inject a large number of animals (or "patients"), e.g., poultry, fish, sheep, goats, cattle, and the like, the injecting should be fast and efficient since there is a large number of individuals involved during each injecting process, typically, tens of thousands.

When injecting to a large number of individuals, it is common that the operator gets tired. In this situation, several malfunctions may occur:

1- The operator may accidentally inject to himself.

2- The operator may inject when the needle did not penetrate yet into the patient.

3- The operator may inject when the needle did not penetrate to the desired depth into the patient.

4- The operator may inject after the needle has been removed from the patient.

5- The operator may inject only a portion of the required dose.

6- The operator may insert the needle into the patient in a wrong orientation.

7- The operator may inject twice to the same individual.

Furthermore, since there is a large number of individuals involved and the process is typically done very quickly, it is sometimes difficult or impossible to monitor the individuals that were actually injected. Moreover, it is impossible to monitor the individuals which received the full dose versus those who did not receive the full dose. It is understood that these kinds of malfunctions cause additional cost to the process and further complications, such as an outbreak of a plague, due to the individuals that were not properly injected.

Injection apparatuses for performing these tasks are known. US2009018505(A1) discloses a powered automatic injection device having a hand-held gun-shaped with a handgrip. The device has an internal motor that is powered by connection to a power source, such as AC current or DC battery. A pair of limit switches control the delivery of the medicament by limiting movement of a helical gear that moves a fitting in response to being powered by the internal motor. The helical gear transfers rotational motion from the electric motor into linear motion through a coupling attached to the helical gear.

GB2233234(B) discloses a portable jet injector for avian vaccination that may include two ejection chambers fed separately with different vaccine compositions for being administrated simultaneously to one bird.

WO2004101060(A2) discloses an injector assembly adapted to be carried by the operating person. Contact sensor and positioning sensor delivers information to a controller. The controller orders propelling means, a dosing unit, and the needle to automatically push the medical material. The apparatus can be provided with electronically or physical marker for recording.

US6858020(B2) discloses an automatic repeater vaccinator apparatus for dispensing a predetermined volume of a fluid into an animal, and reloading after each volume of fluid is dispensed.

US8,529,522 to Cohen discloses an injection apparatus having a removable needle cartridge, wherein the cartridge having a plurality of needles. Each of the needles is advanced into a deployment position by means of an advancer.

WO2014/016807 A3 to Cohen discloses a mass vaccination device which can electronically control and deliver a measured amount of a vaccine thorough a needle.

US2008/0177223 A1 to Johnston et al. discloses an injection system that may deliver at least two fluid doses to a small bird by penetrating the skin of the recipient bird with at least one injection needle.

US2005/0209569 A1 to Ishikawa et al. discloses an injection device. After pressing the device against the body of a patient, a needle automatically protrudes from the device into the patient and is immediately removed from the patient, thereby reducing the pain of the patient during insertion and removing of the needle.

Neither of the cited references discloses a method to insert a needle at a predetermined required angle with respect to the avian skin, at the right insertion depth, at a linear line during insertion, and releasing the dose when the front edge of the needle is positioned at the required depth.

US3,964,481 to Gourlandt et al. discloses a device comprising a needle (13) that protrudes at an angle with respect to a retention plate (14). The device comprises a casing (1) which rests on the table through four stuck rubber legs (4). An operation system is separated from a control system. A needle (13) is connected, through guide means (6c), to a housing (6). The needle is protruding to the patient through an aperture (18) in the retention plate (14).

In order to perform an injection, the caregiver person has to hold the bird with one hand, and, with the other hand to hold one of the bird's legs and

abut it against a right-angled abutment or stop member (16) that is found on the retention plate in order to assure the correct position for the injection. At this stage, the person presses a push member (19) and the needle protrudes outwardly from the aperture and makes the injection.

It is unclear how the person performs this task since both of his hands are already occupied as described above. He has to either release one of his hands for pressing the push member (19), or, he has to release one finger for pressing the push member, or, he has to press with the outer portion of his palm when the bird's leg is grabbed by his hand and abutted against the stop member (16). In any case, the operation of the device with living birds is cumbersome.

Disadvantages of the device of '481 are: (1) the device is stationary and not mobile, (2) the bird has to be held with both hands, (3) the operation of the injection is cumbersome, (4) the injection is not being done automatically and it has to be operated by the person, (5) the device cannot get to any bird, but, each of the birds has to be placed on the device, in the exact position, prior to operation of the needle.

It is the object of the present invention to provide an injection apparatus that significantly reduces or overcomes the aforementioned disadvantages.

It is a further object of the present invention to provide an injection apparatus that automatically injects into the animal when it is pressed against the animal.

It is still a further object of the present invention to provide an injection apparatus wherein its needle penetrates into the patient (e.g., poultry or fish) always at the correct desirable angle.

It is still yet a further object of the present invention to provide an injection apparatus wherein its needle moves along a straight line throughout the penetration into the patient.

It is also a further object of the present invention to provide an injection apparatus wherein its needle penetrates into the patient always at the exact desirable depth.

It is another object of the present invention to provide an injection apparatus wherein the treatment material is injected only after the needle has reached the desirable depth.

It is still yet another object of the present invention to provide an injection apparatus that provides full delivery of the treatment material into the patient.

It is still further another object of the present invention to provide an injection apparatus that prevents accidental exposure of the needle or accidental injection.

It is also another object of the present invention to provide an injection apparatus that provides easy and comfortable holding and an ergonomic grip by the entire operator's hand, and prevents from each of the operator's fingers, palm or wrist from becoming tired.

It is another object of the present invention to provide an injection apparatus that marks each patient been injected.

It is yet another object of the present invention to provide an injection apparatus that provides and transmits data regarding the injection process, e.g., number of proper injections, number of faulty injections, amount of injected medicament, rate of injections, intermissions, caregiver person's identifying code, etc.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided an injection apparatus for injecting a medicament into a patient, the injection apparatus comprises:

a body comprising a stationary head and a movable head that is movable with respect to the stationary head, and

a needle attached to a needle holder, the needle holder being held by the movable head and by the stationary head, wherein;

urging the movable head rearwardly moves a front edge of the needle forwardly with respect to a front face of the movable head.

Typically, the movable head is axially movable with respect to the stationary head.

Preferably, the movable head comprises a movable slot,

the stationary head comprises a stationary slot, and

the movable slot is inclined at a crossing angle with respect to the stationary slot, as seen in a side view of the injection apparatus.

Practically, the crossing angle is in the range of 70° to 110°.

Preferably, the movable slot is straight.

If desired, the stationary slot is concave with respect to an imaginary center of curvature of the stationary slot that is located forwardly to the stationary slot.

Advantageously, the needle holder comprises an elongated leading pin, the leading pin passes through the stationary slot and through the movable slot, and wherein:

rearward movement of the movable head with respect to the stationary head urges a forward movement of the leading pin with respect to the movable slot and a rearward movement of the leading pin with respect to the stationary slot.

Practically, the injection apparatus comprises a pair of stationary slots, a pair of movable slots, and a pair of leading pins, and wherein:

the stationary slots, the movable slots and the leading pins are symmetrical with respect to a median plane of the injection apparatus.

Typically, the leading pin has a leading pin length that is larger than a leading pin width, and wherein:

the leading pin length is similar to a stationary slot width and slightly smaller therefrom, and, the leading pin width is similar to a movable slot width and slightly smaller therefrom.

Further typically, the injection apparatus comprises a handle for being held by an operator.

Advantageously, the movement of the needle from a retracted position, in an unpressed position of the movable head, to a fully extended position, in a fully pressed position of the movable head, is along a straight line and at a

predetermined slant angle with respect to a longitudinal axis of the injection apparatus.

Typically, the slant angle is in the range of 0° to 70°.

Advantageously, the medicament is injected automatically when the needle has reached a predetermined fully extended position.

Still further advantageously, the injection apparatus comprises a dosing chamber, and

a piston for pushing the medicament out of the dosing chamber, and wherein

the medicament is loaded automatically into the dosing chamber right after the piston has reached a piston forwardmost position.

Practically, the injection apparatus comprises a control panel for administrating various functions of an injection process, and

the control panel transmits a real-time information to another device.

Advantageously, the injection apparatus comprises control means for setting and verifying different volumes of a dose to be injected. Typically, the control means are formed from an encoder.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention and to show how the same may be carried out in practice, reference will now be made to the accompanying drawings, in which:

Fig. 1 is a front perspective view of an injection apparatus according to the present invention;

Fig. 2 is a rear perspective view of the injection apparatus of Fig. 1;

Fig. 3 is a side perspective view of the injection apparatus of Fig. 1 with the left body portion removed;

Fig. 4 is a side cross-sectional view of the injection apparatus of Fig. 1 with the piston in its rearward position and the movable head in an unpressed position;

Fig. 5 is a side cross-sectional view of the injection apparatus of Fig. 1 with the piston in its forward position and the movable head in a fully pressed position;

Fig. 6 is a side cross-sectional view of the head assembly with the movable head in an unpressed position;

Fig. 7 is a side cross-sectional view of the head assembly with the movable head in an intermediate pressed position;

Fig. 8 is a side cross-sectional view of the head assembly with the movable head in a fully pressed position;

Fig. 9 is a front perspective view of a stamping embodiment of the stationary head and the movable head with the movable head in an unpressed position;

Fig. 10 is a front perspective view of the stationary head of Fig. 9 with the movable head removed; and

Fig. 11 is a front perspective view of the stationary head and the movable head of Fig. 9 with the movable head in a fully pressed position.

