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(54) **CARBINE WITH AN ADJUSTMENT DEVICE FOR GAS-OPERATED WEAPONS**

KARABINER MIT EINER VERSTELLVORRICHTUNG FÜR GASBETRIEBENE WAFFEN

CARABINE DOTÉ D'UN DISPOSITIF DE RÉGLAGE POUR ARMES À GAZ

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Description

[0001] The invention relates to a carbine according to the preamble of claim 1

General background:

[0002] In automatic firearms, so-called gas-operated weapons, such as in the M4- or AR15-based systems, the automatic reloading process can be gas-powered. In this case, a small portion of the gas used for the propulsion of the projectile is removed during the firing of a shot by means of at least one gas removal bore located in the vicinity of the muzzle and guided via a gas block and a gas pipe in the direction of the lock. The high energy of the gas pressure is used to unlock and open the lock and to eject the empty shell.

[0003] Using different types of ammunition results in different removable gas pressures. In order to ensure the correct unlocking and opening of the lock, the removed gas pressure must be adjusted accordingly by means of a gas pressure control option (= gas selector).

[0004] In the prior art, this is achieved as follows:

- Very widespread are rotatable or screwable gas selectors which are arranged, e.g., at the gas block or also near the lock at the so-called "gas key." For example, by means of different diameters of a bore, the gas selectors can regulate the gas flow flowing through in that the rotational movement of the gas selector places different bores between the gas removal bore and the gas pipe. In some cases, selecting "no hole" can completely interrupt the gas flow, which of course means that the weapon no longer reloads automatically. See, e.g., US2015292825A1, or US9372038 B1.
- For example, US2017321978 A1 discloses such a screwable gas selector with differently sized bores in the thread, which regulate the gas flow.
- US2016033218A1 discloses a gas selector which is adjustable by means of a tool, such as a screwdriver.
- Variations with the gas selector located at the so-called "gas key" are disadvantageous for use in the field because the gas flow of the weapon is adjustable only in the disassembled state.
- These gas selectors are frequently only adjustable by means of a tool, such as a screwdriver. Solutions that allow for an adjustment of the gas selector only by means of tools are particularly disadvantageous for field use because without an appropriate tool, the gas pressure cannot be adjusted.
- However, variations with valves are also possible, e.g., WO2016/086191A2 discloses a needle valve for adjusting the gas flow.
- Solutions, in which gas selectors are mounted by means of threaded fasteners, preclude economically required low production costs due to the elaborate and expensive production of threads.
- Variations without catch or stop: inadvertent adjustment to "zero flow" equals no automatic reloading; unusable in the field.
- Slider variations have no automatic seal, and the gas flow can escape sideways in an uncontrolled manner.
- US201615133633A1 discloses a slidable gas selector without an end stop. US20060065112A1 also discloses a slidable gas selector with a catch but without an end stop.
- US8960069B1 is the prior art closest to the invention, describing a slidable gas selector.

[0005] US 8,960,069 B1 discloses a platelet which is slidable transversely to the barrel axis and has two bores which can be alternately aligned with the removal bore in the barrel. A pin, arranged parallel to the barrel axis in the plane of the platelet and pushed by a spring towards the platelet, engages in recesses at the edge of the platelet, thus safely ensuring the position of the platelet without preventing the desired sliding. The sliding, as any sliding without a specific guide, is always threatened by tilting, which greatly impairs the functionality. Notwithstanding the above, the device leaks above and below the platelet with all the associated disadvantages.

Problem addressed by the present invention:

[0006] For economic reasons, the objective is a most cost-effective production of the firearm and a preferably small number of components. There is thus a need for a gas system with a gas selector which does not have the disadvantages of the prior art but has the properties initially described. The problem addressed by the invention is that of providing a gas system with a gas selector, which is reliable, easy to clean, and easily and reliably adaptable, and in one embodiment is supposed to also be sealed to the greatest possible extent.

Solution:

[0007] According to the invention, these problems are solved by a carbine as defined in claim 1, particularly achieving the following advantages:

- The gas system has a gas selector, which is pivotable about an axis and multi-adjustable, for the tool-free adjustment of the gas pressure forwarded from the barrel in the direction of the gas pipe;
- the pivotable gas selector has a locking system, with which at least two predetermined positions of the gas selector are to be selected, wherein no undefined intermediate position can be set;
- the pivotable gas selector has an end stop and can thus not assume a "too far" position;
- the respective selectable position of the gas selector corresponds to a respective associated gas through-bore with a correspondingly designed diameter in order to adjust the gas flow.

[0008] The solution according to the invention makes it possible to achieve the following advantages:
Due to the inventive pivoting mechanism of the gas selector with a simple structure, a small number of parts are achieved, which do not require a thread and therefore allow for a cost-effective production.

[0009] Furthermore, due to the pivotable arrangement of the gas selector, the adjustment of the gas pressure on both sides with one hand (one-handed operation) is made possible without the aid of tools in a quick and simple manner.

[0010] In one embodiment, a special shape of the gas selector with improved haptic surface structure allows for the adjustment of the gas pressure, e.g., in the field in bad weather conditions (cold, wet) and when wearing gloves, for example, with the aid of a cartridge. The improved haptic surface structure acts in a slip-proof manner and can, for example, have the shape of one or more indentations.

