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(54) Lock for a vehicle door

(57) Lock (1) for a vehicle door, comprising a closure mechanism (8) having a fork (9) and a stop (10), and an actuating mechanism (13) arranged to interact with the closure mechanism (8) and comprising a plurality of levers (15, 16, 75) actuated by means of manual control arrangements associated with the door and at least a release arrangement (14) able to cooperate with the stop (10) to release the fork (9); the lock also comprises a first support and housing casing (6) for the closure mechanism (8), the second support and housing casing (11) for the said actuation mechanism (13) and relative securing means (100) between the casings (6, 11), these having respective apertures (46, 59) to allow the interaction of the release arrangement (14) of the actuating mechanism (13) with the stop (10).

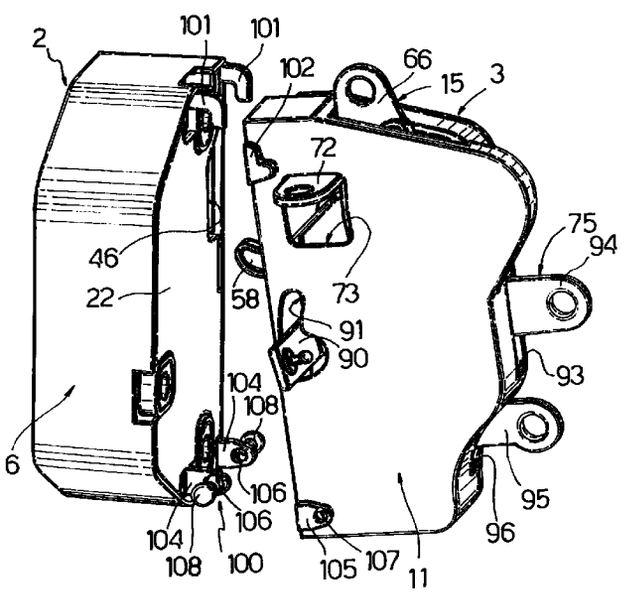

Fig.2

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Description

[0001] This invention concerns a lock for motor vehicle door lock.

[0002] It is emphasized that the term "door" is used in this description and in the claims in its very widest sense, to indicate whatsoever moving components from an opening position and a closing position over an access aperture to the internal compartment of a vehicle. Consequently, with the above terms, in addition to the side doors of the motor vehicles, as will be referred to hereinafter without losing a sense of generality, they also apply to the front and rear hatches and covers.

[0003] As is known, the closure systems for motor vehicle doors shall essentially comprise a lock and a striker respectively fitted to the door and to a fixed portion of the bodywork in close proximity to the actual door (or more seldom, vice versa). The lock comprises a closure mechanism able to cooperate with the striker in such a manner as to achieve a relative locking between the lock and the striker when the door is closed.

[0004] The known locks comprise in addition to the closure mechanism an actuation mechanism together with the closure mechanism and comprising a plurality of levers able to achieve the opening and safety functions.

[0005] In the case of a lock for a door, the actuation mechanism comprises a lever to open from inside able to be connected with an internal handle on the door, an opening lever from outside able to be connected with an external handle on the door and a safety kinetic device actuated by means of a key from outside the door and by means of a knob and/or the internal handle from the inside of the door and able to assume a connected safety position in which the lever for opening from outside is made ineffective and consequently opening by means of the external lever is inhibited, and a disconnected safety position in which opening by means of the external handle is enabled.

[0006] In the vehicles fitted with centralised locking, the actuation mechanism also comprises a door locking actuator and eventual signalling and control components.

[0007] Locks of the type as described are known, in which the closure mechanism and the control mechanism are integrated and assembled in sequence upon a common support body.

[0008] This solution which can be defined as integrated, presents a number of disadvantages from the production and functional viewpoints.

[0009] In the first place the production cycles are rarely flexible; the locks must instead by produced in various versions (for doors of various natures such as front, rear, mechanical or with electrical actuation) and for various applications: an integrated and sequential assembly does not allow flexible transition from one version to another type of lock, or to easily vary the design in accordance with market requirements.

[0010] In addition, the mechanisms composing the lock may operate and consequently be inspected, only on completion of assembly, therefore in the event of inspection recording an anomaly it is not an easy task to identify the causes immediately.

[0011] Locks are also known in which the housing body consists of a plurality of shells, each of which supports a given number of lock components and is fitted in an essentially modular manner; more particularly, locks are known comprising a support and housing shell for the closure mechanism and a support and housing shell for the actuation mechanism.

[0012] Such shells function as supports during the assembly of the relative components, but the mechanisms are only able to operate once the lock is fully assembled in its entirety. In addition, the support provided by the shells to the relative components are sufficient during assembly, in that the shells progress along the line in a predefined arrangement; nevertheless, the lock components are not enclosed and support in a stable manner within the relative shells, and the various modules therefore cannot be treated as free standing components. In particular, they cannot be manufactured on separate lines, inspected separately and freely moved around.

[0013] In addition, the modules are subject to complex functional interrelations such as to give the assembly a complex matter.

[0014] The purpose of the present invention is to achieve a lock for the door of the vehicle, which allows the disadvantageous associated with known locks and outlined above to be eliminated.

