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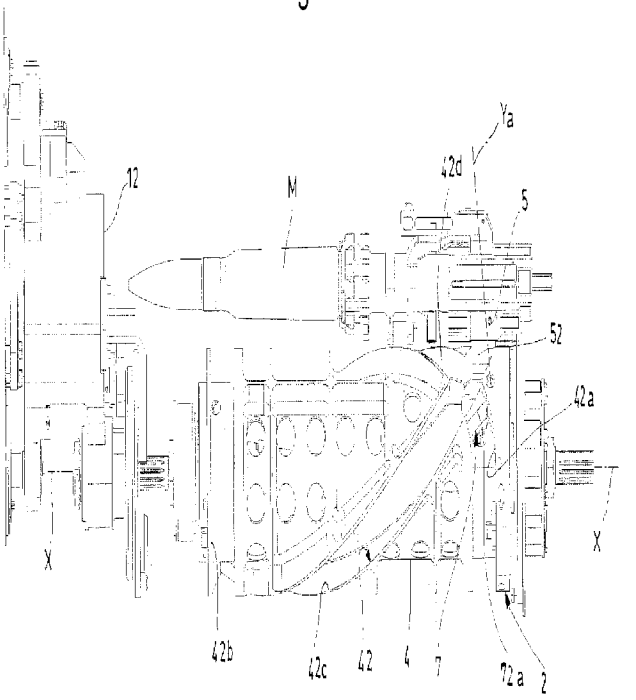
(54) Titre : SYSTEME D'ACTIONNEMENT POUR ARME A FEU
(54) Title: ACTUATION SYSTEM FOR A FIREARM

Fig.3



(57) Abrégé/Abstract:
The actuation system (2) comprises a breechblock assembly (3), a slide (5) whereon the breechblock assembly (3) is mounted, a linear guide whereon said slide (5) is configured to slide linearly, and a cylindrical cam (4) configured to be rotatably actuated by a

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(57) Abrégé(suite)/Abstract(continued):
motor and cooperating with the slide (5) for controlling the movement along the linear guide. The outer surface of the cam (4) defines a path (42) having a first parking section (42a), a second parking section (42b), a forward intermediate section (42c) and a backward intermediate section (42d) connecting the first annular parking section (42a) and said second annular parking section (42b). The slide (5) is moved forward from the first operating position to the second operating position and, respectively, backward from the second operating position to the first operating position.

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Abrégé:

L'invention concerne un système d'actionnement (2) qui comprend un ensemble bloc-culasse (3), une glissière (5) sur laquelle est monté l'ensemble bloc-culasse (3), un guide linéaire sur lequel ladite glissière (5) est conçue pour coulisser linéairement et une came cylindrique (4) conçue pour être actionnée en rotation par un moteur et pour coopérer avec la glissière (5) pour commander le mouvement le long du guide linéaire. La surface externe de la came (4) définit un trajet (42) ayant une première section de stationnement (42a), une seconde section de stationnement (42b), une section intermédiaire avant (42c) et une section intermédiaire arrière (42d) reliant la première section de stationnement (42a) annulaire et la seconde section de stationnement (42b) annulaire. La glissière (5) est déplacée vers l'avant, de la première position de fonctionnement à la seconde position de fonctionnement et, respectivement, vers l'arrière, de la seconde position de fonctionnement à la première position de fonctionnement.

Abstract:

The actuation system (2) comprises a breechblock assembly (3), a slide (5) whereon the breechblock assembly (3) is mounted, a linear guide whereon said slide (5) is configured to slide linearly, and a cylindrical cam (4) configured to be rotatably actuated by a motor and cooperating with the slide (5) for controlling the movement along the linear guide. The outer surface of the cam (4) defines a path (42) having a first parking section (42a), a second parking section (42b), a forward intermediate section (42c) and a backward intermediate section (42d) connecting the first annular parking section (42a) and said second annular parking section (42b). The slide (5) is moved forward from the first operating position to the second operating position and, respectively, backward from the second operating position to the first operating position.

TITLE: "ACTUATION SYSTEM FOR A FIREARM"

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DESCRIPTION

Technical field

The present invention relates to an actuation system for a firearm.

Background art

In the artillery field, it is known to use firearms that typically comprise a breech ring for geometrically closing the firing chamber of the firearm when firing occurs. In particular, the breech ring is configured for receiving a shell to be fired. Such firearms also comprise a barrel, through which the shell is intended to be channelled by the breech ring after firing.

For firing the shell, different kinds of actuation systems are known, which control the closing of the breech ring.

However, prior-art actuation systems suffer from a number of drawbacks which should desirably be overcome.

Summary of the invention

It is one object of the present invention to provide an improved actuation system for a firearm, which are able to overcome the drawbacks of the prior art.

According to the present invention, this and other objects are achieved through an actuation system having the technical features set out in the appended independent claim.

It is understood that the appended claims are an integral part of the technical teachings provided in the following detailed description of the present invention. In particular, the appended dependent claims define some preferred embodiments of the present invention that include optional technical features.

US 4 131 052 A discloses a drum cam for reciprocating the operating group of an externally powered weapon, wherein hang-fire is prevented by transferring the cam follower to a separate cam path when the group is in in-battery position, and the follower dwells until a chambered round has fired before permitting the operating group to recoil.

Further features and advantages of the present invention will become apparent in light of the following detailed description, provided merely as a non-limiting example and referring, in particular, to the annexed drawings as summarized below.

Brief description of the drawings

Figure 1 is a perspective view of a firearm comprising an actuation system made in accordance with an exemplary embodiment of the present invention.

Figure 2 is a enlarged partial side elevation view of the firearm shown in Figure 1, wherein the above-mentioned actuation system is better visible.

Figure 3 is a side elevation view of the above-mentioned actuation system, which comprises a slide represented in a first operating position.

Figure 4 is a side elevation view of the above-mentioned actuation system, wherein the slide is represented in a second operating position.

Figure 5 is a side elevation view of the above-mentioned actuation system, wherein the slide is represented in an intermediate position between the first operating position and the second operating position.

Figures 6 and 7 are perspective views of a cam belonging to the actuation system.

Figures 8 and 9 are perspective views of a routing mechanism belonging to the actuation system.

Detailed description of the invention

With reference to Figures 1 and 2, numeral 1 designates as a whole a firearm. By way of example, the firearm 1 is a single-barrel firearm.

In a per se known manner, such firearm 1 comprises a breech ring 12 configured for receiving a shell, e.g. a thirty-millimeter (30mm) caliber shell, intended to be fired. The firearm 1 comprises a barrel 13, through which the shell is channelled when firing occurs.

Moreover, the firearm 1 comprises an actuation system 2 made in accordance with an exemplary embodiment of the present invention.

The system 2 comprises a breechblock assembly 3 configured to close the breech ring 12 of the firearm 1.

Moreover, the system 2 comprises a slide 5, whereon the breechblock assembly 3 is mounted. In particular, the breechblock assembly 3 moves as a unit together with the slide 5.

Furthermore, the system 2 comprises a linear guide, which is per se known (and is not shown), whereon the slide 5 is configured to slide linearly.

The system 2 also comprises a cylindrical cam 4 configured to be rotatably actuated about a central axis X-X by a motor, which is per se known (and is not shown). In the illustrated embodiment, the cam 4 is configured to be rotatably driven by the motor in a clockwise direction (in particular when viewing the cam 4 from the rear, i.e. from an opposed side to the breech 12 and the barrel 13, which are situated in front of said cam 4).

