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(54) Lock for a door of a motor vehicle

(57) Described herein is a lock (1) for a door of a motor vehicle provided with a closing mechanism (4) designed to couple in a releasable way with a lock striker (6). The closing mechanism (4) is provided with a fork (8) elastically loaded towards an opening position, in which it allows engagement and disengagement between the lock striker (6) and a seat (13) thereof, of a dog (9) that can be coupled via snap-action in a releasable way with the fork (8) to block it in at least a primary closing position, in which it holds the lock striker (6) inside its seat (13) and prevents disengagement, and with a supplementary retention lever (25) that can couple with the fork (8) to block it in a completely closed position, wherein the fork (8) is disposed downstream the primary closing position with reference to the direction of movement from the opening position, is detached from the dog (9) and prevents the lock striker (6) from being disengaged from its seat (13); the supplementary retention lever (25) may be deactivated by operation of the dog (9).

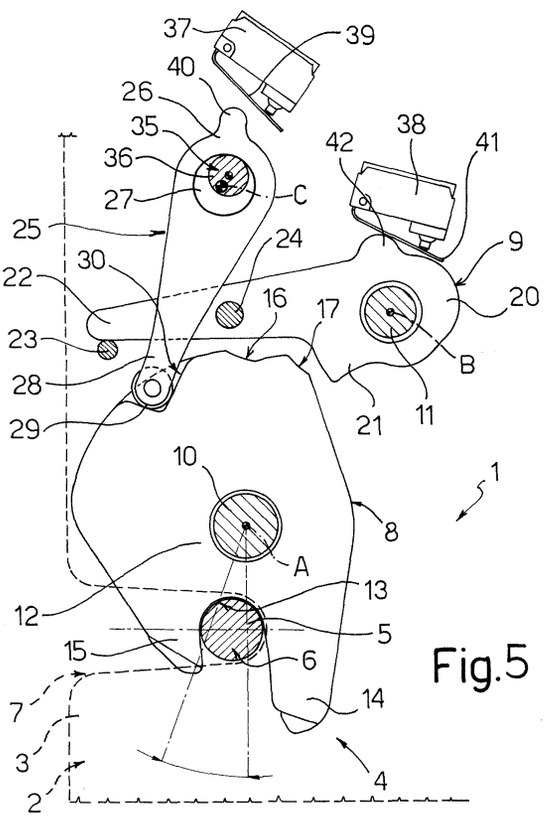

Fig.5

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Description

[0001] The present invention relates to a lock for a door of a motor vehicle.

[0002] As is known, locks for motor vehicles generally comprise a supporting body designed to be fixed to a door of the motor vehicle, and a closing mechanism carried by the supporting body and designed to couple with a lock striker integral with an upright of the frame of said door. There are also solutions, used much less frequently, wherein the supporting body of the lock is fixed to the upright and the lock striker is instead fixed to the door.

[0003] In both cases, the closing mechanism is composed essentially of a fork and of a dog hinged to the supporting body around respective fixed axes parallel with each other.

[0004] The fork has an engagement seat for a generally cylindrical portion of the aforesaid lock striker, is elastically loaded towards an opening position, wherein the lock striker can be engaged and disengaged from its seat, and is disengaged in a closing position, wherein it holds the cylindrical portion of the lock striker inside its seat and prevents disengagement.

[0005] The dog is thrust by a spring to couple via snap-action, by means of an engagement edge thereof, with a peripheral retention shoulder of the fork to block the latter in a releasable way in the closing position.

[0006] In particular, after the door is slammed the fork moves, under the thrust of the lock striker, from the opening position to an overtravel position disposed beyond the closing position; during the portion of travel between the closing position and the overtravel position, the fork moves, with its retention shoulder, beyond the dog, to enable the latter to snap, with its engagement edge, into a position facing the aforesaid shoulder. During subsequent elastic return of the fork towards the opening position, the retention shoulder is positioned against the engagement edge of the dog, thus defining the closing position of the fork on the lock striker.

[0007] As when motor vehicles are being driven they are normally subjected to vibrations and impacts that can be transmitted to the relative locks, the dog must ensure a certain retention load on the fork, to prevent inopportune opening of the doors. This is obtained by suitably sizing and shaping the fork and dog in the zone of interaction.

[0008] Nonetheless, the greater the retention load exerted by the dog on the fork in the closing position is, the greater the opening load of the lock will be, that is the force the user must exert to open the door of the motor vehicle.

