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(71) Applicant: **INTIER AUTOMOTIVE CLOSURES S.p.A**
10090 Cascine Vica-Rivoli (To) (IT)

(72) Inventor: **Casalini, Paolo**
56124 Pisa (IT)

(74) Representative: **Jorio, Paolo et al**
STUDIO TORTA S.r.l.
Via Viotti, 9
10121 Torino (IT)

(54) Vehicle lock safety control device

(57) There is described a safety control device (1) for a vehicle lock (2), having a control member (13) which interacts with actuating means (7) of the lock (2), and can be set to at least two operating positions (α,β) respectively enabling and disabling release of the lock (2); drive means (11) activated selectively to move the control member (13) into the operating positions (α,β); and motion transmission means (12) interposed between the control member (13) and the drive means (11), and which have at least two actuating members (16, 17) for moving the control member (13) respectively from one to the other of the operating positions (α,β) and vice versa; each actuating member (16, 17) is movable along a predetermined path including an interacting portion, in which the actuating member (16, 17) engages the control member (13) to move it between the operating positions (α,β), and an idle portion, in which the actuating member (16, 17) is detached from the control member (13).

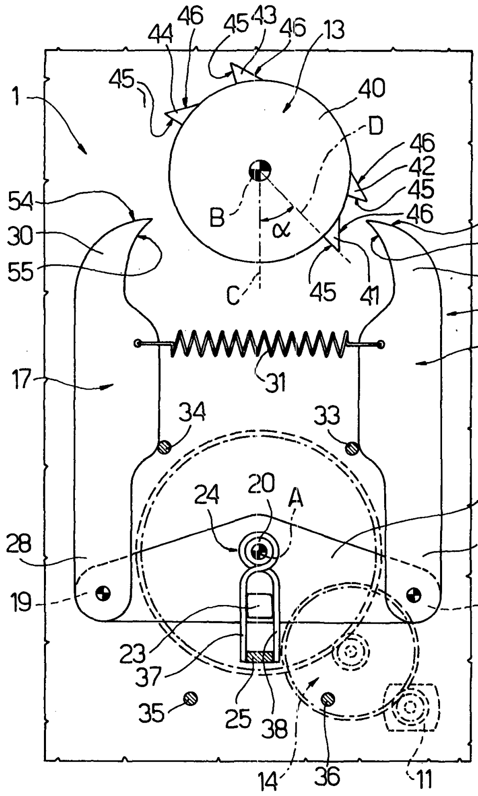

Fig.2

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Description

[0001] The present invention relates to a vehicle lock safety control device.

[0002] As is known, vehicle locks substantially comprise a supporting body fixed to a door of the vehicle; and a lock mechanism fitted to the supporting body and which engages a striker integral with a door post.

[0003] Solutions are also known in which the lock is fixed to the door post, and the striker is integral with the door.

[0004] Conventional locks normally also comprise a control assembly activated by the manual control members on the vehicle door, e.g. the inside and outside handles, and which interacts with the lock mechanism to release it, i.e. from the striker.

[0005] Locks normally also feature a safety assembly comprising a safety control device activated selectively by the user; and a lever mechanism activated by the safety control device and which acts on the control assembly to enable/disable release of the lock mechanism using the outside and/or inside door handle.

[0006] More specifically, the safety assembly can be set to substantially three distinct operating configurations: preventing release of the lock from outside the vehicle (external safety function engaged, or "external lock" configuration); preventing release of the lock from outside (external safety function engaged) as well as from inside (internal safety or "dead lock" function engaged) the vehicle ("double lock" configuration); and enabling release of the lock from both outside and inside the vehicle (external and internal safety functions released, or "unlock" configuration).

[0007] Safety control devices are known comprising an electric actuator; a control member operated by the actuator and connected to the lever mechanism interacting with the control assembly; and an electric circuit for selectively powering the actuator.

[0008] More specifically, the actuator, when supplied by the electric circuit with two different voltage values, rotates the control member in a direction and at an angular speed depending on the sign and the value of the difference between the two voltage values; conversely, when the voltage values are equal, the actuator and the control member remain stationary.

[0009] The control member can be rotated about its axis into three distinct operating positions corresponding respectively to the safety assembly external lock, double lock, and unlock configurations.

[0010] The control member also comprises a cam for regulating electric power supply to the actuator, and which is defined by a radial projection shaped to interact with the electric circuit when the control member is in the operating position corresponding to the external lock configuration (external safety function engaged), and not to interact with the electric circuit in the other two operating positions.

[0011] The electric circuit comprises three actuator power supply terminals, which are supplied selectively with different voltage values; and a selector for varying the way in which the terminals are connected to the actuator.

[0012] More specifically, one terminal is connected permanently to the actuator by a first power line; and the selector, depending on the operating position of the control member, can be set to two distinct alternative positions, each connecting one of the other two terminals to the actuator by a second power line.