The cam 4 co-operates with the slide 5 for controlling the movement of the slide 5 along said linear guide between a first operating position, shown in Figure 3, and a second

operating position, shown in Figure 4. In particular, the slide 5 is situated at the top of the cam 4.

By way of non-limiting example, the linear guide may be provided as a casing that surrounds the cam 4, allowing the latter to rotate about the central axis X-X. Such casing may have a straight groove within which the slide 5 is slidably coupled. For example, the groove may be formed on the top of said enclosure, so that the slide 5 is movable over the cam 4.

In the illustrated embodiment, the cam 4 is a single drum-type cam.

In the illustrated embodiment, the cam 4 is a positive-control multi-revolution cam.

With reference to Figure 3, the first operating position of the slide 5 corresponds to a condition in which the breechblock assembly 3 is in a remote position relative to the breech ring 12. In this condition, the breechblock assembly 3 allows the extraction of the shell case of the fired piece of ammunition and the insertion of a new piece of ammunition. In particular, Figure 3 shows that the breechblock assembly 3 carries a piece of ammunition M intended to be pushed into the breech ring 12.

With reference to Figures 2 and 4, the second operating position of the slide 5 corresponds to a condition in which the breechblock assembly 3 is in proximity to the breech ring 12. In such a condition, the breechblock assembly 3 is able to co-operate with the breech ring 12 during the ammunition firing phases. In such a condition, in particular, when firing occurs the breechblock assembly 3 closes the firing chamber of the firearm in which the piece of ammunition M is contained.

The outer surface of the cam 4 defines a path indicated

by reference 42.

In the illustrated embodiment, the slide 5 comprises a coupling element 52 coupled with the path 42 defined by the cam 4. In particular, the coupling element 52 is a pin, and the path 42 is formed by a groove in which said pin is slidably coupled.

With particular reference to Figure 3, said path 42 has a first parking section 42 (e.g. substantially annular), where the slide 5 is kept in the first operating position.

With particular reference to Figure 4, said path 42 has a second parking section 42b (e.g. substantially annular), where the slide 5 is kept in the second operating position.

In addition, the path 42 has a pair of intermediate sections 42c and 42d that connect the first parking section 42a and the second parking section 42b. Through the intermediate sections 42c and 42d, the slide 5 is alternately moved between the first operating position and the second operating position.

The forward intermediate section 42c is configured to allow the slide 5 to move from the first operating position, in the first parking section 42a, to the second operating position, in the second parking section 42b.

The backward intermediate section 42d is configured to allow the slide 5 to move from the second operating position, in the second parking section 42b, to the first operating position, in the first parking section 42a.

Preferably, the forward intermediate section 42c is shaped as a helical portion having a winding direction that is discordant from the rotation direction in which the cam 4 is driven by the motor.

Preferably, the backward intermediate section 42d is shaped as a helical portion having a winding direction that

is concordant with the rotation direction in which the cam 4 is driven by the motor.

In the illustrated embodiment, the intermediate sections 42c, 42d intersect each other at their ends, at the first parking section 42c on one side and at the second parking section 42d on the other side. In particular, when the intermediate sections 42c, 42d are shaped as helical portions, their intersections form cusp-shaped regions.

Preferably, the system 2 further comprises a routing mechanism 7 configured to assume selectively a forward condition and a backward condition, or blocking condition.

In the forward condition, visible in Figure 8, the routing mechanism 7 constrains the slide 5 to move from the first parking section 42a to said second parking section 42b through the forward intermediate section 42c.

Vice versa, in the backward condition, the routing mechanism 7 constrains the slide to move from the second parking section 42b to the first parking section 42a through the backward intermediate section 42d.

In the illustrated embodiment, the routing mechanism 7 comprises a pair of diverters 72a, 72b.

With particular reference to Figures 3 and 4, the first diverter 72a is associated with the first parking section 42a (in particular, it is situated therein) and is configured for selectively connecting the first parking section 42a with the forward section 42c and with the backward section 42d when the routing mechanism 7 is in the forward condition and, respectively, in the backward condition.

With particular reference to Figure 5, the second diverter 72b is associated with the second parking section 42b (in particular, it is situated therein) and is configured for selectively connecting the second parking section 42b

with the forward section 42c and with the backward section 42d when the routing mechanism 7 is in the forward condition and, respectively, in the backward condition.

In Figures 3 to 5, the routing mechanism 7 is in the forward condition, in which the diverters 72a and 72b create a guiding path from the first parking section 42a to the second parking section 42b through the forward section 42c. At the same time, in this forward condition, the diverters 72a and 72b interpose themselves between the ends of the backward intermediate section 42d and the parking sections 42a, 42b. In the backward condition, the diverters 72a, 72b are in an opposed position to that shown in Figures 3 to 5.

Preferably, the routing mechanism 7 comprises a synchronization device 70 configured for synchronizing the movement of said pair of diverters 72a, 72b. In this manner, the synchronization device 70 is configured to cause the first diverter 72a and the second diverter 72b to simultaneously provide the connection with the forward intermediate section 42c when the routing mechanism 7 is in the forward condition. Vice versa, the device 70 is configured to cause the first diverter 72a and the second diverter 72b to simultaneously provide the connection with the backward intermediate section 42d when the routing mechanism 7 is in the backward condition.

In the illustrated embodiment, the synchronization device 70 is a bistable linkage. In particular, the linkage has a first stable arrangement, visible in Figure 8, corresponding to the forward condition of the routing mechanism 7, and a second stable arrangement, visible in Figure 9, corresponding to the backward condition of the routing mechanism.

Preferably, said linkage comprises a shaft 71

configured for simultaneously moving the diverters 72a, 72b each time the routing mechanism 7 switches between the forward condition and the backward condition.

In particular, the shaft 71 is configured for making the diverters 72a, 72b rotate about respective transverse axes of rotation Ya, Yb. For example, the transverse axes of rotation Ya, Yb are substantially parallel to each other and, in a preferred manner, substantially perpendicular to both the longitudinal axis X'-X' of the shaft 71 and the central axis X-X about which the cam 4 is able to rotate. In the illustrated embodiment, the longitudinal axis X'-X' of the shaft 71 and the central axis X-X of the cam are mutually incident and define a plane relative to which the transverse axes of rotation Ya, Yb are substantially perpendicular.

For example, each one of the ends 71a, 71b of the shaft 71 is hinged to an arm of a respective rocker 74a, 74b, which is in turn pivoted about a respective transverse axis of rotation Ya, Yb, and which carries a corresponding diverter 72a, 72b on the opposed arm.

In the illustrated embodiment, the cam 4 rotates as a unit together with the routing mechanism 7. In particular, the diverters 72a, 72b are supported by the outer surface of the cam 4; moreover, the synchronization device 70 is housed inside the cam 4, which is advantageously hollow.

When the actuation system 2 is in operation, at each full revolution of the cam 4 about the axis X-X, the routing mechanism 7 is switched between the forward condition and the backward condition, in particular by means of the synchronization device 70, e.g. through an action exerted by the pin 52 of the slide 5 upon a respective diverter 72a (or 72b), which, through the linkage comprising the shaft 71, causes a simultaneous movement of the other diverter 72b (or

72a). Thus, when the slide 5 starts from the first operating position, it goes into the second operating position after one revolution of the cam 4 and returns into the first operating position from the second operating position after one further revolution of said cam 4. Therefore, after each two revolutions of the cam 4, the actuation system 2 will find itself in the starting position again.

