

Description

Breech drive for a weapon with linear breech or ammunition feed

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The invention relates to drive kinematics with a thrust crank for a feed, in particular a linear feed, of a breech or of a cartridge into a weapon barrel.

10 In externally powered machine guns, the energy for driving the weapon is not obtained from a gas pressure or from weapon recoil, but is provided by an electrical or hydraulic drive.

15 Particularly in the case of electrically driven weapons, the rotary movement of the motor must for this purpose be converted to an oscillating movement of the breech. Furthermore, the breech requires times for which it is stationary at the limit positions of its
20 displacement movement. In a first limit position, the case of the previous round must be removed in front of the breech, and a new cartridge must be fed in front of the breech before said cartridge is driven into the cartridge chamber of the weapon barrel. In a further
25 limit position, the breech must be locked and the cartridge fired. Once the gas pressure in the weapon barrel has fallen, the breech can then be unlocked.

A rigidly locked linear breech for an externally driven
30 machine gun has been published in DE 36 27 361 C1. A control roll is also proposed here, for space-saving locking, without bouncing.

DE 37 12 905 A1 describes a machine gun which, inter
35 alia, has a cam drum which is operated by an external drive and is used for linear movement of a linear breech. The cam drum correspondingly has a control cam which runs endlessly over the circumference.

Furthermore, a short radially acting control cam and a longer axially acting control cam are arranged on the circumference.

5 DE 10 2005 045 824 A1 proposes a physically small weapon whose control roll is integrated on the plane of the barrel bore axis. The control roll has a control body to which at least two control cams are fitted. In this case, the cam information is converted to a linear
10 feed of the breech.

From DE 10 2007 048 468.4, which was not published prior to this, a drive is preferred for linear feeding of a breech or of the ammunition into a weapon barrel
15 or a cartridge chamber by means of a chain. In contrast to the bushmaster drive, in which a chain is passed over four sprocket wheels, in the form of a rectangle, and by means of which the stationary times of the breech are defined, the chain is in this case itself
20 passed tightly around two sprocket wheels in a simple manner. A chain link or a stud on the chain is integrated in a guide or groove which is located under the movable slide. This allows the chain to continue to run during the times when the weapon is stationary,
25 which are defined by a separate function control means. The chain itself can be driven by an electric motor. A rapid stopping means is in this case integrated in the path of the chain.

30 A linear feed of a breech with respect to the weapon barrel or cartridge chamber is described in DE 10 2007 054 470.9, which was not published prior to this. In this case, a linear guide groove is integrated in the drive kinematics. A means which is physically
35 connected to the breech is guided in the guide groove. The guide groove is itself surrounded by a circumferential positive guide (slotted link) which itself interprets the necessary times for the breech to

be stationary during locking, firing and unlocking in its front position and during the loading, once the breech has been moved to its rear position. A further means is guided within the positive guide, as drive
5 means for the breech. The drive transmission can be provided by sliding rollers, gear wheels or the like, which are driven by a motor etc. The drive itself continues to run during the times in which the weapon is stationary, while the breech is moved out and back
10 in again later during the stationary times.

Although the three last-mentioned solutions themselves already deal with practicable drives, which produce satisfactory results in terms of firing rate and
15 mechanical wear, the invention is based on the object of specifying a further drive for a breech such as this which is likewise also used for higher firing rates.

The invention is achieved by the features of patent
20 claim 1. Advantageous embodiments are specified in the dependent claims.

The invention is based on the idea of providing a mechanism which has a low-level of breech acceleration
25 and operates smoothly and without jerking, thus decreasing the mass forces, reducing the drive power and allowing the firing rate to be increased. The reduction in the drive power furthermore results in a reduction in the braking power when rapid stopping is
30 required.

For this purpose, the principle of a crank drive is used to convert the rotary movement, preferably of a motor or the like, to a forward and backward movement
35 of the breech. In order to allow the breech to be stationary for times in the limit positions, a connecting rod and crank are arranged such that they can be moved radially with respect to one another, such

that the crank radius changes with the rotation of the crank. The connecting rod is guided radially by a control cam.

- 5 The crank drive has the advantage that low rotating masses (crank, motor and possibly step-up transmissions) are provided, which have to be braked in the event of rapid stopping. It has also been found to be a simple design.