[0013] More specifically, the selector comprises a conductor having one end connected to the second line, and the opposite end connected to either one of the other terminals; a spring for keeping the conductor connected between a first of the other terminals and the second line; and a microswitch connected functionally to the conductor to connect the conductor to the second of the other terminals in opposition to the spring, and cooperating selectively with the control member cam.

[0014] More specifically, when cooperating with the control member cam (external lock configuration), the microswitch moves the conductor in opposition to the spring to connect the second of the other terminals to the second power line; whereas, when the control member cam does not interact with the microswitch (double lock or unlock configuration), the spring moves the conductor into a position connecting the second power line to the first of the other terminals.

[0015] By means of an electronic, even remote, control, the control member can be moved selectively from one to another of its operating positions to switch the safety assembly from one to another of its configurations.

[0016] More specifically, depending on the initial and final operating positions of the control member, the electronic control imposes different or equal voltage values at each terminal, so that the actuator activates the control member correctly.

[0017] Consequently, even the slightest error in the movement of the actuator may result in malfunctioning of the control device, and therefore in unreliable switching of the safety assembly from one operating configuration to another.

[0018] As such, the electric circuit is particularly vital, in that the actuator must be capable of performing rapid, small, highly accurate angular displacements to rapidly accelerate/decelerate the control member and counteract the overall inertia of the masses in motion.

[0019] Particularly as regards the control member operating position corresponding to the external lock configuration, the amount of travel and the operating speed of the microswitch are determined solely by the control member cam profile, by acceleration of the control member by the actuator, by inertia of the control member itself, and by internal friction.

[0020] Consequently, the control member cam must be made to strict size and shape tolerances, and must have an excellent surface finish to cooperate correctly with the microswitch.

[0021] It is an object of the present invention to provide a vehicle lock safety control device designed to provide a straightforward, low-cost solution to the aforementioned drawbacks typically associated with known safety control devices.

[0022] According to the present invention, there is provided a vehicle lock safety control device, as claimed in Claim 1.

[0023] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic side view of a vehicle door fitted with a safety control device in accordance with the invention;

Figures 2 to 8 show larger-scale views of the Figure 1 safety control device in different operating positions.

[0024] Number 1 in the accompanying drawings indicates as a whole a safety control device for a lock 2 of a door 3 of a vehicle (not shown).

[0025] Lock 2 and door 3 are known and only shown schematically as required for a clear understanding of the present invention.

[0026] More specifically, lock 2 is housed in known manner inside a bottom box portion 4 of door 3, and is activated by an inside handle 8 and an outside handle 9 of door 3.

[0027] Lock 2 interacts in known manner with a known striker (not shown) integral with a post (not shown) of door 3, and forms part of a centralized vehicle door locking system controlled in known manner (not shown) by the vehicle electric system.

[0028] In the example shown, which is purely non-limiting, for a clear understanding of the teachings of the present invention, lock 2 is a modular type and substantially comprises a lock module 5 incorporating a mechanism (not shown) for releasably engaging the striker to lock door 3; and an actuating module 7 connected functionally to handles 8 and 9 and which interacts with the mechanism of lock module 5 to release the mechanism from the striker.

[0029] More specifically, actuating module 7 comprises, in known manner not shown, one or more levers connected both to handles 8 and 9 and to the mechanism of lock module 5 by remote connecting means, e.g. ties 6.

[0030] Actuating module 7 also comprises a safety assembly 10, which interacts with said levers to enable or disable release of door 3 using handle 8 and/or 9.

[0031] More specifically, safety assembly 10 substantially comprises safety control device 1, described in detail later on; and a lever mechanism (not shown) activated by device 1 and which interacts with the other levers of actuating module 7.

[0032] Safety assembly 10 can be set to three distinct operating configurations: preventing release of lock 2 from outside the vehicle, i.e. using handle 9 (external safety function engaged, or "external lock" configuration); preventing release of lock 2 from both outside and inside the vehicle, i.e. using handles 9 and 8 (external and internal safety functions engaged, or "double lock" configuration); and enabling release of lock 2 from both outside and inside the vehicle, i.e. again using handles 9 and 8 (external and internal safety functions released, or "unlock" configuration).

[0033] With reference to Figures 2 to 8, device 1 substantially comprises a motor 11, e.g. an electric motor); and a control member 13, which interacts with the levers of actuating module 7 in known manner not shown, is connected functionally to motor 11 as explained in detail later on, and can be set to three different operating positions corresponding respectively to the external lock, double lock, and unlock configurations of safety assembly 10.

[0034] Device 1 advantageously also comprises a transmission assembly 12 interposed between motor 11 and control member 13, and in turn comprising a rocker arm 15 connected at a respective axis A to a gear train 14 activated by motor 11, and two actuating levers 16, 17 hinged to rocker arm 15 and each movable along a predetermined cyclic path comprising a forward or interacting portion (upward movement in Figures 2 to 8) in which actuating levers 16, 17 interact with control member 13, and a return or idle portion (downward movement in Figures 2 to 8) in which actuating levers 16, 17 are detached from control member 13.

