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CA 2675219 C 2011/05/03

(11)(21) **2 675 219**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(86) **Date de dépôt PCT/PCT Filing Date:** 2008/01/30
(87) **Date publication PCT/PCT Publication Date:** 2008/08/07
(45) **Date de délivrance/Issue Date:** 2011/05/03
(85) **Entrée phase nationale/National Entry:** 2009/07/09
(86) **N° demande PCT/PCT Application No.:** EP 2008/000732
(87) **N° publication PCT/PCT Publication No.:** 2008/092669
(30) **Priorité/Priority:** 2007/01/30 (DE10 2007 004 588.5)

(51) **Cl.Int./Int.Cl.** *F41A 19/14* (2006.01)

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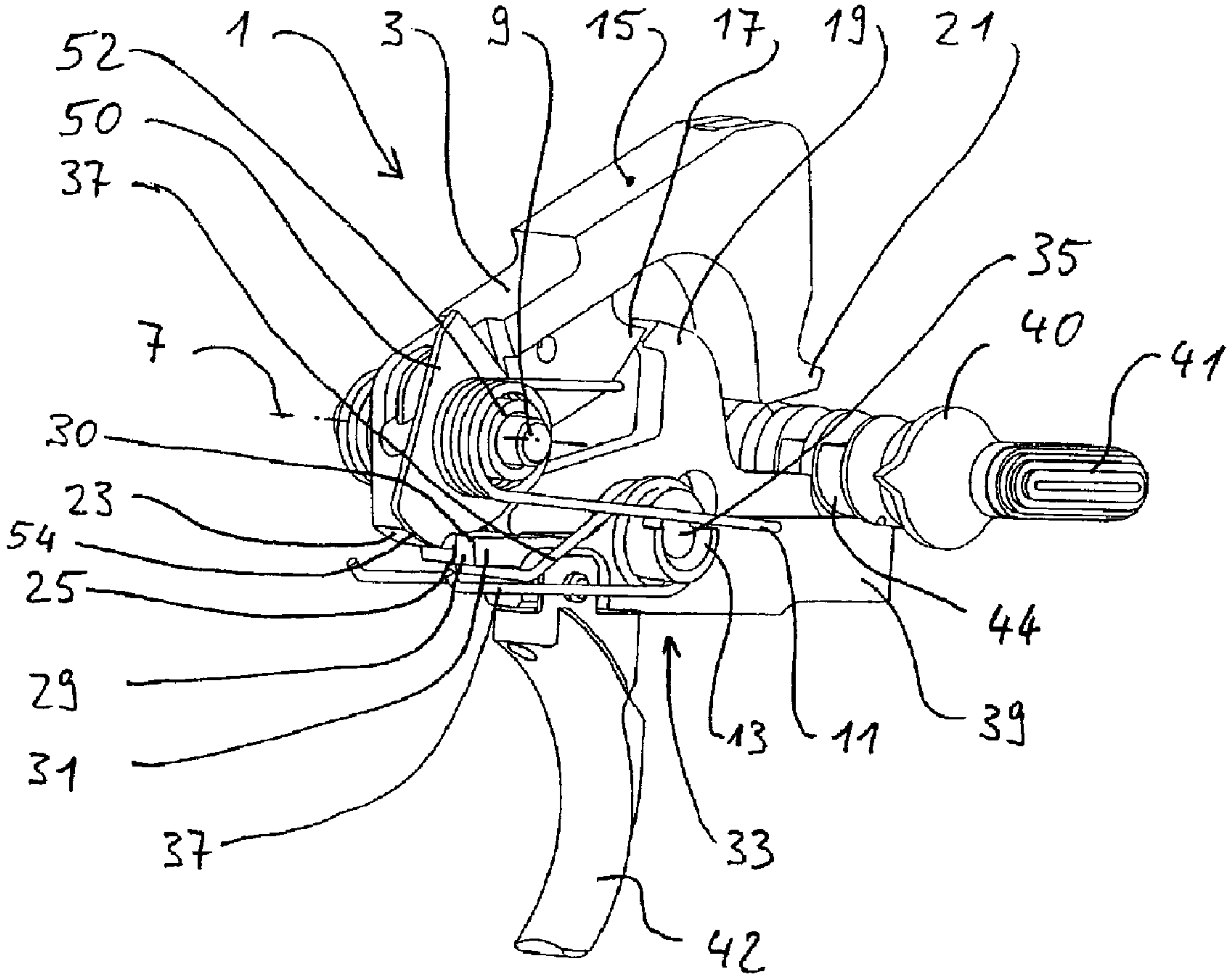
(54) **Titre :** ELEMENT DE COMMANDE, MECANISME DE TIR ET MODULE DE TIR DESTINES A UNE ARME
(54) **Title:** CONTROL ELEMENT, FIRING UNIT AND FIRING ASSEMBLY FOR A WEAPON



(57) **Abrégé/Abstract:**
The invention relates to a control element (50) for a hammer (3) that can be pivoted about a pivoting axis (7). The hammer can be locked in the loaded position with a counter-surface (29) of a release element (30, 31) by means of a detent surface (27). The

(57) Abrégé(suite)/Abstract(continued):

hammer (3) has a control curve section (23), which, in a pivoting position that differs from the loaded position, engages with a control surface (32) of the release element (30, 31), holding the latter in an unlocked position. The control element (50) has a first control curve region (54), which is adjacent to the control curve section (23) and can be adjusted in the pivoting direction to expand said section and which engages with the control surface (32) in order to reduce the required pivoting space of the control curve section (23) and the control curve region (54) when the hammer (3) is moved from a firing position into the loaded position. The invention also relates to a firing unit comprising a control element (50) of this type in addition to an interchangeable firing assembly (1) comprising a hammer (3) and a trigger assembly that has a trigger bar (31), a detent surface (27), which acts by means of an elongated lever arm in relation to the pivoting axis (7), being located on the hammer (3). Said firing assembly (1) is compatible with an existing firing unit and is designed to be interchanged with the latter, the control curve (C) of the assembly having the same or less required pivoting space. The curve is traced by a hammer (A) of the firing assembly, said hammer having a detent surface (B) with a shorter lever arm acting in relation to the pivoting axis.