[0015] The above scope is achieved by the present invention, in that it relates to a lock for a vehicle door, of a type comprising a closure mechanism able to cooperate with a striker and provided with a fork and a stop cooperating with the fork to lock it in a releasable manner in a releasable closure position on the said striker, the said fork and the said stop being hinged about respective pins, and an actuation mechanism able to interact with the closure mechanism and comprising a plurality of levers actuated by means of manual control components associated with the said door and at least a release component able to cooperate with the said stop to release the said fork, characterized by the fact that it includes:

a first support and housing casing for the said closure mechanism, the said pins being supported exclusively by the first said casing;

a second support and housing casing for the said actuation mechanism;

relative fixing means between the said first casing and the said second casing;

the said first and second housing casing having respective apertures to allow interaction between the said exit component and the said stop.

[0016] For a better understanding of the present invention a number of preferred forms of actuation is described hereinafter, as a non-restrictive example and with reference to the appended drawings, wherein:

Fig. 1 is a perspective view of a modular lock with mechanical actuation designed according to the present invention;
Fig. 2 is a perspective view of the lock in Fig. 1, with a closure module and an actuation modules and their detailed breakdown;
Fig. 3 is a plan and sectional view of the closure module for the lock in Fig. 1;
Fig. 4 and Fig. 5 are part sections with design planes IV-IV and, respectively V-V in Fig. 3;
Fig. 6 is a plan view of the locking Figure 1 in section corresponding with the actuation module;
Figs. 7, 8 and 9 are seen in lateral and diagrammatic view of the lock in Figure 1, with parts removed for the sake of clarity, illustrating various operating conditions of the lock;
Fig. 10 is a part view, corresponding with that in Fig. 8, illustrating a variation in design of the lock;
Fig. 11 is a view corresponding with that in Fig. 7 of a second form of actuation of the present invention, in particular for a rear door of a motor vehicle, provided with a child-proof safety device;
the Figs. 12 and 13 illustrate in various operating conditions, a variation in design of the child-proof safety device in Fig. 9;
the Figs. 14 and 15 illustrate respectively in perspective and in diagrammatic side view a lock complete with an electrically actuated door locking actuator according to a third form of actuation of the present invention;
the Figs. 16 and 17 illustrate respectively in perspective and in diagrammatic side view a lock having a door locking actuator and electrical actuation and with a signalling module according to a fourth form of actuation of the present invention,
Fig. 18 is a perspective view illustrating the interchangeability of the actuating modules of the locks according to Figs. 1 and 14.

[0017] With reference to the Figs. 1 to 4, a lock is indicated as an assembly under reference 1 for a motor vehicle (not illustrated).

[0018] The lock 1 is modular and essentially comprises a closure module 2 and actuating module 3 able to be assembled together to form an integrated unit.

[0019] The closure module 2 is arranged to be secured to a portion of the bodywork 4 of a door (Fig. 7) and to cooperate with a fixed striker 5, integral with an upright (not illustrated) of the doorway, and diagrammatically represented by dotted lines in Fig. 3.

[0020] More particularly, with reference to Figs. 1 to 5, the closure mechanism 2 comprises essentially a casing 6 able to be secured to the said portion of bodywork 4 and internally defining an aperture 7 and a closure mechanism 8, housed within the aperture 7 and comprising in turn a fork 9, moving between an operative opening position and operative complete closure position (Fig. 3) on to the striker 5, and a stop 10 able to achieve a spring connection on the fork 9 to lock it in a releasable manner respectively in the complete closure position and in a part closure position, also known as a "first snap connection" (not illustrated), as an intermediary between the opening and complete closure positions.

[0021] With particular reference to Figs. 1 and 5, the casing 6 of the closure module 2 has a prismatic form and is of reduced thickness in relation to other dimensions. The casing 6 has a "sandwich" structure and is constituted by an intermediate shell 20 made of plastic material and by a pair of metal base plates 21, 22 of polygonal shape, mounted on opposing parts of the shell 20 and thereby defining the aperture 7.

[0022] The casing 6 has a flat vertical side 23, defining the greater dimension of the shell and placed vertically in service, and an opposing side 24 with a broken away profile of essentially isosceles trapezoidal form.

[0023] The casing 6 also has a side aperture 27 able to allow the entry of the striker 5 in the aperture 7, recessed in particular in the shell 20 and in the plate 21 corresponding with side 23 of the casing 6.

[0024] The fork 9 and the stop 10 are hinged about respective fixed pins 28, 29 extending between the plates 21, 22 and rigidly supported by these, and having respective access A, B parallel with each other and orthogonal in relation to the plates 21, 22.

[0025] The fork 9 consists of a moulded metal plate covered with plastic material and essentially parallel with plates 21, 22 and hinged to coincide with an intermediate portion around the pin 28 and a peripheral seat 30 in C defined by a pair of teeth 31, 32 and able to receive the striker 5. The fork 9 presents in addition along a peripheral edge 33 and on the opposing part of the seat 30, a pair of shoulders 34, 35 able to cooperate in a spring-like manner with the stop, as will be explained in detail further on.

[0026] The fork 9 rotates about axis A through an opening position (not illustrated), in which the seat 30 is turned towards the aperture 27 of the casing 6 and thus allows the release of the striker 5 from the closure mechanism 2, and the complete closure position (Fig. 3), in which the striker 5 is locked in the seat 30, and the tooth 31 intercepts the aperture 27 preventing its escape; the fork 9 is also pushed in a known manner towards the opening position by means of a spring 36 wound about a pin 28 and secured to the fork 9 and to a portion 37 of the casing 6, indicated in dotted line in Fig. 3.