[0011] Another aspect of the invention relates to the sealing of the gas system. According to the invention, the gas system can be sealed against unwanted gas loss to the outside by means of a self-sealing sealing sleeve, and according to the invention, the full utilization of the gas pressure is accordingly possible without uncontrolled escape of gas on the side.

[0012] The invention shall be explained in more detail in the drawings using an embodiment.

Figure 1 shows a barrel of a carbine with a gas block according to the invention;
Figure 2 shows a cross-section of the barrel with the gas block of Figure 1;
Figure 3 shows an exploded view of the gas block with individual components;
Figures 4a to 4d) show variations of the gas selector;
Figure 5 shows a three-dimensional view of a variation of the gas selector;
Figure 6 shows a cross-section of a gas block; and
Figures 7a and 7b show detailed views of a sealing sleeve in the gas block.

[0013] **Figure 1** shows a typical barrel 1 with the gas block 3 mounted near the muzzle, and a gas pipe 5 of a gas-operated weapon. **Figure 2** shows a cross-section of the barrel axis of a typical barrel 1 with barrel bore 2 and gas removal bore 13, via which a gas flow from the barrel 1 into the gas block 3 and further into the gas pipe 5 is possible.

[0014] The gas block 3, shown in an exploded view in **Figure 3,** has a barrel seat 14 for the barrel 1 and a gas pipe seat 15 for the gas pipe 5. By means of a retaining device 6, consisting of two pins in the depicted embodiment, the gas block 3 is fastened to the barrel 1, and to the gas pipe 5 by means of a gas pipe holding pin 12.

[0015] The gas selector 4 fits into the gas block recess 16 provided for this purpose and is pivotably mounted in the gas block by means of a pivot axis pin 9, wherein the pivoting movement is delimited by a stop pin 10. A catch element 7 with a catch spring 8 effects an automatic meshing of the gas selector 4 at one of the at least two predetermined options of the pivoting movement. Optionally, a sealing sleeve 11 lying in a lower gas bore 24 is provided, which shall be explained in more detail below.

[0016] The gas selector can be actuated without tools and with one hand on both sides. It can have one or more improved haptic surface structurings 21 to allow for an adjustment without slippage, for example, using a cartridge as a "tool." The improved haptic surface structuring 21 is shown as an anti-slip notch, in which, for example, the projectile side of a cartridge engages. This is advantageous particularly when used in the field in adverse weather conditions (e.g., cold, wet) and when using gloves.

[0017] By way of example, **Figure 4** shows a top view of corresponding different, possible shapes of the gas selector 4 with two adjustment options each; the option for providing one or more notches 21 as well as the indentations 17, which interact with the catch element 7, can be clearly seen. As can be clearly seen, the recesses 17 merge, which indicates that no flat surface is formed normally to the movement direction of the catch element 7, and the catch element 7 is thus always pushed into one of the recesses 17 by the spring 8, so that it is reliably prevented that the gas selector 4 is brought into an inactive intermediate position. If this should take place, the catch element 7, due to the effect of the

catch spring 8, will push the gas selector 4 into one of the two possible "correct" positions.

[0018] The two gas through-bores 20 with different diameters can be clearly seen in Figure 4, as well as the axial bore 19, with which the gas selector 4 rotates about the pivot axis pin 9, and the stop bore 18, actually a curved elongated hole which, through interaction with the stop pin 10, delimits the pivoting movement of the gas selector 4 about the pivot axis pin 9.

[0019] **Figure 5** shows a perspective view of a possible shape of the gas selector. It can be clearly seen that, due to the approximately central position of the rotational axis--the axial bore 19 between the front and the rear end of the selector 4--a pushing actuation is possible even if the end of the selector with the gas through-bores 20 is pushed into the gas block 3 all the way to the stop, and so a gripping and (one-handed) pressing from the other side of the weapon is possible, but not necessary.

[0020] The functional principle according to the invention can be summarized as follows:
In the initial state, a cartridge is located in the cartridge chamber (not depicted) of the barrel 1. After firing a shot, the projectile, driven by the gas pressure of the propellant charge, moves in the barrel bore 2 in the direction of the muzzle. After the projectile has passed the gas removal bore 13, shown in Figure 6, a portion of the combustion gases, generated by the combustion process of the propellant charge, flows through the gas removal bore 13 into the corresponding lower gas bore 24 (Figure 3) of the gas block 3 with the sealing sleeve 11, through the gas through-bore 20 of the gas selector 4, through the upper gas bore 23 of the gas block 3 and continues through the gas pipe bore 22 into the interior of the gas pipe 5.