ABSTRACT

The invention relates to a control element (50) for a hammer (3) that can be pivoted about a pivoting axis (7). The hammer can be locked in the loaded position with a counter-surface (29) of a release element (30, 31) by means of a detent surface (27). The hammer (3) has a control curve section (23), which, in a pivoting position that differs from the loaded position, engages with a control surface (32) of the release element (30, 31), holding the latter in an unlocked position. The control element (50) has a first control curve region (54), which is adjacent to the control curve section (23) and can be adjusted in the pivoting direction to expand said section and which engages with the control surface (32) in order to reduce the required pivoting space of the control curve section (23) and the control curve region (54) when the hammer (3) is moved from a firing position into the loaded position. The invention also relates to a firing unit comprising a control element (50) of this type in addition to an interchangeable firing assembly (1) comprising a hammer (3) and a trigger assembly that has a trigger bar (31), a detent surface (27), which acts by means of an elongated lever arm in relation to the pivoting axis (7), being located on the hammer (3). Said firing assembly (1) is compatible with an existing firing unit and is designed to be interchanged with the latter, the control curve (C) of the assembly having the same or less required pivoting space. The curve is traced by a hammer (A) of the firing assembly, said hammer having a detent surface (B) with a shorter lever arm acting in relation to the pivoting axis.

Control Element, Firing Unit and Firing Assembly for a Weapon

The invention at hand concerns a control element for a hammer of a weapon that can be pivoted about a pivoting axis. Via a detent surface, said hammer can be locked in the loaded position with a counter-surface of a release element, for example a trigger bar at the trigger (see, for example, DE 198 46 657/2). The hammer has a control curve section which, in a pivoting position that differs from the loaded position, engages with a control surface of the release element, holding the release element in an unlocked (non-lockable) position.

In automatic rapid rifle guns, for example, such a known mechanism prevents faulty operation at safety equipment affecting the release element.

The subsequently used directional instructions, such as, front, rear, top, bottom, right and left are made from the viewpoint of a shooter ready to fire.

In known mechanisms, the control curve section is in most cases constructed as a peripheral surface which is designed in cam-like fashion, more of less concentrically to the pivoting axis or swing shaft of the hammer.

In such weapons, the release element is usually designed as a rocking arm which has a trigger bar at its (front) end and which interacts at the other (rear) end, for example, with respective control surfaces of a safety roller. Between the two ends, the rocking arm is mounted in a manner that it is rocking about a pivoting axis which defines the center of rotation. Via a trigger lug, said rocking arm can be tilted (if the weapon is released) about the center of rotation in order to release the hammer. As a result, the front surface of the

And basically the friction force acting between the detent surface of the hammer and the respective counter-surface – the front surface of the trigger bar. This friction force must be overcome in order to disengage the trigger bar from the detent surface of the hammer. This friction force is dependent on the active surfaces direction (detent surface and front surface) while engaged, the friction coefficient active between the two surfaces and the force by means of which the detent surface is pressed against the trigger bar. This force, in turn, is dependent on the tension of the spring element engaging at the firing pin and on the effectiveness of the lever arm which defines the effective distance between this detent surface and the pivoting axis of the firing pin. If equal tension is exerted on the firing pin, the friction force increased all the more the closer the detent surface is located at the pivoting axis of the firing pin. In other words, the shorter the effective lever arm the higher the friction force.

Said lever arm also largely determines the required pivoting space of the control curve section which starts at the release edge of the detent surface and in case of a short lever arm runs close to the pivoting axis, and in case of a long lever arm further away from the pivoting axis.

Comparatively high "trigger weights" of between 35 and 40 n (3.5-4 kp) can have an effect of the shooting accuracy. Trigger weight situated lower, for example, in the region of 15-20 N (1,7–2 kp) are better.

There are several possibilities to appropriately reduce the trigger weight in an available gun: For example, it is possible to lower the matching bearing surface and, consequently the friction coefficient between the detent surface of the firing pin and the counter-surface at the trigger bar by a respective treatment of the surfaces (sanding, polishing, coating, etc.). However, such a procedure is costly in terms of construction technology and due to the high stress to which this matching bearing surface is exposed possibly not very durable.

It is also possible to change the direction toward each other of the detent surface and the counter-surface at the trigger bar, decreasing the tendency of these two surfaces to jam into each other. Even though this measure decreases friction, it can also be realized only with high production costs (close production tolerances). However, this can also involve the danger that the catch mechanism functions reliably, possibly releasing a shot through outside forces (hits, percussion, etc.).

A further objective is to reduce the trigger tension. This also appropriately decreases the friction force affecting the matching bearing surface and reduces the trigger weight. However, decreasing the tension that affects the firing pin involves the danger that the impact effect is reduced to the point that in worst case scenario the fired ammunition is no longer ignited reliably.

All measures mentioned above require high production precision in order to adjust at different weapons low trigger weight in a precise and repeatable manner, and in order to maintain the low trigger weight during long operating periods without complex maintenance.

Another possibility to change the trigger weight is to vary the effective lever arm by means of which the detent surface engages with the counter-surface (the front surface of the trigger bar). By means of this measure, it is possible to control the designated effective force and, consequently, the friction effect, without considerably increasing production costs.

Figure 5 shows a hammer A, in which, starting from a locking and control outline B and C, represented by a dashed line, a modified locking and control outline E and F has been provided in which the pull-off force has been reduced by extending the effective lever arm from h to H. At the same time, Figure 5 shows an associated problem, namely that the required pivoting space of the control curve region E has increased in comparison to the control curve region B. This required pivoting space possibly increases to the point that the available spaces in the housing of the weapon are no longer adequate in order to realize this solution. This means that with available weapons it is very difficult to put into practice this measure of reducing the trigger weight because it is not possible to house a respectively modified hammer in the available housing (collision region K). It is required to provide additional modifications (cutout, expansion, etc.).

The problem could not even be solved by appropriately truncating the control curve section in order to avoid collision K with the housing of the weapon (area represented in black). In this case, a considerable control curve section would be missing. In firing position of the hammer, said control curve section would prevent the release unit from being tilted over the trigger bar in such a way that an accidental locking could be excluded (see above).

Based on these facts we have the objective to provide a firing unit or firing assembly which involves a lower trigger weight without affecting other core functions of the trigger/safety mechanism. If possible the required space should not be extended.