[0027] The stop 10 comprises a metal engaging component 38, hinged about the pin 29 and arranged to cooperate by snap connection with the shoulders 34,35 of the fork 9, and an extended actuating arm 39 made of

plastic material, also hinged about the pin 29 and angularly coupled with the engaging component 38 by means of a pair of key components 40, 41. The stop 10 is also pushed towards the fork 9 by a spring 42 wound around the pin 29 and secured to the stop 10 itself and to a portion 43 of the casing 6, indicated by a dotted line in Fig. 3.

[0028] In particular, the engaging component 38 is constituted by a plate essentially coplanar with fork 9 and has an L-shaped end-piece 44 able to snap-couple with the shoulders 34, 35 to lock the fork 9 in releasable manner in the complete closure position and in the part closure position respectively.

[0029] The actuation arm 39 has an extended form in a transverse direction to axis B of the pin 29 and to the side 24 of the shell 20, and is located in superimposition to the engaging component 38 and extends throughout the whole of the width of the casing 6. The actuating arm 39 is hinged about the pin 29 to coincide with its end and carries in overhang, corresponding with an opposing end 24, a projection 45 defining a control portion of the stop intended to interact with the actuating module 3. For that purpose the plate 22 has an aperture 46 at the point of the projection 45, in the form of a vent essentially parallel with the side 23 of the casing 6.

[0030] The actuation module 3 comprises essentially a casing 11 coupled with the casing 6 and internally defining an aperture 12 and actuation mechanism 13 housed within the aperture 12. The actuating mechanism 13 has a transmission lever 14 defining a release lever for the mechanism and able to cooperate with the closure mechanism 8, and in particular with the projection 45 of the stop 10, to determine the disconnection of the stop 10 from the fork 9 and the opening of the lock 1.

[0031] The actuation mechanism 13 comprises in addition an internal control lever 15 (Fig. 7) and external control lever 16 (Fig. 8) cooperating with lever 14 and arranged to connect respectively with an internal handle and an external handle on the door (not illustrated).

[0032] Referring to Figs. 1 and 6 to 9, the casing 11 of the actuation module 3 has an essentially prismatic structure and similarly to the casing 6, a reduced section in relation to all other dimensions. The casing 11, advantageously made of plastic material, consists of a hollow body 50 housing the actuation mechanism 13 and having an essentially flat base wall 51 and a side wall 52, and an essentially flat cover 53. The side wall 52 has an essentially flat face 54, defining the larger dimension of the casing 11.

[0033] When the lock 1 is assembled, the casing 11 is knife-edge mounted on the casing 6 with the face 54 located in contact with plate 22, in a position adjacent to side 23 of the casing 6.

[0034] Referring to Figs. 7 to 9, the transmission lever 14 has an elongated and essentially flat shape, and is advantageously made of plastic material.

[0035] The lever 14 has an intermediate longitudinal slot 55 closed on the inside of an edge 57 in relief in relation to the face of the lever 14 turned towards the cover 53. The slot 55 is engaged by a fixed pin 56, supported between the walls 51 of the body 50 and the cover 53 of the casing 11, and having orthogonal axis G in relation to the wall 51 and the cover 53.

[0036] The lever 14 is mounted on the pin 56 in essentially transverse manner to the face 54 of the casing 11 and presents an end portion 58 engaging an aperture 59 recessed in the face 54 of the casing 11, extended in a direction parallel with the wall 51 of the body 50 and the cover 53 of the casing 11 and facing in the relative assembly position of the modules 2 and 3, the aperture 46 of plate 22 of casing 6. The portion 58 of the lever 14 is designed to cooperate in a spring manner with the projection 45 to move it along an opening stroke C (Fig. 7).

[0037] The lever 14 moves parallel with the wall 51 of the casing 11; more precisely the lever 14 is arranged to rotate about the axis G within the limits imposed by the dimensions of the aperture 59 engaged by the portion 58 and able to travel longitudinally between the limits imposed by the length of the button hole 55, between an advanced position illustrated in Figs.7 and 8 and in dotted lines in Fig. 9, in which it is arranged with the portion 58 projecting from the casing 11 inside the casing 6 and adjacent to the projection 45, and in the withdrawn position, in which the portion 58 does not project inside the casing 6 and is thus out of line with the projection 45.

[0038] Lever 14 is held by a traction spring 61, anchored to the casing 11, in angular resting position (Figs.7, 8, continuous line) in which its portion 58 is placed to bear against a stop component 62 integral with casing 11 and extending transversely to the side 53 towards the inside of casing 11 from a lower longitudinal end of the aperture 59.

[0039] The lever 14 finally presents a control arm 64 opposing portion 58 and arranged to cooperate with levers 15, 16 respectively for internal and external control, as will be outlined in detail below.

[0040] The internal control lever 15, advantageously made of plastic material, is essentially flat and hinged about the pin 56.

[0041] The lever 15 has a control arm 66 externally projecting from casing 11 through a relative upper slot 67 (Figs. 1 & 6), recessed in the side 54a, and arranged for securing to a tie-rod (known and not illustrated) connected with the internal handle of the door.

[0042] The lever 15 is held by a standard type spring, not illustrated, in a rest position, illustrated in Fig. 7 (continuous line) in which the arm 66 cooperates with an end of the slot 67 turned towards the closure module 2. The arm 66 has along one of its opposing edges to the closure module 2, a projection 65 arranged to push-cooperate with the arm 64 of lever 14 to rotate the latter inside the pin 56.

[0043] Finally, the lever 15 has a cam end-piece 83 opposing the arm 66, of essentially trapezoidal form, the purpose of which is explained below.