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The invention will be explained in more detail using one exemplary embodiment and with reference to the drawing, and in which:

- 15 Figure 1 shows a schematic view of a drive with a preferred control cam,

Figure 2 shows a breech drive for implementing the movement sequences from figure 1,

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Figure 3 shows a detail view from figure 2,

Figure 4 shows a partial view from figure 3,

- 25 Figure 5 shows a partial view from figure 3.

Figure 1 shows a first general illustration of a schematically illustrated drive 100. A rotation shaft M of a crank 1, and therefore the crank 1 itself, are
30 driven via a motor or the like (not illustrated in any more detail). A connecting rod 3 is arranged with the rear end E_h such that it can move in a groove 1.1 in the crank 1, and is connected to the front end E_v on the breech 20 or a driver 4 of the breech 20.
35 Furthermore, sliding means such as rollers 5 are arranged at the rear end E_h of the connecting rod 3 and run in a control cam 6 which has a (thick) bean shape in a plan view. The control cam 6 is defined by four

different sectors or areas, which produce the desired movement for feeding the breech 20.

5 The areas of the control cam 6 define the movement processes of the breech 20 as follows:

$\alpha_1 - \alpha_2$ breech 20 to the rear, constant radius around the rear limit position,

10 $\alpha_2 - \alpha_3$ forward movement of the breech 20 in accordance with any desired function,

$\alpha_3 - \alpha_4$ breech 20 to the front, constant radius around the front limit position,

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$\alpha_4 - \alpha_1$ rearward movement of the breech 20 in accordance with any desired function.

20 In order to ensure that the breech 20 remains stationary in its limit positions for a specific time period while the crank 1 is rotated all the time, the control cam 6 has a constant radius in the areas α_1 to α_2 and α_3 and α_4 around the front and rear limit positions of the breech 20, with the length of the
25 connecting rod 3. The shapes of the areas between α_2 to α_3 and α_4 and α_1 are predetermined by the movement functions (for example sinusoidal profiles), that is to say they are defined by the breech movement. These can be optimized, in particular with respect to
30 acceleration, maximum speed, smoothness and freedom from jerking, etc.

The distance which the connecting rod 3 travels between the rear limit position E_v and the front limit position
35 E_{v1} corresponds to the displacement movement of the breech 20. The length of the connecting rod 3 as well as that of the crank 1 and the crank groove 1.1 are appropriately matched thereto and designed for this

purpose.

Figure 2 shows a schematic illustration of the drive
100 for the breech 20 of, in particular, an externally
5 driven weapon 21 (illustrated only partially). A weapon
barrel 22 is mounted in a barrel locking bush 23, or is
attached to the weapon housing. The breech 20 can be
locked thereto. The breech 20 can be moved on breech
guides 2 in the direction of the weapon barrel axis. A
10 crank housing is also shown, and integration in a
weapon housing is also possible, with a housing lower
part 12 and, in the preferred embodiment, with a
housing upper part 13. The control cams 6 are
integrated therein, in each case in mirror-image form.
15 A housing upper part 13 can be dispensed with if the
shaft 11 can be prevented from jamming in only one
control cam 6. The control cam 6 can then be passed
through the housing lower part 12 as a groove which is
open at the bottom.

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Figure 3, in conjunction with figure 5, shows the
breech driver 4, whose driver tab 4.1 is connected in
an interlocking manner to the breech 20 and whose tooth
system engages with that on a pinion 9. On the opposite
25 side, the pinion 9 engages with toothed rods 10 which
are fixed to the housing (this attachment is not itself
illustrated in any more detail), and is mounted such
that it can rotate on the connecting rod head 3.1,
which is in turn connected via a bolt to the connecting
30 rod 3. The connecting rod 3 and the crank 1 are
connected by means of a shaft 11, with the rollers 5,
which are mounted on both ends of the shaft 11 such
that they can rotate, running in the control cams 6 in
the housing lower part 12 and housing upper part 13 and
35 in which case the shaft 11 can be moved in the groove
1.1 in the crank 1. The crank 1 is mounted on the
housing lower part 12 such that it can rotate about the
center shaft M, with the crank 1 being driven by the

motor via the center shaft M.