[0021] **Figure 6** shows the entire structure of an adjustment device according to the invention as a sectional view through the weapon median plane: From the barrel 1, the gas removal hole 13 branches off and opens into the gas block 3 in a lower gas bore 24 (Figure 3). In said gas bore, a sealing sleeve 11 is inserted, the operating principle of which shall be explained below with reference to Figure 7. One of the gas through-bores of the selector 4, also simply called a platelet, is arranged in alignment with the lower gas bore; the upper gas bore 23, which opens into the gas bore 22 of the gas pipe 5, is arranged above. Said platelet is inserted with its front end deep into a seat of the selector 4 and secured by a gas pipe retaining pin 12 running normally to the weapon median plane. In order to avoid undesired gas leakage toward the front, the gas pipe 5 is closed in this area by means of a plug which also contributes to the mechanical robustness in the area of the pin 12.

[0022] In the front area of the gas block 3, a recess, preferably a bore, is provided which runs normally to the barrel 1 in the weapon median plane, and in which the catch element 7 is slidably mounted and pushed under the effect of a catch spring 8 toward the selector 4. The tip of the catch element is preferably designed to be conical, with a rounded tip, in order to be able to interact in the best possible manner with the recesses of the catch positions 17. The pivot pin 9 and the stop pin 10 are mounted in two through-bores, which, in the depicted embodiment, are held in this manner, on the side of the recess which is at a distance from the barrel and on the side close to the barrel, in the gas block 3 for the selector 4, which is particularly advantageous in case of the dynamic load.

[0023] The gas block 3 as a whole is attached to the barrel with a retaining device 6; by way of example, the drawing shows two holding pins which lie in recesses of the gas block and corresponding transverse grooves of the barrel.

[0024] In the gas block 3, as can also be clearly seen in Figure 6, the different bores are parallel to one another and can thus be produced without reclamping; in addition, with the exception of the seat for the catch element 7, they are designed as through-bores, which is also advantageous for the production. It is also possible to design said bores as stepped through-bores , but this requires the use of a spring plate. The incrementing of the diameters of the bores 23, 24, as described below, can also be produced without problems.

[0025] The gas flow from the barrel 1 into the gas pipe 5 via the gas block 3 is regulated by selecting differently sized diameters of the at least two gas through-bores 20 of the gas selector 4. A small diameter causes a lower gas flow (e.g., for cartridges with a larger propellant charge) and correspondingly, a larger diameter causes a larger gas flow (e.g., for use of cartridges with a smaller propellant charge). The gas selector is centrally provided with an axis bore 19; in the installed state, the gas selector 4 is correspondingly pivotable about the pivot axis pin 9 located in the axis bore 19. The stop recess 18 and the stop pin 10 lying therein form an internal end stop and delimit the possible pivoting movement. According to the number of gas through-bores 20, there are at least two catch positions 17 which, in the installed state, each individually align the respective associated gas through-bore 20 in one line with the gas removal bore 13 of the lower gas bore 24 and the upper gas bore 23, thus allowing for the gas flow through the respective gas through-bore 20 with the appropriate diameter.

[0026] **Figures 7a and 7b** show the circled detail of Figure 6, the optionally provided sealing sleeve 11, which lies in the lower gas bore 24, in its installation situation (7a) and in the operating state (7b), while gas flows through it. Figure 7b shows how, due to the sudden pressure increase, the sealing sleeve is carried along by the gas flow, effecting a sealing of the gap between the gas block 3 and the gas selector 4.

[0027] Toward the top, the gas selector 4 is already sealed off with regard to the gas block 3 because the installation takes place without gaps.

[0028] The inner diameter of the sealing sleeve 11 is at least as large as the diameter of the gas removal bore and

tapers toward the top. The tapered inner diameter of the sealing sleeve 11 is greater than the diameter of the largest gas through-bore 20 of the gas selector 4. The "large" diameter of the sealing sleeve 11 is smaller than or equal to the diameter of the lower gas bore 24.

[0029] Due to these measures, the sealing sleeve 11 is lifted up, as shown in Figure 7b, when gas flows from the barrel 1 to the gas pipe 5, closing the gap to the gas selector 4; however, the sealing with regard to the gas block 3 is maintained due to the contact of the jacket of the sealing sleeve with the wall of the lower gas bore 24. Mini gaps occurring in rare cases in the course of unfavorable tolerance accumulations between the gas selector 4 and the upper gas bore 23 are also closed by these measures.

[0030] For the assembly, it shall only be described briefly, with reference to Figure 6, that the catch spring 8, together with the catch element 7, is introduced first into its seat, followed by the insertion of the selector 4 into the slot of the gas block 3, wherein the sealing sleeve 11 is optionally inserted beforehand in the lower gas bore 24, followed by the insertion of the pins 9, 10 which thus hold the selector. The gas block is subsequently pushed onto the barrel, the gas pipe 5 is appropriately threaded, and the pins 6 and 12 are used for the final fastening. By means of an appropriately selected fit, it can be ensured that the pins 8, 9 are not lost during handling; attention must be paid to the correct installation of the sealing sleeve 11. The invention is not limited to the depicted and described embodiments, but can be modified and developed in multiple ways. For example, particularly three or more gas through-bores 20 with different diameters can be provided, the notches 21 can have a different shapes and quantities, on its "underside," the gas selector 4 can also have recesses 17 for the catch element 7 to allow the user to be able to make the changes in the direction familiar to such user, and so forth.

