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(12) **Reissued Patent**
Zittel et al.

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(45) **Date of Reissued Patent:** **May 17, 2016**

(54) **PLURAL COMPONENT SPRAY GUN FOR FAST SETTING MATERIALS**

7/0408 (2013.01); B05B 7/1272 (2013.01);
B05B 15/025 (2013.01); B05B 7/0815
(2013.01)

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(58) **Field of Classification Search**
USPC 239/117, 413, 415, 433, 600;
222/145.1, 145.2, 145.4–145.8
See application file for complete search history.

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(21) Appl. No.: **13/446,222**

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(22) Filed: **Apr. 13, 2012**

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Related U.S. Patent Documents

(Continued)

Reissue of:

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Issued: **Apr. 13, 2010**
Appl. No.: **10/532,436**
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PCT No.: **PCT/US03/33422**
§ 371 (c)(1),
(2), (4) Date: **Aug. 9, 2006**
PCT Pub. No.: **WO2004/037429**
PCT Pub. Date: **May 6, 2004**

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(Continued)

U.S. Applications:

(60) Provisional application No. 60/420,085, filed on Oct.
22, 2002, provisional application No. 60/441,575,
filed on Jan. 21, 2003, provisional application No.
60/462,124, filed on Apr. 10, 2003.

Primary Examiner — Joseph Kaufman
(74) *Attorney, Agent, or Firm* — Kinney & Lange, P.A.

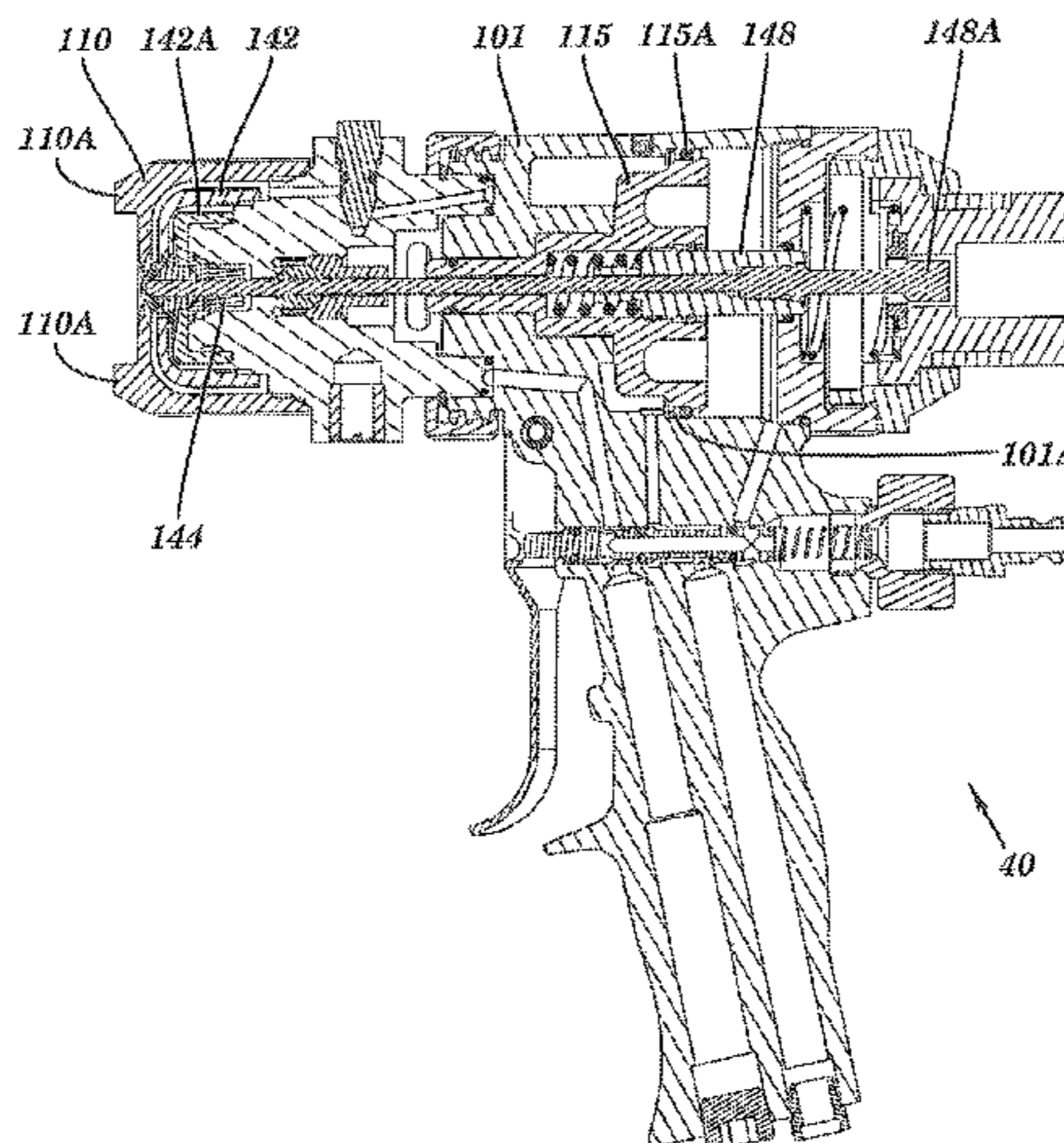
(51) **Int. Cl.**
B05B 15/02 (2006.01)
F23D 11/34 (2006.01)
(Continued)

(57) **ABSTRACT**

A plural component spray gun (1) is designed for spraying quick setting materials such as foams, polyurea and the like. Towards this end, the gun (1) is designed so as to be easily serviceable with a minimum of tools. For example, the side seal cartridges (18) and (20) may be installed and removed without tools by removing the retaining ring (9) and then extracting them from the fluid housing (11). Those cartridges (18) and (20) are easily disassembled and cleaned. Similarly, the fluid housing (11) may be removed from the handle/body (1) by unscrewing the lock ring (7) by hand.

(52) **U.S. Cl.**
CPC **B01F 5/0256** (2013.01); **B01F 13/002**
(2013.01); **B01F 13/0027** (2013.01); **B05B**

16 Claims, 13 Drawing Sheets



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(51)	Int. Cl. <i>F23D 14/50</i> (2006.01) <i>B01F 5/02</i> (2006.01) <i>B01F 13/00</i> (2006.01) <i>B05B 7/12</i> (2006.01) <i>B05B 7/04</i> (2006.01) <i>B05B 7/08</i> (2006.01)	4,925,104 A * 5/1990 Smith 239/71 5,090,814 A * 2/1992 Petcen 366/162.5 5,211,311 A 5/1993 Petcen 5,299,740 A * 4/1994 Bert 239/117 5,400,971 A * 3/1995 Maugans et al. 239/416.1 5,452,855 A * 9/1995 Keller 239/135 5,829,679 A * 11/1998 Strong 239/117 5,950,875 A * 9/1999 Lee et al. 222/145.5 6,264,113 B1 7/2001 Dingler 2004/0195401 A1 10/2004 Strong 2007/0034716 A1 2/2007 Zittel et al.
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 U.S. Appl. No. 60/420,085, Zittel et al., filed Oct. 22, 2002.
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 U.S. Appl. No. 60/462,124, Zittel et al., filed Apr. 10, 2003.

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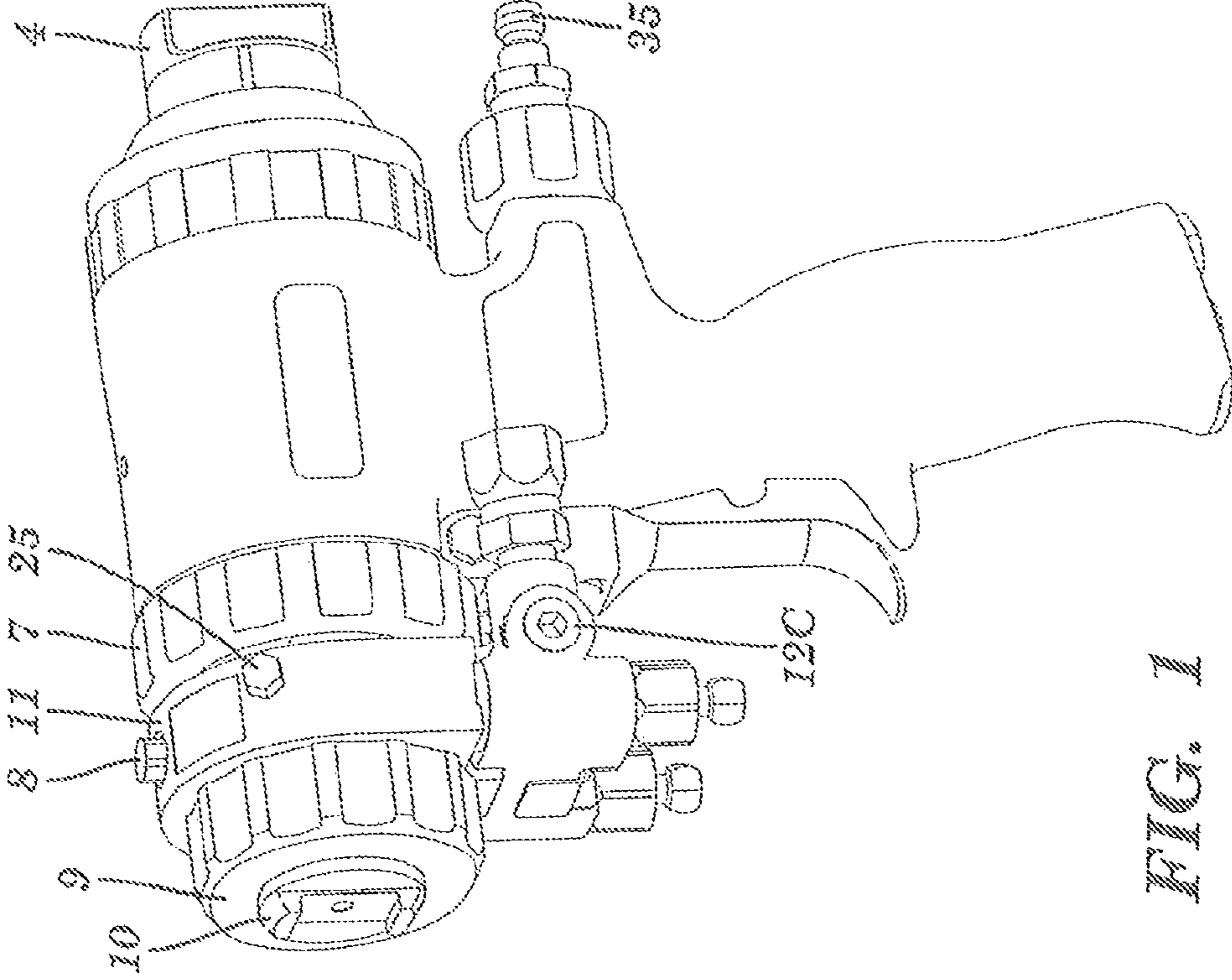