This objective is achieved by means of the control element according to Claim 1.

The invention is characterized in that the control element has a first control curve region which can be adjusted in pivoting direction and which adjoins the control curve section of the hammer. The control element can be adjusted in such a way that, depending on the pivoting position of the hammer, it possibly expands the control curve region in pivoting direction, that is, in peripheral direction and engages in respective pivoting positions at the control surface of the release unit. In this way it maintains the required release function in the designated pivoting range of the hammer. Because of the adjustability of the control element and its control curve region, it is possible to reduce the required control curve section at the hammer and, consequently, also the required pivoting space for this reduced control curve section. However, the control function is realized at the control surface of the release unit for the complete swing distance of the hammer and especially also in firing position of the hammer.

With such a control element it is possible to realize the firing unit according to Claim 9, or a firing assembly according to Claim 10 in which the trigger weight has been reduced by providing a detent surface which affects the hammer by an extended lever arm to the firing rod. Such a firing assembly has been designed to be interface-compatible to an available firing unit and is interchangeable. This does not involve an extension of the required pivoting space. Therefore such firing assembly is also suitable as retrofit equipment for an available weapon.

According to Claim 2, the control element is designed as a cam disc which can be pivoted in coaxial fashion to the pivoting axis of the pivoted lever. By means of this measure, the control element must be located near the area of the pivoted lever carrying the control curve section. Consequently, the control curve section of the cam disc can be designed in such a way that it adjoins and merges with the control curve section. Such a cam disc can be manufactured as a simple stamping part.

According to Claim 3, the new control element has a second control curve region which engages at the release unit if the hammer is in loaded position, thus determining the locking depth between the detent surface of the hammer and the counter-surface at the control element. This simplifies the production of the hammer. Only the detent surface and the effective control curve section require accurate machining. The second control curve region is used as a stop for the depth of engagement of the front surface of a trigger bar. The depth of engagement determines the transition range (the coupling surface) of the active surfaces and, consequently, also the friction force between these surfaces and thus also the trigger weight. Accordingly, the trigger weight can be further adjusted by different radii of the second control curve region.

Claims 4 through 7 involve measures by means of which it is possible to realize the required adjustability between the control element and the hammer, depending on its pivoting position. According to Claim 4, the control element has an adjusting range which restricts the pivoting position toward the hammer by attaching to a counterpart (for example, tappet area of the pivoted lever). To this end, according to Claim 5, a first adjusting range has been provided which attaches to the tappet area during the loading process and adjusts the control element in the designated way. In the case at hand this can occur in that the control curve zone consisting of control curve section and control curve region is reduced, thus minimizing the required pivoting space.

According to Claim 6, a second adjusting range has been provided which has an opposite effect and which guarantees that, if the firing pin is firing or has been fired, the control curve zone has a maximum expansion and the control function is being performed. According to Claim 7, a third adjusting range has been provided in order to finalize the end position between control element and hammer in firing position and, consequently, also the maximum expansion of the control curve zone.

The pivoting socket at the control element which, according to Claim 8, can be mounted coaxially on the swing shaft of the hammer, allows for clean guidance and attachment of the control element – in particular a cam disc – at the hammer edge, guarantees the required pivoting mobility and prevents the control element from tilting on the swing shaft. The use of such a socket also allows for relatively broad tolerance between the inner surface of the socket and the outer surface of the swing shaft.

Claim 9 concerns a firing unit involving an invention-based control element. Claims 10 and 11 concern a complete firing assembly manufactured according to the invention-which can be completely exchanged with an available firing assembly. In this way it is possible without further intervention and replacement to realize at an available weapon a reduced trigger weight without affecting important aspects of safety and function.

According to Claim 11, such firing assembly can also have a trigger lug, a breaker and a catch for continuous fire. This makes the firing assembly also suitable particularly for semiautomatic or automatic ordinance weapons.

Claim 12 concerns such a firing assembly which is equipped with a respective control element of a firing unit or firing assembly.

The drawings provide a description of an embodiment of the invention at hand. It is shown:

Figure 1 a perspective representation of a firing assembly or firing unit having an invention-based control element,

Figure 2 a partial view of the trigger region of a weapon with a partially exposed trigger mechanism in release position,

Figure 3 the view of Figure 2 having the trigger mechanism in release position,

Figure 4 the representation of Figure 3 without the control element, and

Figure 5 a representation of a modified customary firing unit in which a modified hammer collides with the housing of the weapon.

Figure 1 shows a firing unit or firing assembly 1 having the hammer 3 in loaded position. Figure 2 shows the same assembly in the housing of a weapon 5. The represented hammer 3 rests on a swing shaft 9 housed in the housing 5, which swing shaft defines the pivoting axis 7. A leg spring arrangement 11 functions between a stop 13 and the hammer 3, preloading it in firing direction. As a result, when the hammer is released, its blade 15 strikes against a firing pin (not shown), thus sparking a propellant (firing position: see Figure 3).

The represented hammer 3 is also provided with a catching nose 17 which interacts with a breaker 19. A catch 21 for continuous fire has been arranged at the rear end of the hammer 3.

The control curve section 23 designed in cam-like fashion runs at the front end of the hammer 3, which control curve section is connected via an edge 25 with the detent surface 27 (Figure 3) running rectangular to the control curve section 23. By means of the detent surface, the hammer 3 is kept in its locked position (Figure 1, Figure 2).

Locking occurs via the front surface 29 of the end of the trigger 33 which has been designed as a sear catch 31. The trigger 33 is swivel-mounted in the housing 5 of the weapon via the firing rod 35 and is pressed upward with its front end or sear catch in the direction of the hammer 3 via the trigger spring 37 (here also designed as leg spring arrangement). At the same time, the front surface 29 and the detent surface 27 engage in such a way that the hammer is held in cocked position. The rear end 39 of the trigger 33 serving as safety end engages in respective cam areas 44 of the safety barrel 40, which is twistable over the operating lever 41 which runs on the outside of the housing.

On the bottom side of the trigger 33, the trigger lug 42 sticks out and is protruding from the housing 5 of the weapon into the area of the trigger guard 43. For the release action, the trigger lug 42 is activated. To this end, the trigger 33 is pivoted against the force of the trigger spring 37, and the sear catch 31 is disengaged from the hammer 3. More precisely, the front surface 29 glides along the detent surface 27 until the release edge 30 arrives under the edge 25 and, under the force of the leg spring arrangement 11, the hammer 3 snaps into firing position (figures 3 and 4).