[0031] In the description, as in the prior art, reference is made to the different diameters of the gas through-bores 20; in reality, the different cross-sections of these bores are important.

[0032] All materials already used in the prior art can be taken into consideration as the materials for the gas selector, the pins, and the spring; a person skilled in the art can select them with the knowledge of the expected stress.

[0033] The barrel axis and the axis of the gas pipe are usually located in the weapon median plane which, for example, corresponds to the drawing plane in Figure 6. This is due to the usual structure of a carbine, but it is not important for the structure of the selector according to the invention.

List of reference signs:

1	Barrel	13	Gas removal bore
2	Barrel bore	14	Barrel seat
3	Gas block	15	Gas pipe seat
4	Gas selector, platelet	16	Recess
5	Gas pipe	17	Catch position
6	Retaining device	18	Stop bore
7	Catch element (for gas selector)	19	Axis bore
8	Catch spring	20	Gas through-bore
9	Pivot axis pin	21	Anti-slip notch
10	Stop pin	22	Gas pipe bore
11	Sealing sleeve	23	Upper gas bore
12	Gas pipe holding pin	24	Lower gas bore

Claims

1. Carbine having a barrel with a gas removal bore (13) and a gas system, which guides gas selectively from the gas removal bore (13) through a lower gas bore (24) and a matchingly aligned upper gas bore (23) to a gas pipe (5), with a platelet (4), movable between at least two positions in the gas system, in which at least two gas through-bores (20) of different cross-sections are provided, with a catch element (7) which is under the effect of a catch spring (8) and ensures a selected position of the platelet (4), wherein, in each of the at least two positions of the platelet (4), one of the at least two gas through-bores (20) comes to rest in alignment between the gas bores (23, 24), and wherein the platelet (4) has at least two recessed catch positions (17), into which the catch element (7), under the effect of the catch spring (8), optionally engages, provided that the gas through-bore (20) associated with the respective catch position (17) comes to rest in alignment between the gas bores (23, 24) **characterized in that** the platelet (4) is pivotable about a pivot axis pin (9), immovably provided in the gas system, the axis of which runs parallel to the axis of the bores (23, 24); and that a stop pin (10), immovably provided in the gas system and parallel to the pivot axis pin (9), protrudes into a stop bore (18) of the platelet (4), thus delimiting the pivoting.

2. Carbine according to claim 1, **characterized in that** adjacent recessed catch positions (17) merge into one another.

3. Carbine according to claim 1 or 2, **characterized in that** the platelet (4) is provided on its outline with at least one anti-slip notch (21).

4. Carbine according to claim 3, **characterized in that** the at least one anti-slip notch (21) corresponds geometrically to the projectile side of a cartridge designed for the carbine.

Patentansprüche

1. Karabiner mit einem Lauf mit einer Gasentnahmebohrung (13) und einem Gassystem, das Gas von der Gasentnahmebohrung (13) durch eine untere Gasbohrung (24) und eine dazu fluchtende obere Gasbohrung (23) selektiv zu einem Gasrohr (5) leitet, mit einem zwischen zumindest zwei Positionen im Gassystem beweglichen Plättchen (4), in dem zumindest zwei Gasdurchgangsbohrungen (20) unterschiedlichen Querschnitts vorgesehen sind, mit einem unter der Wirkung einer Feder (8) stehenden Rastelement (7), das eine gewählte Position des Plättchens (4) sicherstellt, wobei in jeder der zumindest zwei Positionen des Plättchens (4) eine der zumindest zwei Gasdurchgangsbohrungen (20) fluchtend zwischen den Gasbohrungen (23, 24) zu liegen kommt, und wobei das Plättchen (4) zumindest zwei vertiefte Rastpositionen (17) aufweist, in die eine, unter der Wirkung einer Rastfeder (8) stehende, Rast (7) wahlweise eingreift, mit der Maßgabe, dass beim Eingreifen der Rast (7) in eine der Vertiefungen die dieser zugeordnete Gasdurchgangsbohrung (20) fluchtend zwischen den Gasbohrungen (23, 24) zu liegen kommt, **dadurch gekennzeichnet, dass** das Plättchen (4) um einen im Gassystem ortsfest vorgesehenen Schwenkachsenstift (9), dessen Achse parallel zur Achse der Bohrungen (23, 24) verläuft, schwenkbar ist, und dass ein zum Schwenkachsenstift (9) parallel im Gassystem ortsfest vorgesehener Anschlagstift (10) in eine Anschlagbohrung (18) des Plättchens (4) ragt und so die Schwenkung begrenzt.

2. Karabiner nach Anspruch 1, **dadurch gekennzeichnet, dass** benachbarte vertiefte Rastpositionen (17) ineinander übergehen.

3. Karabiner nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Plättchen (4) an seinem Umriss mit zumindest einer Antiabrutschkerbe (21) versehen ist.

4. Karabiner nach Anspruch 3, **dadurch gekennzeichnet, dass** die zumindest eine Antiabrutschkerbe (21) geometrisch der Projektilseite einer für den Karabiner bestimmten Patrone entspricht.