FIG. 1

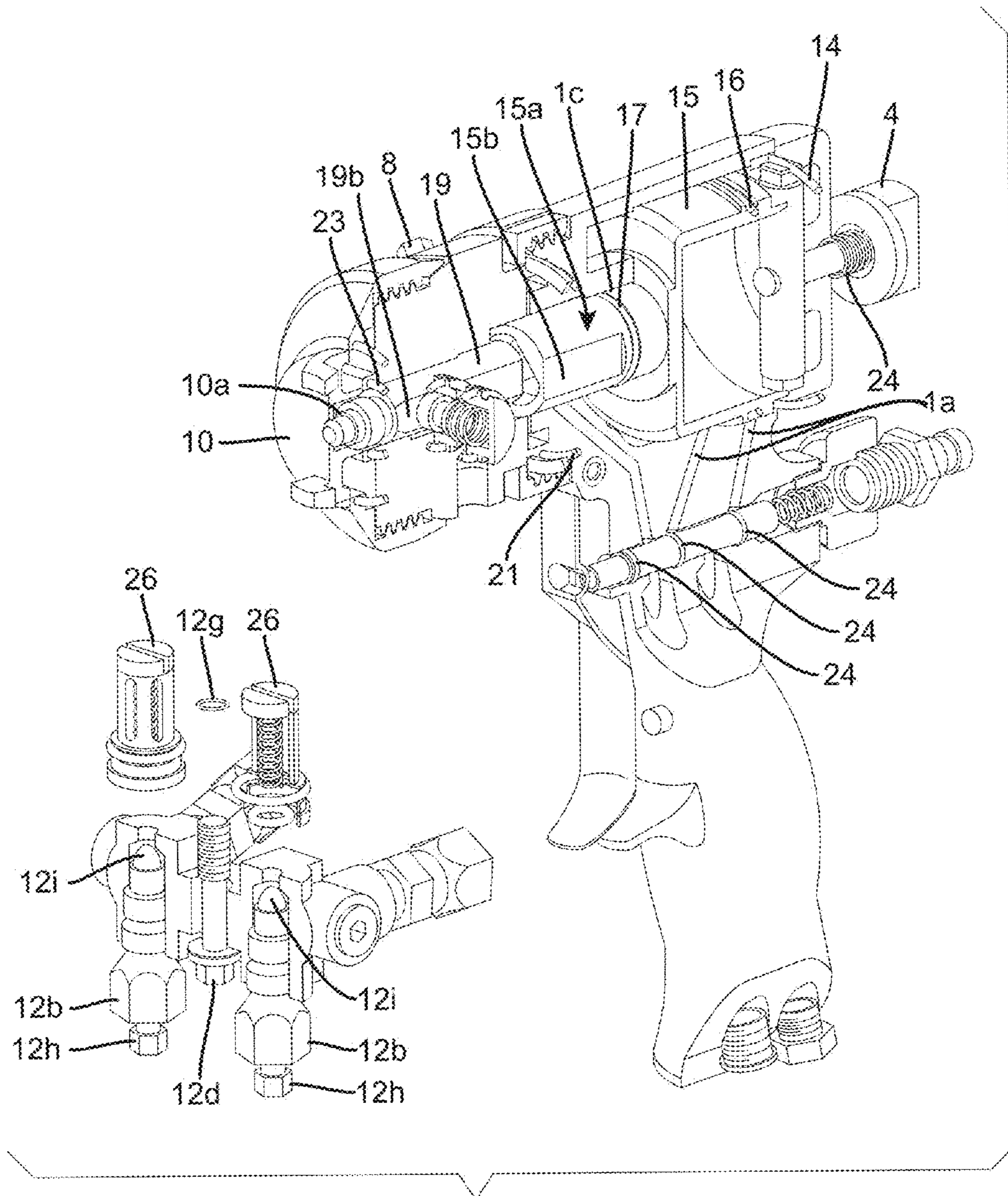


FIG. 2
Amended

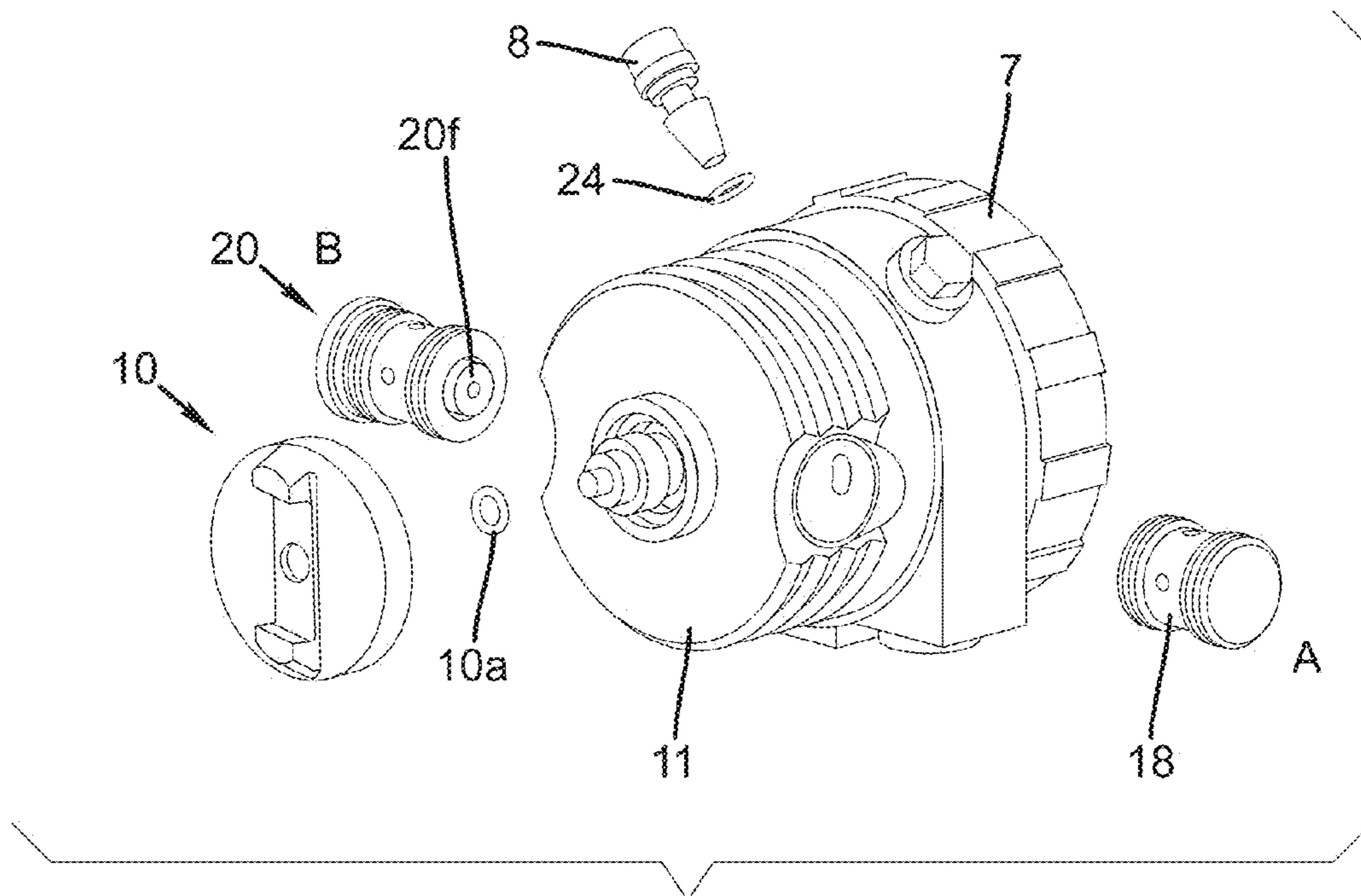


FIG. 3
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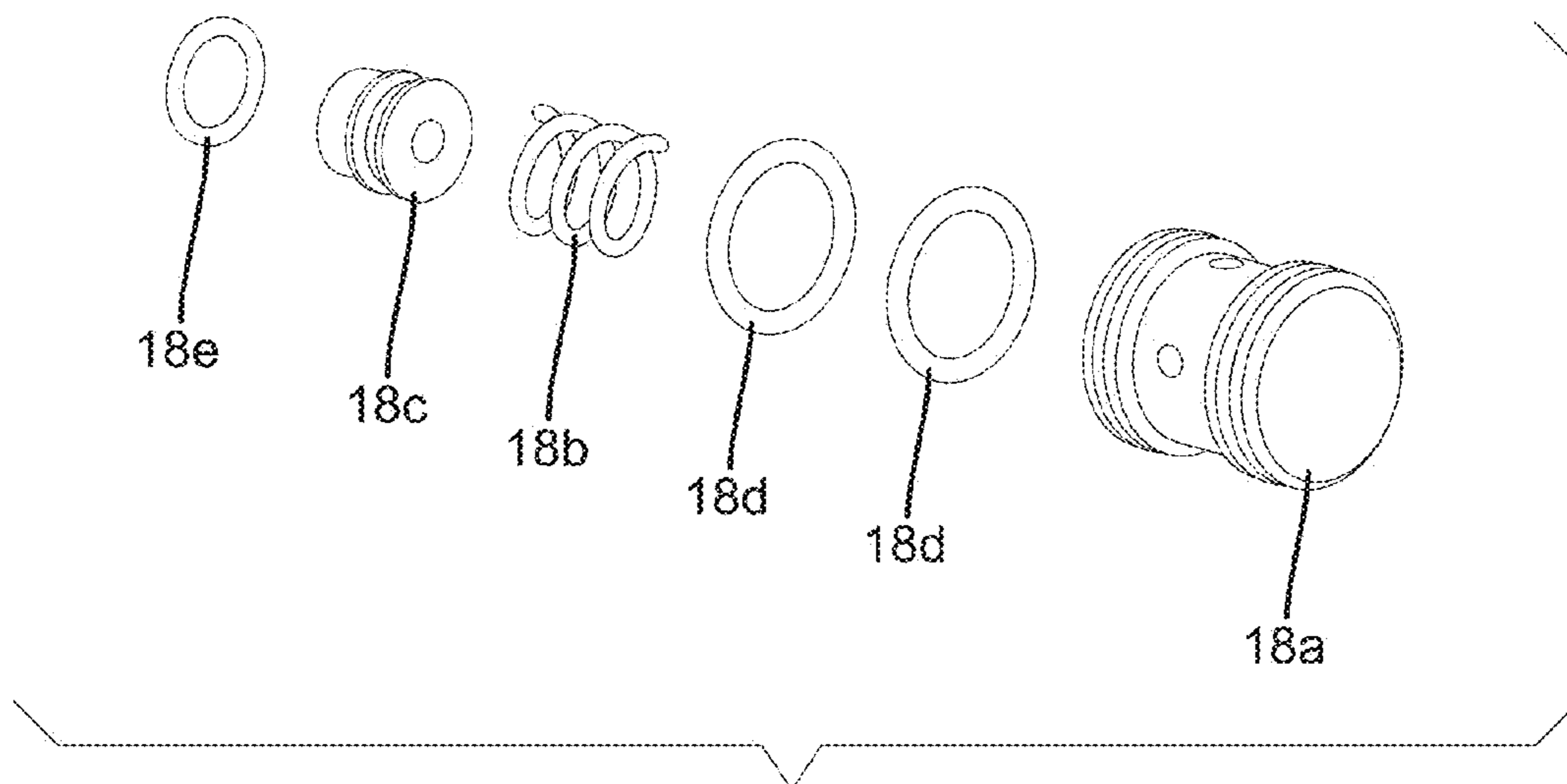