[0035] More specifically, rocker arm 15 is connected at axis A to an output shaft 20 of gear train 14, comprises two hinge portions 18 and 19, for actuating levers 16 and 17, located on opposite sides of and symmetrically with respect to axis A, and has a prismatic projection 23 located eccentrically with respect to axis A and connected by a spring 24 to shaft 20 and to a fixed stop 25.

[0036] Actuating levers 16, 17 are positioned facing each other, extend, in a plane perpendicular to axis A, from rocker arm 15 to control member 13, and have respective first ends 27, 28 hinged to rocker arm 15, and respective opposite, pawl-shaped second ends 29, 30 with their concavities facing control member 13.

[0037] More specifically, end 29 of actuating lever 16 is bounded by two, respectively convex and concave, curved surfaces 51, 52 converging at a sharp or blended edge.

[0038] Similarly, end 30 of actuating lever 17 is bounded by two, respectively convex and concave, curved surfaces 54, 55 converging at a sharp or blended edge.

[0039] Actuating levers 16, 17 are also connected to each other, at respective intermediate portions, by a spring 31, which, in static conditions, is perpendicular to levers 16, 17. More specifically, in the absence of external commands, actuating levers 16, 17 are pulled towards each other by spring 31, and are maintained perpendicular to rocker arm 15 by their respective intermediate portions resting against fixed pins 33, 34 interposed between levers 16, 17.

[0040] Spring 24 is a garter spring, is wound about shaft 20, and has opposite end portions 37, 38, which are parallel in static conditions and house projection 23 and stop 25.

[0041] Two fixed stop pins 35, 36 are located on the opposite side of rocker arm 15 to actuating levers 16, 17 and symmetrically with respect to axis A to define respective stops for rocker arm 15.

[0042] Control member 13 comprises a wheel 40, which rotates about an axis B parallel to axis A, can be set to three distinct angular positions corresponding respectively to the external lock, double lock, and unlock configurations of safety assembly 10, and has two pairs of teeth 41, 42 and 43, 44, which interact with respective ends 29, 30 of actuating levers 16, 17 to enable wheel 40 to be moved by levers 16, 17 between said angular positions.

[0043] More specifically, a first pair of teeth 41, 42 is formed along and projects from a first arc of wheel 40, and a second pair of teeth 43, 44 is formed along and projects from a second arc of wheel 40 diametrically opposite the first arc.

[0044] More specifically, each tooth 41, 42, 43, 44 is defined by a first flank 45, extending radially or sloping inwards of the tooth, and a second flank 46, extending obliquely with respect to axis B, which are joined at a sharp or blended edge at a common end opposite wheel 40.

[0045] Working anticlockwise about control member 13 (Figures 2 to 8), flanks 45 of teeth 41, 42 precede flanks 46, whereas flanks 46 of teeth 43, 44 precede flanks 45.

[0046] With particular reference to Figures 3 to 8, the angular position of control member 13 with respect to axis B is unequivocally identifiable by the anticlockwise angle formed between an arbitrary direction C, fixed with respect to the movement of control member 13 and parallel to the plane perpendicular to axes A and B, and a direction D integral with the movement of control member 13, such as the line joining point 0 - axis A of control member 13 - to flank 45 of tooth 41.

[0047] The angular positions of control member 13 corresponding to the unlock, external lock, and double lock configurations of safety assembly 10 are defined respectively by increasing values α,β,γ of the anticlockwise angle between direction D and direction C.

[0048] More specifically, the angular distance, measured on the lateral circumferential surface of wheel 40, between corresponding portions of tooth 41 and tooth 42 equals angle γ-β, and is less than the angular distance, equal to angle β-α, between corresponding portions of tooth 43 and tooth 44.

[0049] In actual use, on the basis of a user command, control member 13 can be moved selectively into one of the three distinct operating positions interacting with the levers of actuating module 7, defined respectively by values α,β,γ of the angles formed between directions C and D, and corresponding to the unlock, external lock, and double lock configurations of safety assembly 10.

[0050] In the absence of user commands, motor 11 remains idle, and transmission assembly 12 assumes a rest configuration (Figure 2) determined by springs 24 and 31; whereas, in the presence of a user command, motor 11 moves transmission 12, from said rest configuration, along a cyclic path comprising a portion in which actuating levers 16, 17 alternatively move control member 13 anticlockwise/clockwise from one operating position to another, and a portion restoring the rest configuration and in which actuating levers 16, 17 are detached from control member 13.

[0051] More specifically, when transmission assembly 12 is in the rest configuration (Figure 2), actuating levers 16 and 17 are detached from control member 13, are positioned parallel to the line joining axes A and B, in a plane perpendicular to axis A, and are substantially perpendicular to rocker arm 15; and springs 24 and 31 are set to the respective static-condition positions.