[0009] The object of the present invention is to produce a lock for a door of a motor vehicle, which enables, simply and inexpensively, high retention loads to be obtained on the fork in the closing position and, simultaneously, decreased loads during the phase to open the door.

[0010] The aforesaid object is obtained by the present invention, as it relates to a lock for a door of a motor vehicle comprising a closing mechanism designed to couple in a releasable way with a lock striker, said closing mechanism comprising:

- a fork elastically loaded towards an opening position, wherein engagement and disengagement between said lock striker and a seat thereof are possible;
- and
- a dog that can couple via snap-action in a releasable way with said fork to block it in at least a primary closing position, in which it constrains said lock striker in its seat and
- prevents disengagement thereof;

characterized in that it also comprises a supplementary retention lever that can be coupled with said fork to block it in a completely closed position, wherein the fork is disposed downstream the primary closing position with reference to the direction of movement from said opening position, is detached from said dog and prevents disengagement of said lock striker from its seat, it being possible to selectively deactivate said lever by operating said dog.

[0011] For better understanding of the present invention a preferred embodiment is described hereunder, purely as a non-limiting example and with reference to the accompanying drawings, in which:

- Figure 1 is a partially sectional front view with parts removed for clarity, of a lock for a door of a motor vehicle, produced according to the present invention and disposed in an opening condition;
- Figures 2 to 5 are partially sectional front views with parts removed for clarity, of the lock in Figure 1 during the closing sequence; and
- Figure 6 is a partially sectional front view with parts removed for clarity, of the lock in Figure 1 during an initial phase of an opening movement.

[0012] With reference to the attached figures, number 1 indicates as a whole a lock for a door of a motor vehicle (not shown).

[0013] The lock 1 essentially comprises a supporting body 2 with a box-type structure, of which, for clarity, only a plate 3 is shown, partially and with a dashed line, designed to be fixed to the aforesaid door, and a closing mechanism 4 fastened to the supporting body 2 and designed to cooperate with a cylindrical portion 5 of a lock striker 6 represented only in part, integral with a fixed upright (not shown) of the door.

[0014] In particular, the plate 3 defines a C-shaped lateral opening 7 designed to receive the portion 5 of the lock striker 6 during the phase to close the door.

[0015] The closing mechanism 4 essentially comprises a fork 8 and a dog 9 hinged around respective pins 10, 11 fixed integral with the plate 3 and with respective

axes A, B parallel with each other and orthogonal to the plate 3.

[0016] The fork 8 is constituted by a shaped plate produced in metallic material, and hinged at the level of an intermediate portion 12 around the pin 10 and has a peripheral C-shaped seat 13 designed to receive the portion 5 of the lock striker 6 and delimited laterally by a pair of teeth 14, 15.

[0017] Advantageously, the fork 8 is coated externally by a shell made of plastic material, from which the free ends of the teeth 14 and 15 delimiting the seat 13 project.

[0018] The fork 8 is thrust in a known way by a spring (not shown) wound around the pin 10 and connected to the fork 8 and to the plate 3, towards an opening position (figure 1), wherein the seat 13 is facing the same part as the opening 7 of the plate 3 and therefore enables engagement and disengagement of the portion 5 of the lock striker 6.

[0019] Under the thrust of the lock striker 6 and after the door is slammed, the fork 8 rotates about the axis A to close or couple via snap-action with the dog 9 to assume, as will be explained in detail hereunder, two different closing positions, respectively the first and second snap-action coupling closing positions (figures 2 and 3), wherein the portion 5 of the lock striker 6 is blocked inside the seat 13 and the tooth 15 prevents escape by increasingly intercepting the opening 7.

[0020] In particular, the first and second snap-action coupling closing positions are defined by the dog 9 coupling with respective shoulders 16, 17 produced along the peripheral edge of the fork 8 on the opposite side of the teeth 14 and 15.

[0021] The dog 9 is composed of a shaped plate with an elongated structure extending essentially on the same lying plane as the fork 8, is hinged to the pin 11 at the level of one of its ends 20 and is designed to couple in a releasable way, by means of a lateral boss 21 with an L-shaped edge, with the shoulders 16, 17 of the fork 8.

[0022] The dog 9 is thrust in a known way towards the fork 8 by a helical spring (not shown) wound around the pin 11 and connected to the dog 9 and to the plate 3.

[0023] When there is no contact with the fork 8 or interaction with other elements of the lock 1 (as will be explained in greater detail hereunder), the dog 9 is thrust by its spring, with a free end 22 opposite the end 20, against a stop 23 orthogonally projecting in cantilever fashion from the plate 3.