DESCRIPTION OF PREFERRED EMBODIMENTS

Attention is first drawn to Figs. 1 to 5 that show an injection apparatus **10** according to the present invention. For a matter of convenience, the injection apparatus will hereinafter be called the "apparatus" **10**.

The apparatus **10** is gun-shaped and comprises a body **12** and a holding portion **14** transversely directed thereto. For the ease of assembly and maintenance, at some cases the body **12** is formed from two separate portions that are connected to each other, namely, a right body portion **16** and a left body portion **18**. Similarly, the holding portion **14** is formed from two separate portions that are connected to each other, namely, a right holding portion **20** and a left holding portion **22**. At some embodiments, for example, as shown in Fig. 3, the right body portion **16** and the right holding portion **20** are formed as a unitary piece. Similarly, the left body portion **18** and the left holding portion **22** are formed as a unitary piece.

The holding portion **14** comprises a handle **24** having a gripping portion **26** in a forward portion thereof. A safety catch **28** is located in a rear portion of the handle **24**. The safety catch **28** prevents accidental injection by the apparatus **10** when it is not properly held by the operator. A hand protector or guard **30** is positioned forwardly to the handle **24**. The guard has several functions: (1) protecting the operator's fingers from being hurt, (2) enabling free motion and operation of the operator's fingers without being disturbed, and, (3) serving as a hanger to the injection apparatus **10** when the injection apparatus is not being used.

A medicament conveying pipe **32** for conveying the medicament to be injected enters the handle **24** from a lower side of the handle. The medicament conveying pipe **32** is typically connected to a large bulk medicament container (not shown). The large bulk container is carried by the operator, or, it lays in a location adjacent the operator, so that it could be efficiently being used during the injection process.

It should be noted that directional terms appearing throughout the specification and claims, e.g. "forward", "rear", "upper", "lower" etc., are used as terms of convenience to distinguish the location of various surfaces relative to each other. These terms are defined with reference to the figures, however, they are used for illustrative purposes only, and are not intended to limit the scope of the appended claims.

As can be clearly seen in Fig. 2, the apparatus **10** is provided with a control panel **34** in a rear portion of the body **12**. The control panel **34** comprises operating switches **36** (that, if desired, may be of a "push button" type), for switching between the various functions, and, a screen **38** (or a display) for presenting data and the set functions. The control panel **34** may set and display, but not limited to, the following functions:

1- Number of proper injections

2- Number of faulty injections

3- Amount of accumulated injected medicament

4- Amount of medicament per injection (dosage pre-set adjustment)

5- Rate of injections
6- Intermissions
7- Time of injections (time when each injection took place)
8- Caregiver person (operator) identifying code
9- Date
10-Time
11-Type of medicament
12-Code of farm
13-Code of building within farm
14-Code of poultry enclosure within farm, or of fish pond
15-Code/type of animal
16-Battery status
17-Wireless signal
18-Alert for default
19-General remarks
20-Reports generating

The control panel **34** may provide an alarm when faulty conditions occur. For example, in a case when an injection process is interrupted from any reason (e.g., blocked needle, broken piping, end of medicament, faulty motor, stuck piston, lack of signal to the clutch, faulty operation switch, faulty safety catch, etc.), an alarm is turned-on. The alarm may be a visual signal (such as light, blinking light, or the like), an audio signal (such as a buzzer, a siren, or the like), or, a combination of a visual signal and an audio signal.

During the injecting process, the control panel **34** of each of the injection apparatuses **10** (when there is a multitude of apparatuses involved) transmits the relevant information through Bluetooth, Wi-Fi, wire or other means, to a host computer, Smartphone, or the like. Hence, real-time information regarding the injection process can be continuously observed and monitored at a remote location, thus enabling immediate intervening of authorized personnel whenever necessary.

The medicament is conveyed, through the medicament conveying pipe **32** into a dosing chamber **40** of a cylinder **42**. The medicament conveying pipe **32** is connected to the dosing chamber **40** through an inlet non-return valve **44**. The inlet non-return valve **44** enables medicament flow into the dosing chamber **40** during a "refilling" or "medicament loading" stage, and, prevents return flow of the medicament into the medicament conveying pipe **32** during an "injection" stage. The dosing chamber **40** is limited in a rear portion thereof with a piston head **46** of a piston **48**.

The piston head **46** comprises a sealing ring **50** for sealing between the piston head **46** and the cylinder **42**. A piston rod **52** extends rearwardly from the piston head **46** and protrudes through a cylinder rear cap **54** that encloses the cylinder **42** at its rear portion. A coil spring **56** is located between the piston head **46** and the cylinder rear cap **54**. The coil spring **56** urges the piston head **46** forwardly.

A rear portion of the piston rod **52** comprises a rack **58** that corresponds with a pinion **60** turning thereon. The rack **58** is designed such that in a rearwardmost position of the piston head **46** a rack rear end **62** does not protrude rearwardly from the control panel **34**, and, in a forwardmost position of the piston head **46**, the rack **58** is still in engagement with the pinion **60**.

The pinion **60** is engaged through a clutch assembly **64** to a driving shaft **66**. The driving shaft **66** is engaged to an electrical motor **68** through a gear assembly **70**. Typically, the gear assembly **70** is a reducing gear, to reduce the revolutions of the electrical motor **68** to the required revolutions at the pinion **60**.

According to a preferred embodiment, the electrical motor **68** is a 12V DC motor. The voltage to the electrical motor **68** is supplied from a battery (not shown) that is carried by the operator, and, typically, hanged on the operator's belt. Preferably, the battery is a rechargeable battery.

A supply cable **72** provides power from the battery to the electrical motor **68** and the control panel **34**. For a matter of convenience, the supply

cable **72** is connected to the medicament conveying pipe **32** at several connection points (not shown) in order to increase safety when using the injection device **10** and preventing the supply cable **72** and the medicament conveying pipe **32** from being accidentally caught by other objects. According to a preferred embodiment, the supply cable **72** and the medicament conveying pipe **32** are bundled together, or, laid together within a single conveying shield **76**, thus further increasing the safety of operation of the injection device **10** and ease of its use.

An encoder **78** is assembled on the driving shaft **66**. The encoder **78** provides the control panel **34** information regarding the exact actual turn of the electrical motor **68**, thereby enabling the operation of the various functions on time, as will be later described.

Attention is now drawn to Figs. 6-8. An apparatus front end **80** comprises a stationary head **82** and a movable head **84** that is axially movable with respect to the stationary head **82** along a longitudinal axis **A** of the injection apparatus **10**. Preferably, the longitudinal axis **A** overlaps a longitudinal axis of the cylinder **42** and the piston **48**. According to a specific embodiment of the present invention, the stationary head **82** and the movable head **84** are generally cylindrical.

A needle **86**, having a needle diameter **D1** and a needle axis **B**, is fixedly held by a needle holder **88** that is positioned within the stationary head **82** and the movable head **84**. The needle **86** is hollow and has a needle opening **90** that is directed oblique with respect to the needle axis **B**, opens substantially in a forward direction of the injection apparatus **10**, and ending with a sharp front edge **92**.

The needle axis **B** is slanted at an acute slant angle α with respect to the longitudinal axis **A** as seen in a side view of the injection apparatus **10**. Typically, the slant angle α is in the range of 0° to 70°. According to a specific embodiment of the present invention, the slant angle α is preferably 45°. In an unpressed position of the movable head **84**, the front edge **92** of the needle **86**

rests within a needle exit opening **94**, having an exit opening diameter **D2**, and positioned at a point that is rearward to a front face **96** of the movable head **84**.

The needle exit opening **94** is directed, like the needle axis **B**, at the same slant angle α with respect to the longitudinal axis **A** as seen in a side view of the injection apparatus **10**. The exit opening diameter **D2** is larger than the needle diameter **D1** such that the needle **86** always freely passes through the needle exit opening **94** but also may be supported by it.

A median plane **P** of the injection apparatus **10** is defined between the longitudinal axis **A** and the needle axis **B** and passes therethrough. A dose conveying pipe **98** connects between a front end of the dosing chamber **40** and a rear end of the needle holder **88**. The dose conveying pipe **98** is seen in Figs. 4 and 5 only in the vicinity of the outlet non-return valve **128** since the rest of the dose conveying pipe **98** is not positioned in the plane shown in these figures, i.e., the median plane **P**.

The stationary head **82** is provided with a pair of stationary slots **100** that are symmetrical with respect to the median plane **P**. Each of the stationary slots **100** has a stationary slot width **W1** that is constant from a stationary slot rear end **102** to a stationary slot forward end **104**. According to a preferred embodiment of the present invention, the stationary slot **100** is concave with respect to an imaginary center of curvature of the stationary slot (not shown) that is located forwardly to the stationary slot **100**.

The movable head **84** is provided with a pair of movable slots **106** that are straight, and, symmetrical with respect to the median plane **P**. Each of the movable slots **106** has a movable slot width **W2** that is constant from a movable slot rear end **108** to a movable slot forward end **110**.

The movable slot **106** is transversely directed to the stationary slot **100** as seen in a side view of the injection apparatus **10**, i.e., when drawing an imaginary first line **L1** between a center of the stationary slot rear end **102** and a center of the stationary slot forward end **104**, and, an imaginary second line **L2** between a center of the movable slot rear end **108** and a center of the movable slot forward end **110**, as seen in a side view of the injection apparatus

10, the first line **L1** is generally perpendicular to the second line **L2**, or, forming a crossing angle ß therebetween that is typically in the range of 70°-110°, that, as shown in Fig. 6, is measured from the second line **L2** to the concave side of the first line **L1**, when the movable slot forward end **110** and the stationary slot rear end **102** are the vertexes of the measured angle.