[0052] When transmission assembly 12 is in the rest configuration and control member 13 is in the operating position defined by angle α (unlock configuration of safety assembly 10, Figure 2), end 29 of actuating lever 16 is detached from and interposed between teeth 41 and 42, while end 30 of actuating lever 17 is positioned facing flank 45 of tooth 44.

[0053] When transmission assembly 12 is in the rest configuration and control member 13 is in the operating position defined by angle β (external lock configuration of safety assembly 10), respective ends 29, 30 of actuating levers 16, 17 are detached from control member 13 and adjacent to flanks 45 of teeth 41, 44 respectively.

[0054] When transmission assembly 12 is in the rest configuration and control member 13 is in the operating position defined by angle γ (double lock configuration of safety assembly 10), end 30 of actuating lever 17 is detached from and interposed between teeth 43 and 44.

[0055] The cyclic path in which actuating lever 16 moves control member 13 anticlockwise moves safety assembly 10 from the unlock to the external lock configuration or from the external lock to the double lock configuration.

[0056] More specifically, starting from the rest configuration of transmission assembly 12 (Figure 2), motor 11, in the presence of an appropriate control signal, rotates rocker arm 15 anticlockwise by means of gear train 14, so that actuating lever 16 interacts with control member 13, and actuating lever 17 slides against pin 34 away from control member 13, thus stretching spring 31.

[0057] In the Figure 4 situation, in which control member 13 is in the operating position defined by angle α, convex surface 51 of end 29 of actuating lever 16 pushes flank 45 of tooth 42 to move control member 13 into the operating position defined by angle β.

[0058] In the Figure 5 situation, in which control member 13 is in the operating position defined by angle β, surface 51 of end 29 of actuating lever 16 pushes flank 45 of tooth 41 to move control member 13 into the operating position defined by angle γ.

[0059] In both the above situations, rocker arm 15 rotates anticlockwise until arrested against stop pin 35, and, as it rotates, takes projection 23 with it to move end portion 38 of spring 24 away from end portion 37, which is maintained in a fixed position by stop 25.

[0060] When rocker arm 15 comes to rest against pin 35, and control member 13 is set, in the first of the above situations, to the operating position defined by angle β, or, in the second of the above situations, to the operating position defined by angle γ, motor 11 stops, and transmission assembly 12 is restored by springs 24 and 31 to the rest configuration, as shown in Figure 6.

[0061] More specifically, spring 24, previously parted and no longer subjected to external forces, closes back to the static condition, so that end portion 38, cooperating with projection 23, rotates shaft 20 and rocker arm 15 clockwise about axis A to detach end portion 29 of actuating lever 16 from control member 13.

[0062] Spring 31 also contracts back to the static condition, so that clockwise rotation of rocker arm 15 restores actuating levers 16, 17 to the Figure 2 position.

[0063] More specifically, as transmission assembly 12 returns to the rest configuration, concave surface 52 of end 29 of actuating lever 16 slides along oblique flank 46 of tooth 42, and along oblique flank 46 of tooth 41 in the second of the situations described above, without exerting any thrust on teeth 42, 41, and therefore without altering the position assumed by control member 13.

[0064] Similarly, the cyclic path in which actuating lever 17 moves control member 13 clockwise moves safety assembly 10 from the double lock to the external lock configuration or from the external lock to the unlock configuration.

[0065] More specifically, starting from the rest configuration of transmission assembly 12, motor 11, in the presence of an appropriate control signal, rotates rocker arm 15 clockwise by means of gear train 14, so that actuating lever 17 interacts with control member 13, and actuating lever 16 slides against pin 33 away from control member 13, thus stretching spring 31.

[0066] In the Figure 7 situation, in which control member 13 is in the operating position defined by angle γ, convex surface 55 of end 30 of actuating lever 17 pushes flank 45 of tooth 43 to move control member 13 into the operating position defined by angle β.

[0067] In the Figure 8 situation, in which control member 13 is in the operating position defined by angle β, surface 55 of end 30 of actuating lever 17 pushes flank 45 of tooth 44 to move control member 13 into the operating position defined by angle α.

[0068] In both the Figure 7 and 8 situations, rocker arm 15 rotates clockwise until arrested against stop pin 36, and, as it rotates, takes projection 23 and spring 24 with it.

[0069] More specifically, end portion 38 of spring 24 is prevented from following rocker arm 15 by stop 25, whereas end portion 37 is drawn along by projection 23, thus parting spring 24.

[0070] When rocker arm 15 comes to rest against pin 36, and control member 13 is set to the operating position defined by angle α, or to the operating position defined by angle β, motor 11 stops, and transmission assembly 12 is restored by springs 24 and 31 to the rest configuration.

[0071] More specifically, spring 24, previously parted and no longer subjected to external forces, closes back to the static condition, so that projection 23 rotates shaft 20 and rocker arm 15 anticlockwise about axis A to detach end portion 30 of actuating lever 17 from control member 13.