At the left edge of the hammer 3, a control element has been arranged which has been designed as a flat cam disc 50 and which is also swivel-mounted via the socket 52 on the swing shaft 9.

The first control curve region 54 of the cam disc 50 laterally adjoins the control curve section 23, expanding it in peripheral direction. In loaded position of the hammer 3, a second control curve section 56 engages at the release edge 30 or the control surface 32 protruding from the release edge, determining the depth of engagement of the sear catch 31 of the front surface 29 at the detent surface 27.

The rotational position of the control element 50 with regard to the hammer in loaded position is determined by the first adjusting range 58 which adjoins a tappet area 22 of the hammer 3, preventing that the cam disc 50 turns further toward the hammer 3 (in Figure 2 counterclockwise turning of the cam disc 50 toward the hammer 3).

In the other direction, a second adjusting range 60 restricts the rotational position of the cam disc 50 with regard to the hammer 3, if the hammer moves from loaded position to firing position (see Figure 3).

The following happens: After the release edge 30 has been uncoupled from the edge 25, the hammer 3 shoots forward and possibly turns against the cam disc 50 (the cam disc 50 shifts clockwise with regard to the hammer 3), until the second adjusting range 60 attaches to the tappet edge 22 and then turns together with the hammer 3. At the end of the hitting movement of the hammer 3 – which now takes on firing position – the cam disc 50 and the third adjusting range 62 attaches to the housing wall 6.

During the firing movement of the hammer 3, the cam disc 50 turns clockwise toward the hammer. In the process the first control curve section 23 shifts in peripheral direction toward the control curve section 23. As a result, the release edge 30 or control surface 32 (the upper side of the sear catch 31) only rests against the control curve region 54 of the cam disc 50 and presses by means of the sear catch 31 the trigger 33 into the position shown in Figure 3.

In this position, the control curve region 54 presses the sear catch 31 downward and, consequently, the rear end 39 of the trigger 33 upward and engages in the respective cam area 44 of the safety barrel 40. The cam area has been designed in such a way that it cannot be shifted from the released position shown in Figure 3 (rear end 39 up) into the safety position shown in Figure 2 (rear end 39 down).

This mechanism guarantees that during the repeating process the hammer 3 can be returned into loaded position. Without the cam disc 50, which is used as control element, the trigger spring 37 would press the trigger 33 into the position shown in Figure 4. The rear end 39 of the trigger 33 would be in a position in which it would be possible to bring the safety barrel 40 into safety position. In safety position the cam area 44 blocks the trigger 33. In this position the sear catch 31 would block the hammer 3. It could not be cocked or would damage the trigger 33 during cocking or could possibly break off the sear catch 31.

At the same time, such a control element (here the cam disc 50) reduces the required pivoting space of the control curve section 23. This control curve section is reduced to the point that, if the hammer 3 is pivoted into loaded position, it does not reach the area of the housing wall 6 which restricts the pivoting space. In other words, the control element (here the cam disc 50) allows for a relatively long lever arm between the pivoting axis 7 and the detent surface 27. This allows for lower trigger weight toward a detent surface which is located closer to the pivoting axis 7 (in this regard, see also the description in the introducing part of Figure 5).

By pivoting the hammer 3 from aiming position to loaded position, the cam disc 50 turns again toward the hammer 3 until the tappet edge 22 attaches to the first adjusting range 58. The control curve section 23 engages with the release edge 30 or the control surface 32, and cam disc 50 and hammer 3 move together into loaded position (Figure 2), in which the sear catch 31 reaches the detent surface 27. The pivoting space between hammer 3 and housing wall 6 is sufficient. There will be no collision. The cam disc 50 shifts according to the pivoting position of the hammer 3. In the process, the control curve zone consisting of control curve section 23 and the first control curve region 54 is reduced (loaded position Figure 2) or expanded (firing position Figure 3). The available pivoting space is used to an optimum degree.

Consequently, it is possible to realize a firing unit or a firing assembly 1 which can be used as a replacement unit in exchange for a respective assembly having a shorter lever arm. It is not necessary to change the mountings of the swing shaft 9 and the firing rod 35. It is also not required to reduce the firing force. Such a replacement assembly can also be arranged in such a way that it is equipped with other known locking mechanisms (breaker 19, catch for continuous fire 21) which interact appropriately with an available safety barrel 40. If required, it is also possible to exchange the safety barrel 40 along with such a replacement unit.

Further variations and modifications of the invention at hand can be derived from the attached patent claims.

Claims

1. A control element (50) for a hammer (3) of a weapon that can be pivoted about a pivoting axis (7),

   which hammer (3) can be locked via a detent surface (27) in the loaded position with a counter-surface (29) of a release element (30, 31),

   the hammer (3) has a control curve section (23) which, in a pivoting position that differs from the loaded position, engages with a control surface (32) of the release element (30, 31), holding the release element in an unlocked position, whereas

   the control element (50) has a first control curve region (54) which can be adjusted in pivoting direction and which adjoins the control curve section (23), and

   depending on the pivoting position of the hammer, the control element expands the control curve region in pivoting direction, and

   engages with the control surface (32),

   in order to reduce the required pivoting space of the control curve section (23) and the control curve region (54) during the process of adjusting the hammer (3) from aiming position to loaded position.

2. A control element (50) according to Claim 1, which is designed as a cam disc and which can be pivoted in coaxial fashion to the pivoting axis (7) of the hammer (3).

3. A control element (50) according to Claim 1 or 2, which has a second control curve region (56) which engages at the release unit (30, 31) if the hammer (3) is in loaded position, thus defining the locking depth between the detent surface (27) and the counter-surface (29).

4. A control element (50) according to one of claims 1 through 3, which has an adjusting range (58, 60, 62) which, depending on the pivoting position of the hammer (3), restricts the pivoting position toward the hammer (3) by attaching to a counterpart (26, 6).

5. A control element (50) according to Claim 4, in which a first adjusting range (58) has been designed to attach to the tappet area (22) of the hammer (3) during the loading process and in loaded position.