Naturally, without prejudice to the principle of the present invention, the forms of embodiment and the implementation details may be extensively varied from those described and illustrated herein merely by way of non-limiting example, without however departing from the scope of the invention as set out in the appended claims.

CLAIMS

1. Actuation system (2) for a firearm (1); said system comprising:

- a breechblock assembly (3) adapted to close a breech ring (12) of said firearm (1);
- a slide (5) whereon said breechblock assembly (3) is mounted;
- a linear guide whereon said slide (5) is configured to slide linearly; and
- a cylindrical cam (4) configured to be rotatably actuated by a motor and co-operating with said slide (5) for controlling the movement of said slide (5) along said linear guide between a first operating position and a second operating position; the outer surface of said cylindrical cam (4) defining a path (42) having:

a substantially annular first parking section (42a) wherein said slide (5) is kept in said first operating position, wherein said breechblock assembly (3) is in a remote position relative to said breech ring (12) and allows the extraction of the shell case and the insertion of a new piece of ammunition,

a substantially annular second parking section (42b) wherein said slide (5) is kept in said second operating position, wherein said breechblock assembly (3) is in proximity to said breech ring (12) and is able to co-operate with said breech ring (12) during the ammunition firing phases,

a helical portion shaped forward intermediate section (42c) and a helical portion shaped backward intermediate section (42d) connecting said first parking section (42a) and said second parking section (42b), and wherein said slide (5) is moved forward from said first operating position to

said second operating position and, respectively, backward from said second operating position to said first operating position.

2. System according to claim 1, wherein said forward intermediate section (42c) is shaped as a helical portion having a winding direction that is discordant from the rotation direction in which the cam (4) is driven by the motor.

3. System according to claim 1 or 2, wherein the backward intermediate section (42d) is shaped as a helical portion having a winding direction that is concordant with the rotation direction in which the cam (4) is driven by the motor.

4. System according to any one of the preceding claims, wherein the intermediate sections (42c, 42d) intersect each other at their ends, at the first parking section (42c) on one side and at the second parking section (42d) on the other side

5. System according to claim 4, wherein the intersection between the intermediate sections (42c, 42d) form cusp-shaped regions.

6. System according to any one of the preceding claims, wherein said system comprises a single drum-type cam (4).

7. System according to any one of the preceding claims, wherein said slide (5) comprises a coupling element (52), and said cam (4) has an external groove (42a, 42b, 42c, 42d) which defines said path (42) and in which said coupling element (52) is configured to slide.

8. System according to any one of the preceding claims, wherein said cam (4) comprises a routing mechanism (7) configured to selectively assume:

- a forward condition, wherein said routing mechanism (7)

constrains said slide (5) to move from said first parking section (42a) to said second parking section (42b) through said forward intermediate section (42c), and

- a backward condition, wherein said routing mechanism (7) constrains said slide (5) to move from said second parking section (42b) to said first parking section (42a) through said backward intermediate section (42d).

9. System according to claim 8, wherein said routing mechanism (7) comprises a pair of diverters (72a, 72b), each one of them being associated with a respective parking section (42a, 42b) and being configured for selectively connecting the respective parking section (42a, 42b) with the forward section (42c) and with the backward section (42d), when the routing mechanism (7) is in the forward condition and, respectively, in the backward condition.

10. System according to claim 9, wherein each one of said diverters (72a, 72b) is situated in the respective parking section (42a, 42b) with which it is associated.

11. System according to claim 9 or 10, wherein said routing mechanism (7) comprises a synchronization device (70) configured for synchronizing the movement of said pair of diverters (72a, 72b), so that both of said diverters (72a, 72b) simultaneously provide connection with the forward intermediate section (42c) and, respectively, with the backward intermediate section (42d) when the routing mechanism (7) assumes the forward condition and, respectively, the backward condition.

12. System according to claim 11, wherein said synchronization device (70) is a bistable linkage.

13. System according to claim 12, wherein said bistable linkage comprises a shaft (71) configured for simultaneously moving said diverters (72a, 72b) each time said routing

mechanism (7) switches between said forward condition and said backward condition.

14. System according to claim 13, wherein said shaft (71) is configured for simultaneously rotating the diverters (72a, 72b) about transverse axes of rotation (Ya, Yb).

15. System according to claim 14, wherein said transverse axes of rotation (Ya, Yb) are substantially parallel to each other.

16. System according to claim 15, wherein said transverse axes of rotation (Ya, Yb) are substantially perpendicular to the central axis of rotation (X-X) of said cam (4) and to the longitudinal axis (X'-X') of said shaft (71).

17. Firearm comprising:

- a breech ring (12) configured to receive a shell to be fired;
- a barrel (13) through which the shell is intended to be channelled when firing occurs in the breech ring (12); and
- an actuation system (2) according to any one of the preceding claims.

CLAIMS

1. Actuation system (2) for a firearm (1); said system comprising:

- a breechblock assembly (3) adapted to close a breech ring (12) of said firearm (1);
- a slide (5) whereon said breechblock assembly (3) is mounted;
- a linear guide whereon said slide (5) is configured to slide linearly; and
- a cylindrical cam (4) configured to be rotatably actuated by a motor and co-operating with said slide (5) for controlling the movement of said slide (5) along said linear guide between a first operating position and a second operating position; the outer surface of said cylindrical cam (4) defining a path (42) having:

a first parking section (42a) wherein said slide (5) is kept in said first operating position, wherein said breechblock assembly (3) is in a remote position relative to said breech ring (12) and allows the extraction of the shell case and the insertion of a new piece of ammunition,

a second parking section (42b) wherein said slide (5) is kept in said second operating position, wherein said breechblock assembly (3) is in proximity to said breech ring (12) and is able to co-operate with said breech ring (12) during the ammunition firing phases,

a forward intermediate section (42c) and a backward intermediate section (42d) connecting said first parking section (42a) and said second parking section (42b), and wherein said slide (5) is moved forward from said first operating position to said second operating position and, respectively, backward from said second operating position to said first operating position.

2. System according to claim 1, wherein said system comprises a single drum-type cam (4).

3. System according to claim 1 or 2, wherein said cam (4) is a positive-control multi-revolution cam.

4. System according to one of the preceding claims, wherein said slide (5) comprises a coupling element (52), and said cam (4) has an external groove (42a, 42b, 42c, 42d) which defines said path (42) and in which said coupling element (52) is configured to slide.

5. System according to one of the preceding claims, wherein said cam (4) comprises a routing mechanism (7) configured to selectively assume:

- a forward condition, wherein said routing mechanism (7) constrains said slide (5) to move from said first parking section (42a) to said second parking section (42b) through said forward intermediate section (42c), and
- a backward condition, wherein said routing mechanism (7) constrains said slide (5) to move from said second parking section (42b) to said first parking section (42a) through said backward intermediate section (42d).

6. System according to claim 5, wherein said routing mechanism (7) comprises a pair of diverters (72a, 72b), each one of them being associated with a respective parking section (42a, 42b) and being configured for selectively connecting the respective parking section (42a, 42b) with the forward section (42c) and with the backward section (42d), when the routing mechanism (7) is in the forward condition and, respectively, in the backward condition.