The needle holder **88** is provided with a pair of leading pins **112** that are perpendicular to the median plane **P** and symmetrical with respect thereto. The leading pins **112** are rigidly attached to the needle holder **88** and may form an integral portion thereof. Each of the leading pins **112** has a front arcuate end **114** and a rear arcuate end **116** that are connected by two parallel long sides **118**. The maximal distance between the front arcuate end **114** and the rear arcuate end **116** defines a leading pin length **L**. The distance between the long sides **118** defines a leading pin width **W3**.

Since the leading pin **112** is provided with long sides **118** further to the front arcuate end **114** and the rear arcuate end **116**, the leading pin length **L** is larger than the leading pin width **W3**, thus, the leading pin **112** may be described as an "elongated" or "oval" pin. Therefore, since the leading pin **112** is elongated and not round (in a cross-sectional view thereof parallel to the median plane **P**), it cannot rotate with respect to the movable slot **106**. In this way, it is ensured that the leading pin **112**, and, hence, the needle **86**, will always be at the same angle with respect to the movable head **84** and with respect to the stationary head **82** and the entire injection apparatus **10**.

The leading pin width **W3** is similar to the movable slot width **W2** and slightly smaller therefrom. The leading pin length **L** is similar to the stationary slot width **W1** and slightly smaller therefrom. The leading pin **112**, at each side of the median plane **P**, passes through the adjacent stationary slot **100** and through the movable slot **106**.

Fig. 6 shows an unpressed position of the movable head **84**. In this position, the front edge **92** of the needle **86** rests within the needle exit opening **94**, as mentioned above, and does not protrude forwardly from the front face **96** of the movable head **84**. When the movable head **84** starts to be pressed

rearwardly, as shown in Fig. 7, it exerts a rearwardly directed force on the leading pin **112**. Since the leading pin **112** cannot rotate within the movable slot **106**, it is urged to move within the movable slot **106** a forward movement with respect to the movable slot **106**.

Thus, as shown in Fig. 7, the leading pin **112** has moved forwardly with respect to the movable slot rear end **108**. Now, since the leading pin **112** cannot move forwardly due to the fact that it is limited within the stationary slot **100**, it is urged to move within the stationary slot **100**, at the same orientation, and away from the stationary slot forward end **104**. At this position, the front edge **92** of the needle **86** protrudes forwardly from the front face **96** of the movable head **84**. Thus, further pressing rearwardly the movable head **84** further protrudes the front edge **92** of the needle **86** with respect to the front face **96** of the movable head **84**, and, simultaneously, the leading pin **112** advances forwardly with respect to the movable slot **106**, towards the movable slot forward end **110**, and rearwardly with respect to the stationary slot **100**, towards the stationary slot rear end **102**.

Fig. 8 shows the position of the needle **86** and the needle holder **88** when the movable head **84** is in a fully pressed position. In this position, the needle **86** extends forwardly from the front face **96** of the movable head **84** a maximal protruding depth **D**. In this position, the injection apparatus **10** is ready to deliver the medicament into the patient. According to the described above, during the entire stroke, i.e., the forward protruding of the needle **86** with respect to the front face **96** of the movable head **84**, the needle **86** moves in a straight line, in the same direction, at the same slant angle α with respect to the longitudinal axis **A**.

The injection apparatus **10** can be used for injecting a medicament into any patient. However, the injection apparatus **10** is specifically designed for being used on animals, and is particularly useful for injecting a large number of individuals such as poultry or fish.

When passing from one poultry enclosure to another, or, when switching between fish ponds, it is a general practice to sterilize the injection apparatus **10**. In order to assure a maximal performance of the injection apparatus **10**, it is a common practice to replace several components after a given number of injections. According to a specific embodiment of the present invention, a planned maintenance replacement is accomplished after every 2,000 injections being made. During said replacement, the following parts are replaced: (1) stationary head, (2) movable head, (3) needle holder, (4) needle.

Typically, after 100,000 injections, a more thorough periodical maintenance is being done. During this periodical maintenance worn parts are being replaced. The parts that are being replaced may include, but not limited to, the following: (1) cylinder, (2) piston, (3) sealing ring, (4) coil spring, (5) cylinder rear cap, (6) inlet non-return valve, (7) outlet non-return valve, (8) rack, (9) pinion, (10) clutch assembly, (11) driving shaft, (12) encoder, (13) electric motor, (14) gear assembly.

The present embodiment embodies a slant angle α of 45° between the needle axis **B** and the longitudinal axis **A**. However, according to other embodiments, other slant angles are used. As mentioned above, the slant angles typically vary in a range from 0° to 70°. However, most typically, the slant angles vary in a range from 30° to 60°. In a case where it is required to use a slant angle different than 45°, an entire head assembly **120** is to be replaced. The head assembly **120** includes the stationary head **82**, the movable head **84**, the needle holder **88**, and the needle **86**.

In order to enable proper functioning, the injection apparatus **10** is provided with the following:

1- A "needle out" sensor **S1**, which senses when the needle **86** had reached its outermost position.

2- A "needle in" sensor **S2**, which senses when the needle **86** had reached its innermost position.

3- A "piston forward" sensor **S3**, which senses when the piston **48** had reached its forwardmost position.

4- The encoder **78**, which senses the amount of rotation of the electrical motor **68**, and, due to the connection to the pinion **60** which rotates on the rack **58**, the position of the piston head **46** may be set. This function is useful when it is desired to set different values for the volumes of the medicament to be injected.

Figs. 9-11 show an enlargement of a stamping mechanism **122** of the present invention. The stamping mechanism **122** comprises two rubber or spongy stamps **124** that are symmetrically located at both sides of the median plane **P**. The stamps **124** have a rectangular shape. The front face **96** of the movable head **84** is provided with two stamping slots **126** that correspond to the stamps **124** and are slightly larger therefrom.

According to some embodiments, the stamps **124** are fixed in place thus constantly facing forwardly. In this case, the stamps **124** receive ink or paint from an ink or paint reservoir through a supply mechanism (not shown). According to other embodiment, the stamps **124** are located on a turning mechanism (not shown). In this case, when the stamps face rearwardly, they abut against an ink pad (not shown), and spread with ink. Now, when the stamps face forwardly, they are ready for stamping the patient.

As shown in Fig. 9, in an unpressed position of the movable head **84**, the stamps **124** are rearward to the stamping slots **126** thus not enabling any stamping to be carried out. As shown in Fig. 11, in a fully pressed position of the movable head **84**, when the needle **86** has reached its maximal protruding depth **D**, just in this position the stamps **124** protrude forwardly from the front face **96** of the movable head **84** and stamp against the body of the patient.

Thus, the stamping mechanism **122** enables stamping each patient that has been injected for easy distinguishing thereof comparing to the un-injected patients. However, the stamping mechanism **122** provides "safety stamping", i.e., assuring that only the patients that were injected will be stamped, and any faulty or unintentionally stamping is successfully avoided.

The method of use of the injection apparatus **10** will now be described. The explanation described herein relates to injection to poultry, however, the method is applicable to other animals as well. In a first step, all the required information is set into the control panel **34** by means of the operating switches **36**. Then, the operator verifies that the injection apparatus **10** is supplied with the electrical power and the medicament.

At this stage, the injection process may be easily started. The operator holds the injection apparatus **10** with a single hand at the handle **24**, and, supports a bird with its other hand. Now, the only operation that the operator has to do is to press the front face **96** of the movable head **84** against the required injection area of the bird. The operator does not have to operate or stress any of his fingers, and, since the handle **24** is grabbed by the operator's hand, the safety catch **28** is pressed thus enabling the functioning of the injection apparatus **10**. Thus, as can be appreciated by a man skilled in the art, the injection apparatus **10** is very easy to handle and operate.

When the front face **96** of the movable head **84** is pressed, the needle **86** gradually protrudes outwardly and forwardly with respect to the front face **96**, as explained above with respect to Figs. 6-8, until it reaches its maximal protruding depth **D**. At this position, the front edge **92** of the needle **86** has reached the required depth under the bird skin, and, the needle opening **90** is directed forwardly into the bird.

At this position, the "needle out" sensor **S1** senses that the needle **86** has reached its maximal protruding depth **D** thus signaling the control panel **34** that an injection stroke may begin. Now, the clutch assembly **64** releases the pinion **60** to rotate freely so that the rack **58**, and hence the piston **48**, is unlocked.

Now, the piston head **46** is urged forwardly by the coil spring **56** that has been pre-loaded after the previous injection. The piston head **46** compresses the medicament found at the dosing chamber **40** thus pushing it, through an outlet non-return valve **128** and through the dose conveying pipe **98** into the needle **86**, and, through the needle opening **90** into the patient. The piston forward sensor **S3** signals the control panel **34** that the entire dose had been

delivered into the bird, so that another "loading" or "refilling" stroke may begin.

According to some embodiments, after a successful delivery of medicament, the control panel **34** signals a "successful injection". This may take place as a visual signal, e.g., by a blink of a green light, or, as an audio signal, e.g., by a short "beep" sound, or, by a combination of a visual signal and an audio signal.

When the operator releases the pressure of the front face **96** of the movable head **84** against the bird, taking into account that the entire injection process lasts a fraction of a second, the operator puts aside the injected bird and grabs another bird to be injected. When the pressure against the front face **96** of the movable head **84** has ceased, a head spring **130** urges the movable head **84** forwardly with respect to the stationary head **82** until the movable head **84** returns to its initial unpressed position.