6. A control element (50) according to Claim 4 or 5, in which a second adjusting range (60) has been designed to attach to the tappet area (22) of the hammer (3) during the firing process.

7. A control element (50) according to one of claims 4 through 6, in which a third adjusting range (62) has been designed to attach to a housing component (6) in order to determine the end position between control element (50) and hammer (3) in firing position.

8. A control element (50) according to one of claims 1 through 7 having a pivoting socket (52), which can be mounted coaxially on the swing shaft (9) of the hammer (3).

9. A firing unit (1) having a control element (50) according to one of claims 1 through 8,

   which can be mounted coaxially to the swing shaft (9) of a hammer (3), and

   the first control curve region (54) of the control element engages with a sear catch (31) of a trigger (33) in firing position of the hammer (3), so that the safety end (39) of the trigger (33) engages with a safety equipment (40, 43) in such a way that said safety equipment cannot be brought into safety position.

10. A firing assembly (1) having a control element (50) according to claims 1 through 8, a hammer (3) and a trigger assembly comprising a trigger (33),

whereas a detent surface (27) is positioned at the hammer (3) which acts about an extended lever arm in relation to the pivoting axis (7),

whereas the firing assembly (1) has been designed to be interface-compatible with an existing firing unit and can be interchanged with the firing unit, and

the control curve (C)of the assembly has the same or less required pivoting space, which control curve is located at a hammer (A) of the firing assembly in which a detent surface (B) with a shorter lever arm is acting in relation to the pivoting axis.

11. A firing assembly (1) according to Claim 10, also comprising a trigger lug (42), a breaker (19) and a catch for continuous fire (21).

12. A weapon having a control element (50) according to one of claims 1 through 8, a firing assembly (1) according to Claim 9 or a firing assembly (1) according to Claim 10 and 11.