7. System according to claim 6, wherein each one of said diverters (72a, 72b) is situated in the respective parking section (42a, 42b) with which it is associated.

8. System according to claim 6 or 7, wherein said routing

mechanism (7) comprises a synchronization device (70) configured for synchronizing the movement of said pair of diverters (72a, 72b), so that both of said diverters (72a, 72b) simultaneously provide connection with the forward intermediate section (42c) and, respectively, with the backward intermediate section (42d) when the routing mechanism (7) assumes the forward condition and, respectively, the backward condition.

9. System according to claim 8, wherein said synchronization device (70) is a bistable linkage.

10. System according to claim 9, wherein said bistable linkage comprises a shaft (71) configured for simultaneously moving said diverters (72a, 72b) each time said routing mechanism (7) switches between said forward condition and said backward condition.

11. System according to claim 10, wherein said shaft (71) is configured for simultaneously rotating the diverters (72a, 72b) about transverse axes of rotation (Ya, Yb).

12. System according to claim 11, wherein said transverse axes of rotation (Ya, Yb) are substantially parallel to each other.

13. System according to claim 12, wherein said transverse axes of rotation (Ya, Yb) are substantially perpendicular to the central axis of rotation (X-X) of said cam (4) and to the longitudinal axis (X'-X') of said shaft (71).

14. Firearm comprising:

- a breech ring (12) configured to receive a shell to be fired;
- a barrel (13) through which the shell is intended to be channelled when firing occurs in the breech ring (12); and
- an actuation system (2) according to any one of the preceding claims.