During the forward movement of the movable head **84** with respect to the stationary head **82**, the needle "retracts" into the movable head **84** until the "needle in" sensor **S2** senses that the needle **86** is completely back into the movable head **84** and signals to the control panel **34** that another "injecting" stroke may begin. The purpose of the "needle in" sensor **S2** is to assure that the needle **86** has been fully retracted into the movable head **84** before injecting the next bird so that the front edge **92** of the needle **86** will not injure the outer skin of the bird prior to inserting the needle **86** into and under the bird's skin.

Hence, when the piston forward sensor **S3** signals the control panel **34** that the entire dose had been delivered into the bird, a new "loading" stroke commences. Thus, the electrical motor **68**, through the gear assembly **70**, rotates the pinion **60** which turns on the rack **58**. Since the driving shaft **66** is fixedly placed in its position, the rack **58** forces to move backwards, and, as being a part of the piston rod **52**, the entire piston **48** moves backwards and the piston head **46** presses rearwardly the coil spring **56** which remains loaded for the next injecting stroke. The rearward movement of the piston head **46** provides suction of medicament into the dosing chamber **40** since the outlet

non-return valve **128** is closed during the suction stage. Thus, a new dose of medicament is placed into the dosing chamber **40** and ready for being injected. The encoder **78** verifies that the turn of the electrical motor **68** is in conformity with the rearward travel of the piston rod **52** that corresponds to the set volume of the medicament to be injected.

Simultaneously to the injecting process, the stamps **124** protrude outwardly and forwardly from the stamping slots **126**, as described above, and stamp the bird to show that it had been injected.

When the operator presses the front face **96** of the movable head **84** against another bird, the process described above is repeated.

Although the present invention has been described to a certain degree of particularity, it should be understood that various alterations and modifications could be made without departing from the spirit or scope of the invention as hereinafter claimed.

For example, the injection apparatus does not have to be provided with a medicament conveying pipe. Alternatively, the injection apparatus is provided with a built-in medicament reservoir for retaining therein the medicament. According to some embodiments, the medicament reservoir is located within the body and/or the holding portion, or, is located above the body or in front of the guard, or, it is a part of the guard. According to some embodiments, the medicament reservoir is refillable. According to other embodiments, the medicament reservoir is exchangeable, thus, when the bulk quantity of medicament within the medicament reservoir is finished, the medicament reservoir is replaced with another reservoir filled with medicament.

The electrical motor does not have to be a 12V DC motor, and, according to other embodiments, the electrical motor is a 24V DC motor, or, a DC motor rated for another voltage.

The electrical motor does not have to be fed from a battery, and, if desired, it may be fed from the mains through a transformer. Furthermore, the electrical motor may be a stepper motor or an AC motor.

The injection apparatus does not have to be provided with a gear assembly. According to other types of motors, the speed obtained by the motor is the same speed that corresponds to the speed of the driving shaft.

In other embodiments, the piston is moved through a worm gear, thus preventing the need of a gear assembly. In this case, the electrical motor is connected, through the driving shaft, to a worm of a worm gear. The worm is connected to a worm wheel having an axis of rotation that substantially overlaps with the longitudinal axis of the injection apparatus. An inner portion of the worm wheel rotates, through a clutch (which is typically magnetical or mechanical), a threaded portion of the piston rod. Thus, the electric motor effectively moves the piston rod through a "two-stage" reducing mechanism during the "loading" stroke, and, the piston rod is disengaged from the rotating mechanism so that it could freely move forwardly during the "injection" stroke by the forwardly urging force applied by the coil spring on the piston head.

The stationary head and the movable head do not have to be cylindrical and other shapes that enable their relative axial motion may be applied. For example, the stationary head and the movable head may have an oval or a square cross-section.

The stationary slot does not have to be curved and it may be straight.

The injection apparatus is not always provided with the stamping embodiment as described above and according to other embodiments the head assembly is not provided with a stamping mechanism.

The driving shaft may be perpendicular to the longitudinal axis, or, may be slanted with respect to a perpendicular line to the longitudinal axis, as seen in a side view of the injection apparatus.

The stamps do not have to be formed from rubber or sponge and other known stamps may be similarly applicable. The stamps do not have to be rectangular and any other shape may be used. Furthermore, the stamps do not have to be similar and each stamp may have a different shape.

The stamping mechanism do not have to include two stamps and any other number of stamps may be used, e.g., one, three, or more. The stamps are

typically of the same stamping color, however, if desired, different stamps may use different colors.

According to other embodiments, the injection apparatus is not held by an operator hand and is fixed to a fixed object, e.g., a table, a wall, or a frame. In this case, the safety catch is override, or, operated by a foot pedal. In order to operate the injection apparatus in this case, a bird is brought in front of the movable head until it presses it. In this mode, the operator may catch and move a bird by both of his hands. Furthermore, if desired, the operator may hold a bird in each of his hands thus speeding up the speed of injecting by injecting alternatively a bird by each hand.

CLAIMS:

1. An injection apparatus for injecting a medicament into a patient, the injection apparatus comprises:

a body comprising a stationary head and a movable head that is movable with respect to the stationary head, and

a needle attached to a needle holder, the needle holder being held by the movable head and by the stationary head, wherein;

urging the movable head rearwardly moves a front edge of the needle forwardly with respect to a front face of the movable head.

2. The injection apparatus according to claim 1, wherein:

the movable head is axially movable with respect to the stationary head.

3. The injection apparatus according to claim 1, wherein:

the movable head comprises a movable slot,

the stationary head comprises a stationary slot, and

the movable slot is inclined at a crossing angle with respect to the stationary slot, as seen in a side view of the injection apparatus.

4. The injection apparatus according to claim 3, wherein:

the crossing angle is in the range of 70° to 110°.

5. The injection apparatus according to claim 3, wherein:

the movable slot is straight.

6. The injection apparatus according to claim 3, wherein:

the stationary slot is concave with respect to an imaginary center of curvature of the stationary slot that is located forwardly to the stationary slot.

7. The injection apparatus according to claim 3, wherein:

the needle holder comprises an elongated leading pin, the leading pin passes through the stationary slot and through the movable slot, and wherein:

rearward movement of the movable head with respect to the stationary head urges a forward movement of the leading pin with respect to the movable slot and a rearward movement of the leading pin with respect to the stationary slot.

8. The injection apparatus according to claim 7, wherein:

the injection apparatus comprises a pair of stationary slots, a pair of movable slots, and a pair of leading pins, and wherein:

the stationary slots, the movable slots and the leading pins are symmetrical with respect to a median plane of the injection apparatus.

9. The injection apparatus according to claim 7, wherein:

the leading pin has a leading pin length that is larger than a leading pin width, and wherein:

the leading pin length is similar to a stationary slot width and slightly smaller therefrom, and, the leading pin width is similar to a movable slot width and slightly smaller therefrom.

10. The injection apparatus according to claim 1, wherein:

the injection apparatus comprises a handle for being held by an operator.

11. The injection apparatus according to claim 1, wherein:

the movement of the needle from a retracted position, in an unpressed position of the movable head, to a fully extended position, in a fully pressed position of the movable head, is along a straight line and at a predetermined slant angle with respect to a longitudinal axis of the injection apparatus.

12. The injection apparatus according to claim 11, wherein:

the slant angle is in the range of 0° to 70°.

13. The injection apparatus according to claim 1, wherein:

the medicament is injected automatically when the needle has reached a predetermined fully extended position.

14. The injection apparatus according to claim 1, wherein:

the injection apparatus comprises a dosing chamber, and

a piston for pushing the medicament out of the dosing chamber, and wherein

the medicament is loaded automatically into the dosing chamber right after the piston had reached a piston forwardmost position.

15. The injection apparatus according to claim 1, wherein:

the injection apparatus comprises a control panel for administrating and displaying various functions of an injection process, and

the control panel transmits a real-time information to another device.

16. The injection apparatus according to claim 1, wherein:

the injection apparatus comprises means for setting and verifying different volumes of a dose to be injected.