FIG. 4
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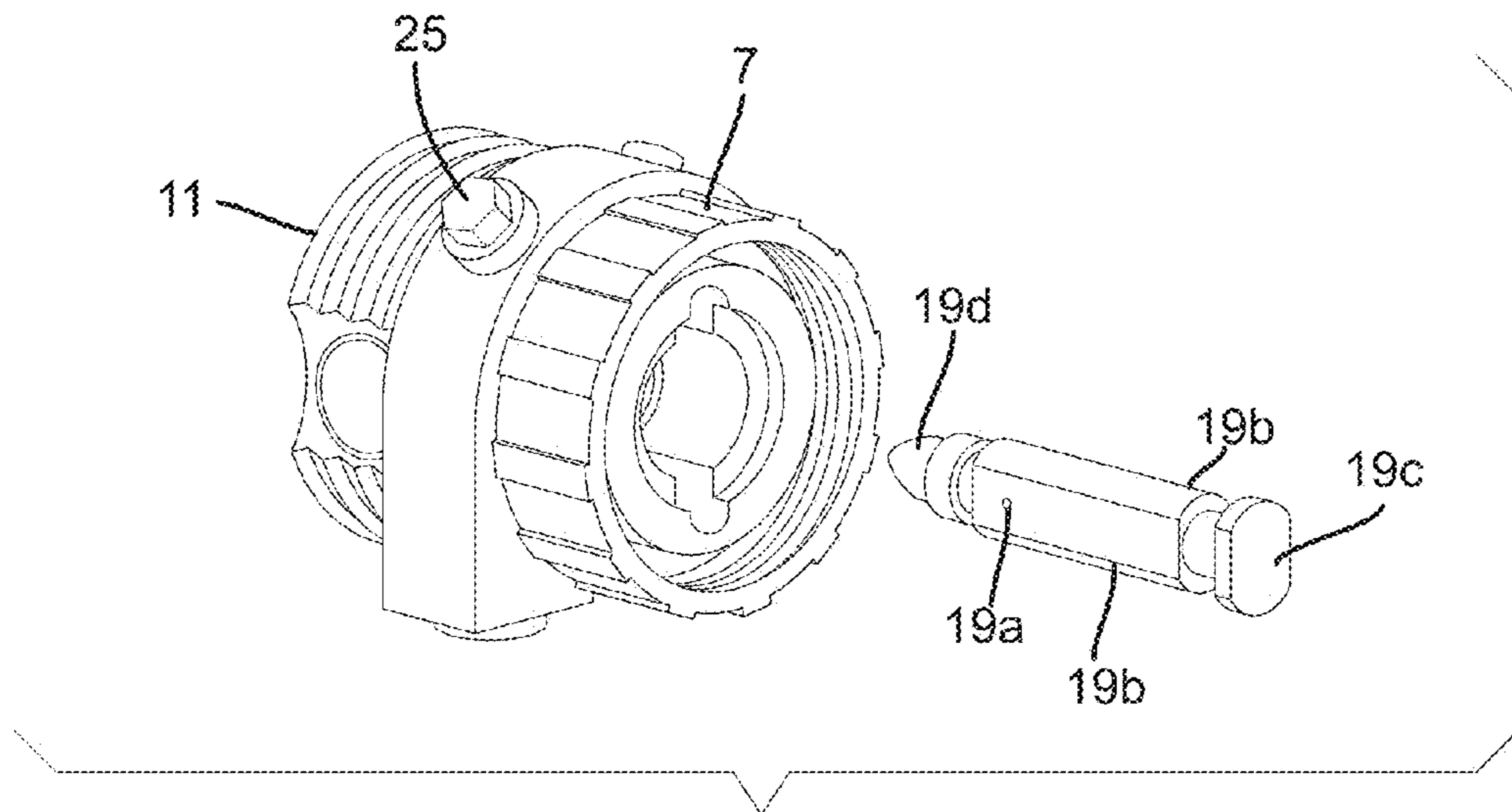


FIG. 5
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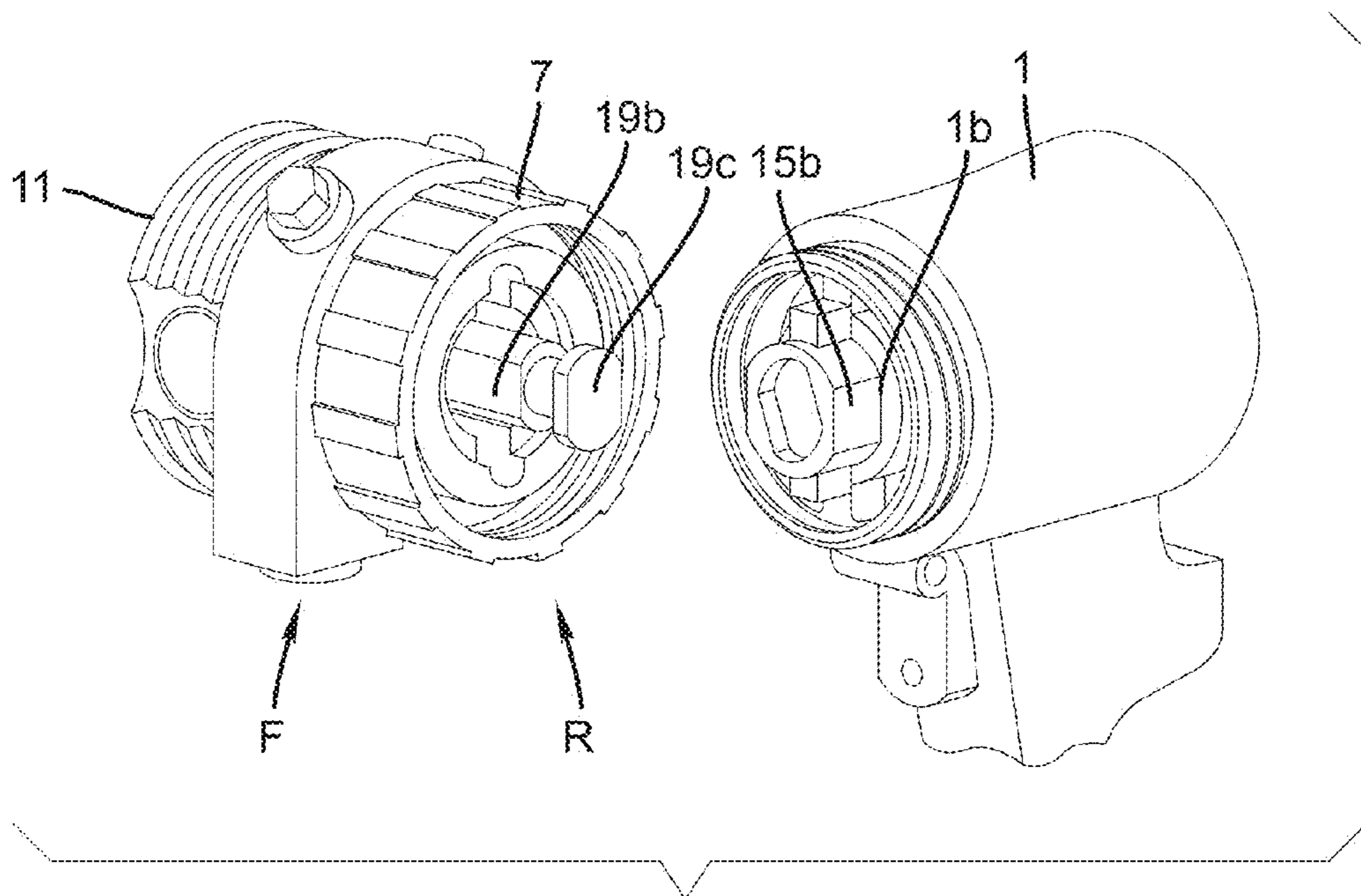


FIG. 6
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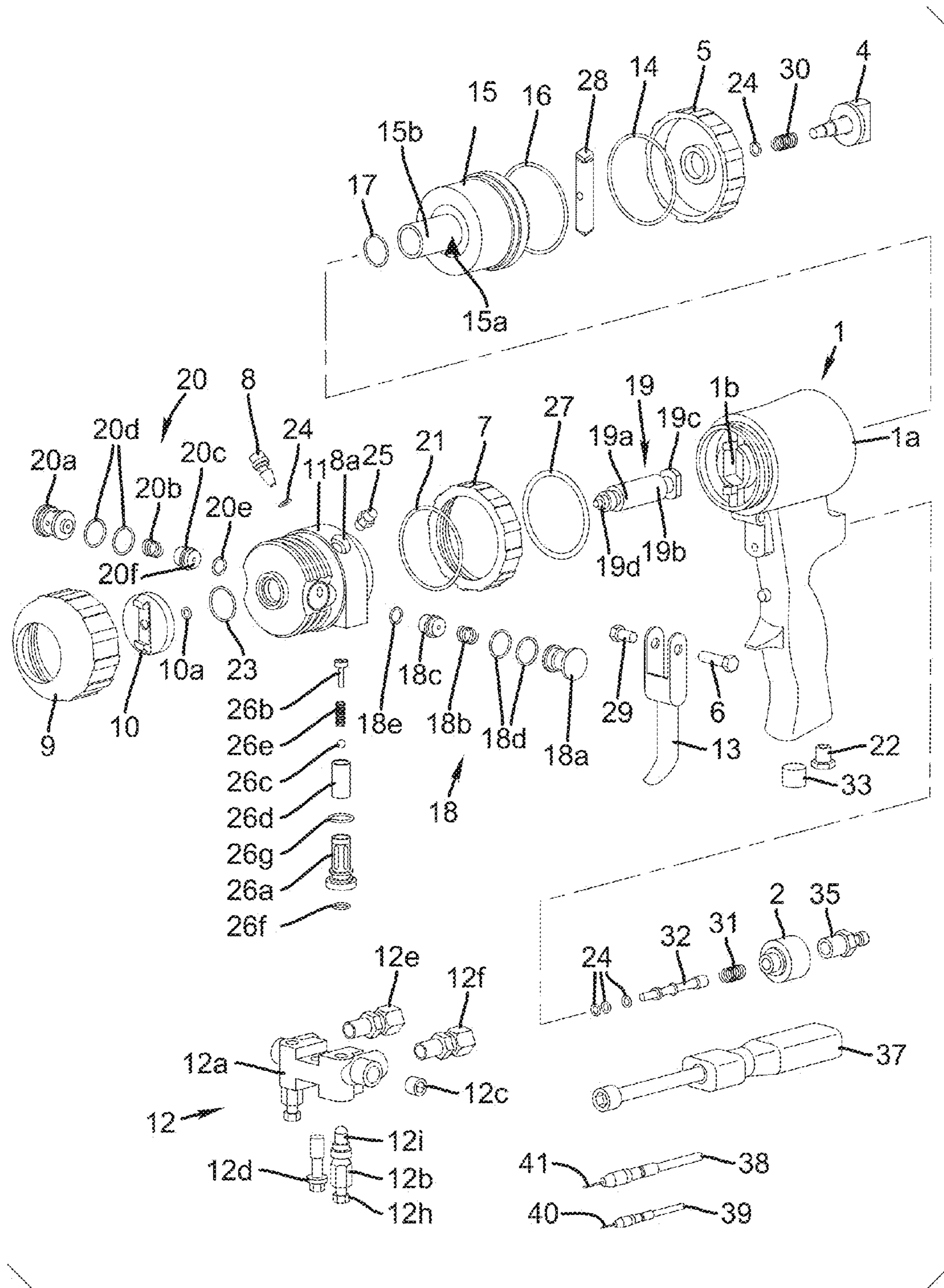