[0072] Spring 31 also contracts back to the static condition, so that anticlockwise rotation of rocker arm 15 restores actuating levers 16, 17 to the Figure 2 position. In this case too, as transmission assembly 12 returns to the rest configuration, concave surface 55 of end 30 of actuating lever 17 slides along oblique flank 46 of tooth 43, and along oblique flank 46 of tooth 44 in the Figure 8 situation, without exerting any thrust on teeth 43, 44, and therefore without altering the position assumed by control member 13.

[0073] The advantages of device 1 according to the present invention will be clear from the foregoing description.

[0074] In particular, transmission assembly 12 of device 1 is moved by motor 11 along a cyclic path, in which each actuating lever 16, 17 moves along a predetermined path comprising a portion in which the actuating lever interacts with control member 13, and a portion in which the actuating lever is detached from control member 13.

[0075] As a result, motion is transmitted intermittently from motor 11 to control member 13, and control member 13 is not always integral with motor 11.

[0076] Consequently, the positioning precision of control member 13 in defining the various operating configurations of safety assembly 10 is unaffected by acceleration/deceleration of the electric motor, and by inertia of the masses in motion.

[0077] Moreover, featuring no cam transmission members, device 1 involves no rigorous, high-cost dimensional and shape tolerances or surface finish.

[0078] Clearly, changes may be made to safety control device 1 as described and illustrated herein without, however, departing from the scope as defined in the accompanying Claims.

[0079] In particular, pins 35, 36 may be eliminated, and rocker arm 15 arrested by pins 33, 34.

Claims

1. A safety control device (1) for a vehicle lock (2), comprising:

    - a control member (13) which interacts with actuating means (7) of said lock (2), and can be set to at least two operating positions (α,β) respectively enabling and disabling release of the lock (2); and

- drive means (11) activated selectively to move said control member (13) into said operating positions (α,β);

characterized by also comprising motion transmission means (12) interposed between said control member (13) and said drive means (11), and which comprise at least two actuating members (16, 17) for moving said control member (13) respectively from one to the other of said operating positions (α, β) and vice versa, each said actuating member (16, 17) being movable along a predetermined path comprising an interacting portion, in which the actuating member (16, 17) engages said control member (13) to move it between said operating positions (α,β), and an idle portion, in which said actuating member (16, 17) is detached from said control member (13).

2. A device as claimed in Claim 1, **characterized in that** said actuating members (16, 17) and said control member (13) define a ratchet transmission.

3. A device as claimed in Claim 1 or 2, **characterized in that** each said actuating member (16, 17) comprises a pawl-shaped portion (29, 30) cooperating with a relative toothed portion (41, 42, 43, 44) of said control member (13) to move said control member (13) in one direction between said operating positions (α,β).

4. A device as claimed in any one of the foregoing Claims, **characterized in that** said motion transmission means (12) comprise a rocker arm (15) activated by said drive means (11) and connected functionally to both said actuating members (16, 17).

5. A device as claimed in Claim 4, **characterized in that** said rocker arm (15) comprises a fulcrum portion (A), and, for respective said actuating members (16, 17), hinge portions (18, 19) located on opposite sides of said fulcrum portion (A); and **in that** said control member (13) rotates about a first axis (B), and comprises, on diametrically opposite sides of the first axis (B), respective said toothed portions (41, 42, 43, 44), which cooperate with and are pushed by respective said pawl-shaped portions (29, 30) of said actuating members (16, 17).

6. A device as claimed in Claim 5, **characterized in that** each said toothed portion (41, 42, 43, 44) comprises a first flank (45) radial with respect to said first axis (B) or sloping inwards of the toothed portion, and an opposite second flank (46) oblique with respect to said first axis (B); and **in that** each said pawl-shaped portion (29, 30) comprises a push surface (51, 54) cooperating with said first flank (45) of the relative said toothed portion (41, 42, 43, 44) along said interacting portion of the path of the relative said actuating member (16, 17), and a slide surface (52, 55) cooperating with said second flank (46) of the relative said toothed portion (41, 42, 43, 44) along said idle portion of the path of the relative said actuating member (16, 17).

7. A device as claimed in Claim 5 or 6, **characterized in that** said control member (13) can be set to three distinct operating positions (α,β,γ) respectively enabling release of said lock (2), disabling release of said lock (2) from outside the vehicle, and disabling release of said lock (2) from both outside and inside the vehicle; and **in that** said control member (13) comprises two said toothed portions (41, 42, 43, 44) for each said actuating member (16, 17).

8. A device as claimed in any one of the foregoing Claims, **characterized by** comprising elastic means (24, 31) for restoring said motion transmission means (12) to a rest configuration when said drive means (11) are stopped.

