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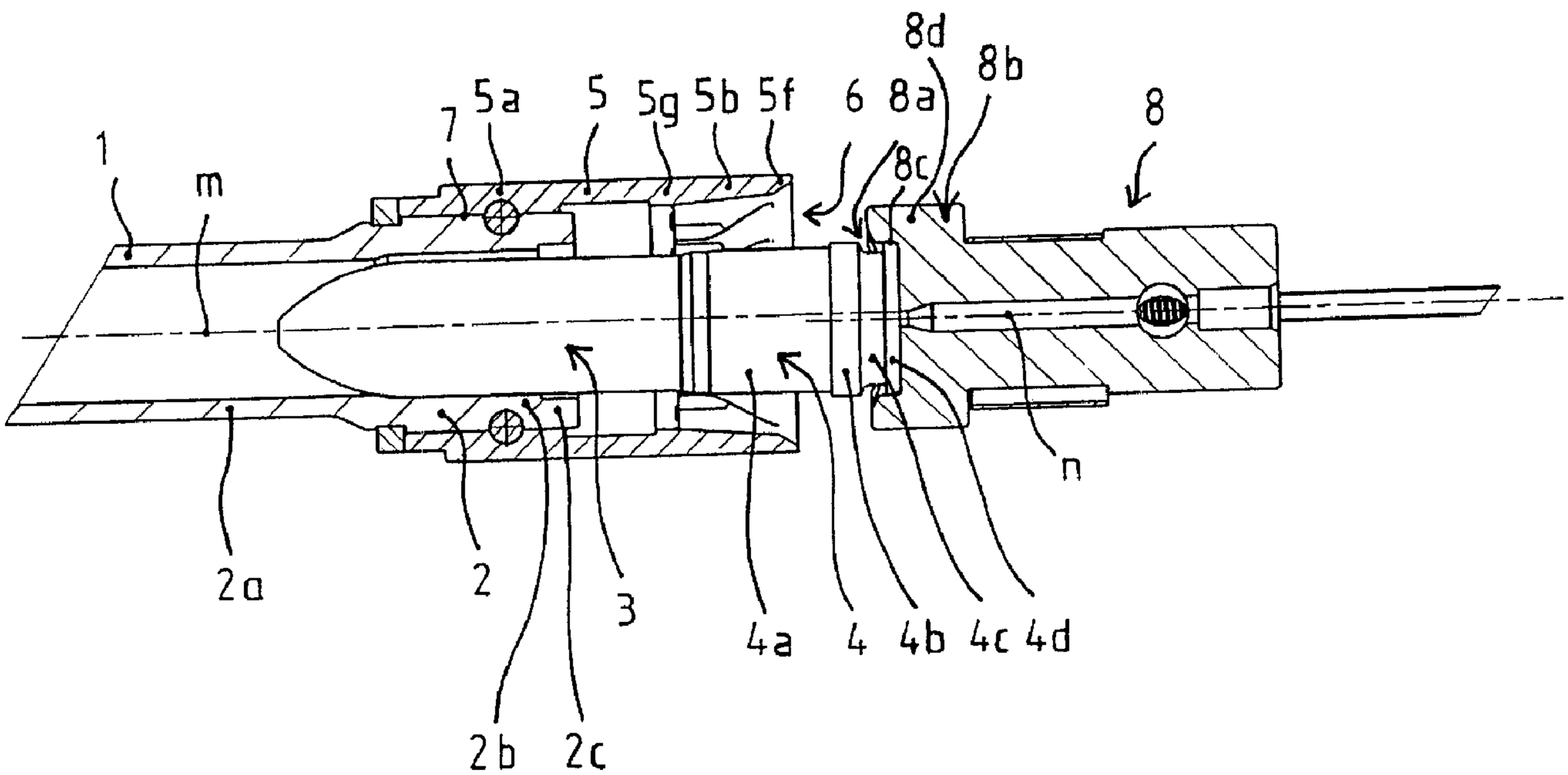
(72) Inventeur/Inventor:
MURELLO, JOHANNES, DE

(73) Propriétaire/Owner:
HECKLER & KOCH GMBH, DE

(74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : ELEMENT DE CENTRAGE DE CULASSE
(54) Title: BOLT CENTERING ELEMENT




(57) Abrégé/Abstract:
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**(71) Anmelder** *(für alle Bestimmungsstaaten ausser US)*: HECKLER & KOCH GMBH [DE/DE]; Alte Steige 7, D–78727 Oberndorf/Neckar (DE).

**(72) Erfinder; und**
**(75) Erfinder/Anmelder** *(nur für US)*: MURELLO, Johannes [DE/DE]; Hessestrasse 20, D–78652 Deisslingen (DE).