Revendications

1. Carabine comprenant un canon avec un trou d'évacuation des gaz (13) et un système de gaz qui guide les gaz de manière sélective depuis le trou d'évacuation des gaz (13) à travers un trou de gaz inférieur (24) et un trou de gaz supérieur (23) aligné de façon à coïncider, jusqu'à un tube à gaz (5), comportant une plaquette (4), déplaçable entre au moins deux positions dans le système de gaz, dans laquelle sont prévus au moins deux trous de gaz débouchants (20) de sections transversales différentes, comprenant un élément d'encliquetage (7) qui est sous l'effet d'un ressort d'encliquetage (8) et assure une position sélectionnée de la plaquette (4), sachant que dans chacune des au moins deux positions de la plaquette (4), l'un des au moins deux trous débouchants (20) vient se placer dans l'alignement entre les trous de gaz (23, 24), et sachant que la plaquette (4) présente au moins deux positions d'encliquetage (17) en retrait, dans lesquelles l'élément d'encliquetage (7) s'engage de manière facultative sous l'effet du ressort d'encliquetage (8), à condition que le trou de gaz débouchant (20) associé à la position d'encliquetage (17) respective vienne se placer dans l'alignement entre les trous de gaz (23, 24),

   caractérisée en ce que la plaquette (4) peut être pivotée autour d'une tige formant axe de pivotement (9), prévue de manière fixe dans le système de gaz, dont l'axe s'étend parallèlement à l'axe des trous (23, 24) ;
   et **en ce qu'**une goupille d'arrêt (10), prévue de manière fixe dans le système de gaz et parallèle à la tige formant axe de pivotement (9) avance dans un trou d'arrêt (18) de la plaquette (4), en limitant ainsi le pivotement.

2. Carabine selon la revendication 1, **caractérisée en ce que** les positions d'encliquetage (17) en retrait adjacentes se fondent l'une dans l'autre.

3. Carabine selon la revendication 1 ou 2, **caractérisée en ce que** la plaquette (4) est pourvue d'au moins une encoche antidérapante (21) sur son pourtour.

4. Carabine selon la revendication 3, **caractérisée en ce que** l'encoche antidérapante (21), au nombre d'au moins une, correspond sur le plan géométrique au côté projectile d'une cartouche conçue pour la carabine.