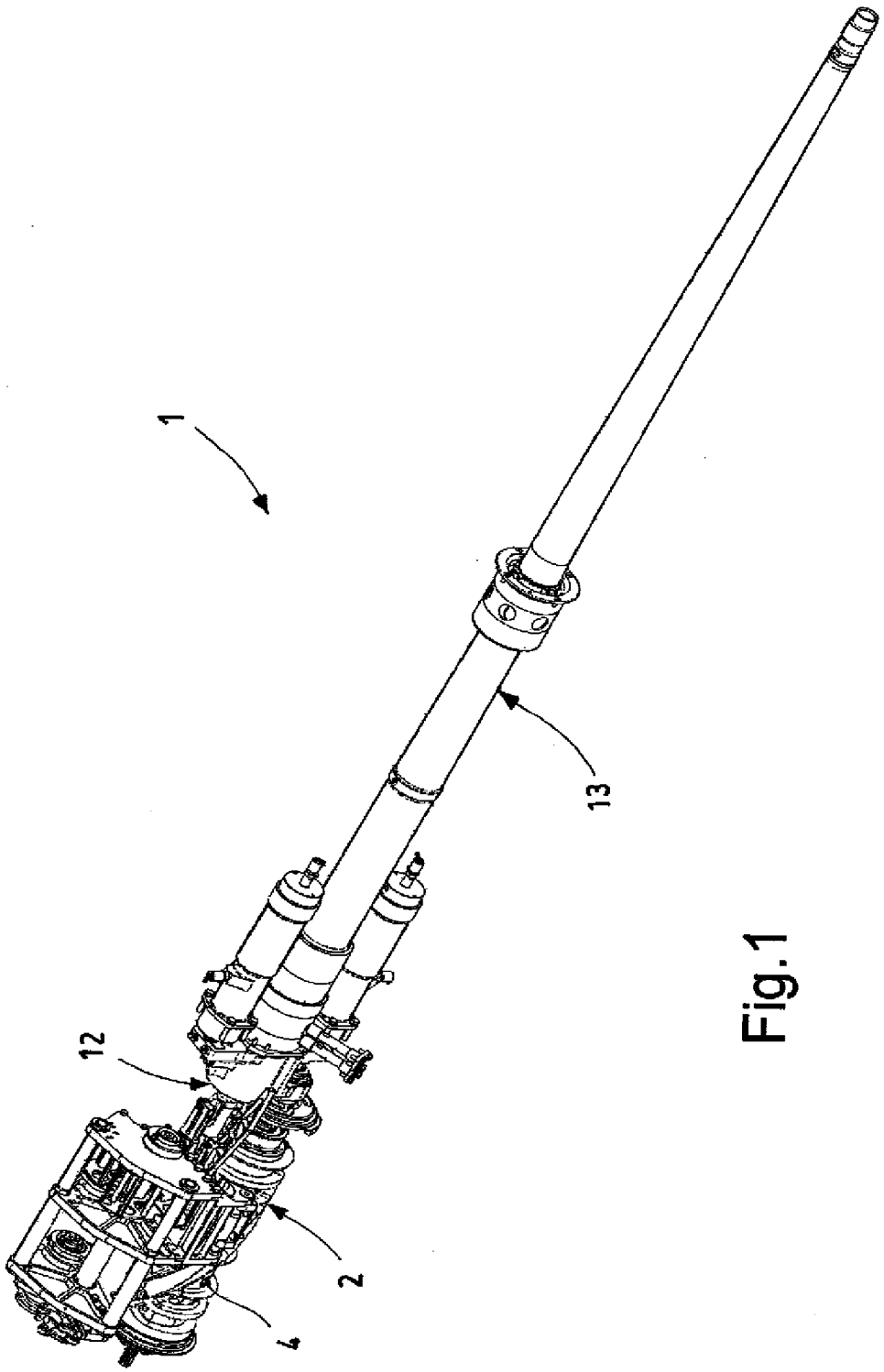


Fig.1

Fig.2

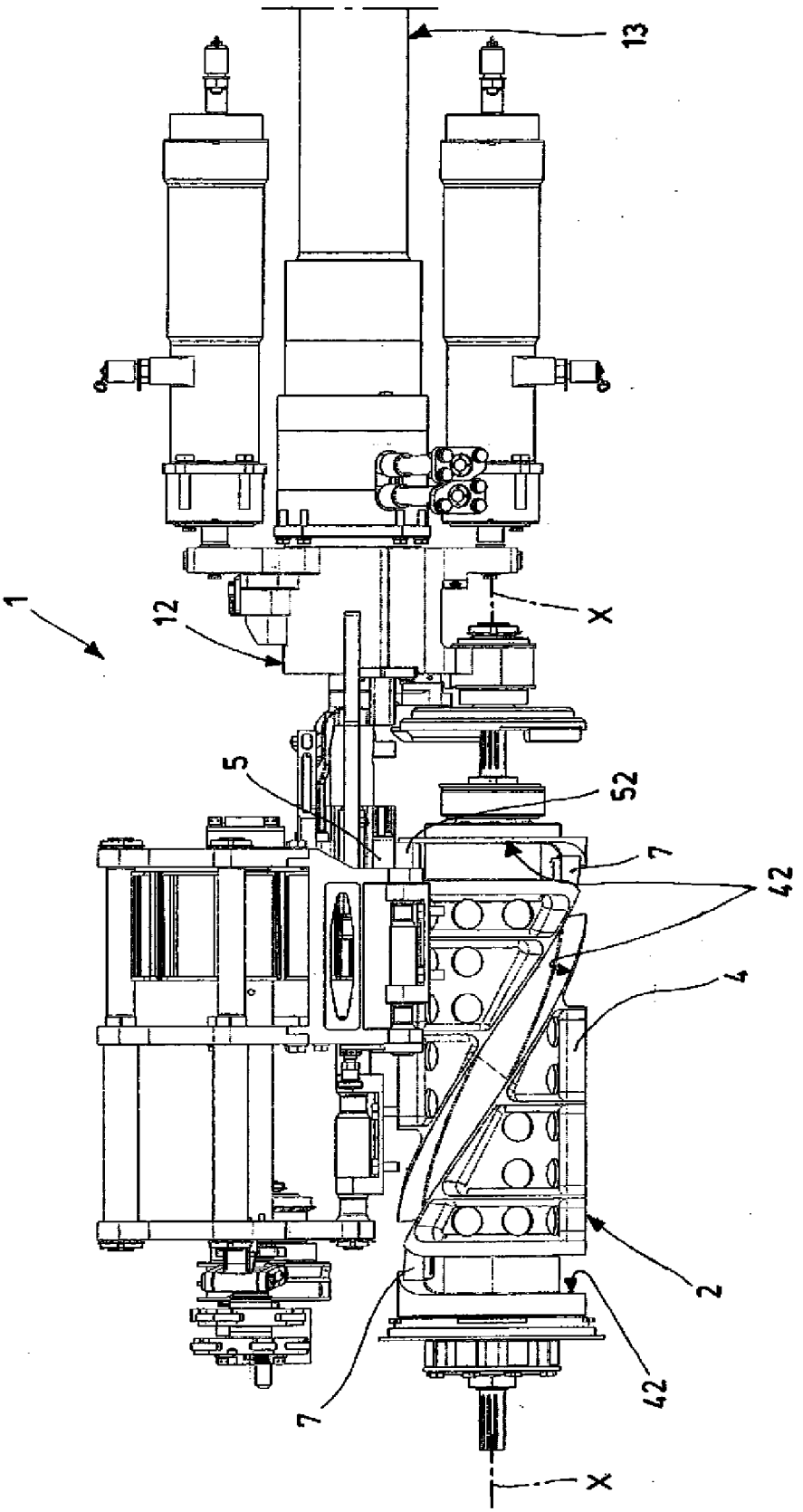


Fig.3