**(74) Anwälte:** VON SAMSON–HIMMELSTJERNA, Friedrich, R. usw.; Widenmayerstrasse 5, D–80538 München (DE).

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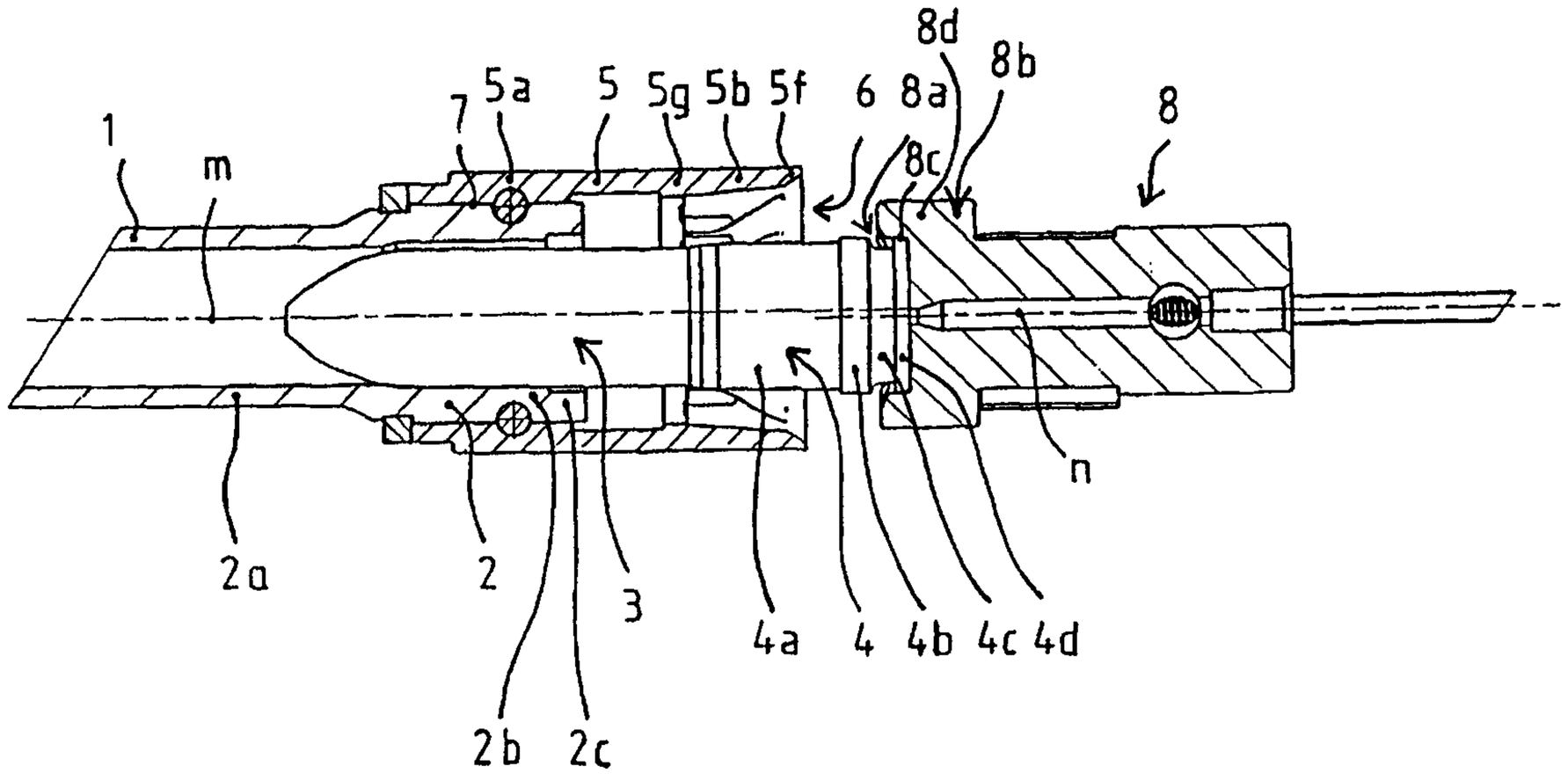
*Mit internationalem Recherchenbericht.*

**(54) Title:** BOLT CENTERING ELEMENT

**(54) Bezeichnung:** VERSCHLUSSZENTRIERUNG




**(57) Abstract**

The invention relates to a device and a method for loading a cartridge (3) into a battery (2) of a barrel (1) of an autoloading firearm. Said device comprises a bolt (8) which is able to slide in the longitudinal direction of the firearm and serves to move the cartridge (3) and to introduce said cartridge (3) into the battery (2). The invention provides for at least one centering element (5b) which is irremovably fixed to the barrel (1) and serves to center the bolt (8) in relation to said barrel (1).

**14 May, 2001**

## Bolt Assembly Centering

The invention concerns a device for loading a cartridge into a cartridge chamber of a barrel of an automatic small arm according to the preamble of Claim 1.

Entrainment of the cartridge occurs via a bolt head on the front end of the bolt assembly of the weapon. A recess that forms a recessed percussion base can be situated on this front side. During reloading of the weapon, the uppermost cartridge of a magazine, the next cartridge of a horizontal belt feed or the like is brought into a feed position in front of the bolt head. A recoil spring pushes the bolt assembly with the bolt head forward. The cartridge is then moved, together with the bolt assembly, forward, during which it is raised so that the rear end of the cartridge casing finally reaches, if present, the recess of the bolt head. During subsequent forward movement, the cartridge is pushed into the cartridge chamber of the barrel. Because of the narrow tolerances between the engagement of the cartridge and the cartridge chamber, the cartridge is centered with reference to a center axis of the barrel (bore). Thereupon, the bolt assembly is connected to the barrel by means of a locking piece fastened on the barrel, for example, by rotation. The weapon is then loaded.

The bolt assembly must then be centered with reference to the cartridge and barrel. This centering occurs by the seat of the rear end of the cartridge casing in the recessed percussion base. Substantial tolerances can therefore be present between the bolt assembly and a housing that guides it, which permit trouble-free functioning of the weapon even when strongly soiled. However, the tolerances between the engagement of the rear end of the casing and the bottom of the cartridge must be close; the periphery of the percussion base must be countersunk, in order to facilitate entry of the cartridge into the percussion base.

A firearm, in which the barrel has a shoulder with a conical input opening behind the cartridge chamber, is described in US-PS 3,641,692, in which the bolt assembly is introduced during loading of the weapon. Substantial tolerances are present between the introduced bolt assembly and the shoulder. Centering of the bolt assembly with reference to the center axis of the barrel therefore occurs in the usual manner by the seat of the cartridge casing on the front end of the bolt assembly.

It is proposed in the small arm described in US-PS 3,225,657 to configure the outer surfaces of the front end of the bolt assembly conical. These come in contact in the front end position of the bolt assembly after loading of the weapon with the also conically-shaped inside surfaces of a part coupled to the rear end of the barrel, so that this is sealed to the rear.

A cylindrical bolt assembly with extremely limited tolerances is known from US-A-3 742 638.

US-A-5 499 569 (corresponds to the preamble of Claim 1) and US-A-3 641 692 each use an inner cone directly connected to the cartridge chamber to the rear, into which an outer cone on the front side of the bolt assembly engages. In each case, however, the purpose of this cone is to prevent gas escape from the barrel to the rear. Centering is neither sought nor disclosed in these documents.

The invention has set the objective of modifying the ordinary device and ordinary method for loading the cartridge by devising numerous advantages.

It achieves this objective by a device for loading a cartridge into a cartridge chamber according to Claim 1.

Centering of the bolt assembly is then understood to mean generally alignment of a center axis of the bolt assembly with the center axis of the barrel (bore), especially the center axis of its cartridge chamber. Before alignment, the bolt assembly center axis intersects the center axis of the barrel or is skewed or parallel to it. After alignment, the axes lie roughly, preferably precisely, coaxially to each other. In the narrower sense, centering of the bolt assembly is subsequently understood to mean centering of the center axis of the bolt head of

the bolt assembly, especially a center axis of the percussion base or, if present, the recess in the bolt head that serves to accommodate the cartridge casing.