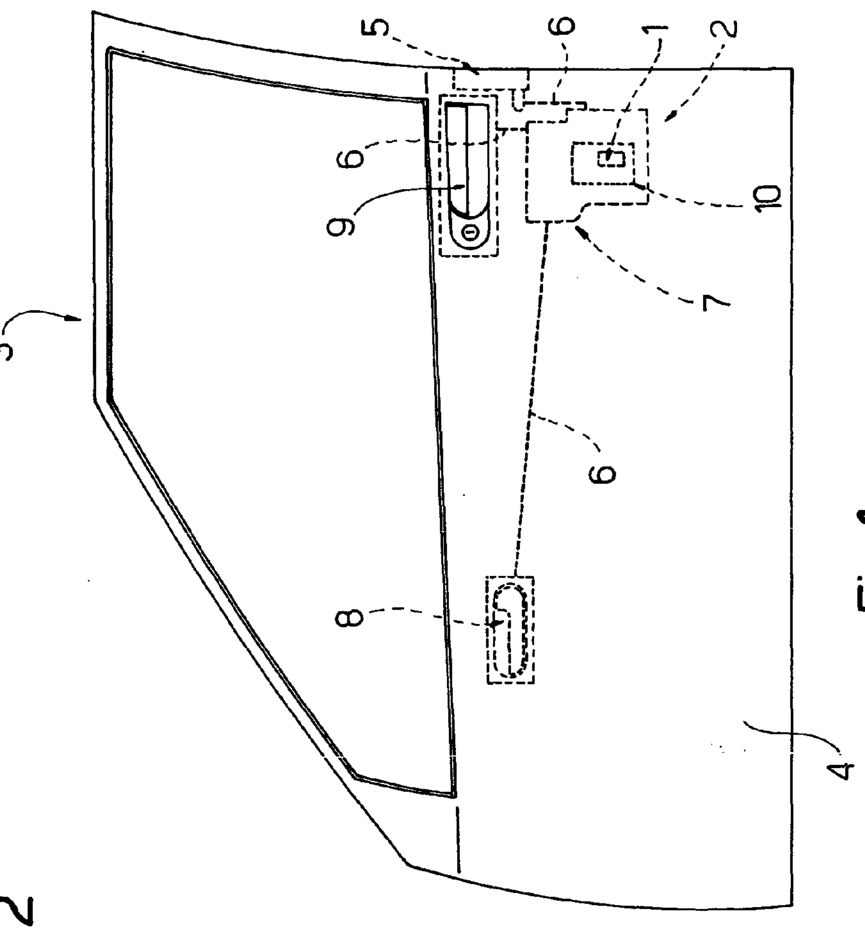

Fig.1

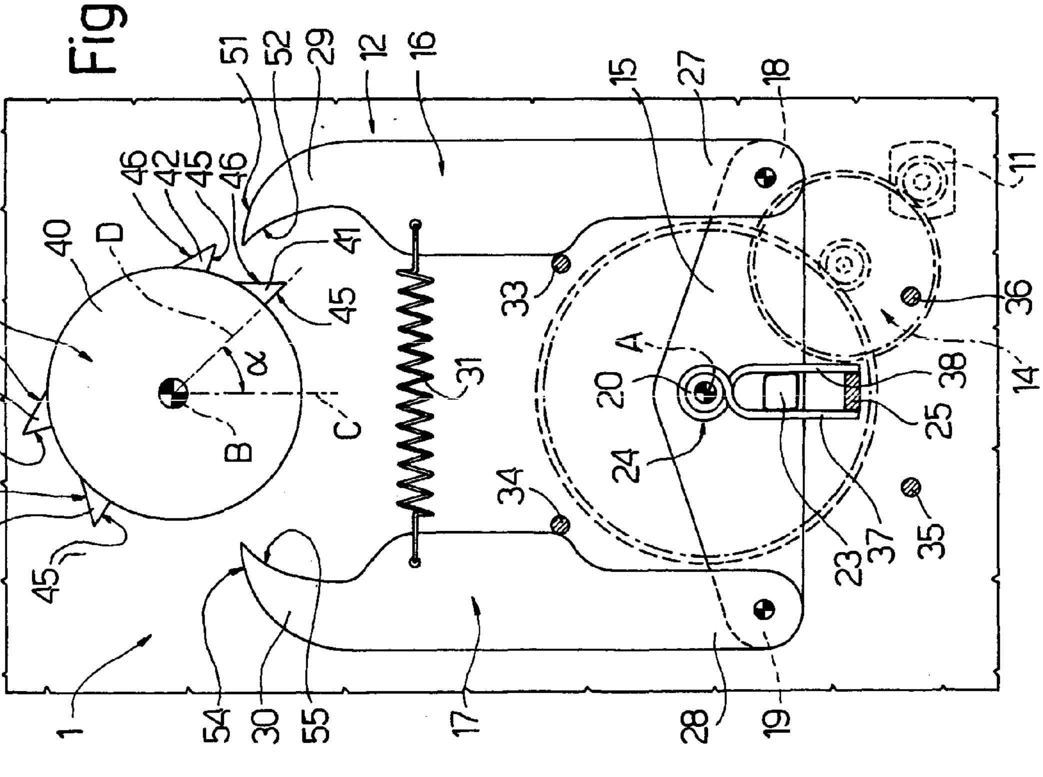

Fig.2

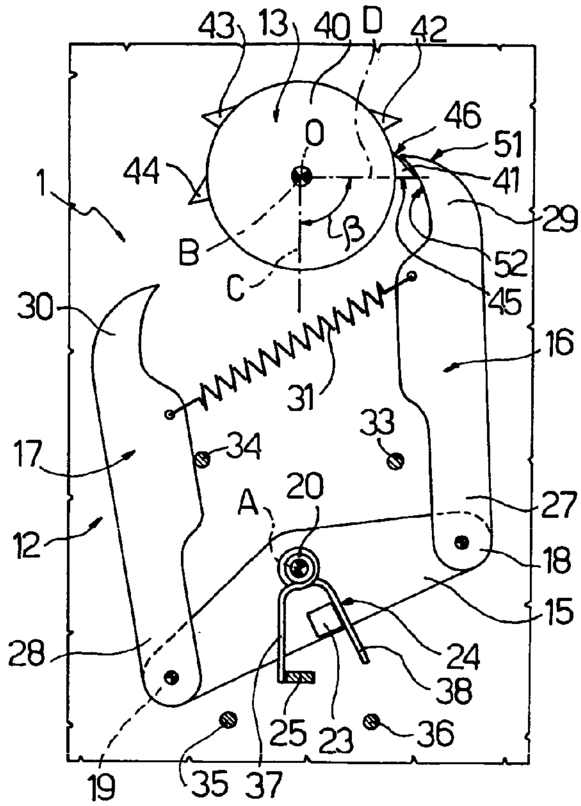

Fig.3

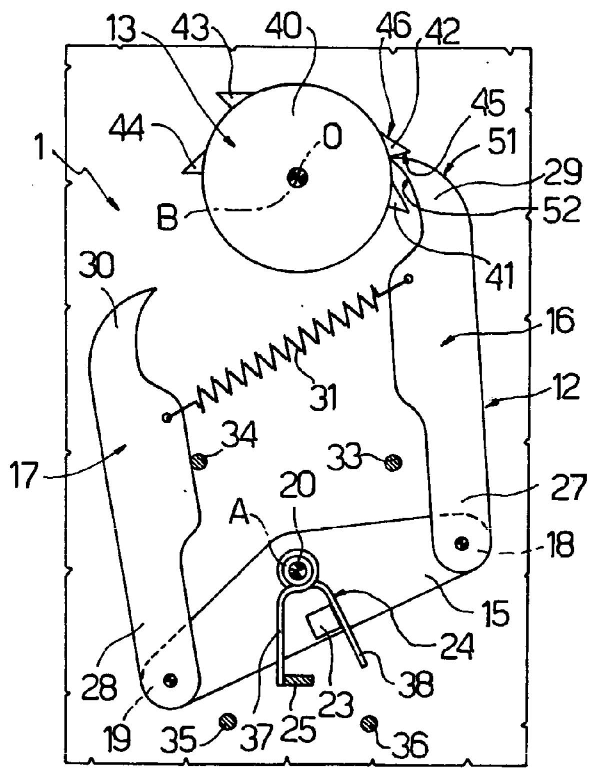

Fig.4