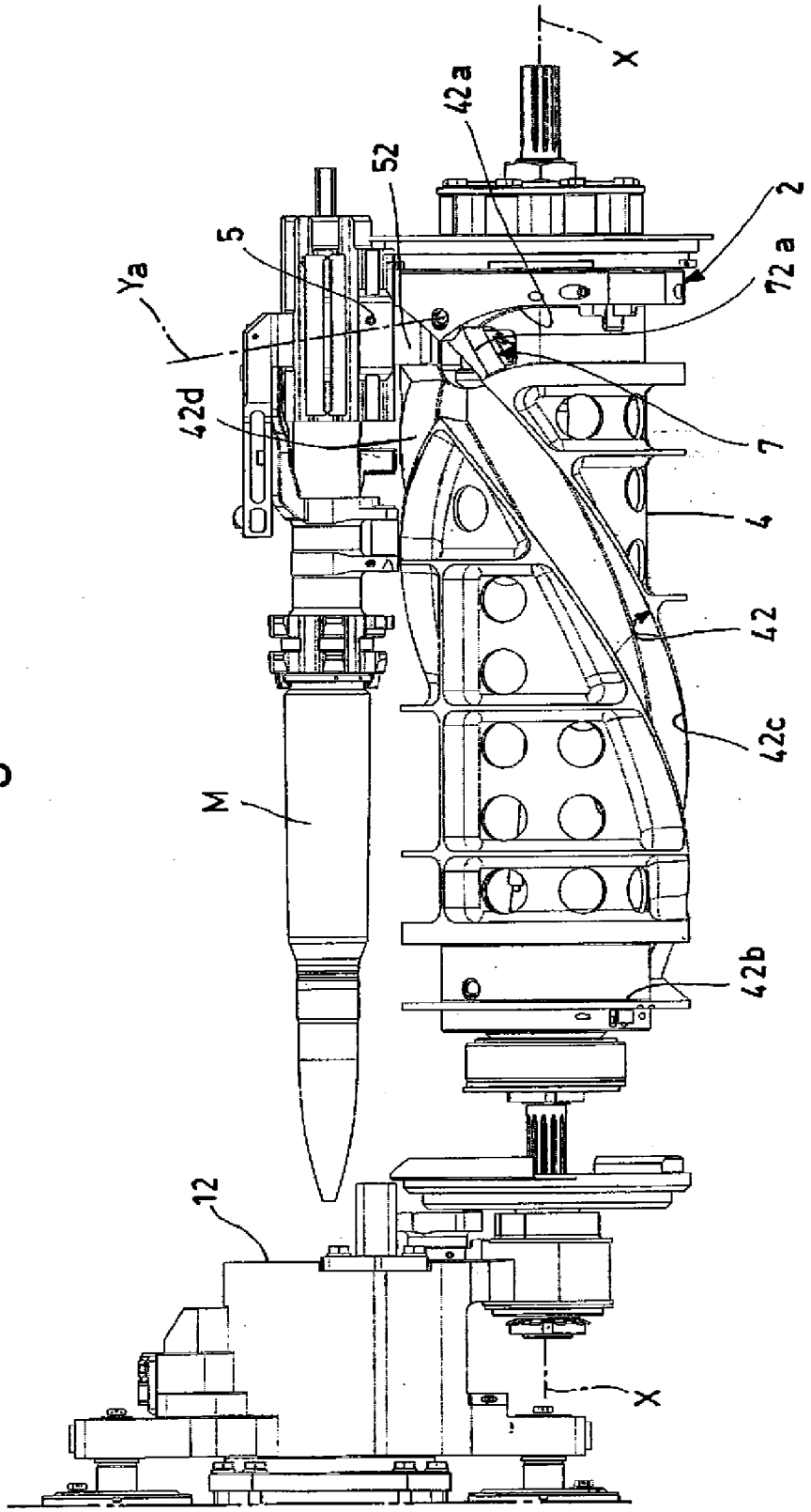


Fig.4

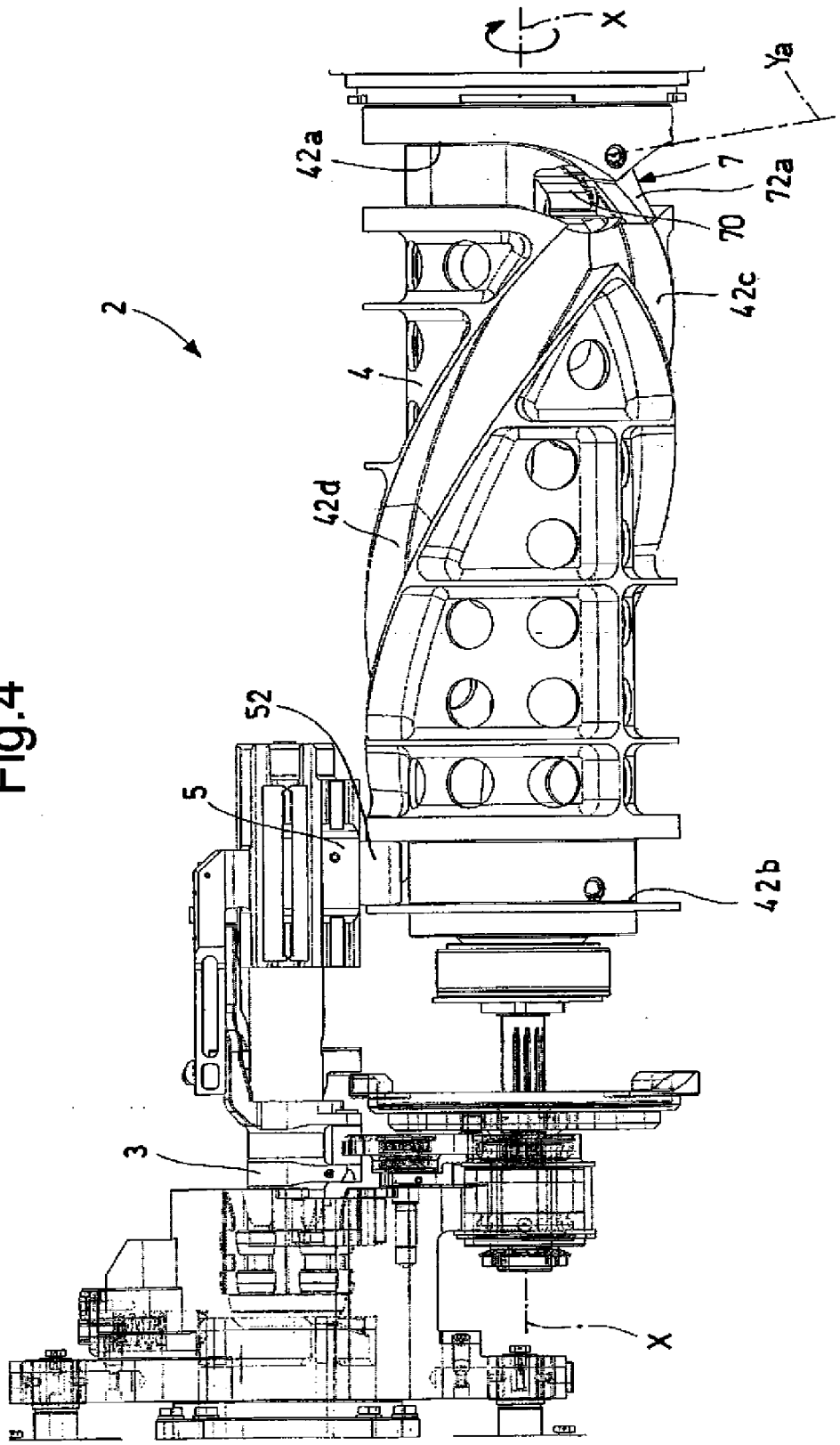
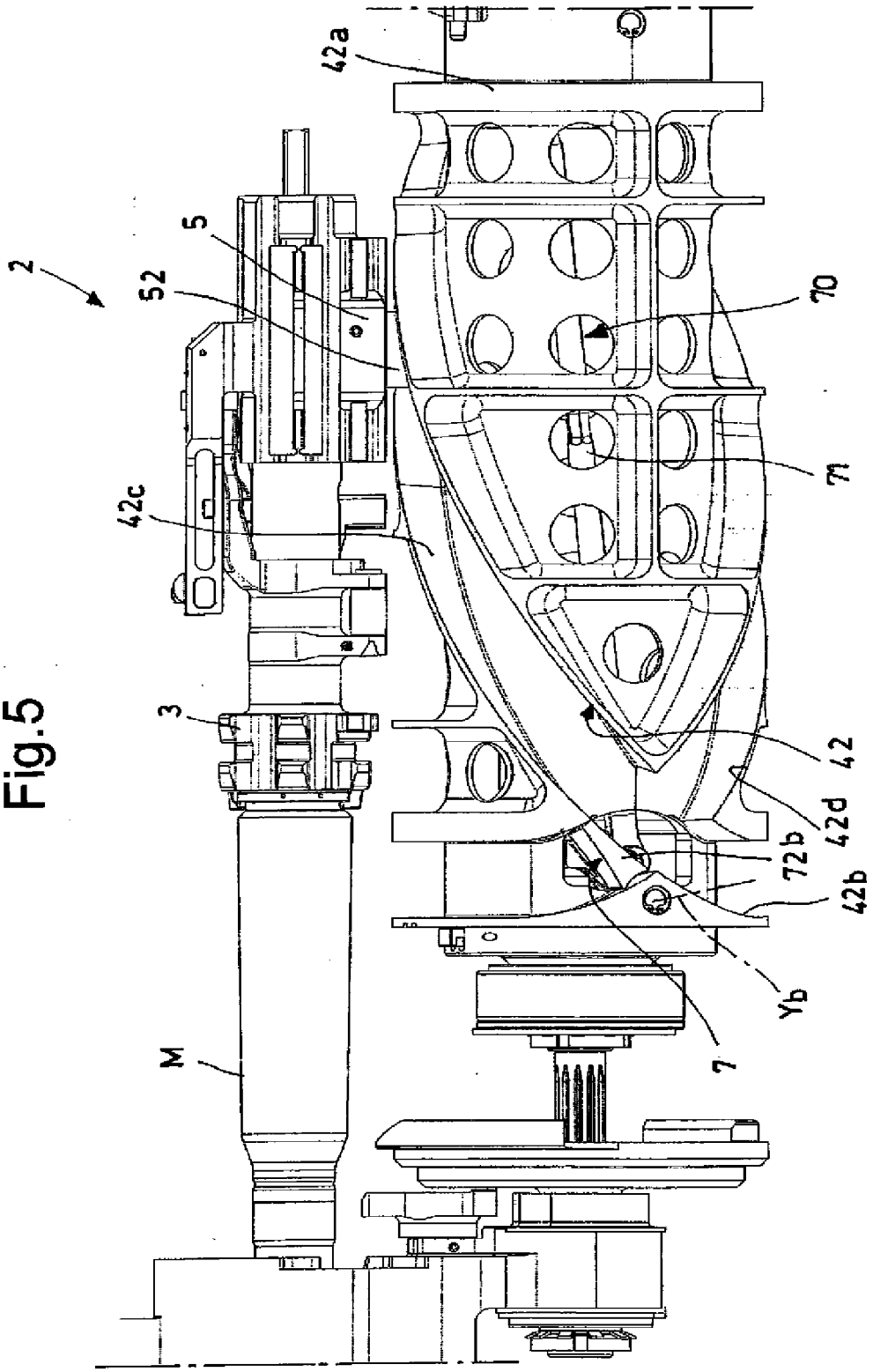