This centering occurs by the centering element according to the invention connected to the barrel and not (or only partially) via the seat of the rear end of the casing in the recess in the bolt head. Relatively large tolerances preferably therefore exist between the periphery of the cartridge casing and the percussion base. During centering of the cartridge during its insertion into the cartridge chamber, the bolt assembly is then not centered by it (or only partially co-centered). Because of this, the cartridge is less severely loaded during loading. This is a particular advantage in cartridges with sensitive rounds.

The bolt assembly is also aligned with greater accuracy to the bore of the barrel by the centering according to the invention. On this account, after each loading, compatibility conditions are ensured during firing. The invention is therefore particularly advantageous in sharpshooter weapons.

The bolt assembly or bolt head is centered by the centering element during a forward displacement of the bolt assembly. "Forward displacement" is then understood to mean displacement of the bolt assembly in the direction of the cartridge chamber. During centering of the bolt assembly, the cartridge is already advantageously centered with reference to the barrel. As an alternative, the cartridge can be centered by the bolt assembly, preferably right before or shortly before it reaches the cartridge chamber. The cartridge is advantageously already in the cartridge chamber during centering of the bolt assembly.

The centering element is directly connected to the barrel. The connection between the barrel and centering element is then advantageously not releasable. By integrated design of the centering element, even greater accuracy during centering of the bolt assembly with reference to the barrel is achieved. Addition of component tolerances is avoided. Because of this, further improved accuracy is achieved. As an alternative, the centering element and the barrel, and/or the centering element and the cartridge chamber can be designed integrally. The accuracy of centering is therefore even further increased.

The centering element advantageously centers the bolt assembly via a bolt head of the bolt assembly. As explained above, the bolt head on the front end of the bolt assembly serves to entrain the cartridge casing. If centering of the bolt assembly occurs via the bolt head, this

is centered relatively accurately, and therefore so is the percussion base recessed in it. Because of this, particularly uniform compatibility conditions during firing are achieved and firing accuracy is increased. Moreover, the functional reliability of the bolt assembly system is improved.

The centering element is preferably arranged next to the cartridge chamber and the bolt assembly is centered next to the cartridge chamber.

The cartridge is co-centered (pre-centered) during centering of the bolt assembly by the centering element. Greater accuracy during introduction of the cartridge into the cartridge chamber is achieved on this account. The inside wall of the cartridge chamber and the outside wall of the cartridge, especially the round, are therefore less strongly loaded during loading. Moreover, greater independence is achieved in cartridge geometry. The cartridge need not (or needs only partially) center itself by a correspondingly designed outer wall. Preferably, the cartridge is initially roughly pre-centered by the bolt assembly, for example, right before or shortly after its introduction into the cartridge chamber by engagement of the bolt assembly in the cartridge casing. Fine centering of the cartridge then occurs in the usual manner on contact of the cartridge outer wall and inner wall of the cartridge chamber.

The bolt assembly is centered by a surface of the centering element lying obliquely to the longitudinal direction of the weapon. The surface is preferably sloped in the direction toward the barrel or cartridge chamber. If a front edge of the bolt assembly strikes this surface during forward displacement in the longitudinal direction of the weapon, the bolt assembly is then additionally displaced in the transverse direction. Because of this, the center axis of the bolt assembly can be advanced on the bore of the barrel. As an alternative, a similar effect can be achieved by a surface of the bolt assembly lying obliquely to the longitudinal direction of the weapon that is sloped in a direction toward the barrel.

Centering of the bolt assembly can occur by the obliquely lying surface of the centering element and by an additional obliquely lying surface of an additional centering element. The two surfaces advantageously lie opposite each other. The additional centering element is preferably directly connected to the barrel and designed integrally. With particular advantage, however, the obliquely lying surface and a second obliquely lying surface, through which the bolt assembly is centered, are provided on the same integral centering element.

Because of this, addition of tolerances between different components is prevented. Further increased accuracy during centering of the bolt assembly is therefore achieved.

The centering element has a continuous cavity. Centering of the bolt assembly is then achieved advantageously by the fact that a conical inside surface of a first section of the cavity tapers from the rear to the front. As an alternative, an outer surface of the bolt assembly can also taper conically from the rear to the front.

The cavity advantageously has recesses, whose inside surfaces taper conically from the rear to the front. If the bolt assembly has shoulders complementary to the recesses of the cavity, in addition to centering of the bolt assembly, rotation of the bolt assembly is simultaneously prevented. The outer surface(s) of the bolt assembly, especially the outer surfaces of the shoulders, then extends/extend in the horizontal direction. An embodiment, in which the outer surfaces of the guide rails form between two recesses of the cavity taper conically from the rear to the front, is preferred.

After centering of the bolt assembly, it is advantageously guided into the centered position with reference to the barrel. For this purpose, the centering element preferably has a hollow cylindrical section. The inside diameter of the hollow cylindrical section is advantageously roughly equal to an outside diameter of the bolt assembly, especially the bolt head. Because of this, sealing of the cartridge chamber outward is achieved. Soiling of the weapon housing on release of gases during firing is thus reduced. It is conceivable as an alternative that the bolt assembly is guided between at least two guide elements in front of the cartridge chamber in the centered position.

As an alternative, the bolt assembly can have grooves, whose inside surfaces taper conically from the rear to the front. Outer surfaces of rails formed between two grooves of the bolt assembly then also taper conically from the rear to the front. The inside surfaces of the complementary recess of the cavity then preferably extend in the usual manner in the horizontal direction. The outer surfaces of guide rails formed between the two recesses are then also parallel.

The centering element is preferably part of a locking piece and, with particular preference, integrated with it. The locking piece serves to lock the bolt assembly with the barrel after introduction of the cartridge chamber. Since the locking piece is fastened to the barrel, with

integral design of the centering element locking piece, a separate fastening of the centering element on the barrel can be dispensed with.