[0024] Finally, in an intermediate position, the dog 9 is provided with a thrust boss 24 (the function of which will be explained hereunder) orthogonally extending in cantilever fashion from an intermediate portion of the dog 9. More precisely, the boss 24 is disposed on the opposite side to the boss 21 with respect to the end 20 hinged to the plate 3.

[0025] As is known, the dog 9 is selectively movable against the action of its spring to disengage the fork 8 and free the lock striker 6, enabling the door to open. This movement may be obtained by lever mechanisms of known types (not shown), connected to the inner and outer handles (again not shown) associated with the door.

[0026] According to an important characteristic of the present invention, the lock 1 also comprises a supplementary retention lever 25 that can be activated selectively to block the fork 8 in a completely closed position (figure 5), wherein the fork 8 is disposed downstream the first and second snap-action coupling closing positions with reference to the direction of movement from the opening position and is detached from the dog 9, which is held by the stop 23.

[0027] In particular, the lever 25 has an elongated structure and extends on a lying plane parallel to the plane of the fork 8 and of the dog 9 so that it intersects the dog 9 transversely between the boss 24 and the end 22.

[0028] The lever 25 is hinged, at the level of one of its ends 26, to the plate 3 by means of a pin 27 with an axis C parallel to the axes A and B and fixed to the plate 3 in an axially fixed position and in an angularly revolving way.

[0029] The lever 25 has a structure tapered towards one of its ends 28 opposite the end 26 and carries, projecting in cantilever fashion, at the level of the end 28, a rolling roller 29 designed to couple with a notch 30 of the fork 8 to define the completely closed position (figure 5).

[0030] In particular, the roller 29 is preferably produced in vibration-damping plastic or chromed aluminum and enables the friction loads between the lever 25 and the fork 8 to be reduced to a minimum.

[0031] The lever 25 is loaded, analogously to the dog 9, towards the peripheral edge of the fork 8 by a helical spring of known type (not shown), wound around the pin 27.

[0032] At the level of the opening position of the fork 8, the lever 24 rests, with its roller 29, on the peripheral edge of the fork 8 on the side of the tooth 15 and comes into contact with the boss 24 laterally to hold the dog 9 in a position detached both from the fork and from the stop 23.

[0033] The notch 30 has an essentially flattened V-shaped profile and is produced along the peripheral edge of the fork 8 on the opposite side of the shoulder 16 with respect to the shoulder 17.

[0034] More specifically, the notch 30 is disposed on the fork 8 in a position so that it can be engaged by the roller 29 of the dog 9 at the end of the closing travel of the fork 8 under the thrust of the lock striker 6.

[0035] Blocking of the lever 25 in the condition of coupling with the fork 8 and, consequently, movement and blocking of the fork 8 in the completely closed position are obtained by loading the lever 25 towards the bottom of the notch 30 performed by an electrically operated rotary type actuator 35 (per se known and shown to the

extent required to understand the present invention), for example a geared motor, with a cylindrical output element 36 coupled angularly to the pin 27 in an eccentric position.

[0036] In this way, subsequent to coupling of the roller 29 with the notch 30, activation of the actuator 35 is designed to determine a movement of the lever 25 towards the fork 8 to make it rotate beyond its end of travel position in the closing direction on the lock striker 6, detaching the shoulder 17 of the fork 8 from the boss 21 of the dog 9.

[0037] Disengagement of the lever 25 from the fork 8 can be obtained by an action of lateral thrust performed by the boss 24 during rotation of the dog 9 away from the stop 23.

[0038] In particular, in order to be activated by the boss 24 of the dog 9, the lever 25 extends obliquely with respect to the direction of movement of the boss 24 consequent to a rotation of the dog 9 against the action of its spring.

[0039] Activation/deactivation of the actuator 35 is controlled by a pair of microswitches 37, 38 associated respectively with the lever 25 and with the dog 9.

[0040] In particular, the microswitch 37 is disposed on the opposite side of the lever 25 with respect to the fork 8 and is designed to interact, by means of a mechanical actuation element 39, with a tab 40 projecting radially from the end 26 of said lever 25.

[0041] More precisely, the microswitch 37 is held closed by the tab 40 in the condition of disengagement between the lever 25 and the fork 8 and opens through the effect of movement of the lever 25 in the coupling position with the fork 8, commanding activation of the actuator 35.

[0042] In an entirely analogous way, the microswitch 38 is disposed in proximity to the end 20 of the dog 9 on the opposite side to the one facing the fork 8 and is designed to interact, by means of a mechanical actuation element 41, with a tab 42 projecting radially from said end 20.