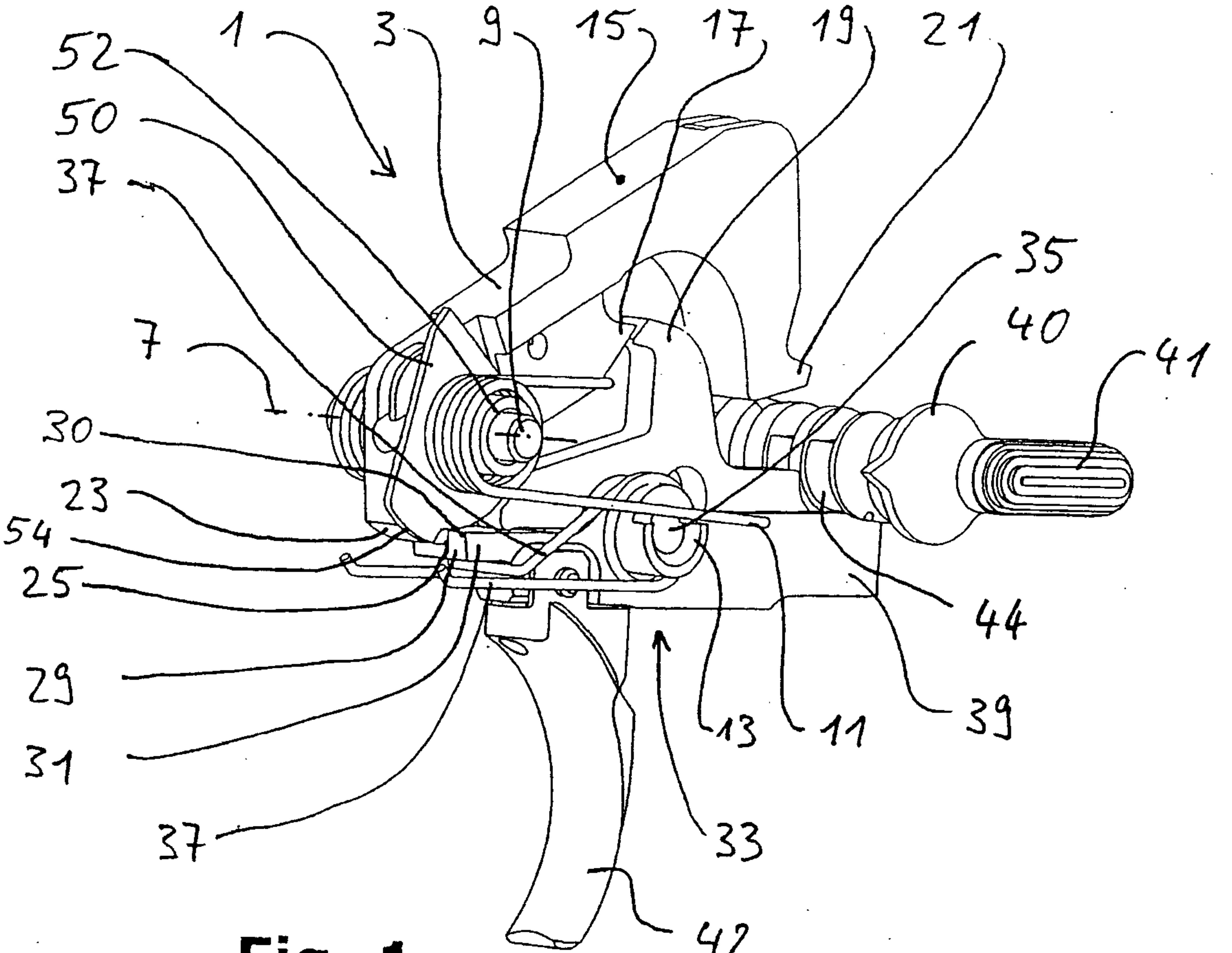

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Fig. 1

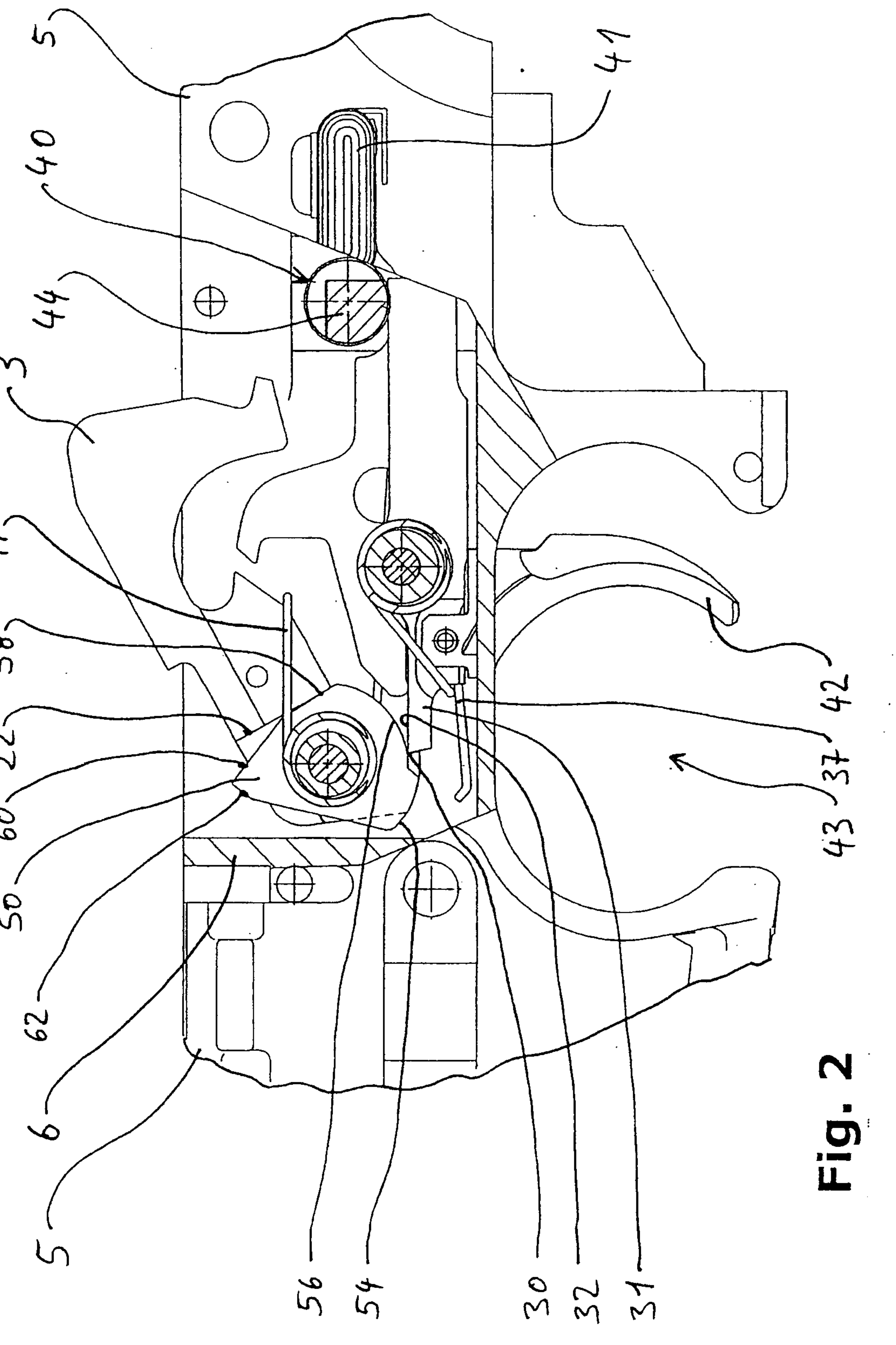