Fig.5



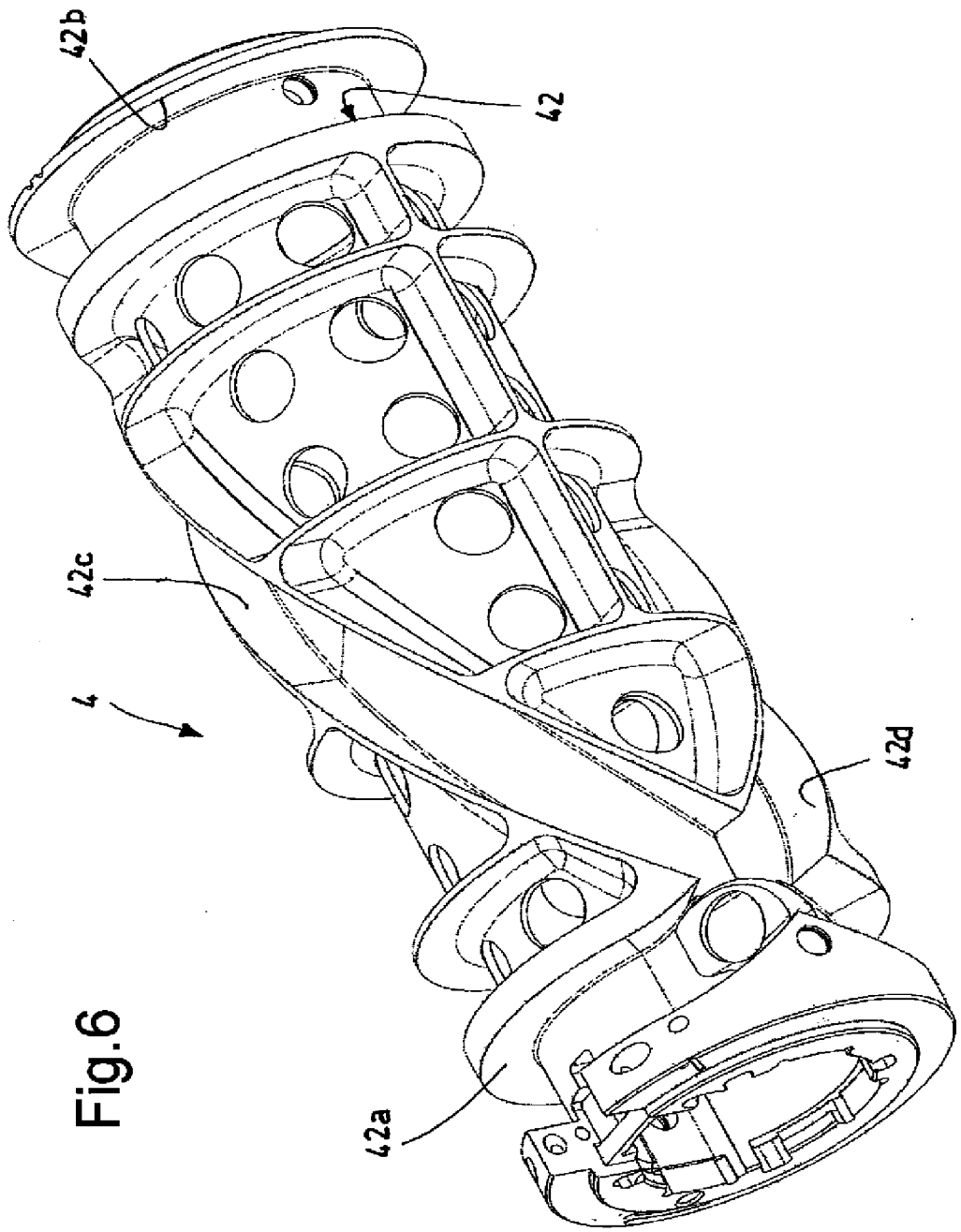


Fig.6

Fig.7

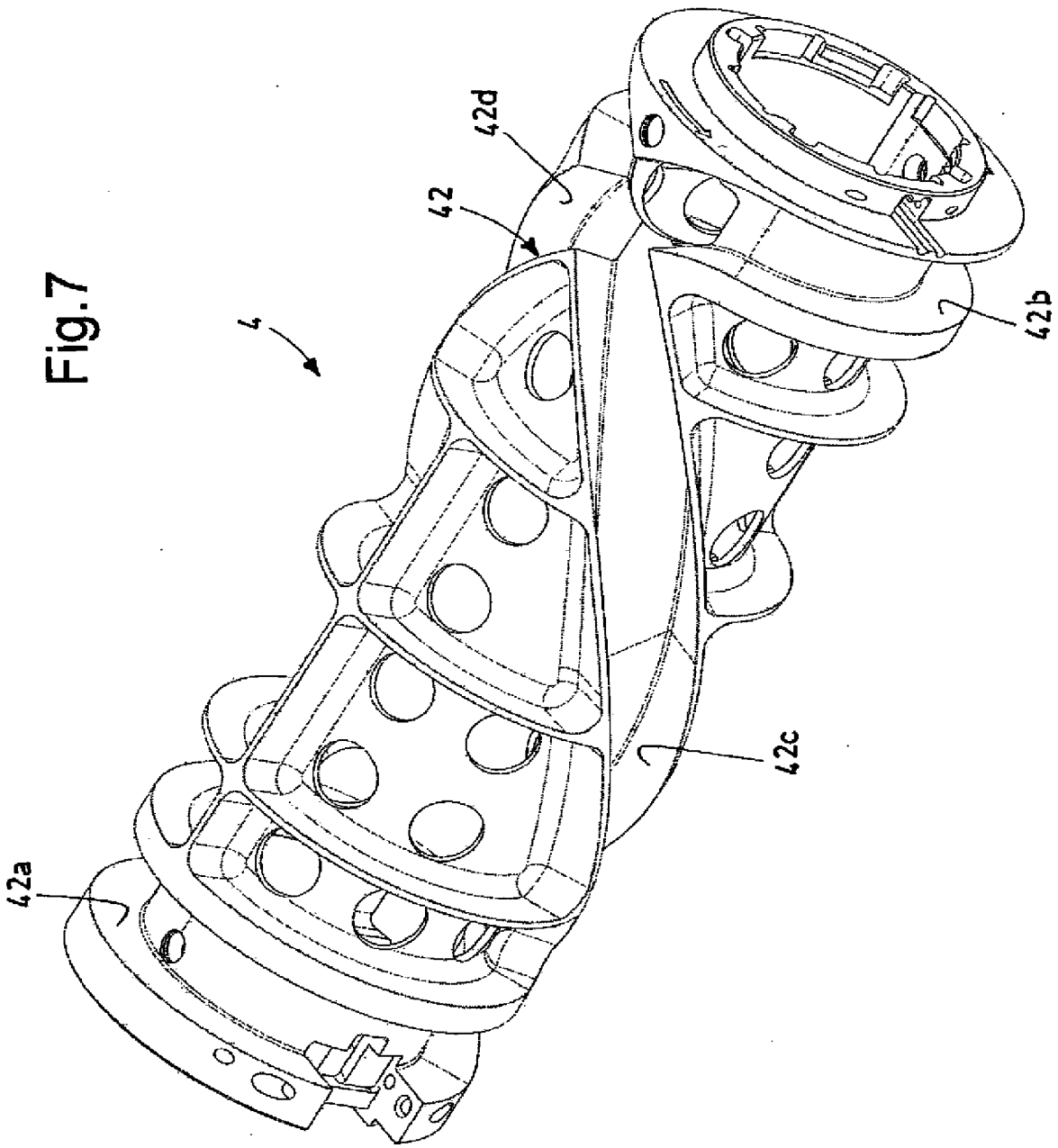