The invention and additional advantages and features of the invention are further explained below by means of a preferred practical example with reference to the accompanying drawing. In the drawing:

Fig. 1 shows a schematic longitudinal section of a section of an automatic small arm in a first position of the bolt assembly and cartridge;

Fig. 2 shows another longitudinal section of the section of the automatic firearm depicted in Fig. 1 in a second position of the bolt assembly and cartridge;

Fig. 3 shows another longitudinal section of the section of the automatic firearm depicted in Figures 1 and 2 in a third position of the bolt assembly and cartridge;

Fig. 4 shows a cross sectional view of the bolt head of the automatic firearm depicted in Figures 1, 2 and 3;

~~conceivable as an alternative that the bolt assembly is guided between at least two guide~~ elements in front of the cartridge chamber in the centered position.

As an alternative, the bolt assembly can have grooves, whose inside surfaces taper conically from the rear to the front (Claim 15). Outer surfaces of rails formed between two grooves of the bolt assembly then also taper conically from the rear to the front (Claim 16). The inside surfaces of the complementary recess of the cavity then preferably extend in the usual manner in the horizontal direction. The outer surfaces of guide rails formed between the two recesses are then also parallel.

The centering element is preferably part of a locking piece (Claim 17) and, with particular preference, integrated with it. The locking piece serves to lock the bolt assembly with the barrel after introduction of the cartridge into the cartridge chamber. Since the locking piece is fastened to the barrel, with integral design of the centering element locking piece, a separate fastening of the centering element on the barrel can be dispensed with.

The invention and additional advantages and features of the invention are further explained below by means of a preferred practical example with reference to the accompanying drawing. In the drawing:

Fig. 1 shows a schematic longitudinal section of a section of an automatic small arm in a first position of the bolt assembly and cartridge;

Fig. 2 shows another longitudinal section of the section of the automatic firearm depicted in Fig. 1 in a second position of the bolt assembly and cartridge;

Fig. 3 shows another longitudinal section of the section of the automatic firearm depicted in Figures 1 and 2 in a third position of the bolt assembly and cartridge;

Fig. 4 shows a cross sectional view of the bolt head of the automatic firearm depicted in Figures 1, 2 and 3;

Fig. 5 shows a cross sectional view of the rear section of the locking piece of the automatic firearm depicted in Figures 1, 2, and 3.

A barrel 1 made of steel or titanium of an automatic firearm is shown in Fig. 1. A cartridge chamber 2 to receive a cartridge 3 (belt cartridge) with a cartridge casing 4 is designed integral with barrel 1 on its rear (on the right in the drawing) end section. The inside

diameter of a front cartridge chamber section 2a, lying to the left in the drawing, is identical to the inside diameter of barrel 1. A central cartridge chamber section 2b, lying in the drawing to the right of the front cartridge chamber section 2a, has a larger inside diameter than the front cartridge chamber section 2a, and a rear cartridge chamber section 2c, lying to the right of the center cartridge chamber section 2b in the drawing, has a greater inside diameter than the center cartridge chamber section 2b. The inside diameter of barrel 1 and the front cartridge chamber section 2a correspond to the outside diameter of a projectile on the front end of cartridge 3. The outside diameter of a front section 4a, lying to the left in the drawing, of the cartridge casing 4 also corresponds to the inside diameter of the center cartridge chamber section 2b, and the outside diameter of a center cartridge casing section

4b, lying in the drawing to the right of the front cartridge casing section 4a, corresponds to the inside diameter of the rear cartridge chamber section 2c.

A locking piece 5 is fastened to cartridge chamber 2. The locking piece 5 has a continuous cavity 6. An inside wall of a front section 5a of the locking piece 5, lying to the left in the drawing, lies on an outside wall 7 of the center and rear cartridge chamber sections 2b, 2c and is connected to them.

A rear cartridge casing section, lying to the right in the drawing, has, on its rear end, a projection 4d with greater outside diameter than the other rear cartridge casing section 4c. As an alternative, the outside diameter can also be equally large (not shown). The rear cartridge casing section 4c with projection 4d is accommodated in a hollow cylindrical recess 8a in a front end, lying to the left in the drawing, of a bolt head 8b of a bolt assembly 8. The inside diameter of recess 8a is greater than the diameter of projection 4d of the rear cartridge casing section 4c. A relatively large clearance is therefore present between an annular inside surface 8c of recess 8a and an annular outside surface of projection 4d.

The bolt assembly 8 has shoulders 8d on bolt head 8b running in the longitudinal direction, which extend outward, according to Fig. 4, from bolt head 8b, according to equal angular sections. The shoulders 8d each have flat outer surfaces 8e and flat side surface 8f that extend roughly in a horizontal direction, referred to Fig. 1.

Complementary to the shoulders 8d of bolt assembly 8, a rear section 5b, lying to the right in Fig. 1 of the locking piece 5, has recesses 5c according to Fig. 5, so that a guide rail 5h is produced between each two recesses 5c. The shoulders 8d of the bolt head 8 then correspond in cross sectional shape to the recesses 5c of the locking piece 5. The recesses 5c and the guide rails 5h run, as shown in Fig. 1, from a front end of a rear part 5f of the rear section 5b of locking piece 5 in the longitudinal direction forward to a rear end of a front part 5g of rear section 5b of locking piece 5. The front part 5g of the rear section 5b of locking piece 5 has the shape of a hollow cylinder.

The recesses 5c of the rear section 5b of locking piece 5 extend, according to Fig. 5, into the interior of the rear section 5b of locking piece 5 according to the same angular sections. They each have flat inside surfaces 5e and flat side surface 5d. As shown in Fig. 1, the opposite inside surfaces 5e of recesses 5c taper conically forward and the opposite outside surfaces 5i of guide rails 5h run parallel. In an alternative variant, the opposite outside surfaces 5i of guide rails 5h taper conically forward. The outer surfaces 5i of guide rails 5h then grade flatly into the inside surface of the rear part 5f of the locking piece, and the guide rails 5h are triangular in longitudinal section.

The inside surface of the rear part 5f of the rear section 5b of locking piece 5 has the shape of a cone that tapers from the rear to the front. The tapering is stronger than in the inside surfaces 5e of recesses 5c and, in the aforementioned alternative variant, stronger than in the outside surface 5i of guide rails 5h.