[0044] The external control lever 16 is advantageously made of clipping and stamping sheet metal and comprises a main flat portion 68 which extends along a plane parallel with levers 14 and 15, on the opposing side of the lever 15 in relation to lever 14 (Fig. 6).

[0045] The lever 16 is hinged from the casing 11, at one end 69 of the main portion 68, by means of a pin 70 with axis M supported in a projection 71 of casing 11 opposing the face 54.

[0046] The lever 16 extends transversely to the casing 21 and has a control end-piece 72 extending from an opposing end of the main portion 68 and projecting outside the casing 11 through an aperture 73 in the base wall 51 (Figs. 1, 2 and 6).

[0047] The said appendix 72 is designed to be secured to a strut (known and not shown) connected to the external handle of the door and arranged to transmit to the lever 16 a "push" force downwards. The lever 16 has a rounded projection 74 arranged to cooperate by thrust with the arm 64 of lever 14 to rotate the latter around axis G.

[0048] The lever 16 is normally retained by a spring of known type and not shown in a raised resting position, illustrated in Fig. 2 and in Fig. 8 (continuous line), in which the appendix 72 cooperates with an upper edge of the aperture 73 of the casing 11.

[0049] The actuation mechanism 13 also comprises a safety lever 75, which is hinged around a pin 75 fixed to the casing 11, having an axis N parallel with axis G of pin 56 and lying on a parallel plane to the face 54 of casing 11 and containing axis G. The lever 75 extends over a parallel plane to the resting planes of levers 14 and 15, and is located on the part opposing lever 14 in relation to lever 15 (Fig. 6).

[0050] Lever 75 is made of clipping sheet metal and has an essentially cruciform shape, with an intermediate portion 77 hinged from pin 76, a first pair of arms 76, 79 extending from the opposing part of portion 77 in essentially vertical direction, respectively upwards and downwards, and a second pair of control arms 80, 81, extending from opposing parts of portion 77 in a essentially horizontal direction, respectively towards the closure module 2 and the opposing part of module 2 itself.

[0051] The upper arm 78 has a rounded shape and has a passing hole 84 engaging with a clearance from the edge 57 and raised from the button hole 55 of lever 14. The lower arm 79 is secured to the casing 11 by a two-way spring 82, of known type, able to make two different angular positions of lever 7 stable, illustrated in Fig. 10 respectively in dotted lines and in a continuous line, and respectively corresponding with the conditions of connected safety (i.e. inhibition of the opening of the lock 1 from the outside) and disconnected safety (i.e. enabling the opening of lock 1 from the outside). The connected safety position is obtained with respect to the disconnected safety position by way of a slight anticlockwise rotation of the lever 75, referring to Fig. 10.

[0052] Consequently, in the disconnected safety position the upper arm 78 of lever 75 is displaced towards the closure module 2 and holds the lever 14 in the advanced position, by way of the engagement of the edge 57 in the hole 84. The angular locking of lever 75 is determined by contact with the edge 57, in turn bearing against the pin 56 which occupies an end portion of the button hole 55.

[0053] In the connected safety position, the upper arm 78 of lever 75 retains lever 14 in the withdrawn position, still by means of the engagement of the edge 57 in the hole 84. The angular locking of the lever 75 is also determined in this case by contact with the edge 57, in turn bearing against the pin 56 which occupies an opposing end of button hole 55.

[0054] The control arm 80 has an end portion 90 folded back at 90° and projecting from casing 11 through a passing aperture 91 recessed in the base wall 51 of the body 50, and provided with a spherical head 92 for ball joint connection to a key control on the outside of the door.

[0055] The arm 81 projects from the casing 11 through an aperture 93 with an end 94 which connects to a knob (not illustrated) for connecting the safety means associated with the door. A side appendix 95 on the arm 79, essentially parallel with arm 81 projects from the casing 11 through a respective aperture 96. The said appendix is used instead of the arm 81 to connect with the knob, in the event of a rear lock; both connection possibilities are provided for with a view to using the same lever 75 for the front and rear versions of the lock, for purposes of economy of scale.

[0056] Finally the lever 75 has a tooth 91 projecting with an overhang from the intermediate portion 77 in close proximity to the arm 78 and able to cooperate with the cam appendix 83 of lever 15.

[0057] The position of the tooth 91 is such as to intercept the end-piece 83 during the opening stroke of the lever 15, when the safety lever 75 is located in the connected safety position, as will be better described below.

[0058] The lock 1 finally comprises rapid fixing means between the closure module 2 and the actuating module 3, indicated as an assembly under reference 100 in Figure 2.

[0059] The securing means 100 essentially comprise a pair of L-shaped hooks 101 projecting with an overhang from the plate 22 of casing 6, in close proximity to an upper side of the plate, and cooperating with the respective projections 102 recessed in corresponding positions of the wall 51 and of the cover 53 of the casing 11.

[0060] The hooks 101 define a lateral location for module 3, and cooperate with the projections 102 to define a bearing point in the vertical direction and a preliminary securing point essentially hinged between the two modules 2, 3.

[0061] The securing means 100 also comprise a pair of small plates 104 parallel with each other and extend-

ing with an overhang from the plate 23 in close proximity to a lower side of the plate itself. The casing 11 has its portion designed to be interposed between the two small plates 104, corresponding side projections 105 recessed respectively on wall 51 and cover 53 and arranged to cooperate with the small plates 104 to lock module 3 laterally.