FIG. 7
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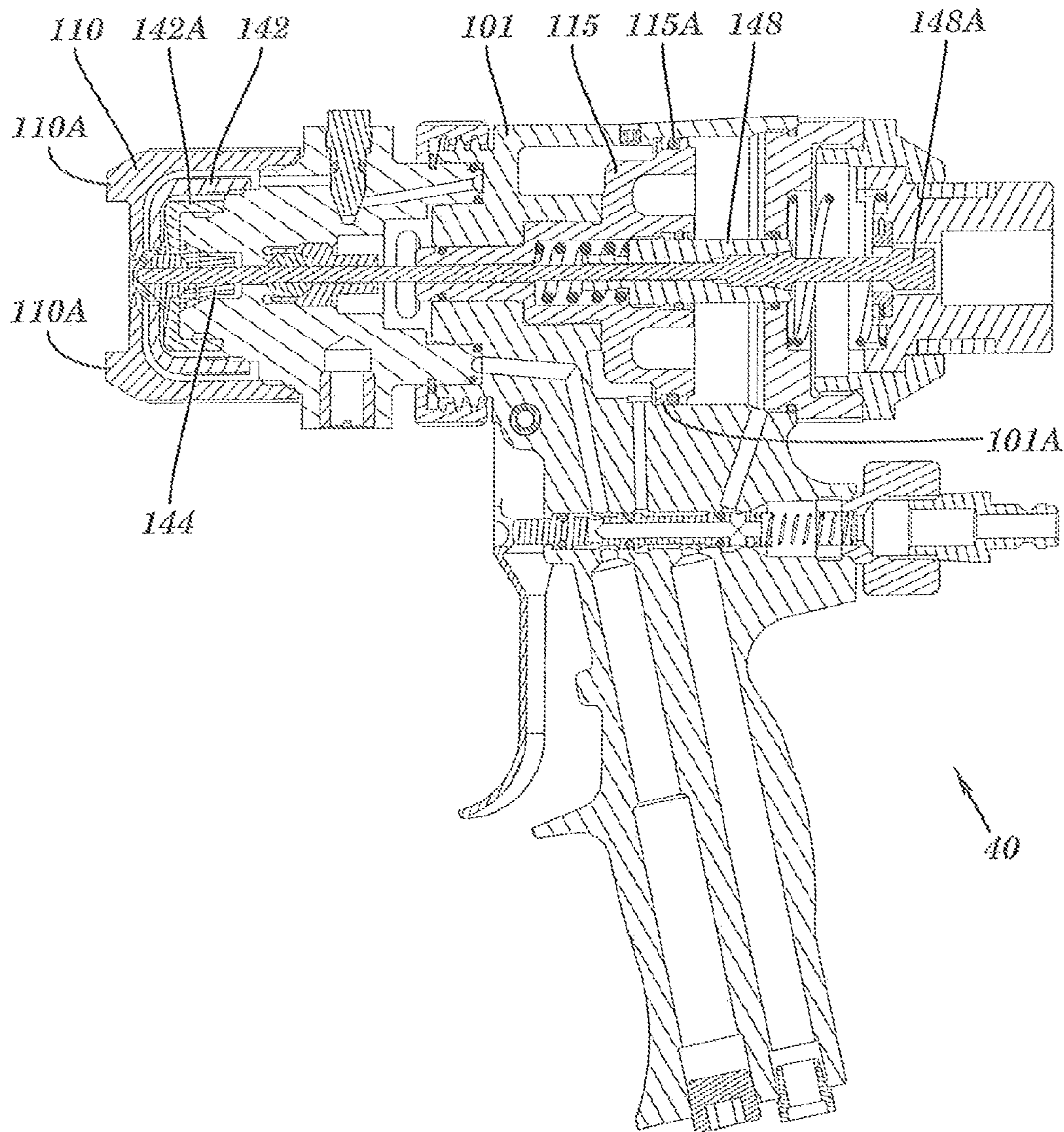