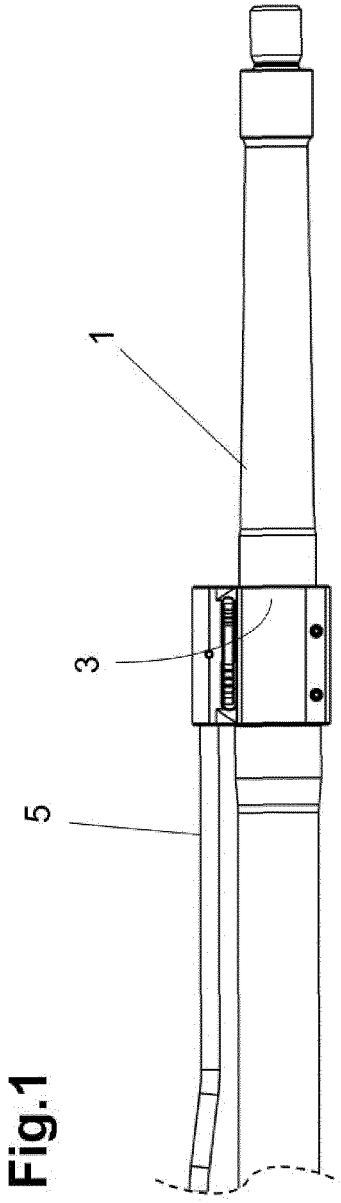


Fig.1

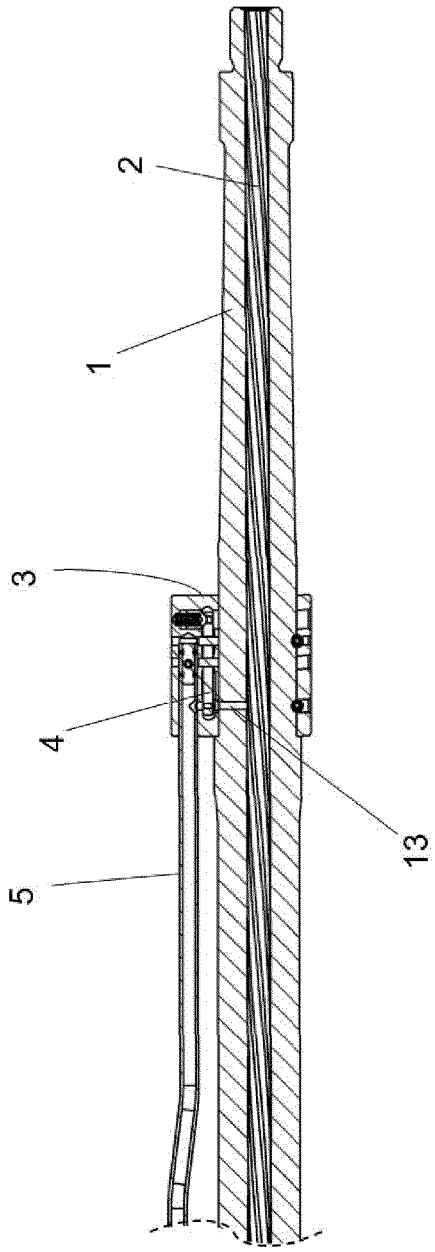


Fig.2

Fig.3

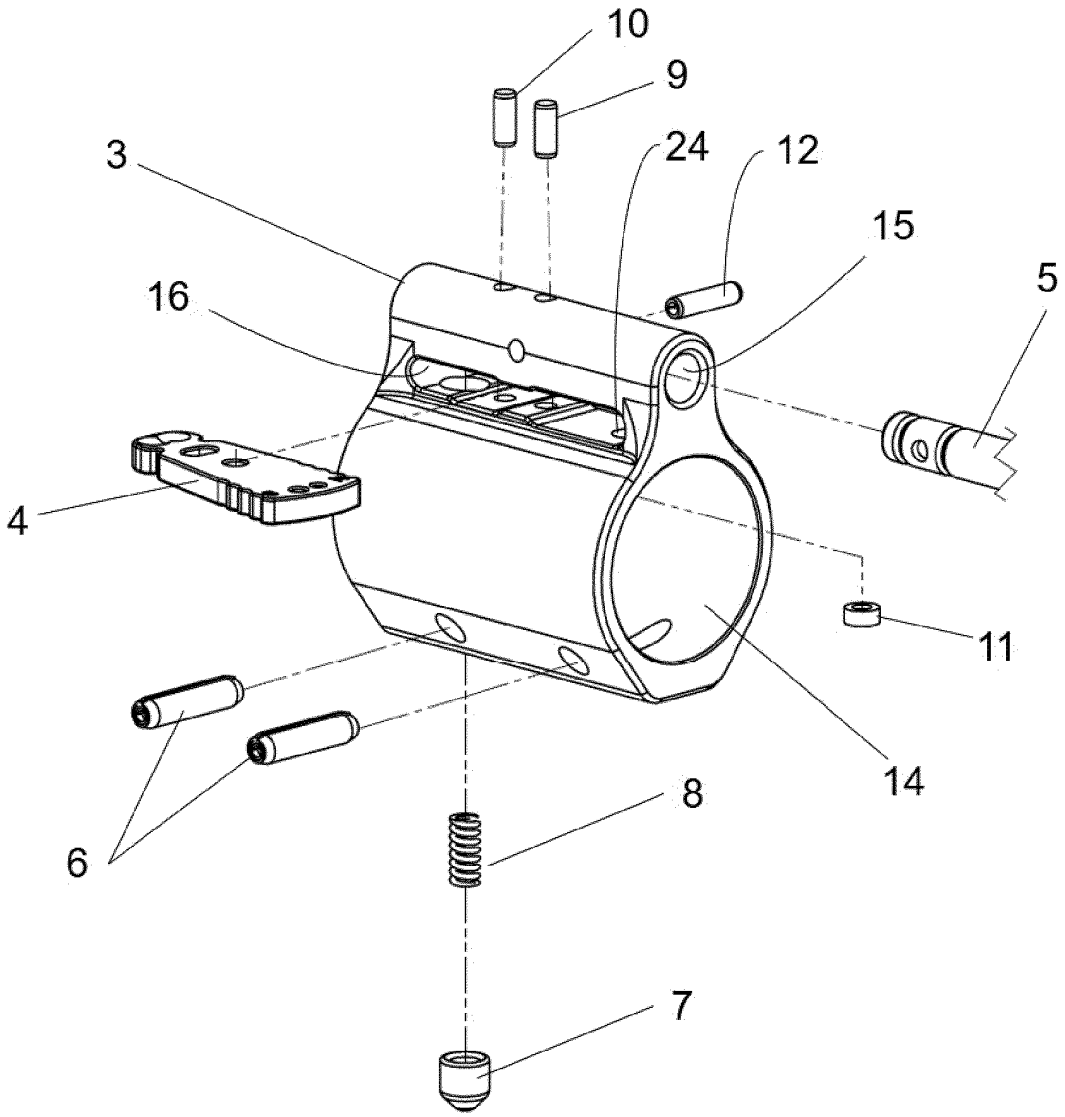