[0062] The small plates 104 and the projections 105 have respective holes 106, 107 for push-fitting respective locking pins 108.

[0063] From the above it is clear how the modules 2 and 3 can be produced, separately inspected and eventually assembled as autonomous units on separate assembly tracks to define the lock 1; the said lock once assembled in turn forms an integrated unit.

[0064] The operation of the lock 1 is described on the basis of the closure configuration with a disconnected safety, corresponding with the position of the closure module 2 illustrated in Figure 3, and the actuation module position illustrated in Figure 7.

[0065] In module 2 closure position, in a known manner, the striker 5 is locked in the seat 30 of the fork 9, and prevented from rotating by the stop 10. This position is achieved in a normal manner, by simple door movement. In the disconnected safety position of the actuating module 3, as stated previously, the transmission lever projects inside the closure module 2, in close proximity to the projection 45 of the stop 10.

[0066] The opening of the lock 1 from the outside of the vehicle is achieved by acting on the external control lever 16, by means of the external handle on the door, as shown in Figure 8. A clockwise rotation of the lever 16 around axis M defines a thrust action of the projection 74 against the appendix 64 on lever 14, which is rotated in an anti-clockwise direction around the pin 56; during the rotation of the lever 14, portion 58 cooperates by thrust with the projection 45 of the actuating arm 39 of the stop 10, moving it along the opening stroke C and thus defining a rotation of the stop 10 around axis B in anti-clockwise direction as in Figure 3. This rotation defines the decoupling of the engaging component 38 from the shoulders 34 of the fork 9, which is thus released to rotate towards the opening position under the pressure of the spring 36 releasing the striker 5.

[0067] Connection of the safety device may be effected from the outside by means of a key, or from the inside by means of knob. In the first case the control reacts on the ball joint 92 of the safety lever 75 and defines the rotation of the lever around axis N in anti-clockwise direction (Fig. 9), from the enabling position (dotted line) to the inhibiting position (continuous line). That rotation moves the lever 14 from the advanced position to the withdrawn position, making it run along the stop component 62; that movement misaligns portion 58 of lever 14 from the projection 45; in consequence, by acting on the external control lever 16, a free displacement is induced in lever 14 which cannot cooperate with the stop 10.

[0068] Connection of the safety means from inside is obtained by reacting with the knob on arm 81, in the case of the forward door, or on end-piece 95, in the case of the rear door; a displacement of lever 75 is induced in both cases identically to that seen in the case of connection of the safety means using a key.

[0069] Opening from the inside is achieved by reaction with the internal handle on the internal control lever 15 and producing an anti-clockwise rotation around pin 56 as shown in Figs. 7 and 9.

[0070] If the safety means is connected (Fig. 9, continuous line), during a first portion of the angular movement of lever 15 around axis G, the cam portion 92 of lever 15 cooperates by thrust with the tooth 91 of lever 75 until that lever 75 is taken into the enabling position; the initial and final positions of lever 15 in this phase of operations are illustrated in Fig. 9, respectively with a continuously line and a dotted line. From that point onwards, the projection 65 on lever 15 cooperates with the arm 64 of lever 14 defining just as previously shown with reference to opening from outside, the movement of the projection 45 along the opening stroke C and the decoupling of the engaging element 38 of the stop 10 from the fork 9.

[0071] Opening occurs in a similar manner when the safety means is not connected (Fig. 7); in that case there is a first free rotation stretch for lever 15 until the projection 65 contacts the end-piece 64 of lever 14.

[0072] Figure 10 illustrates a variation in design of the actuation module 3, in which the opening operation from outside is of the "pull" type instead of the "push" type as described previously.

[0073] In this case the lever 16 illustrated in Fig. 8 is replaced by a lever 16' complete with a control end-piece 72' and a lateral tooth 74', extending in the proximity of the end-piece 72' and arranged to cooperate from the bottom with lever 14, in close proximity to portion 58 of the said lever 14, to lift the stop 10.

[0074] Fig. 11 illustrates a second form of actuation of the present invention indicated as an assembly under reference 110 and described hereinafter using the same reference numbers to define the same components as those of lock 1 and already described.

[0075] The lock 110 in Fig. 8 is suitable for use on a rear door and differs from the lock only in the fact that it comprises an actuation module 3a provided with an arrangement 111 which selectively inhibits opening of the lock 1 by way of the internal handle (generally described as "child-proof safety"). The closure module 2 is identical to that of lock 1.

[0076] The arrangement 111 comprises a small shaft 112 supported in rotary manner but axially fixed in a tubular end-piece 113 of body 50 of the casing 11 extending and overhanging from an upper end of face 54 and in an orthogonal direction to the face itself; the length of the small shaft 112 is such as to project with one of its ends 114 from the plate 21 of the closure module 2, in such a way as to project in service from the por-

tion of the bodywork 4 and consequently be accessible. The end 114 presents in a known manner a notch 115 for manual rotation by means of an arrangement (for example the tip of the lock opening key).

[0077] At the other opposing end the small shaft 112 has an integral radial tooth 116 extending towards lever 15 in the connection position for the child-proof safety illustrated in Fig. 11. Lever 15 has an end-piece 117 able to interact with the tooth 116 in the first phase of the opening stroke (that is to say before the projection 65 reaches the control arm 64 of transmission lever 14), preventing any actuation of the stop 10. The internal handle on the door is thus locked.

[0078] Figs. 12 and 13 illustrate a variant in embodiment of the device arrangement 111 shown in its assembly under reference 120. According to that variation the internal handle of the door is free as opposed to locked when the child-proof safety is connected.