Fig. 2

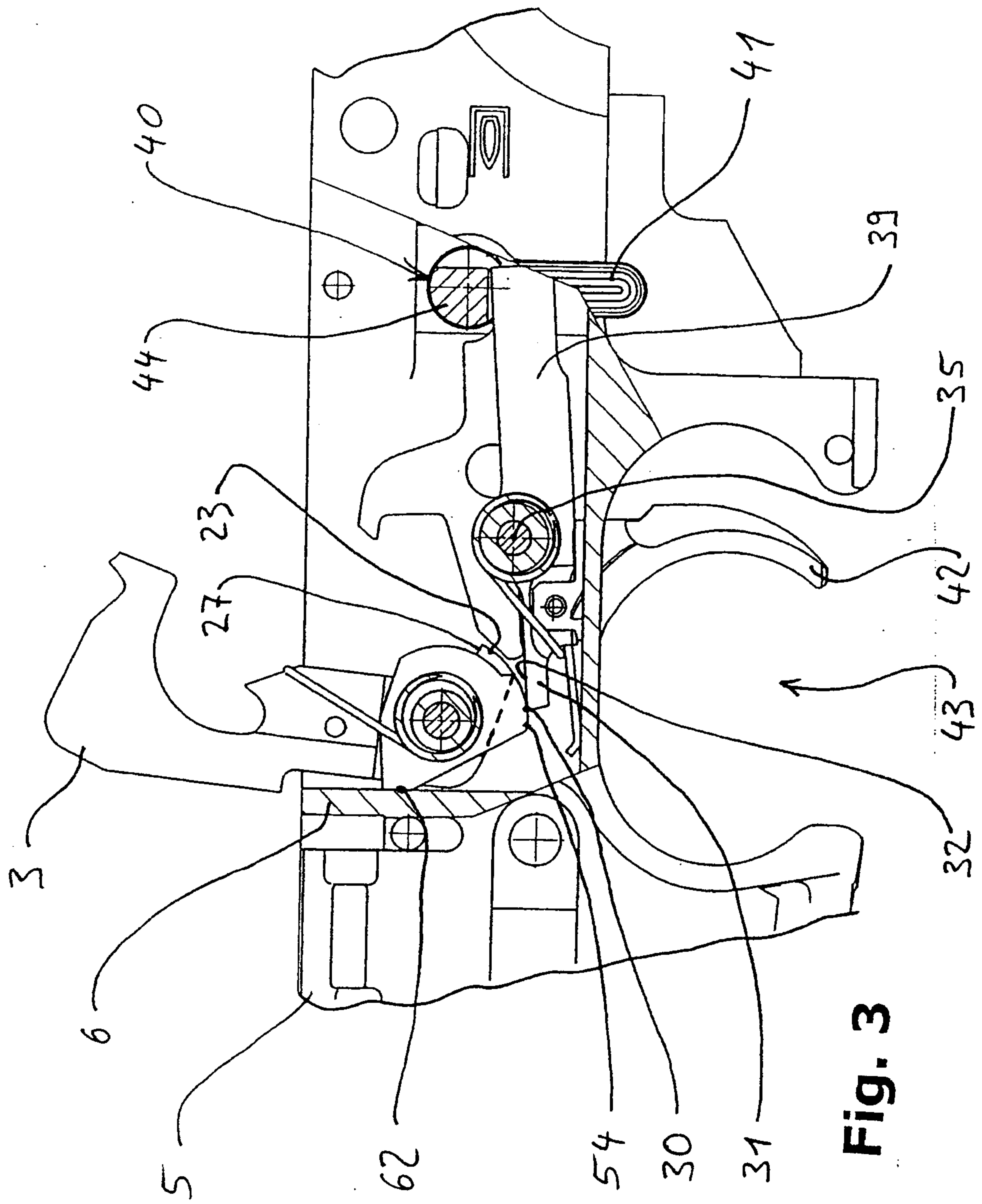


Fig. 3

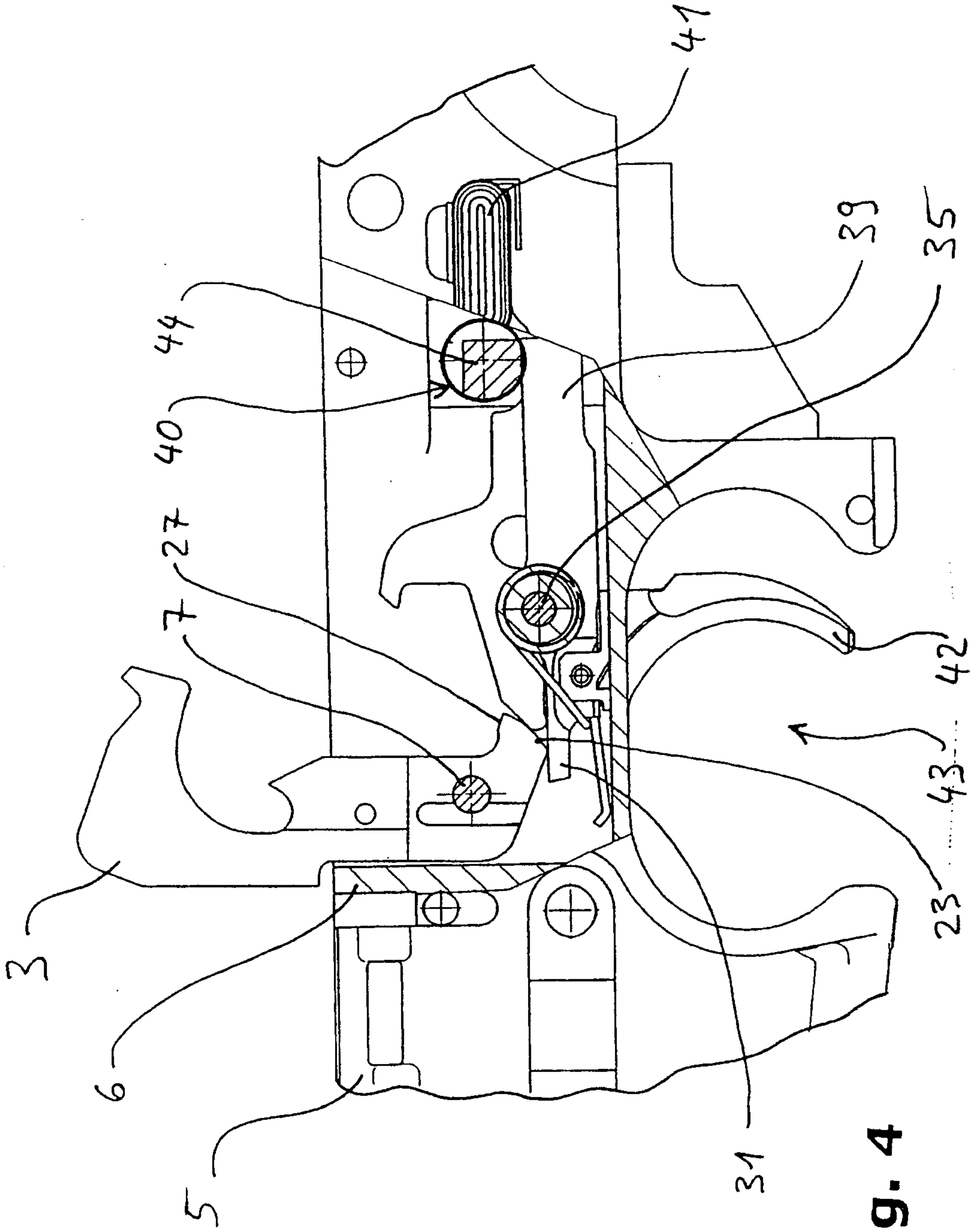


Fig. 4