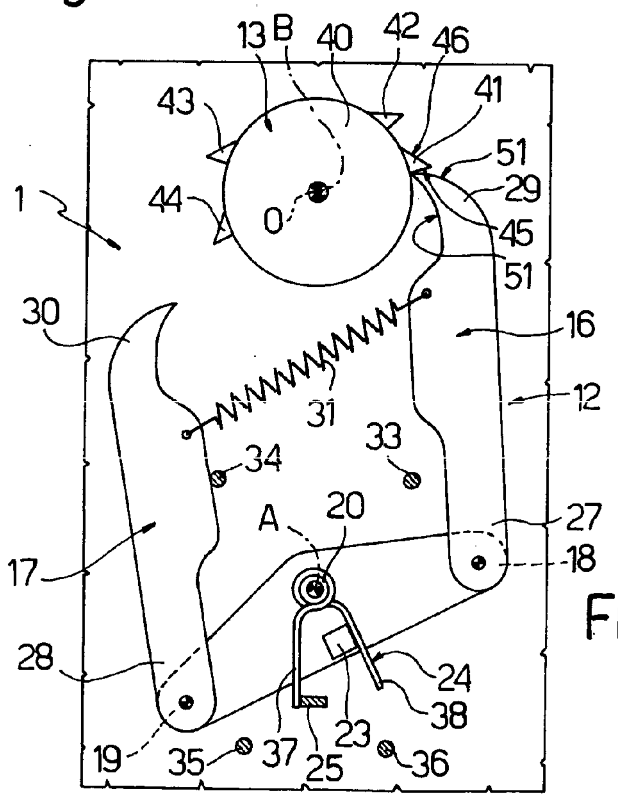

Fig. 5

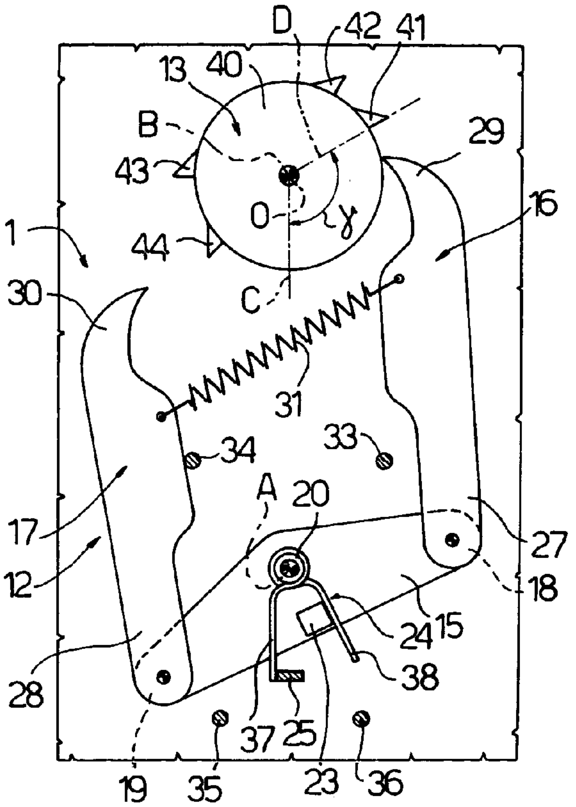

Fig.6

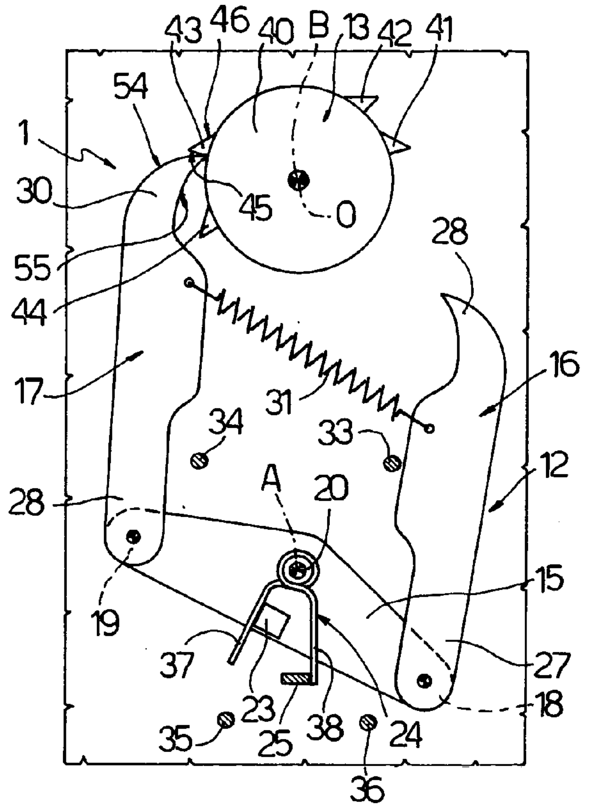

Fig.7

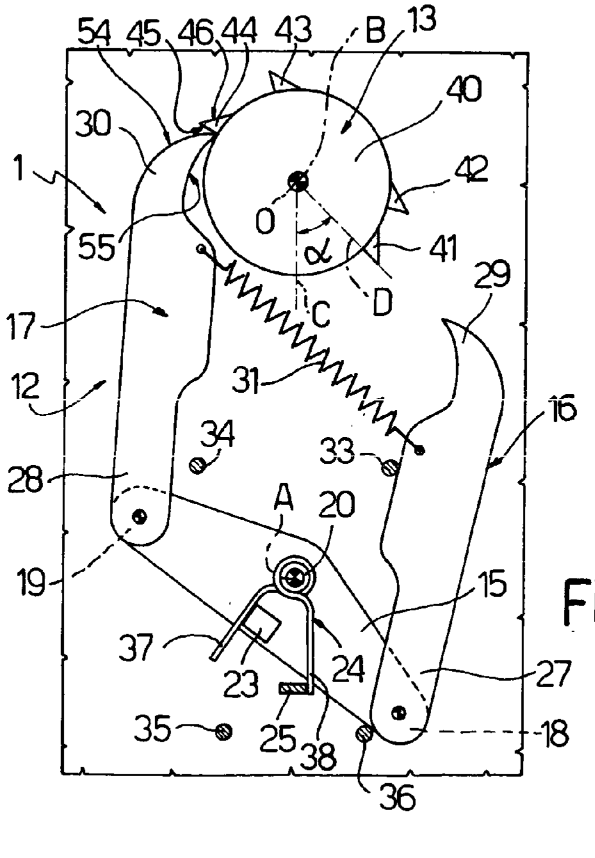

Fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5813

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	9 May 2005	Van Beurden, J

CATEGORY OF CITED DOCUMENTS

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