The distance d', according to Fig. 5, between two opposite inside surfaces 5e of recesses 5c of the rear locking piece section 5b, as shown in Fig. 1, becomes smaller from the rear to the front. The same applies in the aforementioned alternative variant for the distance between two opposite outside surfaces 5i of guide rails 5h. The distance d" between two opposite inside surfaces 5e of recesses 5c is minimal on a front end of the recesses 5c and there corresponds to the distance d", according to Fig. 4, between two opposite outside surfaces 8e of bolt head 8, as well as the inside diameter of an inside wall of the adjacent hollow cylindrical front part 5g of the rear section 5b of locking piece 5. Accordingly, in the aforementioned alternative variant, the distance between two opposite outside surfaces 5i of guide rails 5h is minimal on a front end of the guide rails 5h and there correspond to the distance between two opposite inside surface 8i between two shoulders 8d of bolt head 8.

When the firearm is loaded, the bolt assembly 8 is moved forward in the direction of the position depicted in Fig. 1 initially by recoil spring (not shown). The bolt assembly 8 then pushes cartridge 3 forward. In so doing, cartridge 3 is lifted, in which, in the variant depicted here, the rear cartridge casing section 4c of cartridge 3 is finally introduced into the recess 8a of bolt head 8b. On further movement of cartridge 3 forward, an outer wall of the projectile finally comes in contact with an inside wall of the rear cartridge chamber section 2c, and then, according to Fig. 1, an inside wall of the middle cartridge chamber section 2b.

A center axis n of bolt assembly 8 or recess 8a of the bolt head 8b intersects a center axis m of barrel 1, lies skewed relative to it or is parallel to it. The bolt assembly center axis n is therefore still not centered with reference to the barrel center axis m. The same applies for a center axis of the cartridge (not shown).

If the bolt assembly 8 with cartridge 3 is moved farther forward in the direction of the position depicted in Fig. 2, the outer wall of the projectile of cartridge 3 comes in contact with an inside wall of the front cartridge chamber section 2a. Since, as explained, the inside diameter of barrel 1 and the front cartridge chamber section 2a is equal to the outside diameter of the projectile of cartridge 3, the center axis (not shown) of cartridge 3 is centered on the barrel center axis m. On the other hand, the center axis n of bolt assembly 8 is initially still not centered with the barrel center axis m. Between the annular inside surface 8c of recess 8a and the outside surface of the projection 4d of cartridge 3, a clearance is present, as explained above.

On further movement of bolt assembly 8, the front cartridge chamber section 4a reaches the center cartridge chamber section 2b. A front edge between the outer surface 8e of the shoulder 8d, lying on the bottom in Fig. 2, of bolt assembly 8 and its front surface 8g initially touch the inside surface of the rear part 5f and then the inside surface 5e of the recess 5c, lying on the bottom in Fig. 2, of the rear section 5b of the locking piece 5. Because of the conical tapering of the inside surface of the rear part 5f and the inside surface 5e of recess 5c, the bolt assembly 8, during its further forward movement, is raised until finally, in the position depicted in Fig. 2, its center axis n is centered on the barrel center axis m. The edge of bolt assembly 8 has then reached the front part 5g of the rear locking piece section 5b. However, as mentioned, the distance d' there between two opposite outside

surfaces 5e of recesses 5c of locking piece 5 corresponds to the distance d" between two opposite outside surfaces 8e of shoulders 8d of bolt head 8.

If the bolt assembly 8 with cartridge 3 is moved farther forward in the direction of the position shown in Fig. 3, the outer surfaces 8e of shoulders 8d of the bolt assembly 8 touch the inside surface of the adjacent hollow cylindrical front part 5g of the rear section 5b of locking piece 5. The bolt assembly 8 in the hollow cylindrical front part 5g is then guided farther forward with relatively limited clearance in the bolt assembly center axis n.

Finally, the cartridge chamber 4 according to Fig. 3 reaches the cartridge chamber 2 and the front surface 8g of bolt assembly 8 lies right in front of a rear side surface 2d of the rear cartridge chamber section 2c. The shoulders 8d of the bolt head 8b now lie in front of the guide rails 5h of the locking piece 5. In this position, the bolt head 8b can then be rotated in the usual manner and, on this account, the bolt head 8b can be fixed with the locking piece 5 and therefore with barrel 1 against displacement in the longitudinal direction.

A cavity is formed by the bolt assembly 8 in the longitudinal direction that accommodates a firing pin 9. A rear outer surface 4e of cartridge chamber 4, lying to the right in the drawing, lies against a side surface 8h of recess 8a of bolt head 8b. The firing pin 9 is moved forward so that its front end emerges from the side surface 8h of recess 8a of bolt head 8b and the cartridge 3 is fired.

DATE
14 May, 2001

## Patent Claims

1. Device for loading a cartridge (3) into a cartridge chamber (2) of a barrel (1) of an automatic small arm, with a bolt assembly (8) that can be displaced in the longitudinal direction of the weapon to entrain cartridge (3) in cartridge chamber (2),
in which one centering element (5b) rigidly connected to barrel (1) is provided for centering of the bolt assembly (8) or a bolt head (8b) before complete introduction of cartridge (3) into cartridge chamber (2), so that the center axis of bolt assembly (8) initially not lying coaxially to the bore of barrel (1) lies precisely coaxially to the barrel bore after centering (5b), and
in which the centering element (5b)
is configured so that it centers the bolt assembly (8) or the bolt head (8b) during forward displacement of bolt assembly (8),
is directly connected to barrel (1) and
is arranged next to cartridge chamber (2),
characterized by the fact that the centering element (5b) has a continuous cavity (6) with recesses (5c), whose outer surfaces (5e) lying obliquely to the longitudinal direction of the weapon taper conically from the rear to the front.
2. Device according to Claim 1, in which the bolt assembly (8) is centered by an additional obliquely lying surface of an additional centering element.

3. Device according to one of the Claims 1 or 2, in which the outer surfaces (5i) of guide rails (5h) formed between two recesses (5c) of the cavity also taper conically from the rear to the front.

4. Device according to one of the preceding claims, in which the centering element (5b) has a hollow cylindrical section (5g) for guiding the bolt assembly (8) into the centered position relative to barrel (1).

5. Device according to one of the preceding claims, in which the bolt assembly (8) has grooves, whose inside surfaces taper conically from the rear to the front.

6. Device according to Claim 5, in which outer surfaces of rails formed between two grooves of bolt assembly (8) taper conically from the rear to the front.