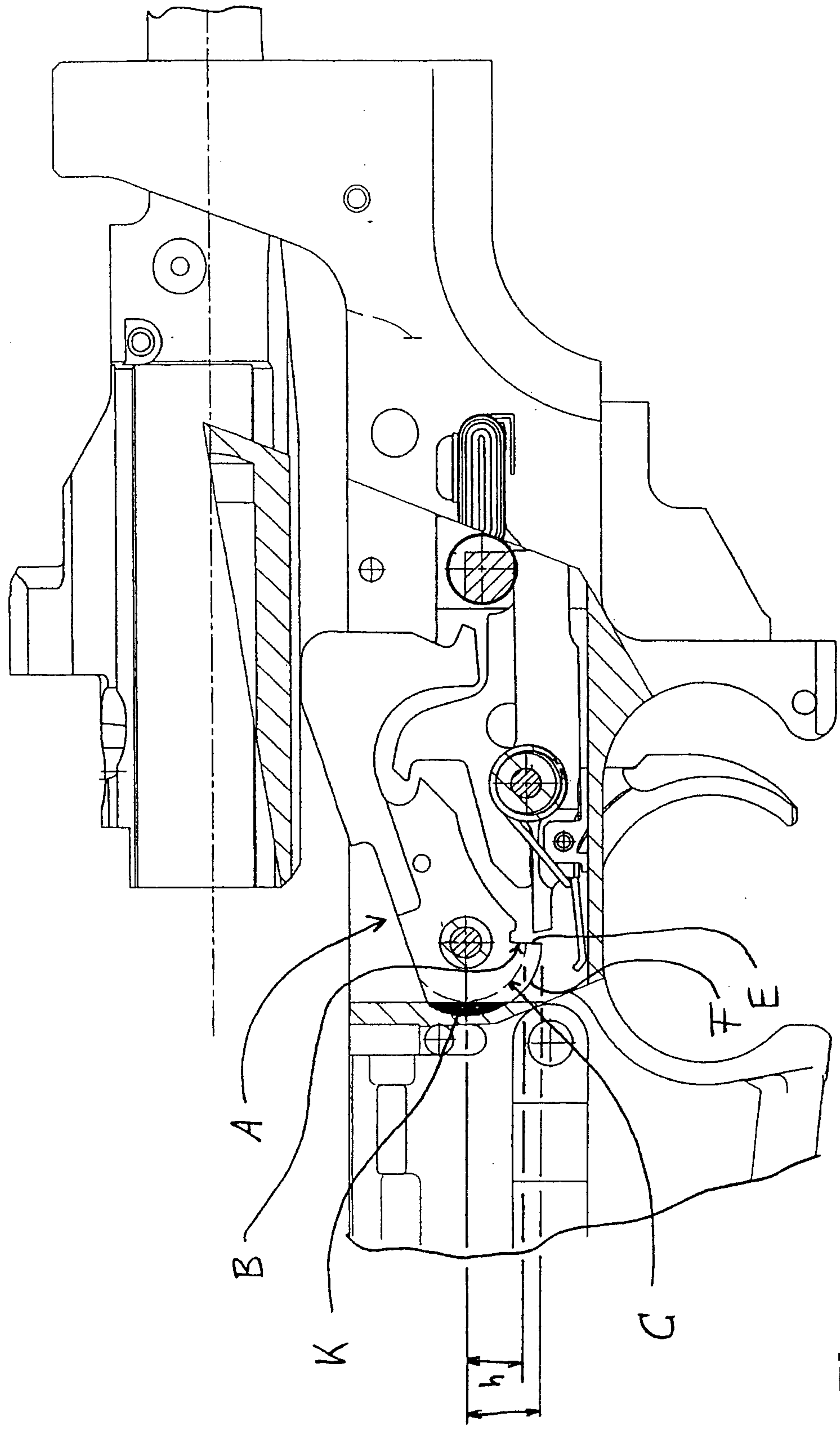
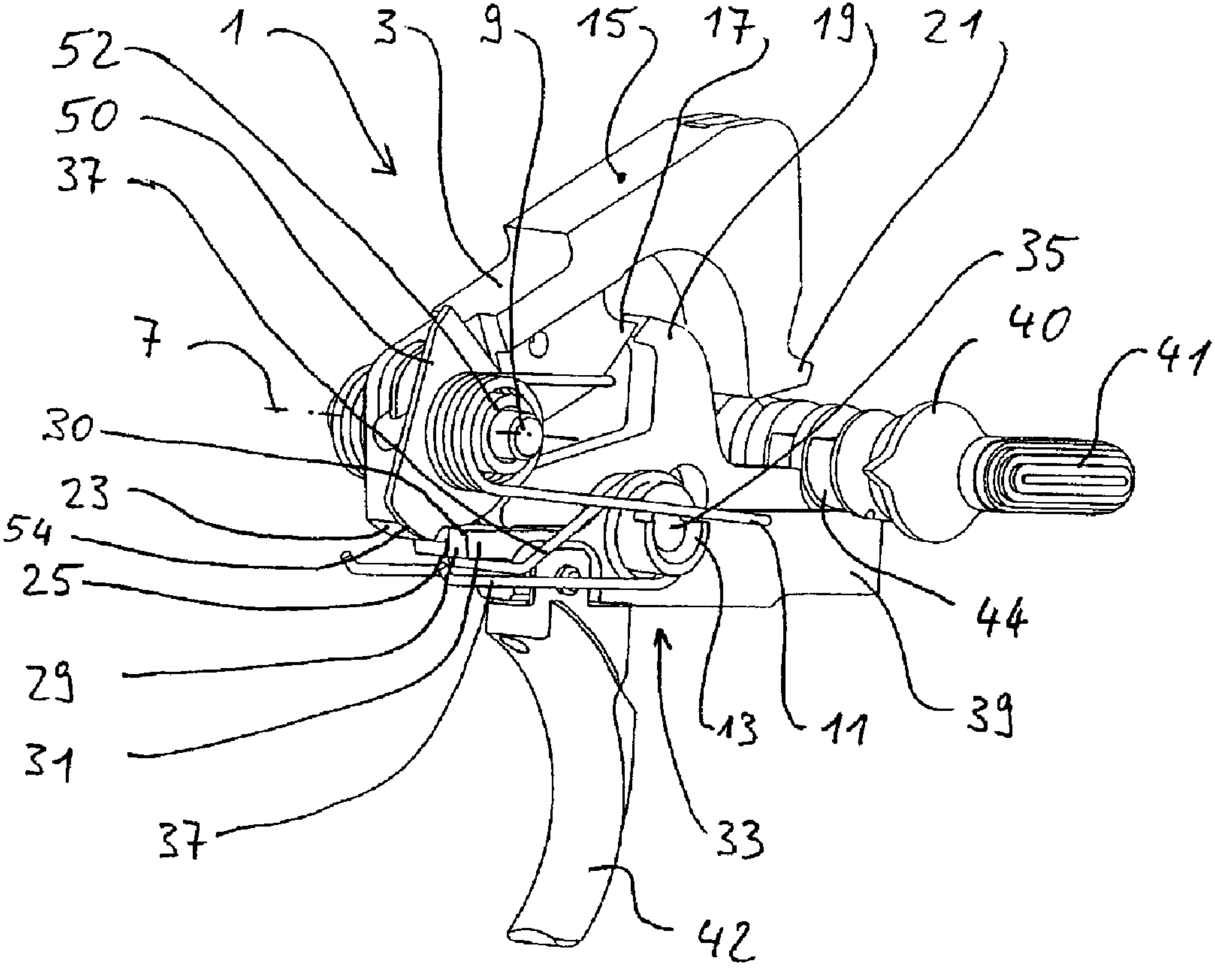


Fig. 5



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