Fig.4

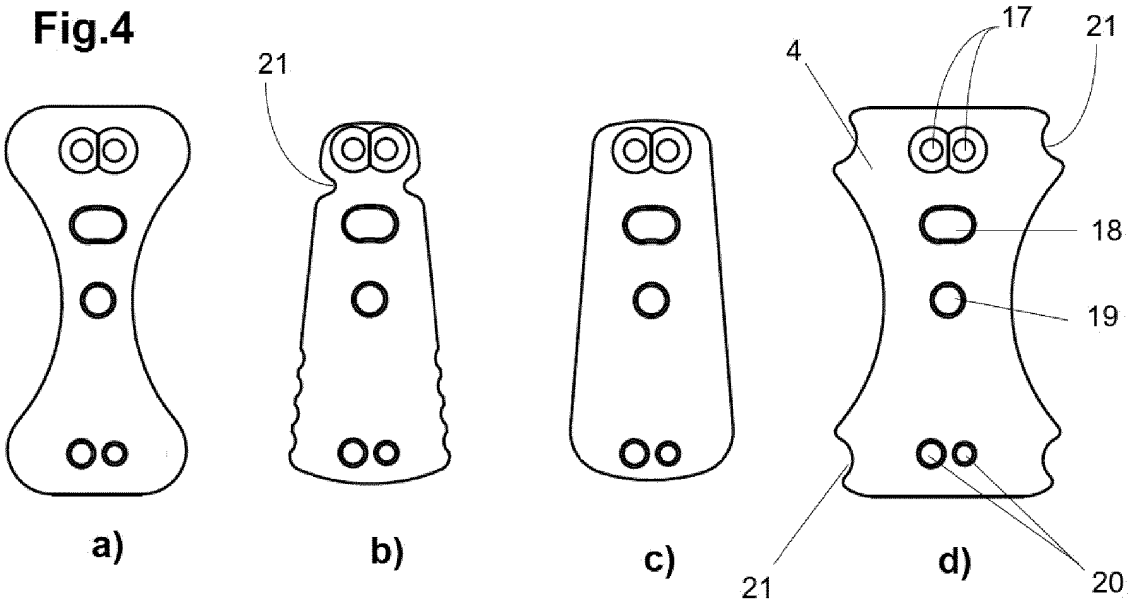


Fig.5

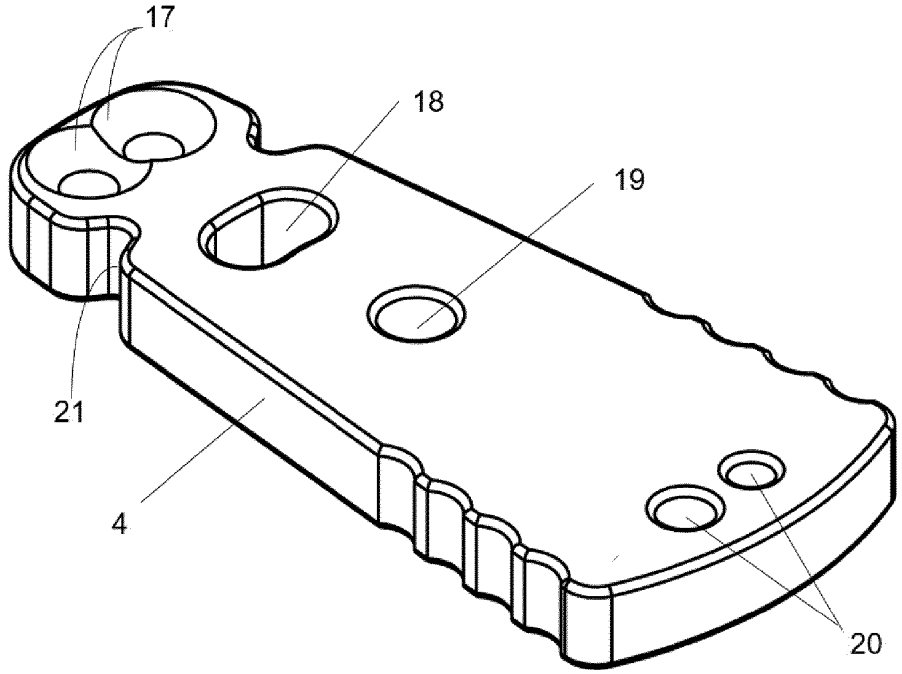


Fig.7

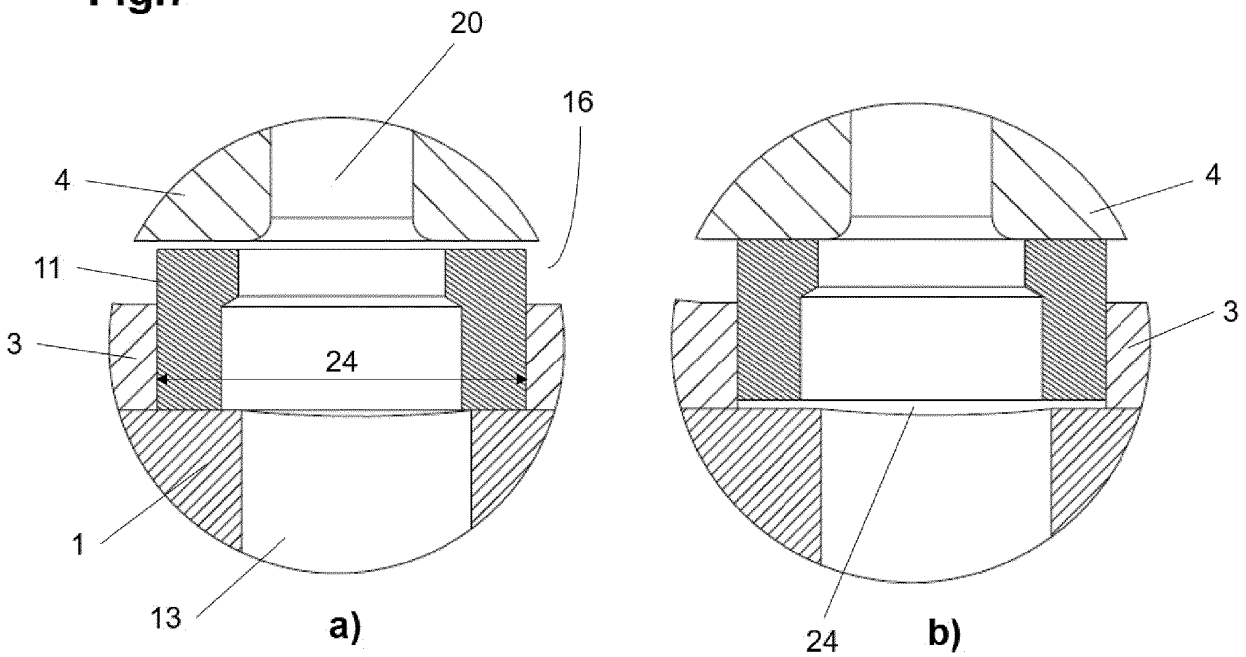