7. Device according to one of the preceding claims, in which the centering element (5b) is part of a locking piece (5).

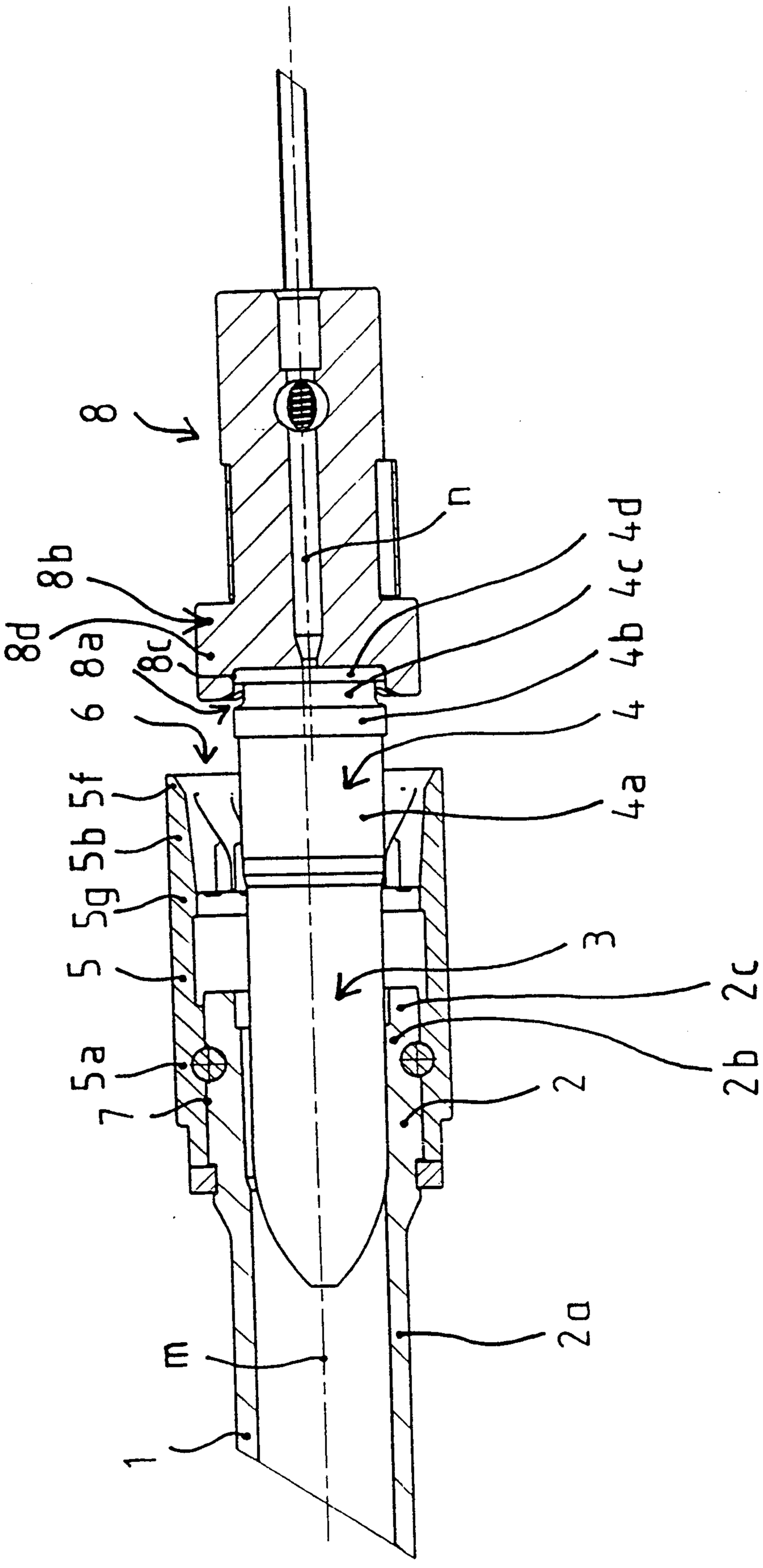