Fig.8

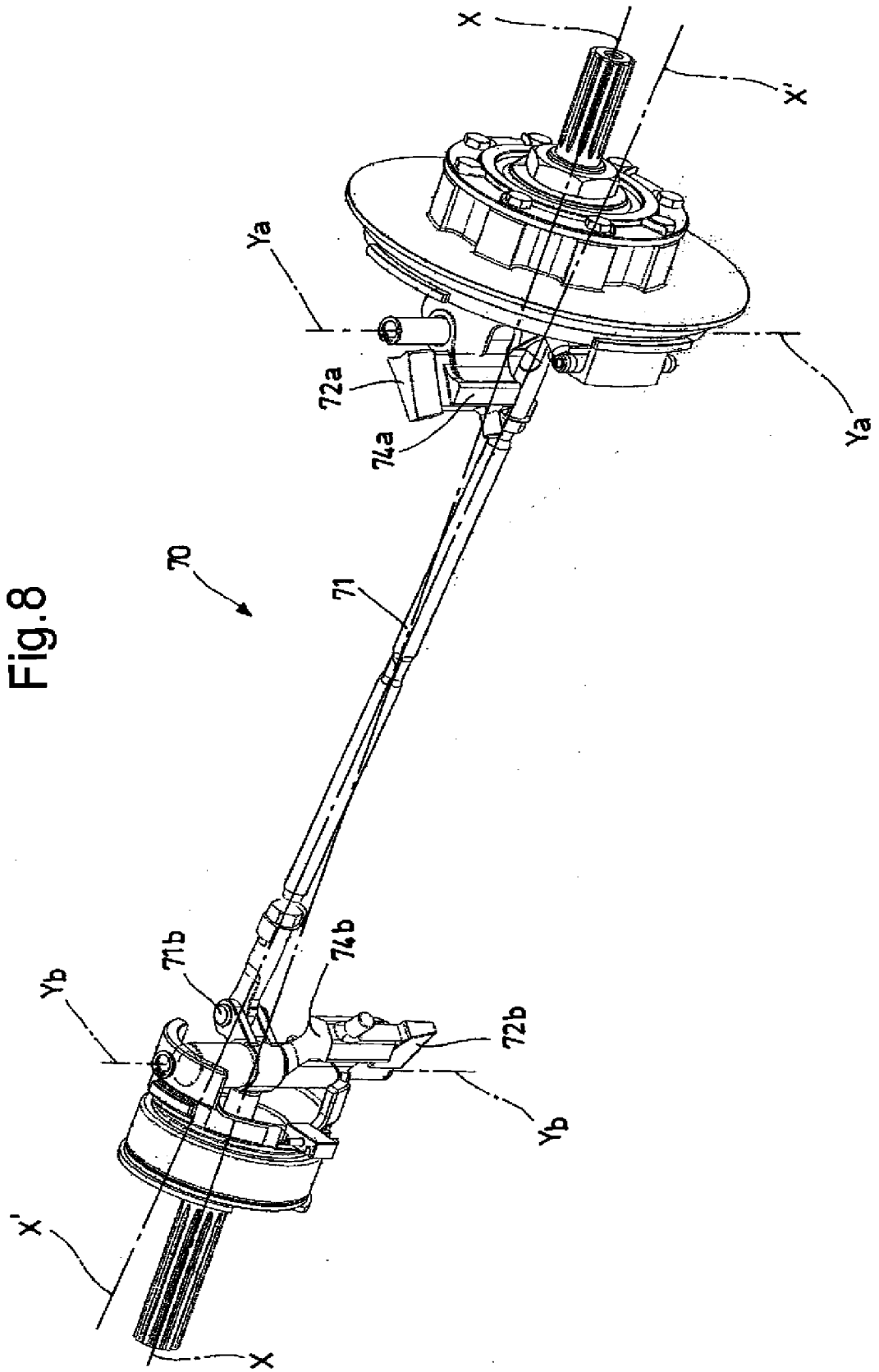


Fig.9

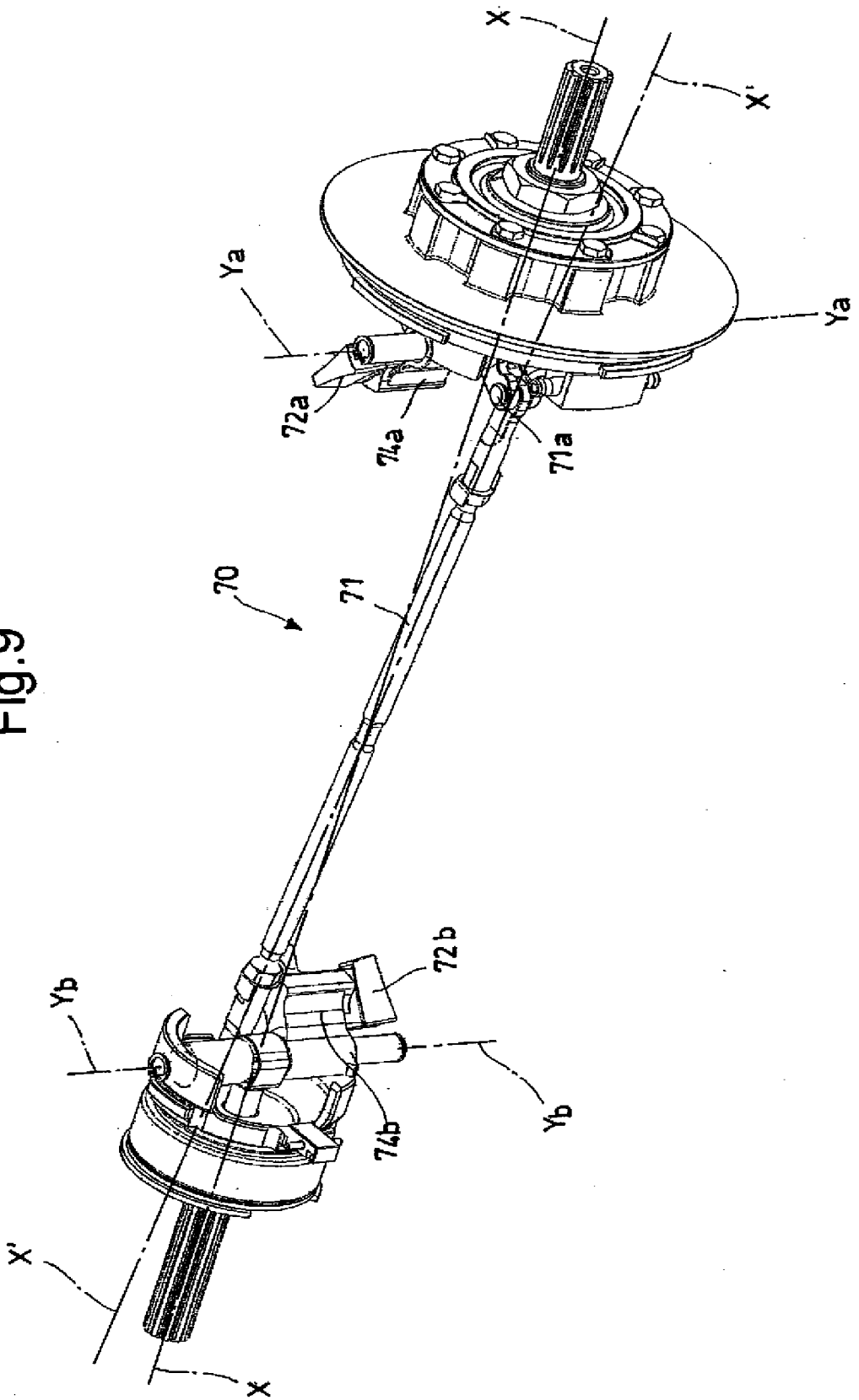


Fig.3