[0079] This is achieved by the fact that the lever 15 is substituted by two levers 121, 122 superimposed one above the other and both hinged from pin 56; as is more clearly visible in Fig. 12, in which part of the components are the removed for the sake of clarity, the lever 121 has an arm 123 able to be connected with the internal handle, and an end-piece 124 adjacent to arm 23 and defining with this a radial seat 125. The lever 122 has an arm 126 complete with a radial slot 127 engaged in sliding manner by the moving pin 128. The slot 127 has an internal end with a profile which can be superimposed over the seat 125, and extends towards the free end of lever 122. That lever also has a lateral projection 65 and a the cam projection 83 similar to that described for lever 15 of lock 1.

[0080] The arrangement 120 comprises a small shaft 122' similar to the small shaft 112 described with the reference to Fig. 11 but provided with an eccentric 133 instead of the tooth 116, and a control lever 134 hinged from a pin 131 secured to the casing 11, and having a first arm 136 secured to the eccentric 133 by means of a small con-rod 137. A second arm 138 of lever 134 has a fork end 139, which interacts with the pin 128 and is able to move it along the slot 127.

[0081] The levers 121, 122 are under load from flexible means not shown here in the rest position illustrated by a full line in Fig. 13.

[0082] The operation of the arrangement 120 is the following.

[0083] Fig. 12 illustrates the position of the arrangement 120 with the child-proof lock in the disconnected condition. The levers 121 and 122 are superimposed and made integral with each other by pin 128, which is retained by lever 134 at the internal end of the slot 127 of lever 122 and inside the seat 125 of lever 121. The result is that when the internal handle is actuated the lever 121 is rotated anti-clockwise and drives the lever 122 by means of pin 128, as illustrated in Fig. 12. The projection 65 thus cooperates with the control arm (partly illustrated in Fig. 12) and rotates lever 14, defining the opening of the stop 10.

[0084] On rotating the small shaft 112', the lever 134 is brought into the position shown in Fig. 13, in which the fork end 139 holds the pin 128 at the upper end of the button hole 127.

[0085] In that condition, the internal handle of the door is actuated lever 121 rotates as in Fig. 12, but the movement is not transmitted to lever 122 since the pin 128 is on the outside of the seat 125 and is not driven by the lever 121.

[0086] Figures 14 and 15 illustrate a lock according to a third form of actuation of the invention, shown as an assembly under reference 140.

[0087] Lock 140 comprises a closure module 2 identical to that of lock 1 and an actuation module 3b having an electrically actuating door locking actuator 144.

[0088] The actuation module 3b is entirely similar to module 3 described insofar as the mechanical part is concerned and in particular is fitted with levers 14, 15, 16 and 75 identical to those previously described.

[0089] The actuator 144 of a known type, is housed inside a lower portion 145 of the casing 11, and comprises a reversing electrical motor 146, a reducer box 147 with gears having as output component a toothed segment 148, and a forked actuation component 149 integral with the toothed segment 148 and hinged with the latter from a common pin 150. The actuation component 149 cooperates with a rod 151 carried by the arm 79 of safety lever 75 to move the latter, according to the actuation of the motor 146, from the connected safety position to the disconnected safety position.

[0090] An electrical connector 152 of which the insulating body 153 is integral with casing 11, as the connection of the motor with the electrical installation on board the vehicle.

[0091] The operation of lock 140 and of the whole assembly is similar to that of lock 1 from the mechanical viewpoint. The actuator 144 reacts on safety lever 75 to move it between the two operative positions described in response to an electrical actuation of the motor 146, producing functional effects entirely similar to those described with reference to manual actuation of the lever 75 for lock 1.

[0092] Figs. 16 and 17 illustrate a final form of actuation of the present invention, indicated in its assembly under reference 160.

[0093] The lock 160 comprises a closure module 2 essentially identical to that of locks 1, 110 and 140 as described, and an actuating module 3c provided in addition to levers 14, 15, 16 and 75 as described and the actuator 144 as in lock 140, with a signalling module 161.

[0094] The signalling module 161 comprises a box-like body 162 housed within the casing 11 and retaining a plurality of micro switches 163, 164 (of which two are visible in Fig. 17) to note the position of the mechanical components of lock 1, as described hereinafter. The micro switches 163, 164 are mechanically supported by

a printed circuit card 165 located in the box-like body 162 and are electrically connected with the printed circuit itself (not illustrated).

[0095] For each micro switch 163, 164 a respective control lever is associated cooperating with the mechanical component of which the position is to be noted.

[0096] More particularly, micro switch 163 is associated with a small lever 166 hinged from the box-like body 162 and having a forked arm 167 secured to a rod 168 carried by the arm 79 of the safety lever 75 and a control arm 169 for the micro switch itself. The micro switch 163 thus notes the position of the safety lever 75 and during the stroke of the lever 75 switches between the connected safety and the disconnected safety positions so as to generate an actuation signal for centralised locking of all the vehicle locks.

[0097] The micro switch 164 has associated with it a lever 170, also hinged from the box-like body 162 and provided with a moulded arm 171 projecting from the actuation module 3 to an aperture 172 in face 54 and penetrating inside the closure module 2 to interact with a rod 174 carried by the fork 9, and a control arm 177 for micro switch 164. The latter thus notes the position of the fork 9 and switches into the proximity of the complete closure position of the fork, so as to generate a signal serving as a signal for a door that is not closed and/or to inhibit the centralised locking when a lock is not in complete closure position.