Fig.1

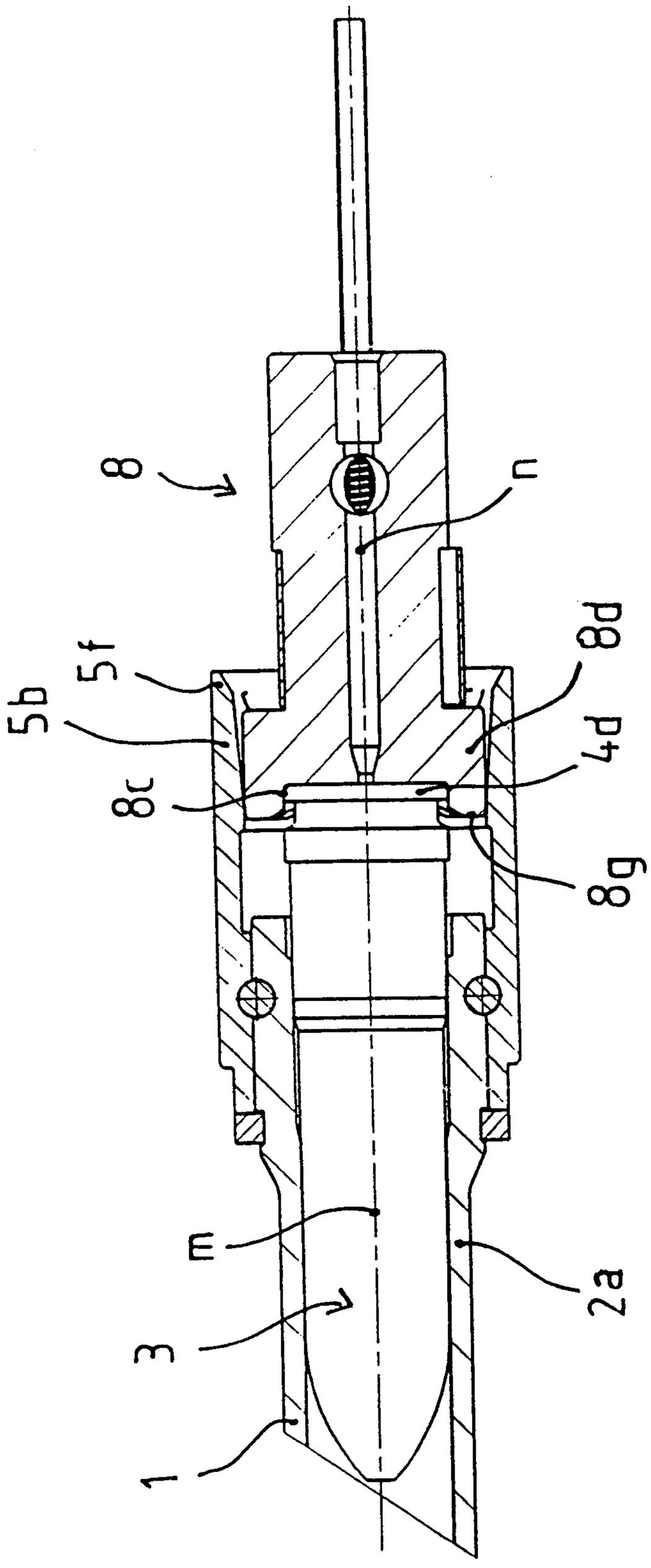



Fig. 2

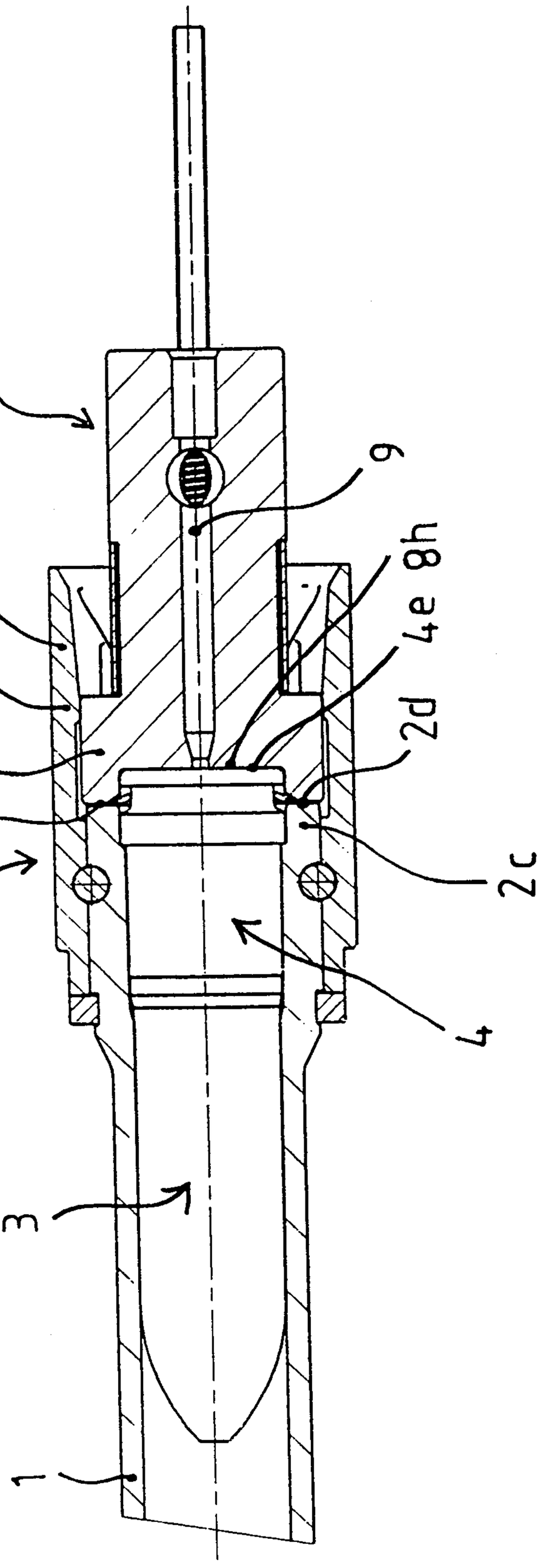



Fig. 3

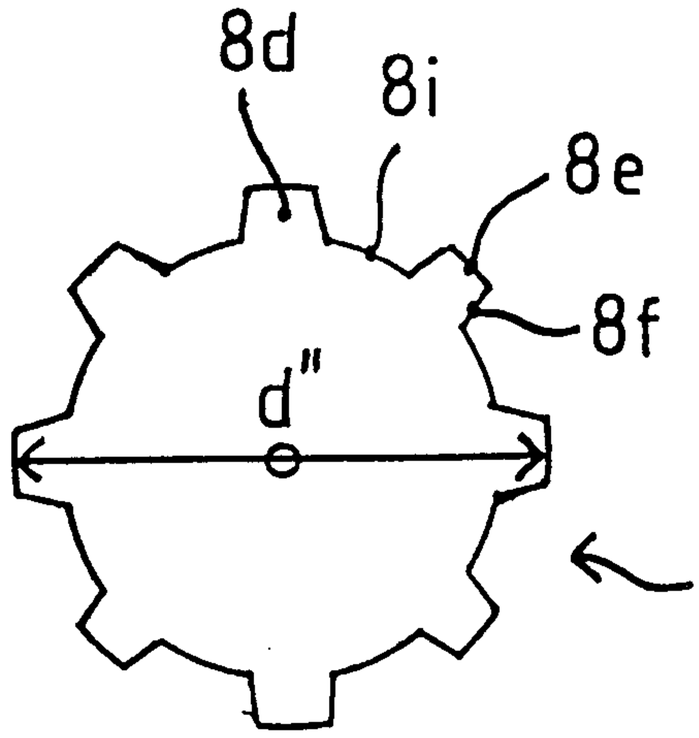