[0043] More precisely, the microswitch 38 is opened in the positions of the dog 9 corresponding to the completely closed position and the first and second snap-action coupling positions of the fork 8, and is closed by the tab 42 through the effect of movement of the dog 9 in the position in which it determines initial disengagement of the lever 25 from the fork 8, commanding deactivation of the actuator 35.

[0044] In use, closing of the lock 1, from outside or from inside the motor vehicle, takes place simply by slamming the door; in this way, the portion 5 of the lock striker 6 is made to knock against the tooth 14 of the fork 8, which rotates in a counter-clockwise direction from the opening position in figure 1.

[0045] Rotation of the fork 8 determines sliding of its peripheral edge on the roller 29 of the lever 25, moving the roller 29 and the notch 30 closer to each other.

[0046] In particular, during its travel the fork 8 passes beyond, with both its shoulders 16 and 17, the boss 21 of the dog 9 (figures 2 and 3) and brings the notch 30 to the level of the roller 29 of the lever 25.

[0047] At this point, the lever 25 couples via snap-action with the fork 8 with its roller 29 engaged in the notch 30. Through the effect of this movement, the tab 40 moves away from the mechanical actuation element 39, opening the microswitch 37 and determining activation of the actuator 35 (figure 4).

[0048] Consequent rotation of the output element 36 of the actuator 35 causes, due to its eccentric coupling with the pin 27, the lever 25 to move towards the fork 8.

[0049] As the direction of thrust of the lever 25 is lateral with respect to the axis A of rotation of the fork 8, the latter is loaded by a counter-clockwise torque that takes it to the completely closed position (figure 5).

[0050] In this position, the fork 8 is completely detached from the dog 9, which is in turn resting against the stop 23, and its shoulder 17 is facing the boss 21. In this way, the dog 9 defines a safety stop for the fork 8 in the event of accidental disengagement of the lever 25.

[0051] The lock 1 (figure 6) is opened from outside or from inside the motor vehicle by activating, using the handles associated with the door, the dog 9 in order to rotate it in a clockwise direction around the axis B against the action of its spring. Through the effect of this rotation, the boss 24 is brought into contact with the lever 25 laterally and determines clockwise rotation around the axis C to disengage it from the notch 30.

[0052] Following the aforesaid movement of the lever 25, the tab 42 closes the microswitch 38, determining deactivation of the actuator 35 and enabling the lock 1 to be returned to the opening condition.

[0053] By examining the characteristics of the lock 1 produced according to the present invention the advantages that can be obtained are apparent.

[0054] In particular, the solution described herein enables, by means of the lever 25, a high retention load to be obtained on the fork 8 in the completely closed position, with consequent unloading of the dog 9; the lock 1 may therefore be opened by acting on the dog 9 with a reduced load of manoeuvre.

[0055] The dog 9 therefore essentially assumes a safety function against any accidental disengagement of the fork 8 by the lever 25, for example due to vibrations or impacts that might occur while the motor vehicle is being driven.

[0056] Moreover, use of the rolling roller 29 on the end of the lever 25 enables friction between the lever 25 and the fork 8 to be reduced to a minimum.

[0057] Finally, it is clear that modifications and variations may be made to the lock 1 without departing from the scope of protection of the present invention.

[0058] In particular, the lock 1 could be fixed to the upright of the door and could cooperate with a lock striker integral with the door.

Claims

1. Lock (1) for a door of a motor vehicle comprising a closing mechanism (4) designed to couple in a releasable way with a lock striker (6), said closing mechanism (4) comprising:

   a fork (8) elastically loaded towards an opening position, wherein engagement and disengagement between said lock striker (6) and a seat (13) thereof are possible; and
   a dog (9) that can couple via snap-action in a releasable way with said fork (8) to block it in at least a primary closing position, in which it constrains said lock striker (6) in its seat (13) and prevents its disengagement;

   characterized in that it also comprises a supplementary retention lever (25) that can be coupled with said fork (8) to block it in a completely closed position, wherein said fork (8) is disposed downstream the primary closing position with reference to the direction of movement from said opening position, is detached from said dog (9) and prevents disengagement of said lock striker (6) from its seat (13), it being possible to selectively deactivate said lever (25) by operating said dog (9).

2. Lock as claimed in claim 1, also comprising locking means (35) that can be activated selectively to block said lever (25) in the coupling arrangement with said fork (8) disposed in said completely closed position.