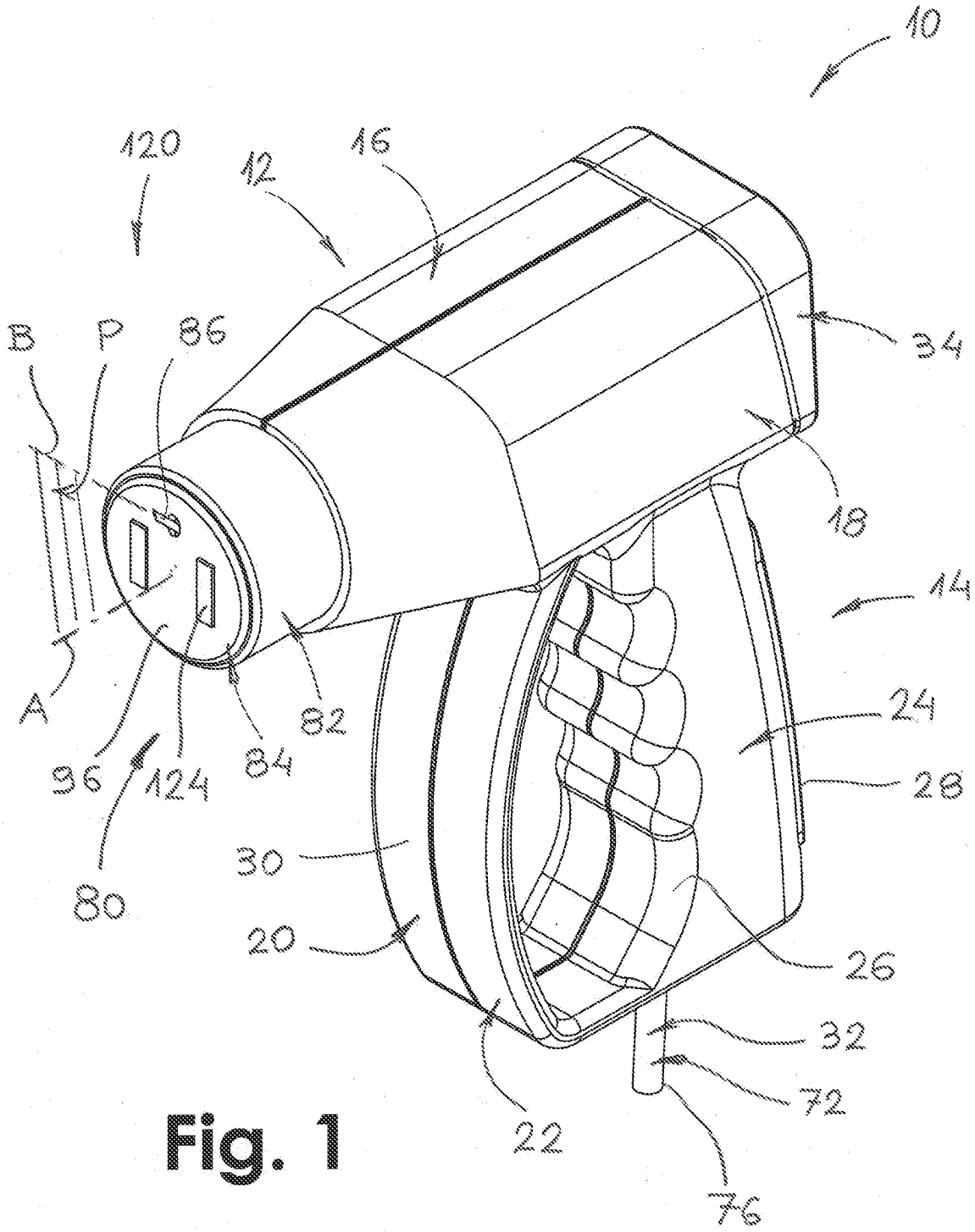

Fig. 1

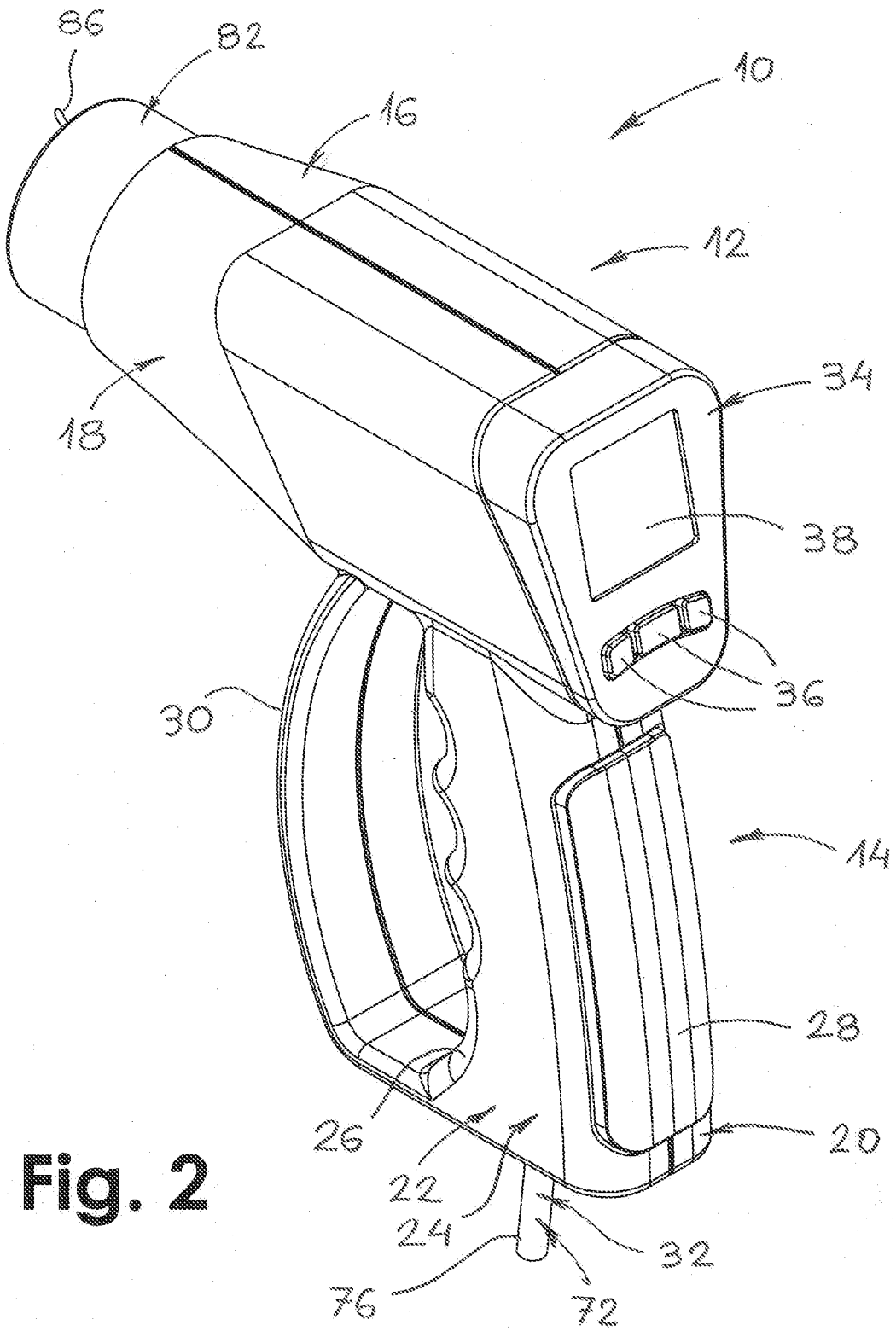

Fig. 2

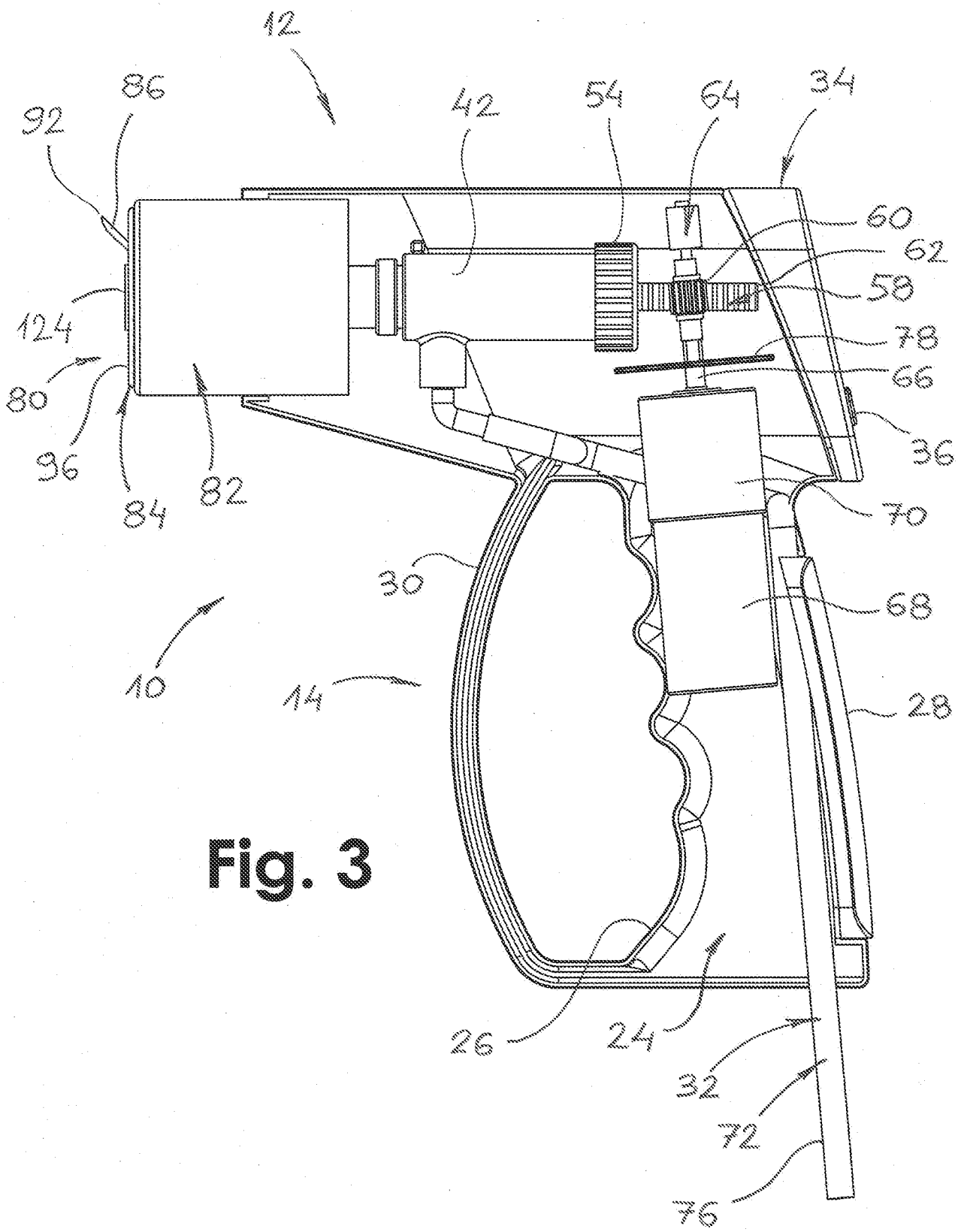
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Fig. 3