FIG. 8

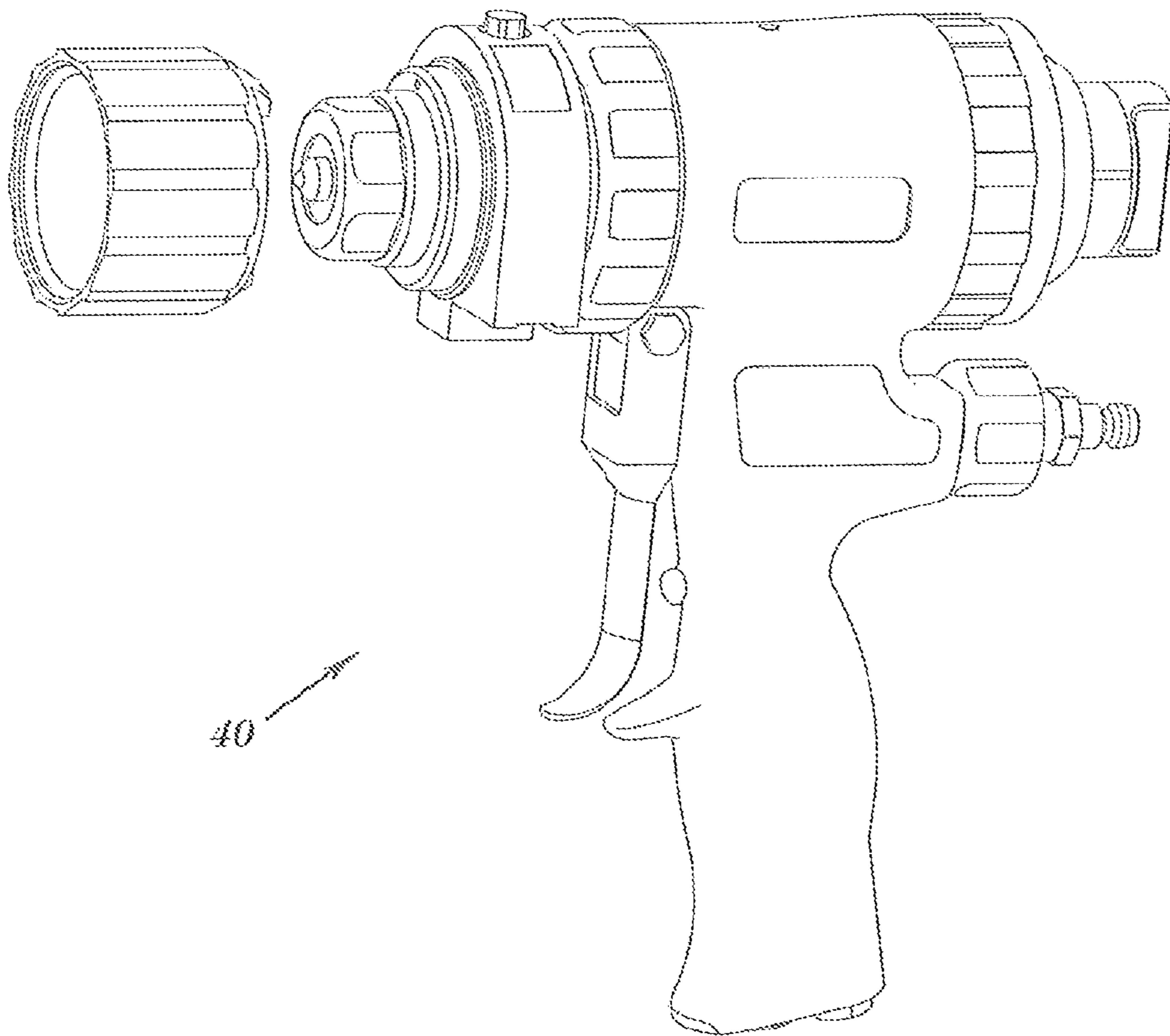


FIG. 9

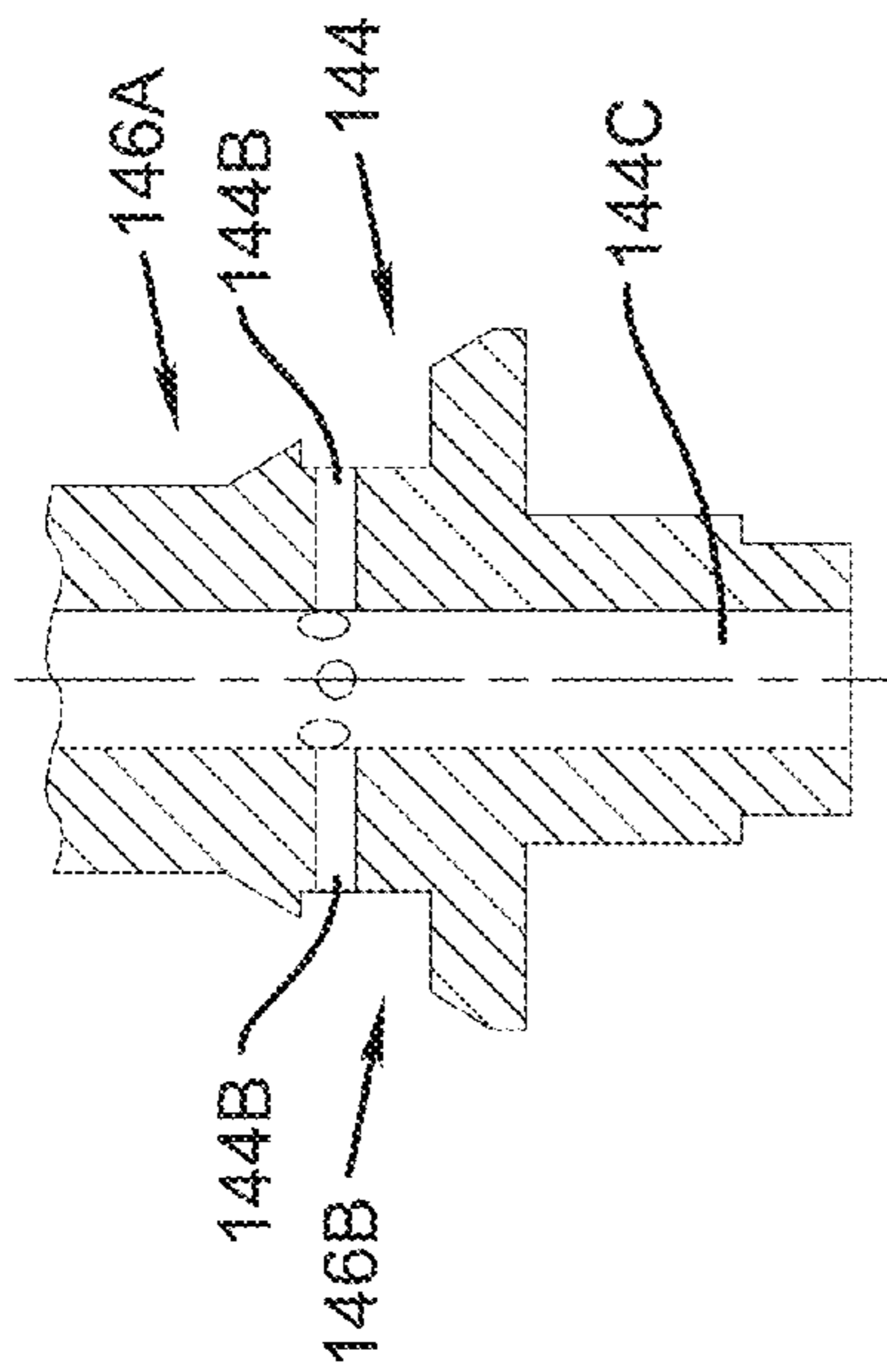


FIG. 12
Amended

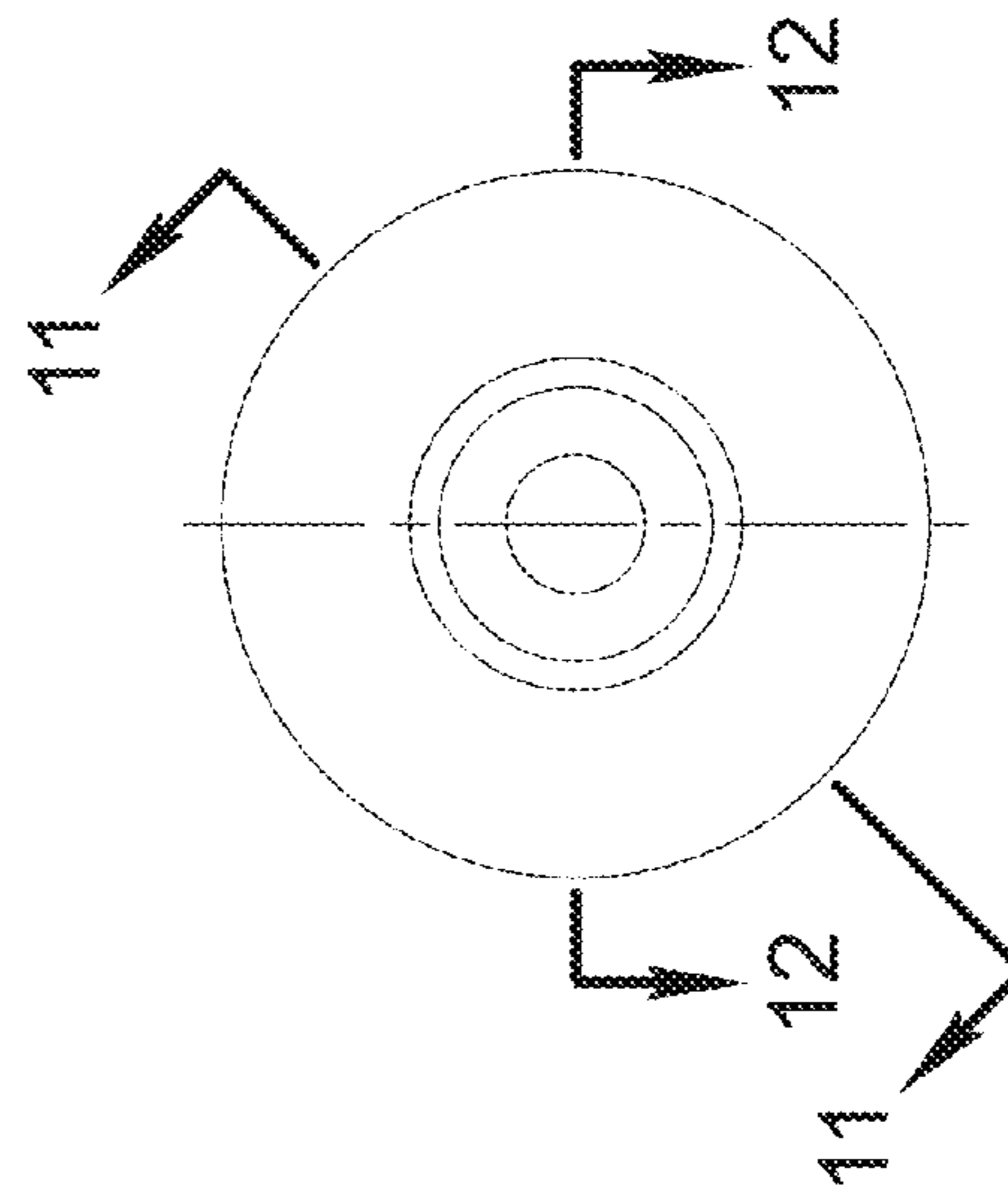


FIG. 10

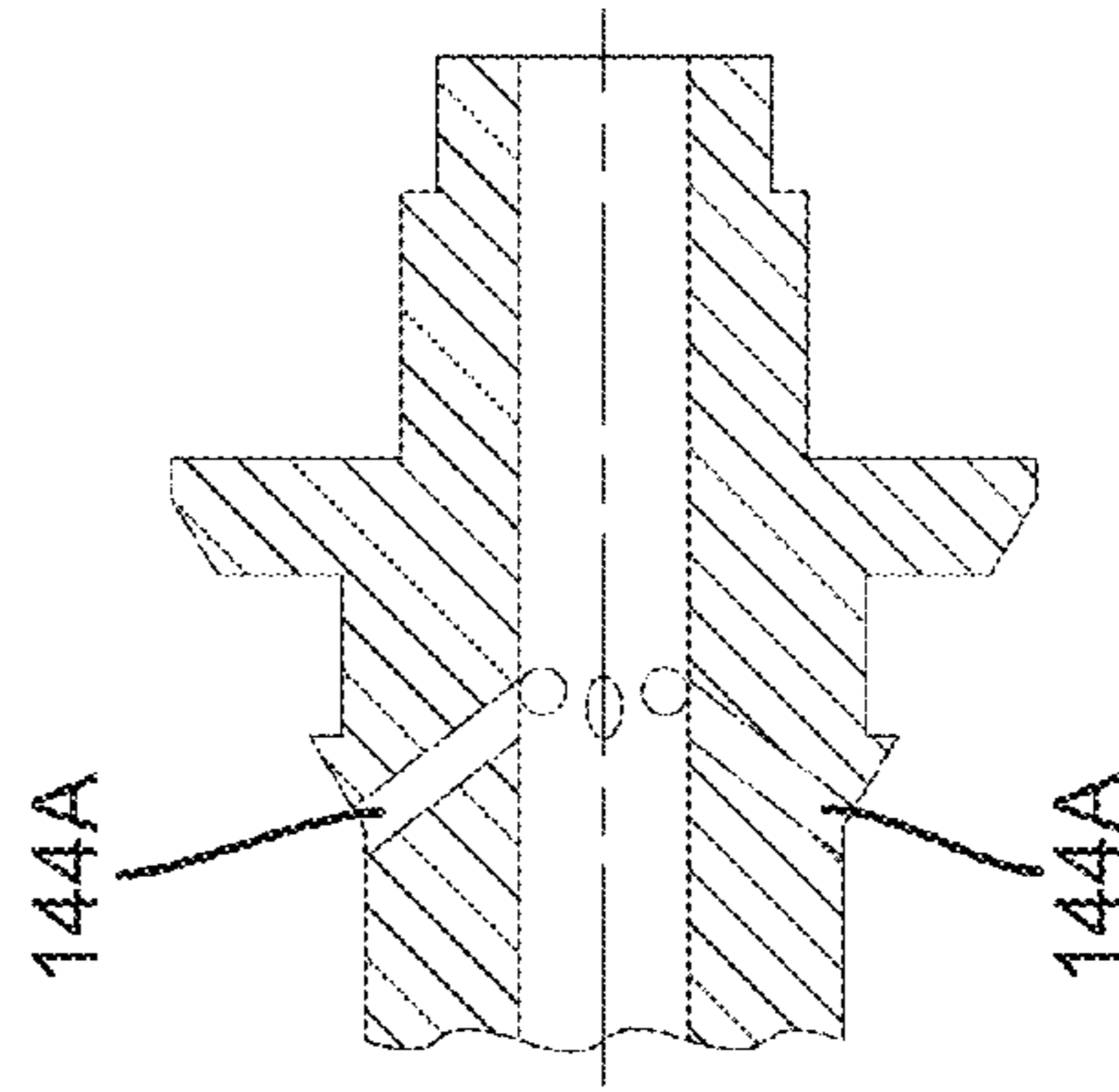


FIG. 11

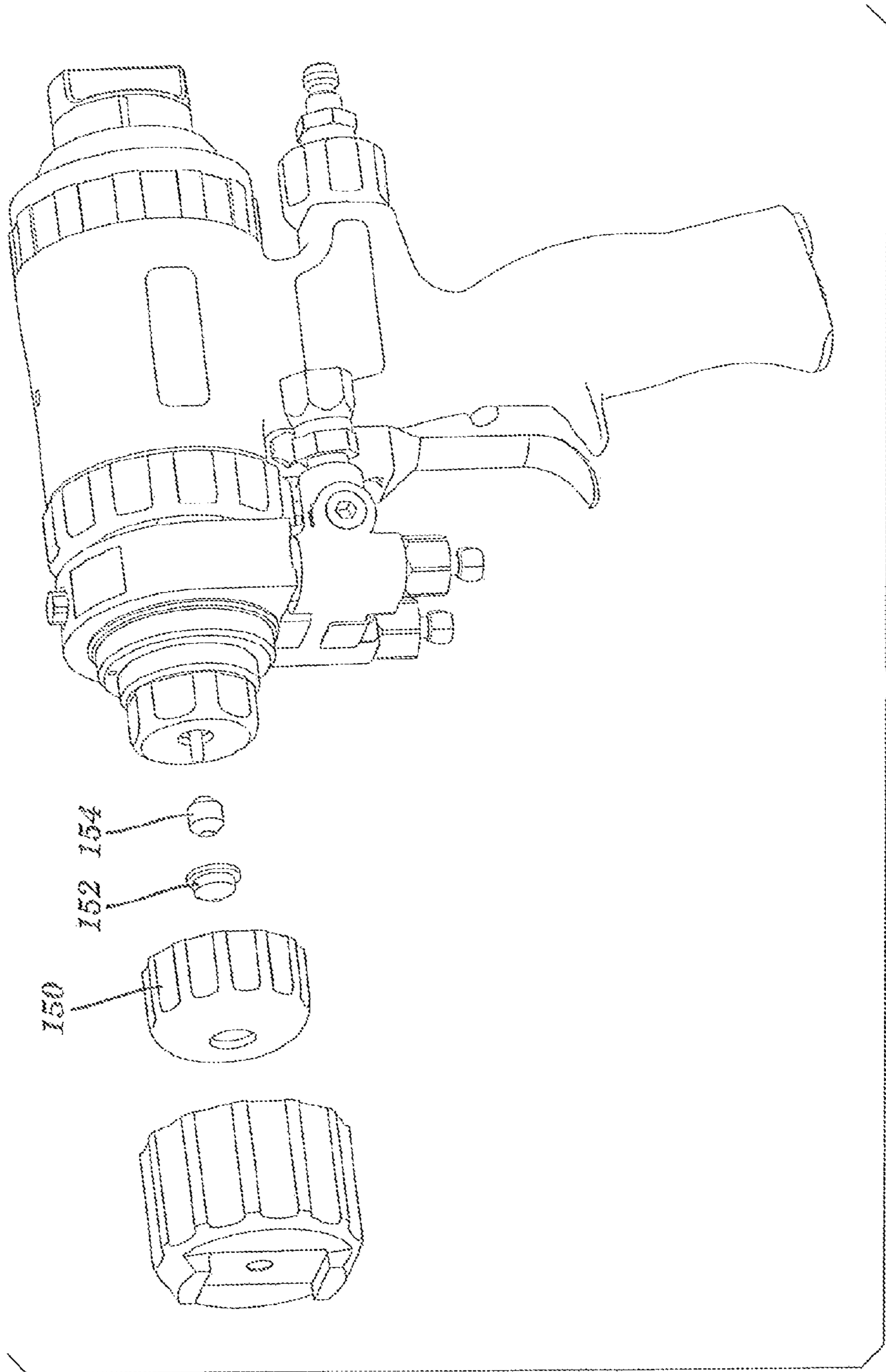


FIG. 13

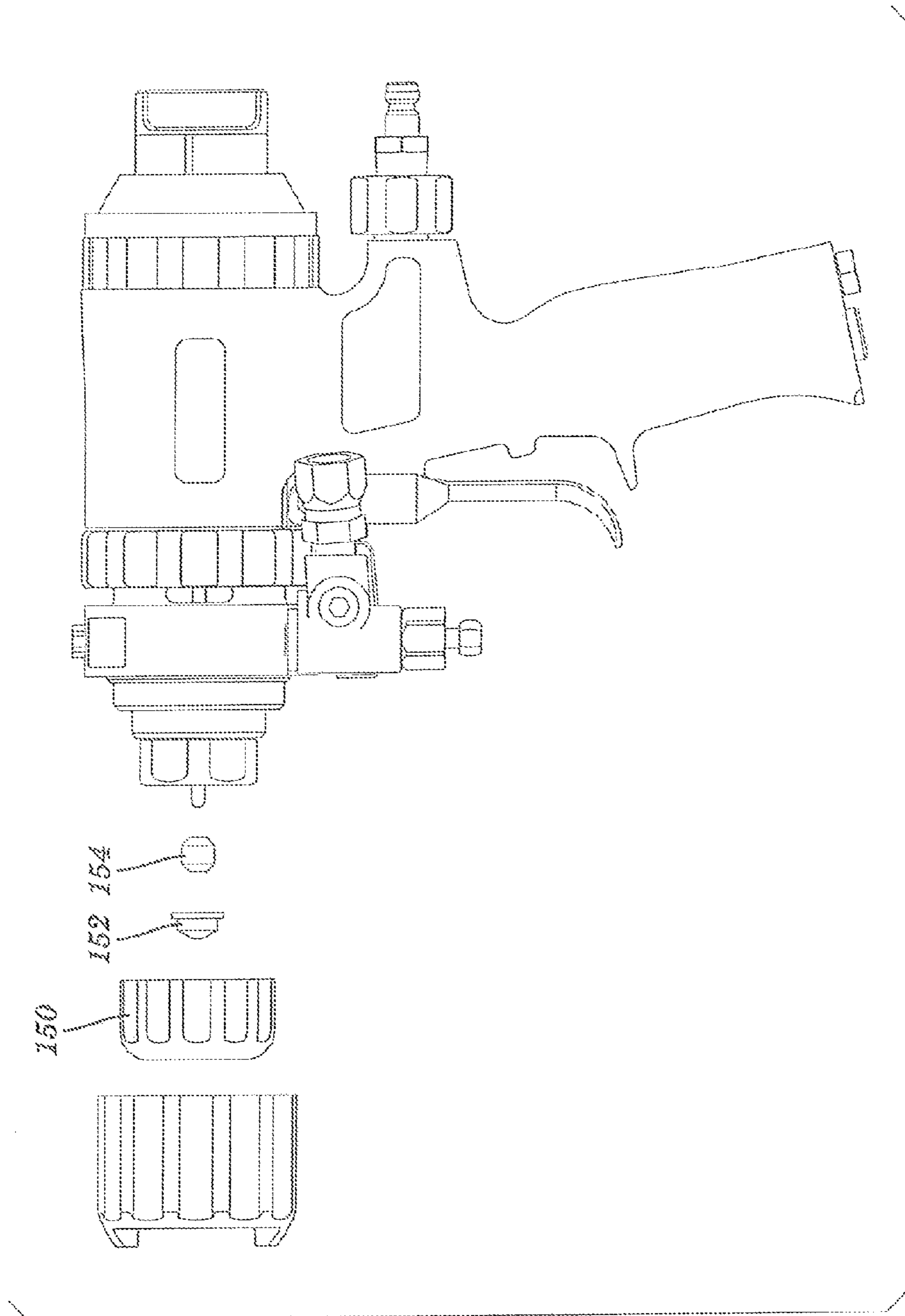


FIG. 14

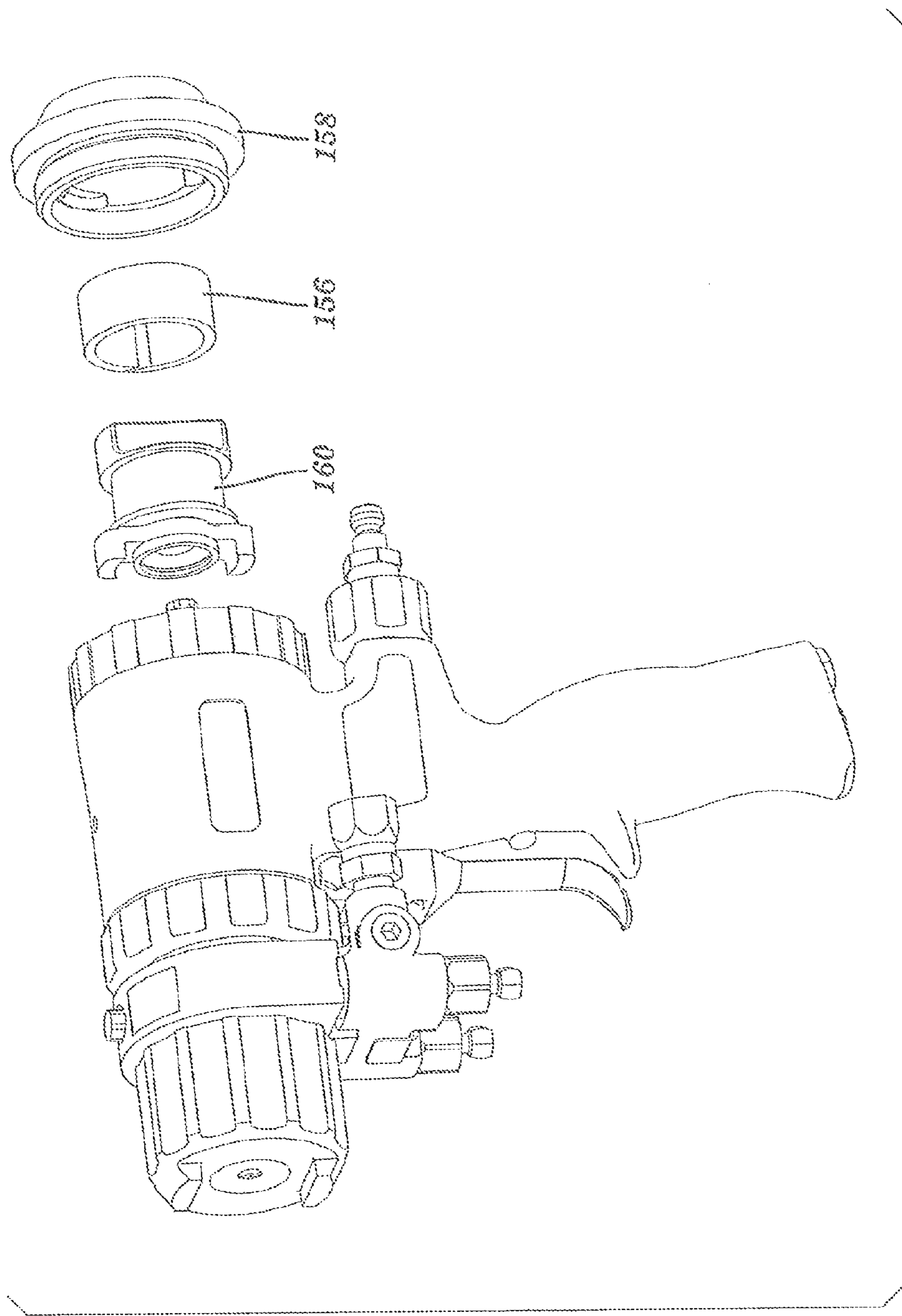


FIG. 15

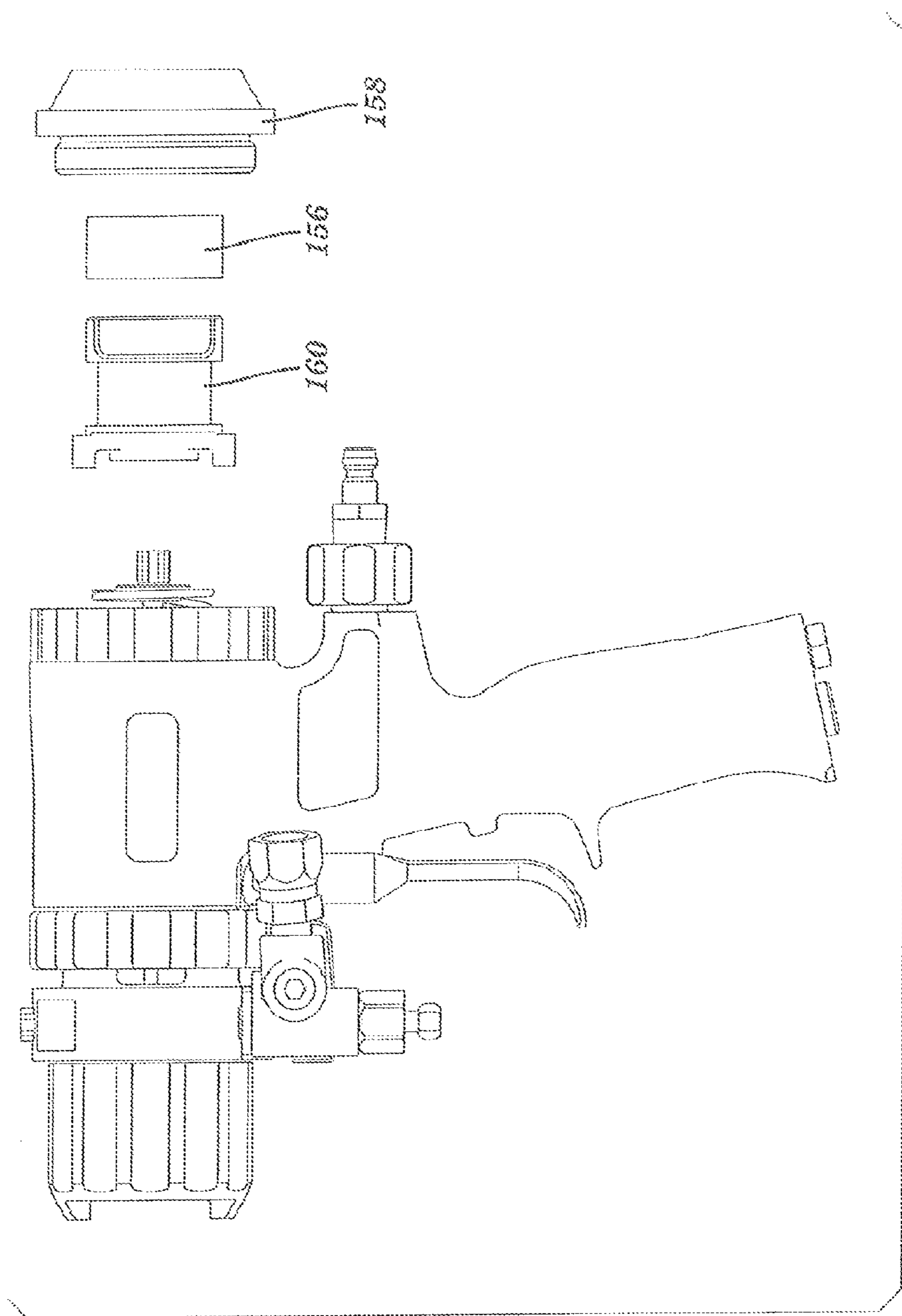


FIG. 16

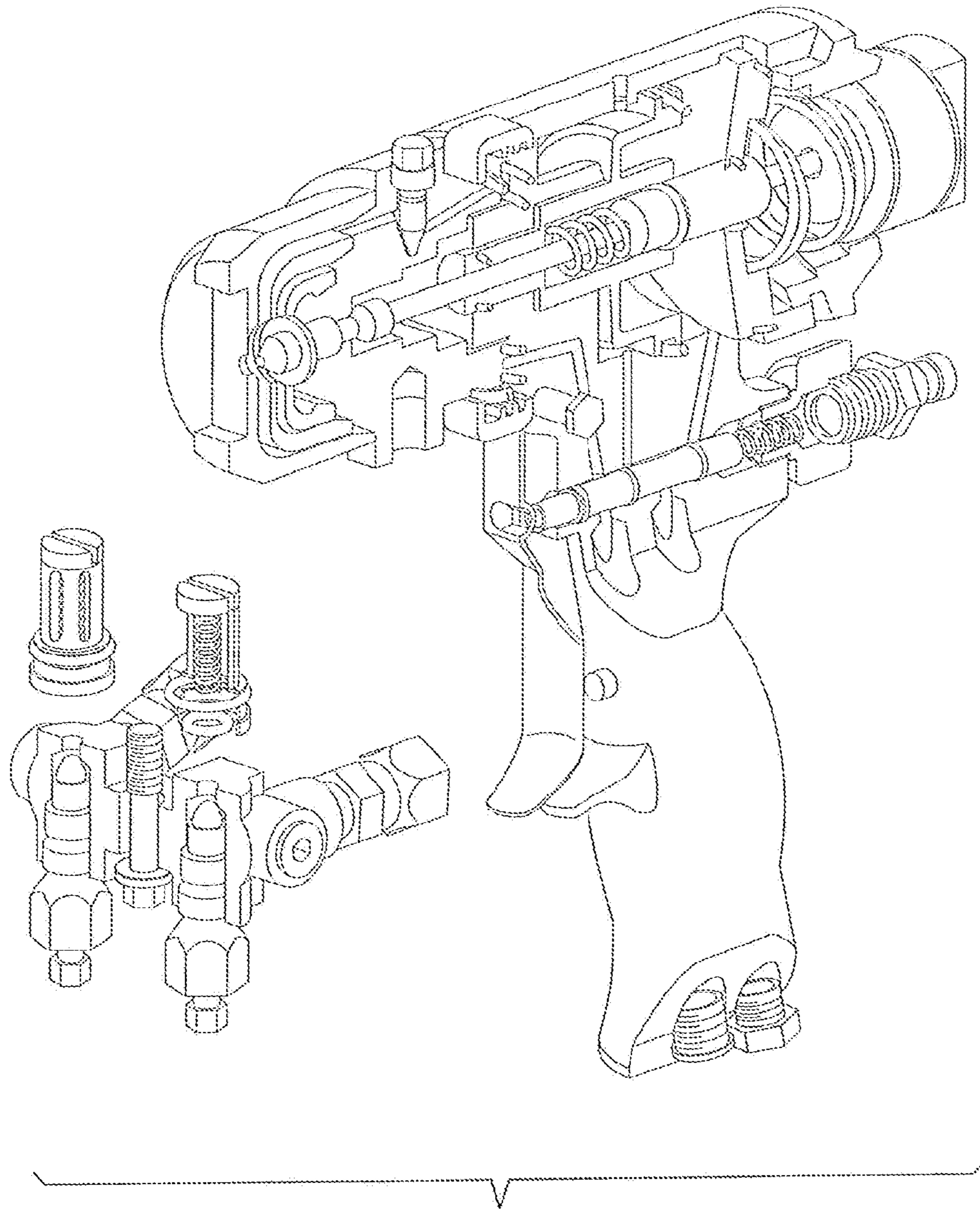


FIG. 17

PLURAL COMPONENT SPRAY GUN FOR FAST SETTING MATERIALS

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

TECHNICAL FIELD

This application claims the benefit of U.S. application Ser. Nos. 60/420,085, filed Oct. 22, 2002, 60/441,575 filed Jan. 21, 2003 and 60/462,124 filed Apr. 10, 2003.

BACKGROUND ART

Plural component spray guns for use with fast setting materials have been popular for applying foams and similar materials. While such application devices are generally effective in applying such materials, they are often cumbersome and can require a number of tools and substantial effort to disassemble and clean.

DISCLOSURE OF THE INVENTION

A plural component spray gun is designed for spraying quick setting materials such as foams and the like. Towards this end, the air purge version of the gun is designed so as to be easily serviceable with a minimum of tools. For example, the side seal cartridges may be installed and removed without tools by removing the retaining ring and then extracting them from the fluid housing using a coin or screwdriver. The cartridges are easily disassembled and cleaned.

Similarly, the fluid housing may be removed from the handle by unscrewing the lock ring (by hand). Grease may be directly injected into the gun for storage without disassembly and is spread through the mix chamber by the purge air. The mixing chamber and piston are easily separated using an 1/8 turn connection. Line of sight air passages in the body are easy to machine and allow easier service in the field if plugged.

Impingement hole cleaning may be accomplished without exposing the fluid to air. The sealing surfaces of the side seal cartridge assemblies and the corresponding surfaces of the mix chamber are made of a hardened metal material such as 440C stainless steel providing a metal-to-metal seal yielding excellent durability.

In a mechanical purge version of the gun, the air cap is provided with a pair of horns spaced so as to correspond with the dimension of the flats on the impingement chamber retainer to allow the retainer to be removed and installed without the use of a separate tool.