[0098] The signalling module 161 also includes an electrical connector 178 to connect the printed circuit to the electrical installation of the vehicle. That connector comprises an insulating body 179 extending in integral manner from the box-like body 162, and projecting outside the casing 11, in an essentially parallel position with the connector 152 of actuator 144, through an aperture 179 in the casing 11 itself.

[0099] From an examination of the characteristics of the locks 1, 110, 140, 160 the advantages presented thereby are evident.

[0100] Above all by forming an integral unit, the lock 1 has a modular structure which allows production and inspection in an independent manner of the closure module 2 (the same for all versions of the lock) and the actuation module 3 (3a, 3b, 3c).

[0101] The closure module is the same for all the versions of the lock. It allows a notable economy of scale to be achieved since with a single assembly cycle it is possible to produce the closure modules for all versions of the lock.

[0102] The actuation module 3 (3a, 3b, 3c), in its various versions allows "custom-designing" of the lock for various applications: with mechanical actuation for the front door (lock 1), with mechanical actuation for the rear door (lock 110), with door locking device (lock 140), with door locking device and signalling functions (lock 160).

[0103] Starting from a common module (2), a series of different locks can be obtained for applications within the scope of a same vehicle module (front or rear door), with various vehicle versions (("standard" or "deluxe", two or four doors, etc.) or for different vehicles.

[0104] The modular nature of the assembly is illustrated in Fig. 18, wherein the closure module 2 and two different versions of the actuation module (3 and 3b) are illustrated.

[0105] The modular construction also allows a reduction in the lock weight; in effect, since the sole closure module is subject to appertaining loads, its dimensions can be suitably organized, and it comprises metal components such as the plates 21, 22, the fork 9, the engaging portion 38 of the striker 10 and the pins 28, 29. However, since the actuation module 3 is subject to reduced mechanical loads, a large part of components, of which a number of the levers, can be made of plastic material.

[0106] Finally, since the actuation module 3 is mounted on closure module 2 in close proximity to the side 23 of the latter presenting the aperture for the striker (i.e. and towards the inside of the door), the module 3 is extended in service in close proximity to the inner side of the door and in particular the inside of the window; this results in a protection against theft in that it is extremely difficult to gain access to it by means of an implement introduced through the window seal, as is frequently the case with known locks.

[0107] Finally, it is clear that the locks 1, 110, 140, 160 as described may be the subject of modifications and variations which do not go beyond the scope of the lesson of the present invention.

Claims

1. Lock (1, 110, 140, 160) for a vehicle door, of the type comprising a closure mechanism (8) arranged to cooperate with a striker (5) and provided with a fork (9) and a stop (10) cooperating with the fork (9) to lock it in a releasable manner in a closure position on the said striker (5), the said fork (9) and the said stop (10) being hinged from respective pins (28, 29) and an actuation mechanism (13) able to interact with the closure mechanism (8) and comprising a plurality of levers (15, 16, 75) actuated by means of manual control components associated with the said door and at least an output component (14) able to cooperate with the said stop (10) to release the fork (9), characterized in that they comprise:

   a first support casing (6) and housing for the said closure mechanism (8), the said pins (28, 29) being exclusively supported by the first casing (6);
   a second support casing (11) and housing for the said actuation mechanism (13);
   relative securing means (100) between the

said first casing (6) and the said second casing (11);

the said first and second casings (6, 11) representing respective apertures (46, 59) to allow the interaction between the said output component (14) and the said stop (10).

2. Lock according to claim 1, characterized in that the said first casing (6) comprises a pair of metal plates (21, 22) supporting the said pins (28, 29) of the said fork (9) and of the said stop (10), and a shell (20) in plastic material interposed between the plates (21, 22).

3. Lock according to claim 1 or 2, characterized in that the second casing (11) is made of plastic material.

4. Lock according to one or other of the previous claims, characterized in that the said first casing (6) has an aperture (27) for the entry of the said striker (5) on its side (23), and the said actuation module (3) is knife-edge mounted on the said first casing (6) with one of its side faces (54) placed adjacent to the said side (23) of the said first casing (6).