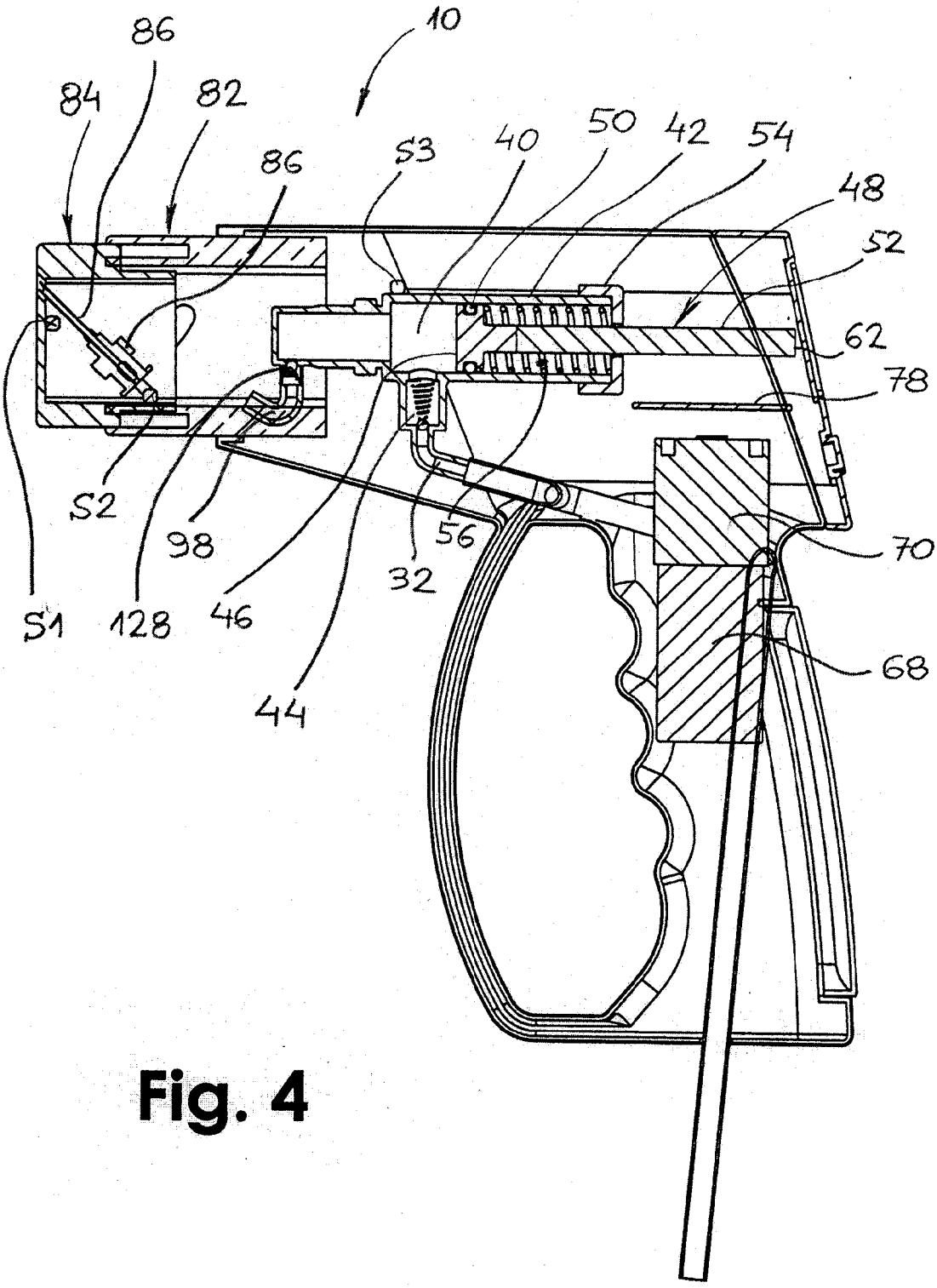

Fig. 4

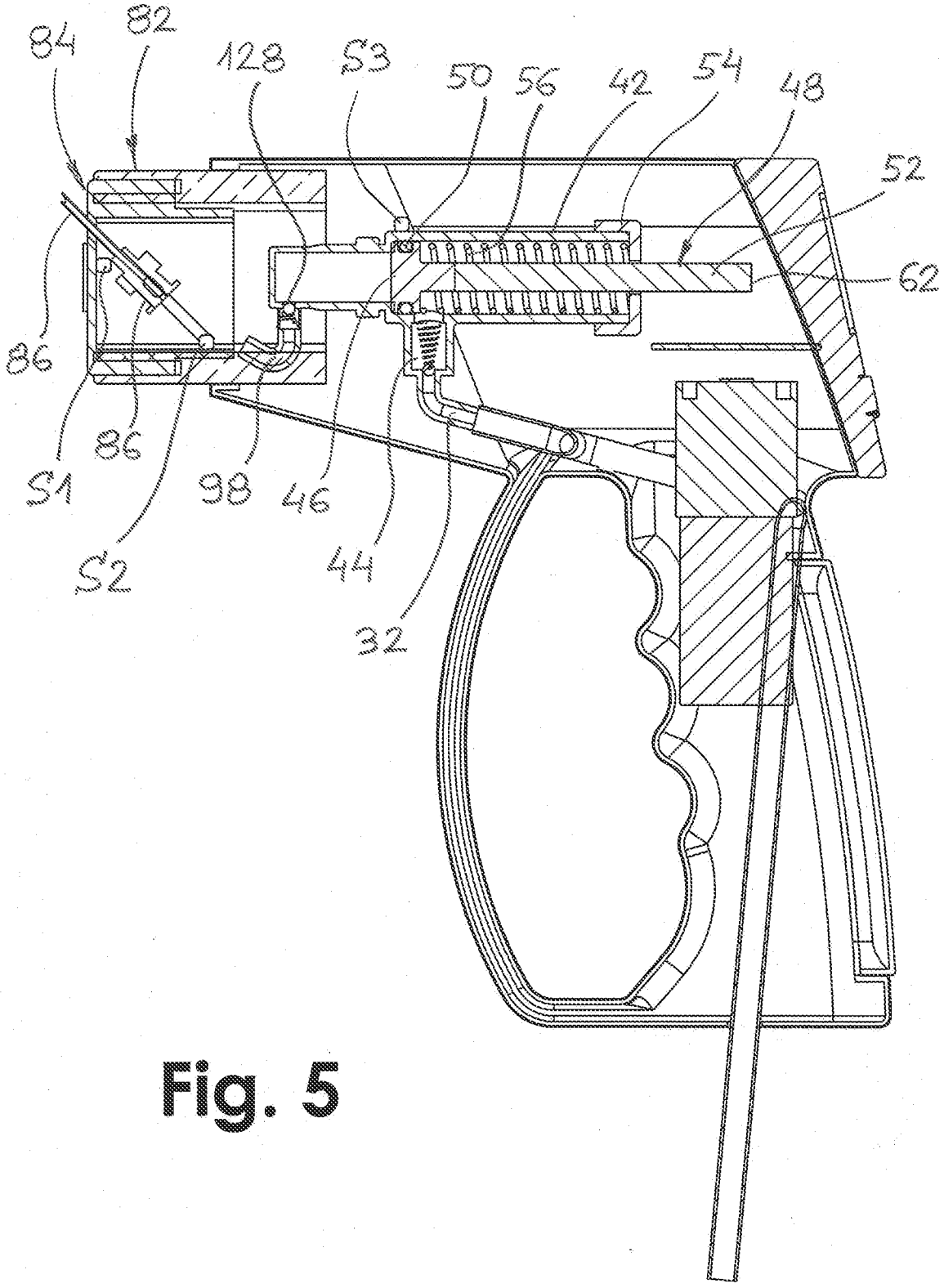

Fig. 5

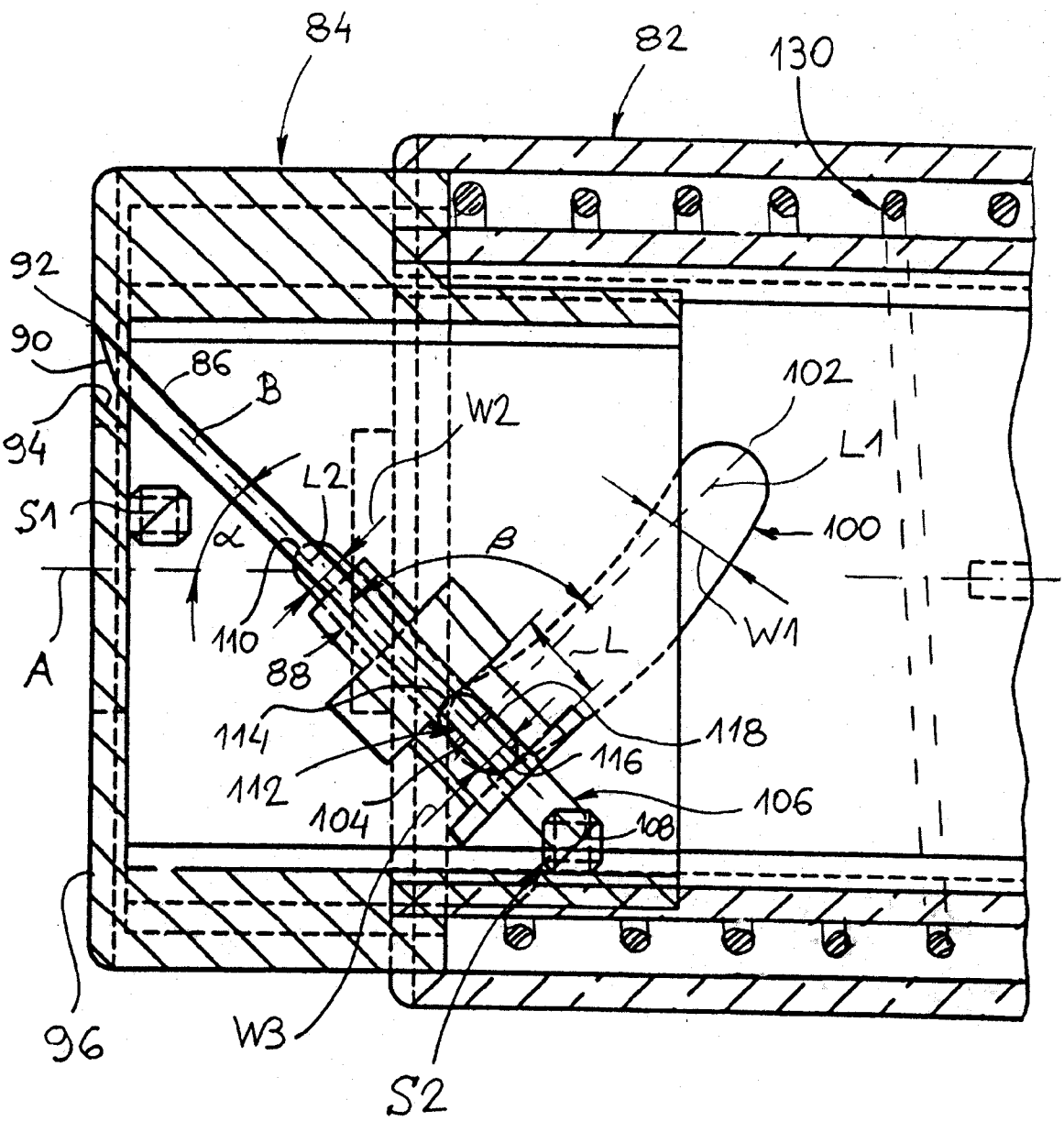
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Fig. 6