Typical prior art mechanical purge guns have two sets of fluid seals to seal the valving rod. The main seal, usually an interference fit, is Delrin A-F and is not adjustable. The front seal is also an interference fit and made from UHMWPE and also not adjustable. When the main seal wears the gun will "spit" fluid out the front of the gun, plugging the tip. The seals typically wear at similar rates, so when the gun spits, the user replaces both seals.

The impingement chamber forms first and second spaced annular chambers about the periphery thereof and first and second sets of passages connect said chambers with the interior passage thereof. The first and second sets of passages

enter the interior passage at the same axial location thereby preventing a lead-lag situation which can produce unmixed material.

An easily adjustment mechanism for the purge rod is provided. The simple adjustment may be accomplished by turning the purge rod at the rear of the gun using a nut driver or similar tool. The purge rod is threadedly engaged in the piston while the piston is prevented from rotating relative to the gun body by means of complementary flats in the bore and on the piston.

These and other objects and advantages of the invention will appear more fully from the following description made in conjunction with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of air purge embodiment of the instant invention.

FIG. 2 is a partially cutaway view of the instant invention from the same angle as FIG. 1.

FIG. 3 shows a partially exploded view of the front of the instant invention.

FIG. 4 shows an exploded view of the side seal cartridge of the instant invention.

FIG. 5 shows assembly of the mix chamber to the fluid housing.

FIG. 6 shows removal of the fluid housing from the gun body.

FIG. 7 shows an exploded view of the instant invention.

FIG. 8 shows a cross section of a mechanical purge embodiment of the instant invention.

FIG. 9 shows a front perspective view of the mechanical purge embodiment of FIG. 8 showing the air cap reversed for impingement chamber retainer removal.

FIG. 10 is a front view of the impingement chamber of the mechanical purge embodiment of FIG. 8.

FIG. 11 is a section view taken along line 11-11 of FIG. 10.

FIG. 12 is a section view taken along line 12-12 of FIG. 10.

FIG. 13 is a partially exploded perspective view of the packing arrangement.

FIG. 14 is a partially exploded side view of the packing arrangement.

FIG. 15 is a partially exploded perspective view of the safety arrangement.