In order to produce the desired oscillating movement of the breech 20 with waiting times in the reversal positions, the crank 1 is caused to rotate continuously about the center shaft by the motor 2. In this case, the crank 1 drives the shaft 11 in the same rotation direction. The shaft is radially guided by the preferably two identical control cams 6 in the housing lower part 12 and the housing upper part 13 in which the rollers 5 on the shaft 11 are guided. The shaft 11 transmits its movement, corresponding to the shape of the control cam 6, by means of the connecting rod 3 to the connecting rod head 3.1 (figure 4).

As can be seen from figure 5, the connecting rod head 3.1 is guided in grooves 15 in the housing lower part 12 and the housing upper part 12 (this is not illustrated in any more detail), where the lateral forces are absorbed. The pinion 9 on the connecting rod head 3.1 rolls on the tooth rods 10, which are fixed to the housing, during movement, and is rotated. The rotary movement of the pinion 9 drives the driver 4, thus doubling the linear movement in comparison to that of the connecting rod head 3.1. If such a long linear movement is not required, the breech 20 can alternatively also be coupled directly to the front end of the connecting rod 3. Since the driver 4 is connected in an interlocking manner to the breech 20 via the driver tabs 4.1, the breech 20 is moved parallel to the axis, but at least in the direction of the weapon barrel axis of the weapon barrel 22.

An even more compact physical form for the control cam or cams 6 can be achieved by arranging a pair of, for example eccentric, gearwheels (not illustrated in any more detail) between the center shaft and the motor 2, and these gear wheels rotate at twice the rotation

speed of the crank 1. Eccentric gearwheels result in a continuous step-up ratio, as a result of which, when the motor rotation speed is constant, the crank 1 rotates more slowly during the waiting time phases, and
5 more quickly during the breech movement phases. The angle ranges α_1 to α_2 and α_3 and α_4 of the control cam or cams 6 can therefore be made smaller, without shortening the waiting times of the breech 20 in the front and rear positions.

Patent Claims

1. A drive (100) for a breech (20) which can be moved in the axial direction with respect to a weapon barrel (22), having a motor (2) or the like, having the following features:
- a crank (1) is driven via its rotation shaft (M),
 - a connecting rod (3) is arranged such that a rear end (E_h) can be moved in a groove (1.1) in the crank (1) and is connected to a front end (E_v) on the breech (20) or a driver (4) of the breech (20) via a pinion (9),
 - with the crank (1) and the connecting rod (3) being connected to one another via a shaft (11) which is integrated in the groove (1.1),
 - at least one sliding means (5) is arranged at the rear end (E_h) of the connecting rod (3) and runs, guided in a control cam (6), along the control cam (6),
 - the control cam (6) is an intrinsically closed cam structure and has defined areas ($\alpha_1, \alpha_2, \alpha_3, \alpha_4$) as a movement profile for the breech (20),
 - the driver (4) of the breech (20) or a part of the breech (20) has a tooth system which engages in a pinion (9) which is integrated at the front such that it can rotate on/in the connecting rod (3), as a result of which
 - the breech (20) is moved via the connecting rod (3) during rotation of the crank (1).
2. The drive as claimed in claim 1, characterized in that the control cam (6) is integrated in the housing lower part (12) of a crank housing.
3. The drive as claimed in claim 2, characterized in that the control cam (6) is a groove which is open at the bottom.
4. The drive as claimed in one of claims 1 to 3,

characterized in that a further control cam (6) is integrated in the housing upper part (13) and is identical to that in the housing lower part (12), but in mirror-image form.

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5. The drive as claimed in one of claims 1 to 4, characterized in that the control cams (6) are defined by four different sectors or areas, by means of which the desired movement of the feed for the breech (20) is produced.

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6. The drive as claimed in claim 5, characterized in that the control cams (6) have a (thick) bean shape.

15 7. The drive as claimed in one of claims 1 to 6, characterized in that a pair of, for example, eccentric gear wheels are located between the center shaft (M) and the motor (2) and rotate at twice the rotation speed of the crank (1).

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8. The drive as claimed in one of claims 1 to 7, characterized in that the breech (20) is coupled directly to the front end of the connecting rod (3), with the driver (4) being connected in an interlocking manner to the breech (20) via the driver tabs (4.1), and with the breech (20) being moved parallel to the axis, but at least in the direction of the weapon barrel axis of the weapon barrel (22).

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