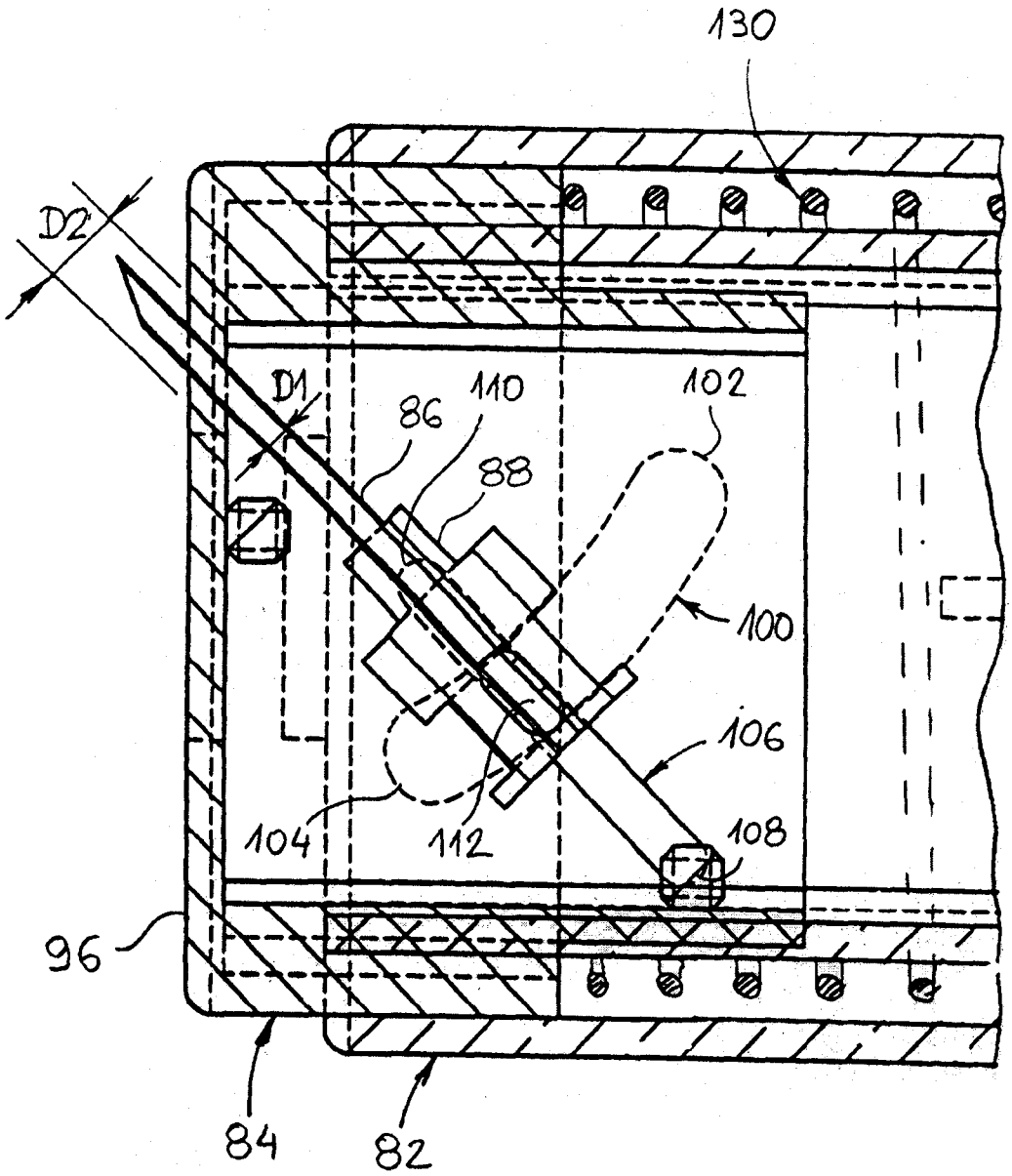

Fig. 7

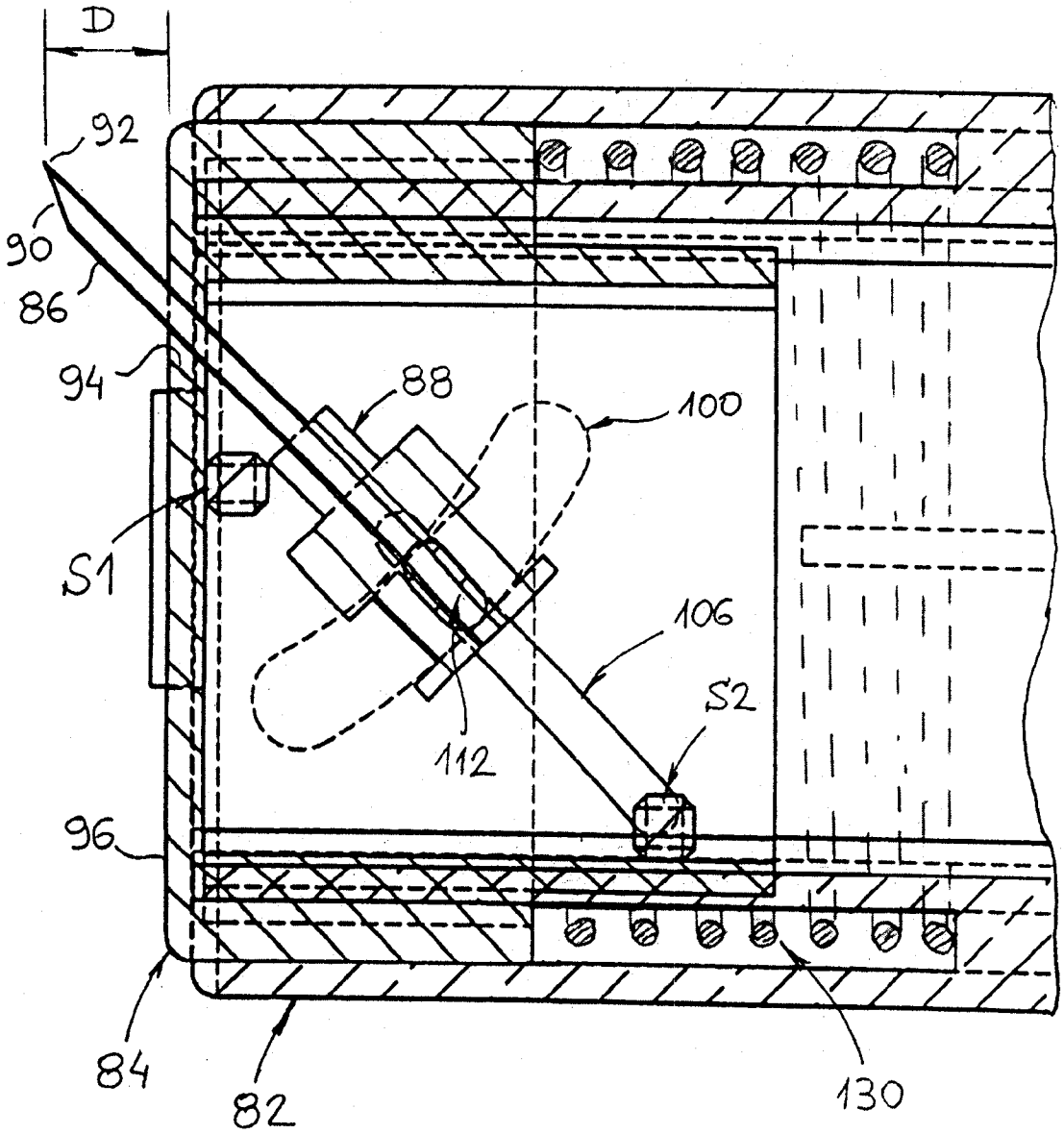

Fig. 8

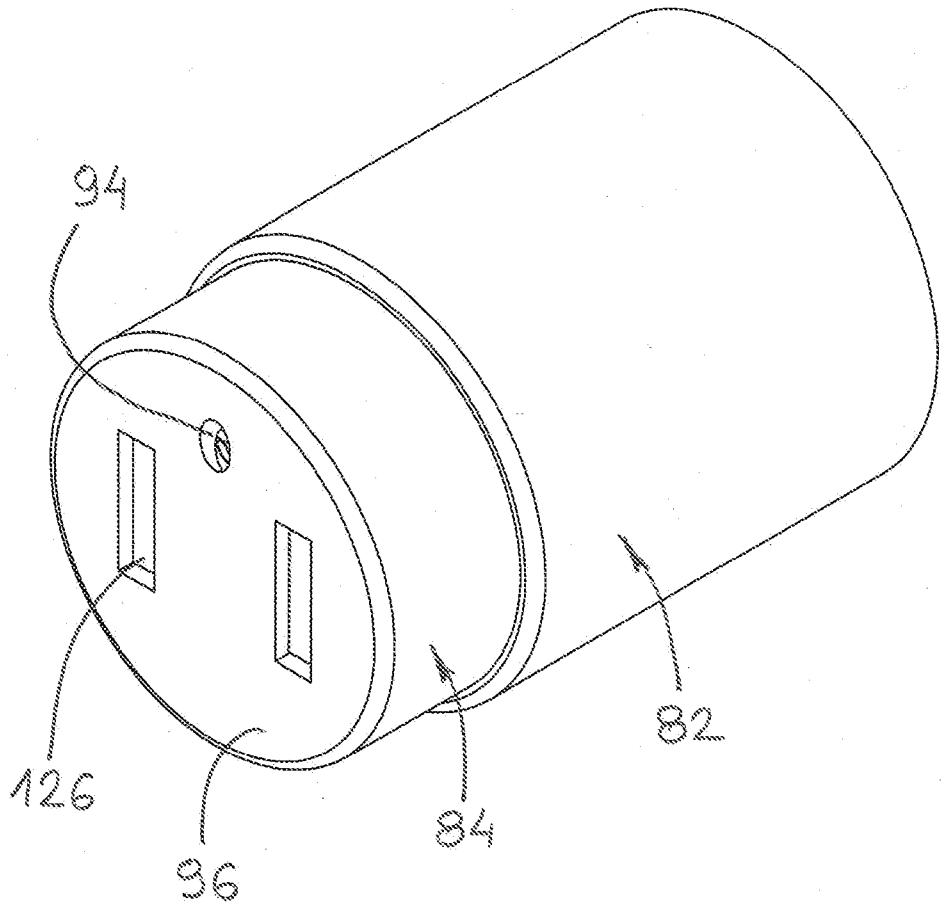

Fig. 9

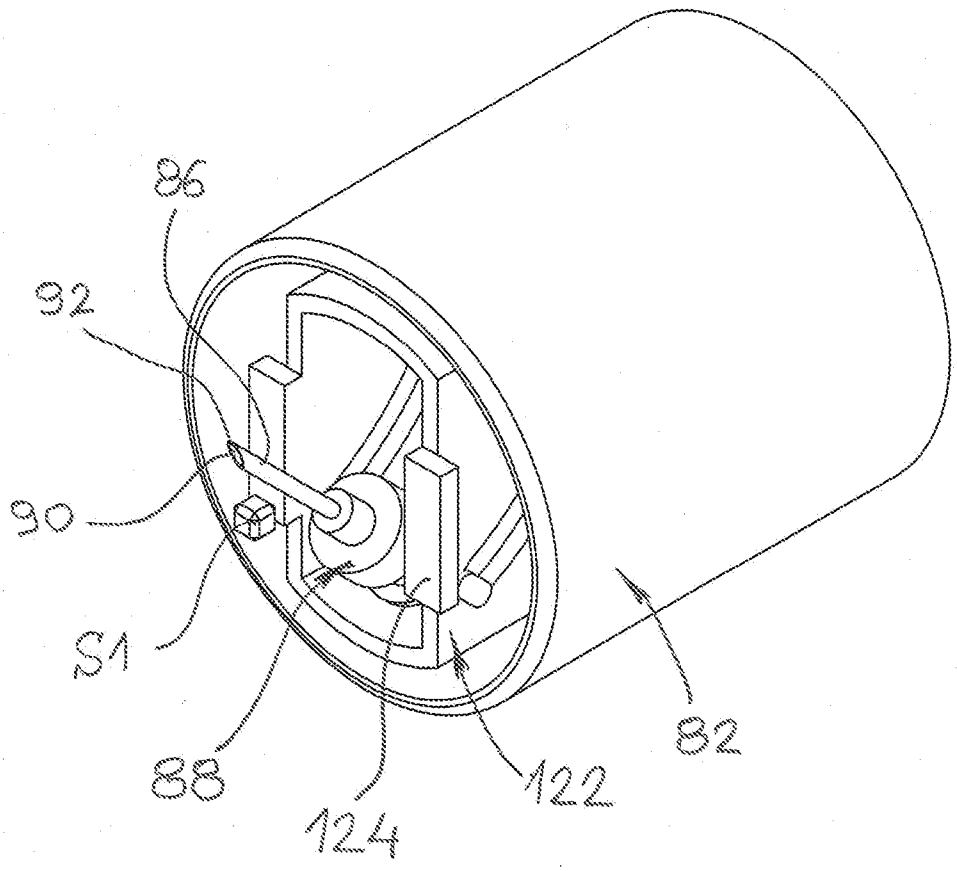

Fig. 10

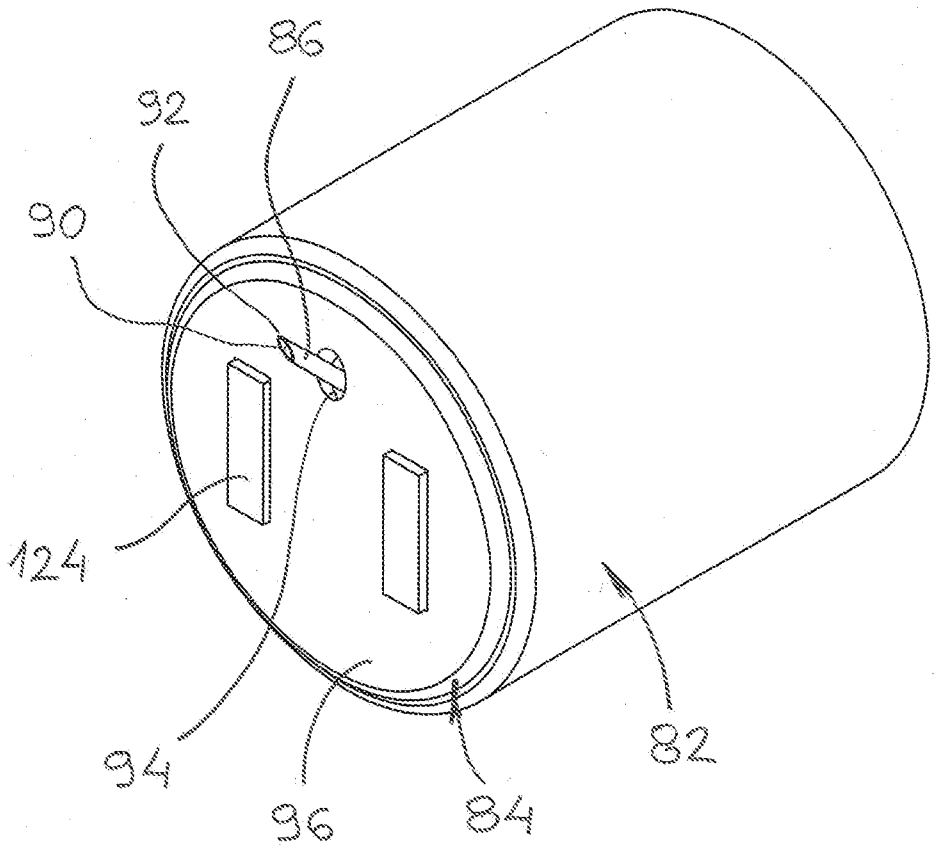

Fig. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2014/051133

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2015.01) A61D 7/00, A61D 1/02, A61M 5/20

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)
IPC (2015.01) A61D, A61M

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)
Databases consulted: THOMSON INNOVATION, FamPat database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/176029 A1 (LAMEPLAST S.P.A.) 27 Dec 2012 (2012/12/27) Abstract; page 2, lines 5-10; page 4, lines 30-31; page 14, lines 4-35, figures 2, 8-10	1,2,10,13-16
X Y	WO 2013/064475 A1 (SANOFI-AVENTIS DEUTSCHLAND GMBH) 10 May 2013 (2013/05/10) Abstract; page 9, lines 8-30; figures 2, 4	1,2 11,12
Y	US 2006/0135910 A1 (LUTHER ET AL.) 22 Jun 2006 (2006/06/22) Abstract; paragraph [0038]-[0040]; figures 5-7	11,12
A	US 4717383 A (N.J. PHILLIPHS PTY. LTD.) 05 Jan 1988 (1988/01/05) the whole document	1-16

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 May 2015	04 May 2015
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	Authorized officer SEGAL Liviu Telephone No. 972-2-5651782

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2014/051133

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/IL2014/051133

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