3. Lock as claimed in claim 2, wherein said lever (25) rotates around a hinging pin (27) connected, in an axially fixed position and in a angularly revolving way, to supporting means (3) of said lock (1), and wherein said blocking means comprise an actuator (35) with an output element (36) coupled angularly in an eccentric position to said pin (27) of said lever (25).

4. Lock as claimed in any one of the previous claims, wherein said dog (9) is elastically loaded towards said fork (8), and wherein stop means (23) are provided to hold said dog (9) detached from said fork (8) disposed in the completely closed position.

5. Lock as claimed in any one of the previous claims, wherein said dog (9) and said lever (25) extend prevalently on parallel planes and reciprocally intersect, and wherein interaction means (24) are provided to determine disengagement of said lever (25) from said fork (8) following operation of said dog (9).

6. Lock as claimed in claim 5, wherein said interaction means comprise a boss (24) projecting in cantilever fashion from said dog (9), designed to come into contact laterally with said lever (25) and with a trajectory of movement transverse to the direction in which said lever (25) extends.

7. Lock as claimed in any one of the previous claims, wherein said lever (25) cooperates with said fork (8) by means of a rolling roller (29).

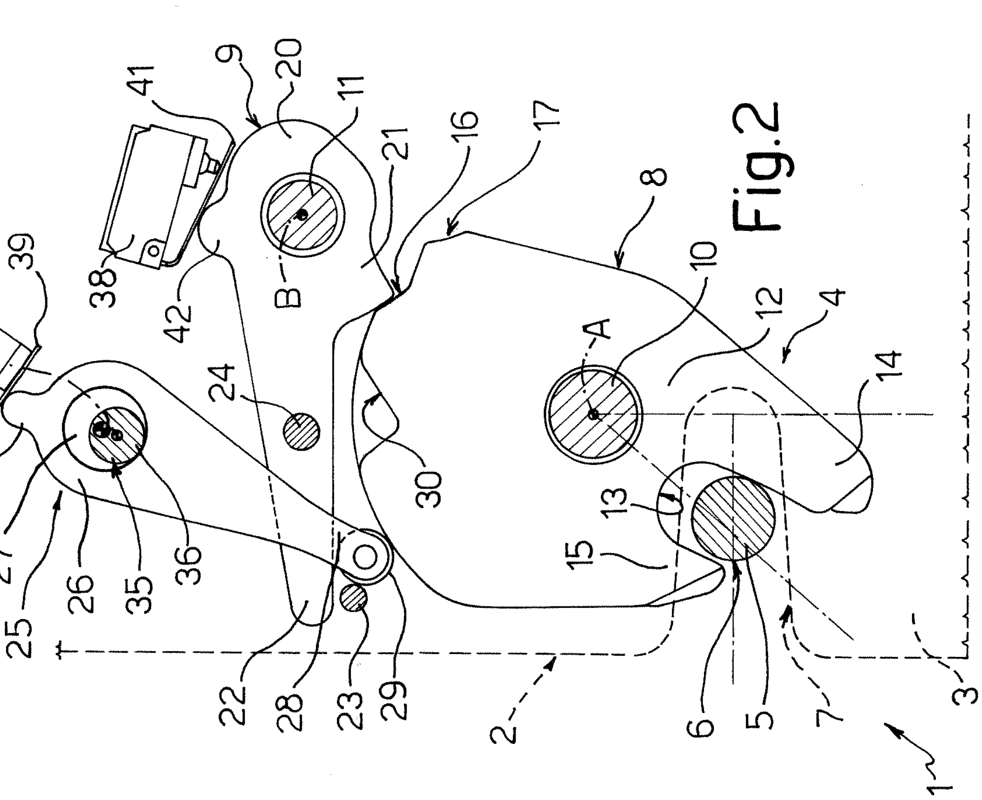

Fig.2

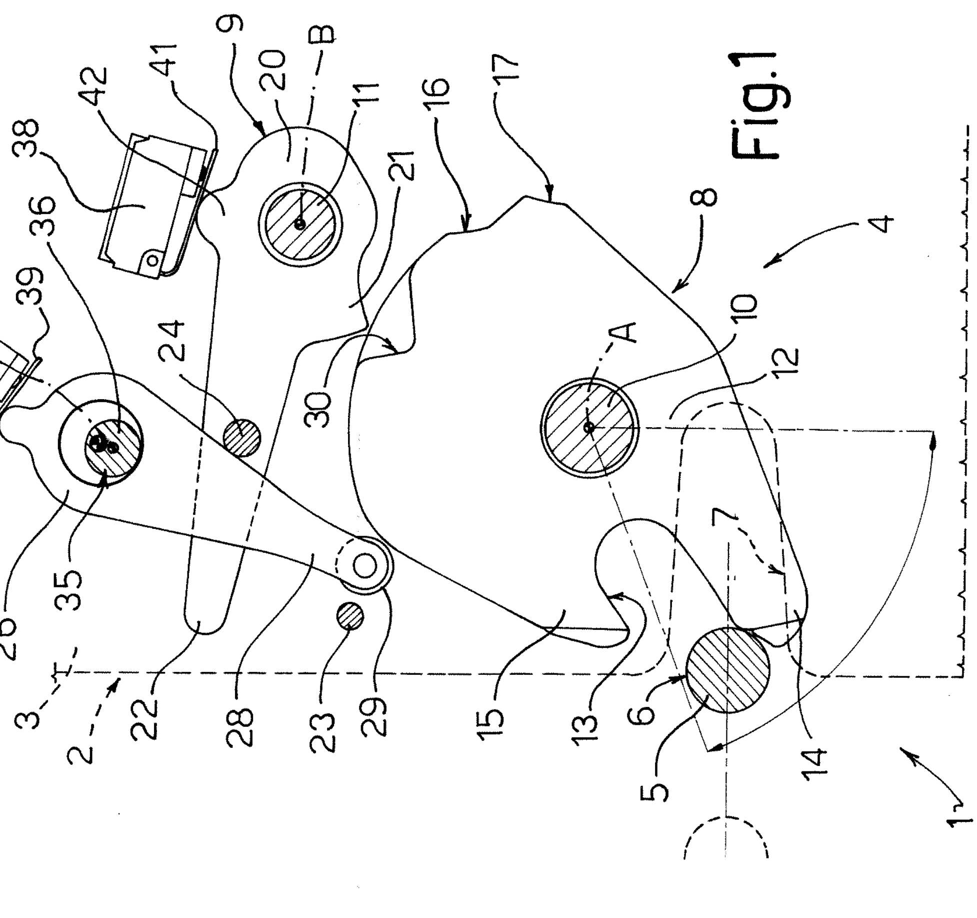