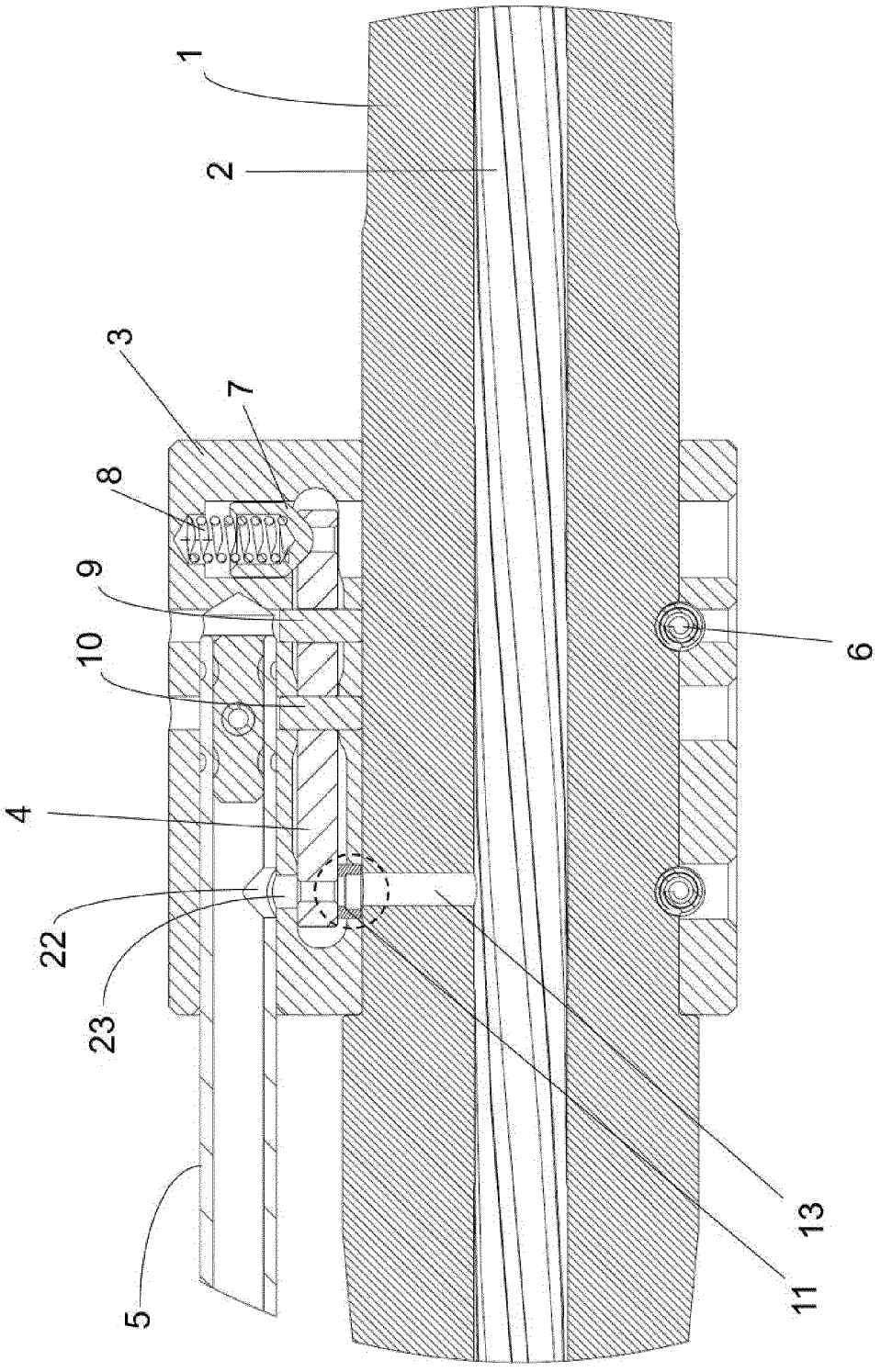


Fig.6



REFERENCES CITED IN THE DESCRIPTION

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