FIG. 16 is a partially exploded side view of the safety arrangement.

FIG. 17 is a partially cutaway view of the mechanical purge embodiment of FIG. 8.

BEST MODE FOR CARRYING OUT THE INVENTION

The air purge spray gun of the instant invention, generally designated 100, is shown in whole in FIGS. 1, 2 and 7. Gun 100 is comprised of a gun body 1. As can be seen in FIG. 2, air passages 1a are all manufactured in the line of sight for ease of machining and maintenance. When the piston 15 is removed, the whole length of each of the passages may be viewed and easily cleaned using a drill bit.

A releasable piston stop 28 is provided and may be actuated (via a push and turn) using safety lock 4. O-ring 24 and spring 30 are located therebetween. A rear cylinder cap 5 threads onto the rear of gun body 1 and is sealed by o-ring 14. One piece piston 15 slides on the interior 1c of gun body 1 (which

have complementary flats **15a** and **1b** to prevent relative rotation) and has a projecting shaft **15a**. Sealing o-rings **16** and **17** are provided.

Mixing chamber **19** has two impingement holes **19a** located diametrically opposite one another. Mixing chamber **19** also has two flattened sides **19b** which maintain the angular orientation relative to the fluid housing **11**. Mixing chamber **19** also has a connecting flange **19c** at the rear end thereof for $\frac{1}{8}$ turn push and turn engagement (similar to a bayonet joint) with piston projecting shaft **15a**. Side seal cartridge assemblies **18** and **20** are engaged and retained in fluid housing **11** by a combination of the friction fit of o-rings **19d** and **20d** and radial retention by retaining ring **9**.

Retaining ring **9** also retains air cap **10** which screws to the front of mix chamber **19**. Lock ring **7** is retained to the rear end of fluid housing **11** by ring **27**. Sealing is provided by seals **10a**, **23** and **21**. This fluid chamber attachment arrangement allows the fluid section to be removed from the body without exposing either of the resin or iso (isocyanate) fluids to atmosphere which would lead to crystallization of the iso.

Side seal cartridge assemblies **18** and **20** are comprised of cartridge housings **18a** and **20a**, springs **18b** and **20b**, seals **18c** and **20c** and o-rings **18d**, **20d**, **18e** and **20e**. The sealing surfaces of side seal cartridge assemblies **18** and **20** (e.g. seal surface **20f**) and the corresponding surfaces **19b** of mix chamber **19** are made of a hardened metal material such as 440C stainless steel.