Fig.1

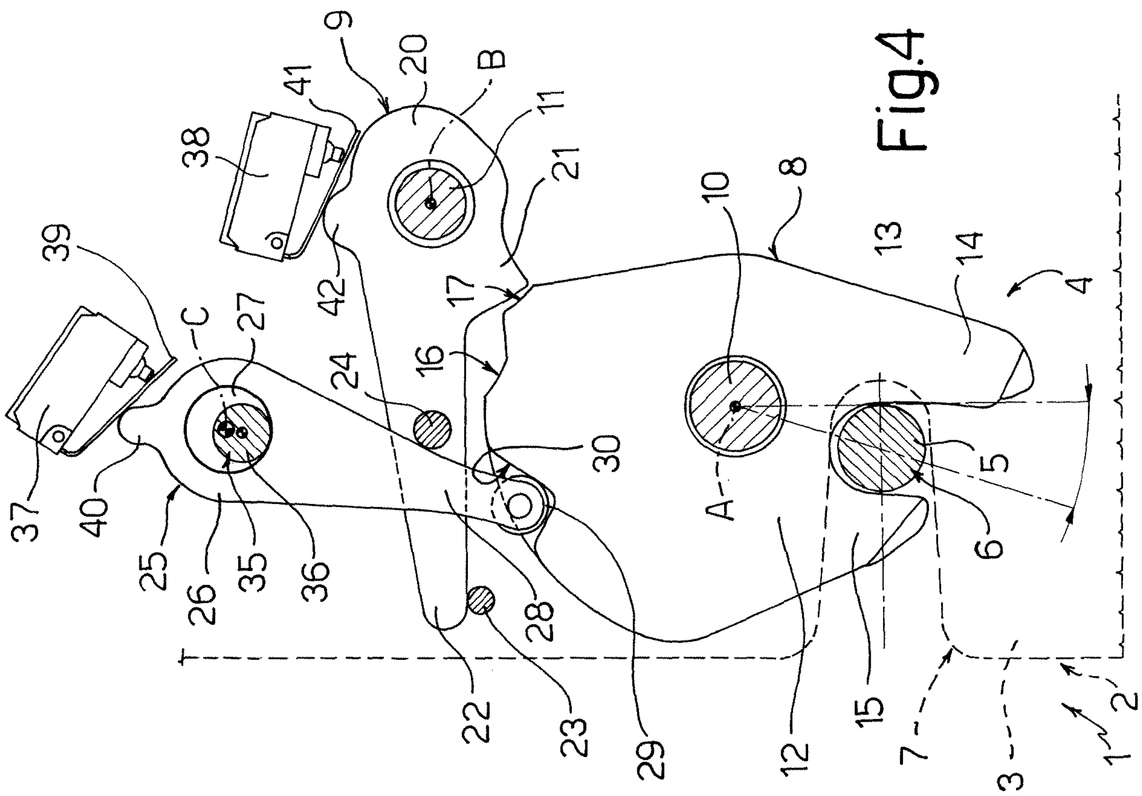

Fig.4

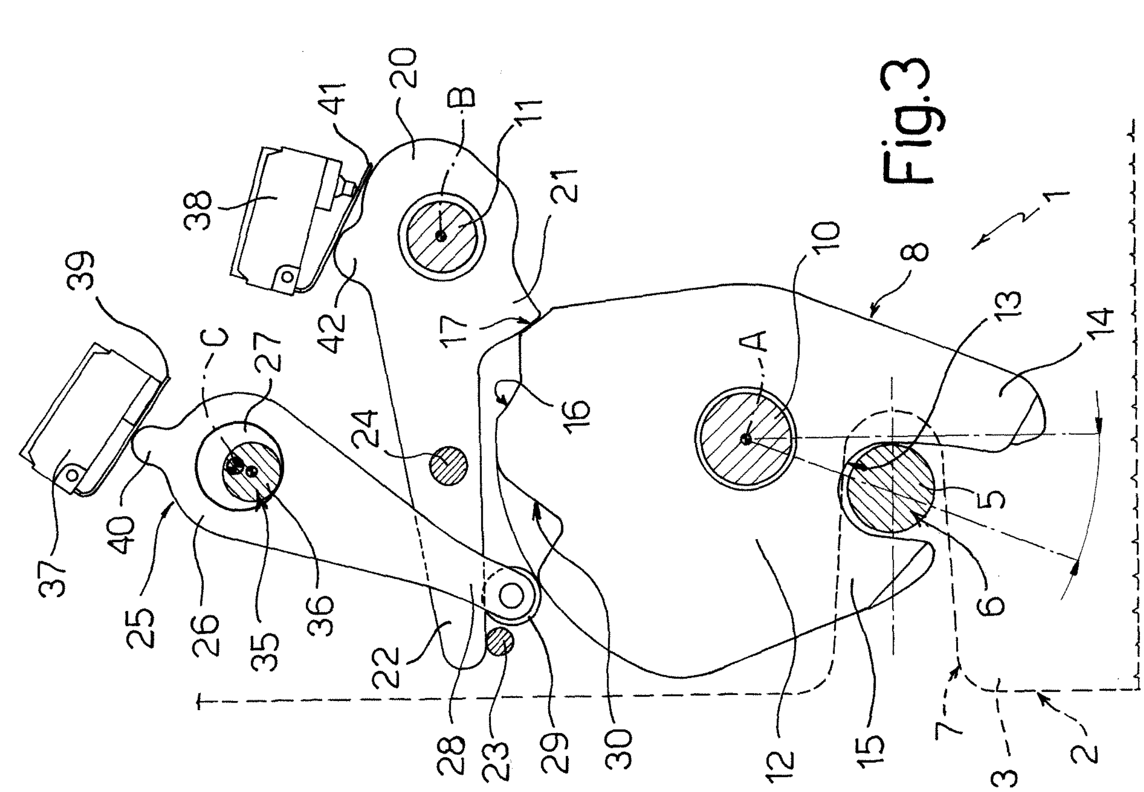

Fig.3

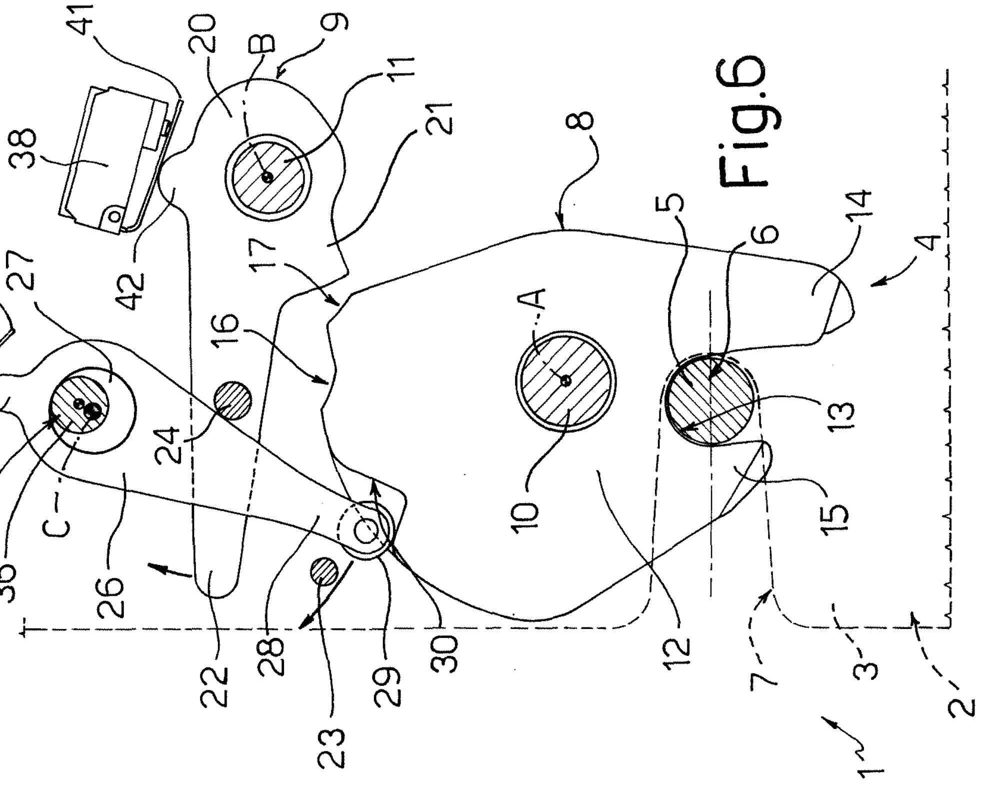

Fig.6

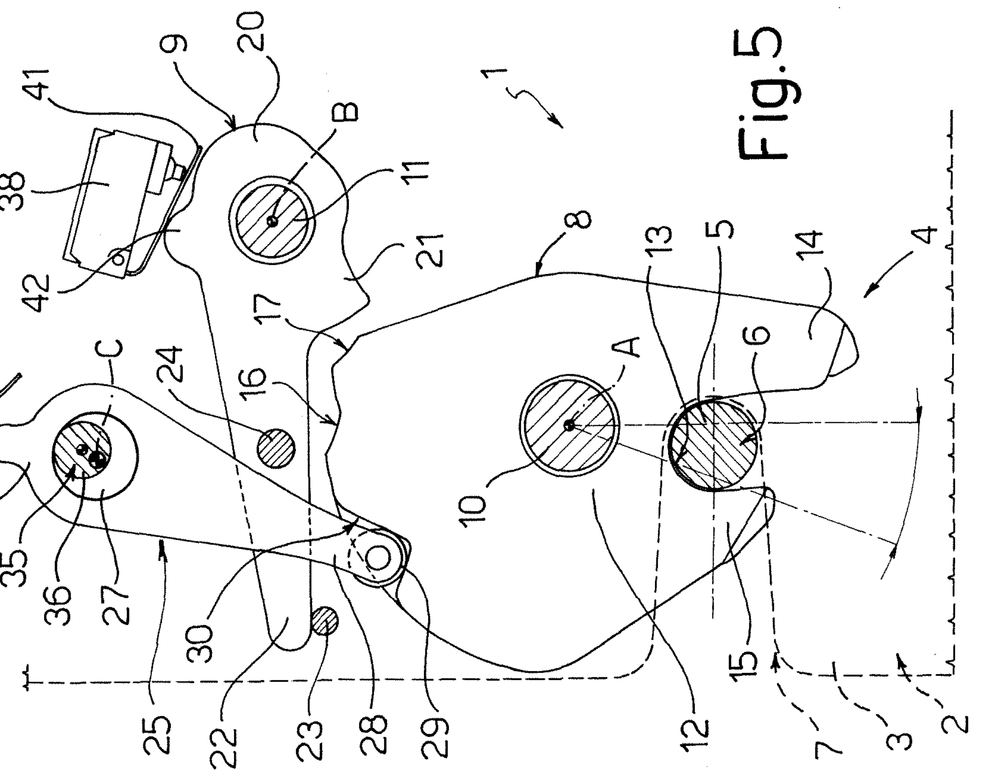

Fig.5

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EUROPEAN SEARCH REPORT

Application Number
EP 04 10 4196

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 December 2004	Friedrich, A

CATEGORY OF CITED DOCUMENTS

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