Fig. 4

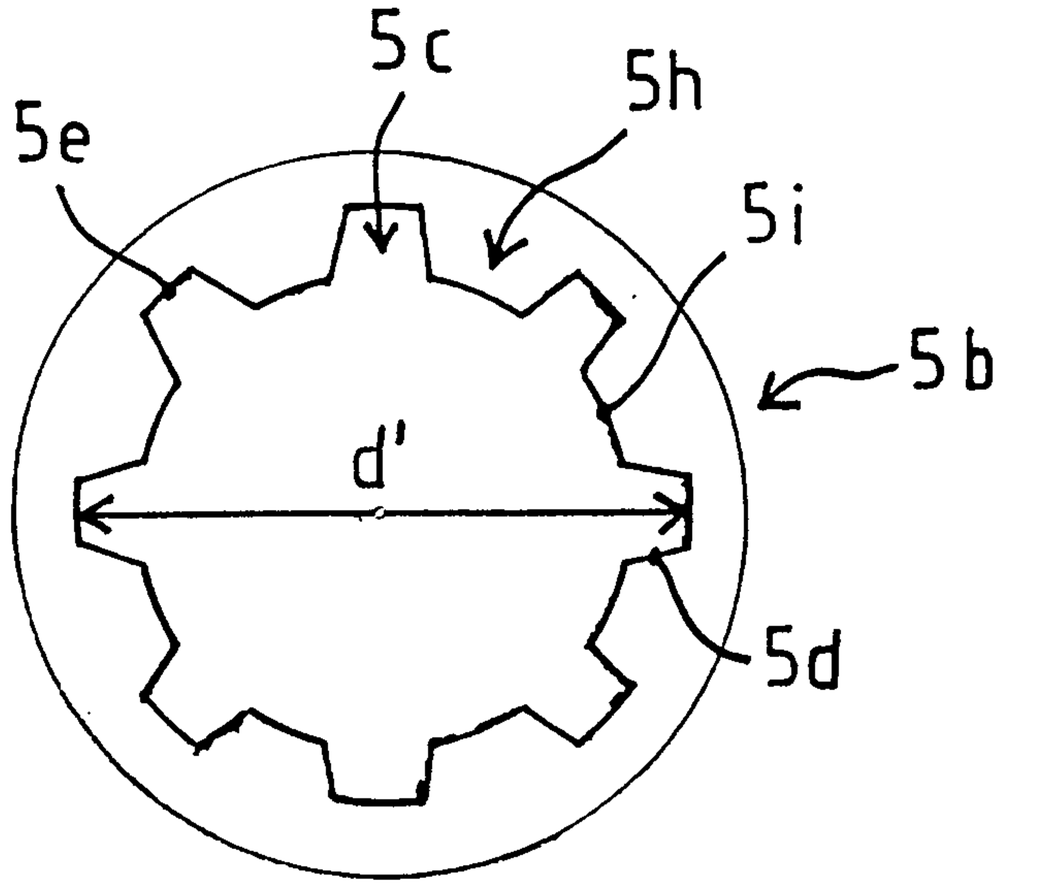
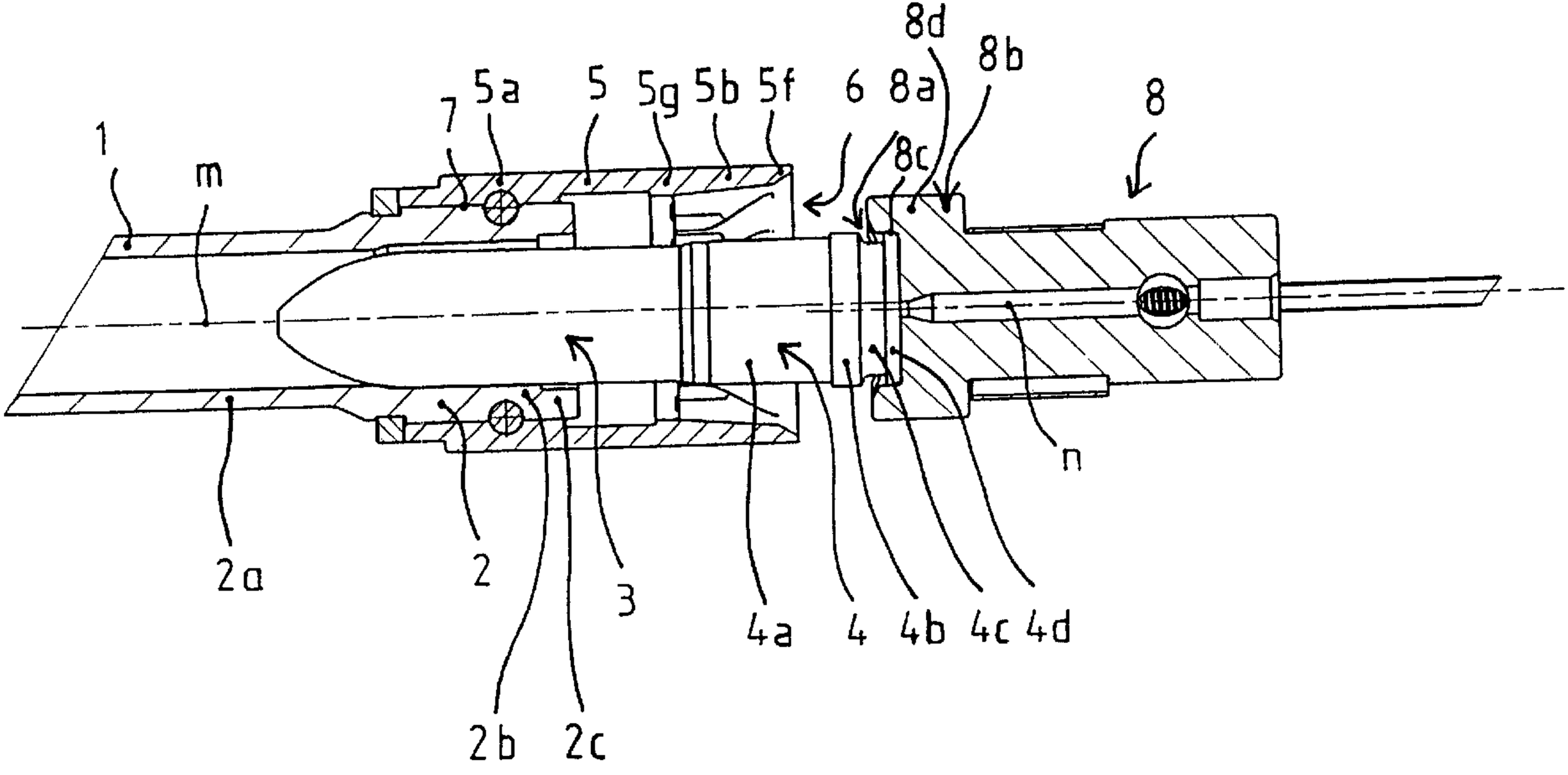



Fig. 5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