Fluid manifold assembly **12** is comprised of a manifold housing **12a**, first and second fluid valves **12b**, plugs **12c**, bolt **12d** and swivels **12e** and **12f**. First and second fluid valves **12b** each are provided with a one piece stem **12h** having a hex head with a seal **12i** threaded onto the other end for releasably shutting off fluid flow of the material being controlled. Fluid manifold **12** attaches to fluid housing **11** via bolt **12d** and sealing o-ring **12g**.

Located on the two sides of fluid housing **11** are check valves **26**, each check valve **26** being comprised of a housing **26a**, a screw **26b**, a carbide ball **26c**, a screen **26d**, a spring **26e** and o-rings **26f** and **26g**. Note that fluid flows from the inside out through the screen so that fluid pressure cannot collapse the screen **26d** as happens on prior art guns.

Trigger **13** is mounted to body **1** by pin **6** and screw **29**. The rear of trigger **13** selectively (by operator operation) contacts spool type air valve **32** in body **1**. Spool type air valve **32** is mounted with 3 o-rings **24**, spring **31** and air valve plug **2** which is in turn backed by an air quick disconnect **35**. O-rings **24** like all o-rings in the gun are solvent-resistant so that the whole gun (not just the fluid section) can be soaked in solvent for cleaning. A muffler **22** and plug **33** are also provided in the bottom of gun body **1**. Air valve disconnect **35** and plug **33** may be exchanged in order to have air come in from the back or bottom as desired by the operator.

A grease zerk fitting **25** is supplied in the fluid housing and connects to the purge air passage **8a**, which is fluidly coupled to purge air passage **8b** in gun body **1**. This allows the fluid passages in the mix chamber **19** and the front end of the gun to be filled with grease (which mixes with the purge air to prevent setup and crystallization. Such injection will allow the spray gun to be stored overnight with having to be completely cleaned. Similarly, the air cap **10** serves to direct cleanoff air around the front of the tip **[19a]** **19d** so as to prevent buildup thereon.

In a mechanical purge version of the gun **40**, The air cap **110** is provided with a pair of horns **110A** spaced so as to correspond with the dimension of the flats **142A** on the impingement chamber retainer **142** to allow the retainer **142** to be removed and installed without the use of a separate tool.

The impingement chamber **144** forms first and second spaced annular chambers **146A** and **146B** about the periphery thereof and first and second sets of passages **144A** and **144B** respectively connect said annular chambers **146A** and **146B** with the interior passage **144C** thereof. The first and second sets of passages **144A** and **144B** enter the interior passage **144C** at the same axial location thereby preventing a lead-lag situation which can produce unmixed material. As can be seen, set **144A** is axially angled and set **144B** radial and normal to the axis to achieve this result.

An easily adjustment mechanism for the purge rod **148** is provided. The simple adjustment may be accomplished by turning the rear end **148A** purge rod at the rear of the gun using a nut driver or similar tool. The one piece purge rod **148** is threadedly engaged in the piston **115** while the piston is **115** prevented from rotating relative to the gun body **101** by means of complementary flats in the bore and on the piston (**101A** and **115A** respectively).

The adjustable packing **154** of the instant invention, held in place by the tip retainer **150** (which also retains tip **152**), allows the user to snug-up the front seal to stop the spitting. This adjustability will allow users to at least finish out the day without changing the main packing.

Mechanical Purge gun operators often must actuate the gun safety, when adjusting air flow or changing tips. The safety **158** must operate easily under all conditions. The guns are often covered with overspray from foam or polyurea, making safety actuation difficult. The safety sleeve **156**, made of polyethylene, ensures the safety **158** will be free moving even when covered in overspray and is shown in FIGS. **15** and **16**. Foam or polyurea will not stick to polyethylene. If there is a build-up on the safety actuator **160**, the polyethylene will shed the over-spray when the safety **158** is actuated.

It is contemplated that various changes and modifications may be made to the spray gun without departing from the spirit and scope of the invention as defined by the following claims.

The invention claimed is:

1. A spray gun for fast setting plural component materials, said spray gun comprising:
 - a gun body;
 - an air cap;
 - a retaining ring;
 - a fluid housing removably attached to said gun body, said fluid housing having a threaded surface for threadedly receiving said retaining ring and generally opposed first and second radial ports in said threaded surface; and
 - first and second seal cartridges retained in said ports by friction and said retaining ring.
2. The spray gun of claim 1 wherein said air valve engages said gun body with no more than three seals.
3. The spray gun of claim 1 wherein said air valve is connected to a muffler in said gun body.
4. The spray gun of claim 1 further comprising a fluid manifold removably fastened to said fluid housing, said fluid manifold being sealed thereto by an o-ring.
5. The spray gun of claim 1 further comprising a fluid manifold, said fluid manifold comprising a body and first and second fluid valves for connection to first and second components of a plural component material, each of said first and second valves comprising
 - a one piece stem having a head thereon to allow manipulation to open or closed positions; and
 - a seal for sealingly engaging said manifold body.
6. The spray gun of claim 1 further comprising:
 - a mix chamber located in said fluid housing;
 - a purge air passage [located in said fluid housing];

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a [zerk] fitting [in said fluid housing and] connected to said purge air passage for receiving protective material.

7. The spray gun for fast setting plural component materials of claim 1 further comprising a fluid housing having a mix chamber located therein and said first and second seal cartridges sealing against said mix chamber, said cartridges and said mix chamber comprising sealing surfaces comprised of a hardened material.

8. The spray gun for fast setting plural component materials of claim 7 wherein said mix chamber is formed from a hardened material.

9. The spray gun for fast setting plural component materials of claim 8 wherein said hardened material is 440C stainless steel.

10. The spray gun for fast setting plural component materials of claim 1 further comprising a grease fitting in said fluid housing for injection of grease into said spray gun for storage.

11. A spray gun for fast setting plural component materials, said spray gun comprising:

a gun body;

an air cap;

a fluid housing attached to said gun [housing] body and receiving said air cap [and generally];

a mix chamber located in said fluid housing;

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a purge air passage [located in said fluid housing]; and a [zerk] grease fitting [in said fluid housing and] connected to said purge air passage [for receiving protective material] through which grease is injected into the fluid housing for storage.

12. The spray gun for fast setting plural component materials of claim 6 wherein the fitting is disposed in the fluid housing.

13. The spray gun for fast setting plural component materials of claim 6 wherein the fitting comprises a zerk fitting.

14. The spray gun for fast setting plural component materials of claim 11 wherein the grease fitting is disposed in the fluid housing.

15. The spray gun for fast setting plural component materials of claim 11 wherein the purge air passage extends from the gun body through the fluid housing.

16. The spray gun for fast setting plural component materials of claim 11 further comprising:

first and second seal cartridges sealing against said mix chamber;

wherein said cartridges and said mix chamber comprise sealing surfaces comprised of a hardened material.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : RE46,002 E
APPLICATION NO. : 13/446222
DATED : May 17, 2016
INVENTOR(S) : Douglas P. Zittel et al.

Page 1 of 1

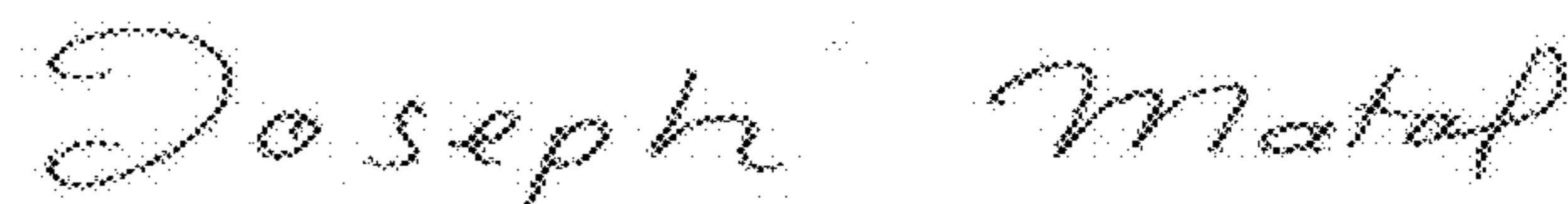
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Please insert in the first sentence as follows:

--Notice: More than one reissue application has been filed for the reissue of patent 7,694,893. The reissue applications are 13/446,222, 14/662,846, and 14/662,864. Reissue applications 14/662,846 and 14/662,864 are reissue divisional applications of application 13/446,222, which is an application for reissue of U.S. Patent 7,694,893.--

Signed and Sealed this
Thirteenth Day of June, 2017



Joseph Matal
*Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office*

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : RE46,002 E
APPLICATION NO. : 13/446222
DATED : May 17, 2016
INVENTOR(S) : Zittel et al.

Page 1 of 1

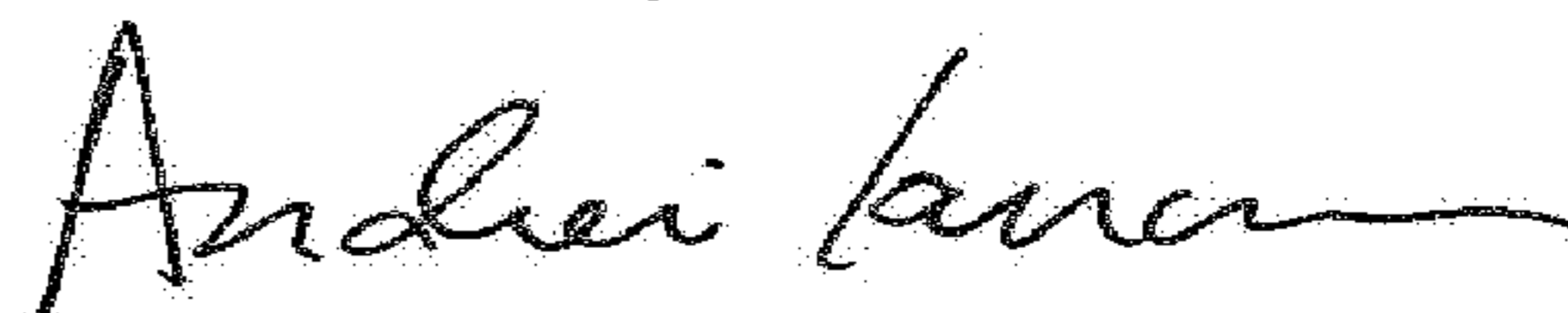
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Please insert Line 11 (approx.) of Column 1 as follows:

--Notice: More than one reissue application has been filed for the reissue of U.S. Patent No. 7,694,893. The reissue applications are U.S. Reissue Patent Application Serial No. 14/662,864, filed on March 19, 2015, now U.S. Reissue Patent No. RE46,291 E, issued January 23, 2017, and U.S. Reissue Patent Application Serial No. 14/662,846, filed on March 19, 2015, now abandoned, each of which are a divisional reissue application of U.S. Reissue Patent Application Serial No. 13/446,222 (the present application), filed on April 13, 2012, now U.S. Reissue Patent No. RE46,002 E, issued May 17, 2016.--

Signed and Sealed this
Fifth Day of June, 2018



Andrei Iancu
Director of the United States Patent and Trademark Office