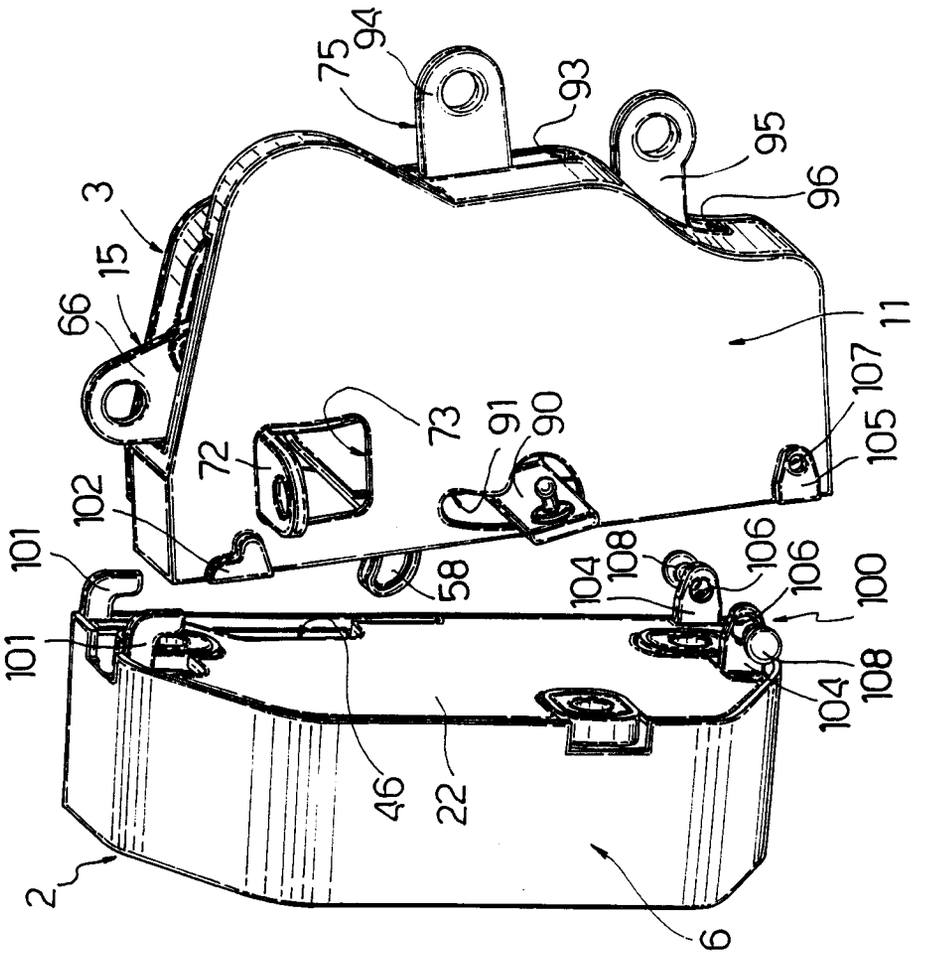
5. Lock according to one of the previous claims, characterized in that the said securing means (100) comprise hook-like means (101) carried by one of the said casings (6) and engaging means (102) carried by another of the said casings (11) and able to cooperate with the said hook means (101) to define a relative assembly position between said first and said second casing, and relative locking means (104, 105, 108) for the said casings (6, 11) in the said relative position.

6. Lock according to one or other of the previous claims, characterized in that the said actuation module comprises a door locking actuator (144).

7. Lock according to claim 6, characterized in that it comprises a signalling module (161) associated with the said actuation module (3c) and provided with a plurality of micro switches (163, 164) noting the position of the mechanical components (75, 9) of the said lock (160), and circuitry means (165) connected to the said micro switches (163, 164) and able to be connected to an electrical installation aboard the vehicle.

8. Lock according to claim 7, characterized in that the said signalling module (161) comprises a box-like body (162) housing all of the said micro switches (163, 164) and the said circuitry means (165) and an electrical connector (178) to connect the said circuitry means (165) with the said electrical installation.

9. A series of locks according to one or other of the previous claims, characterized in that the said locks comprise respective closure modules (2) similar to each other and respective actuation modules (3, 3a, 3b, 3c) adapted to the specific applications.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93
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96
3
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73
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100
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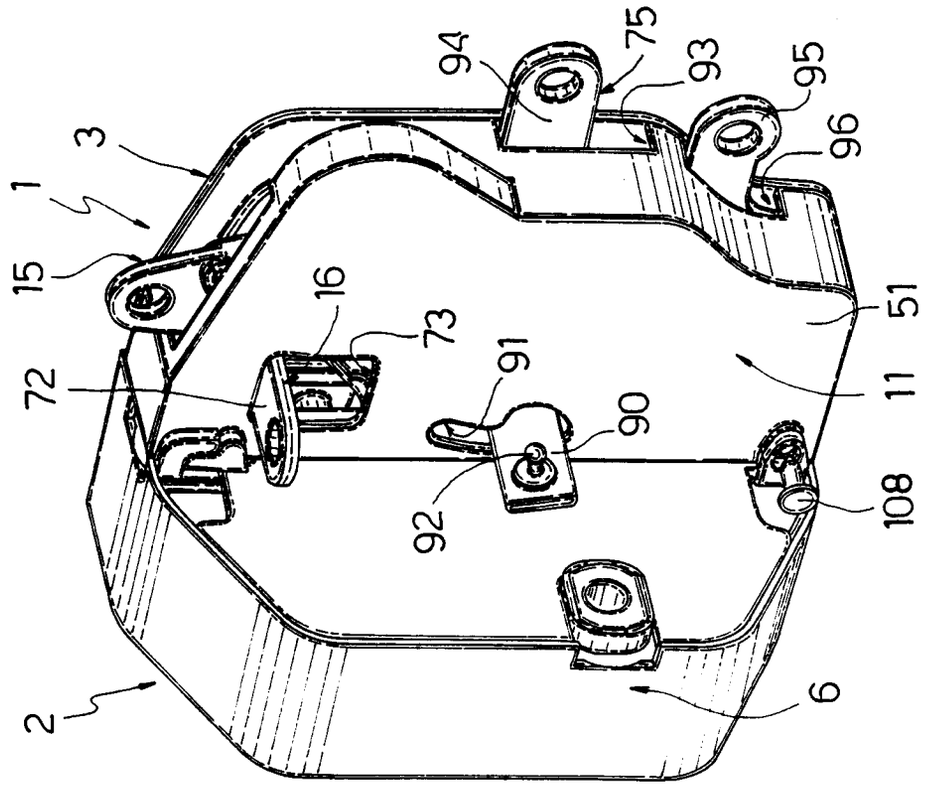
6

Fig.2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92
108
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6

Fig.1

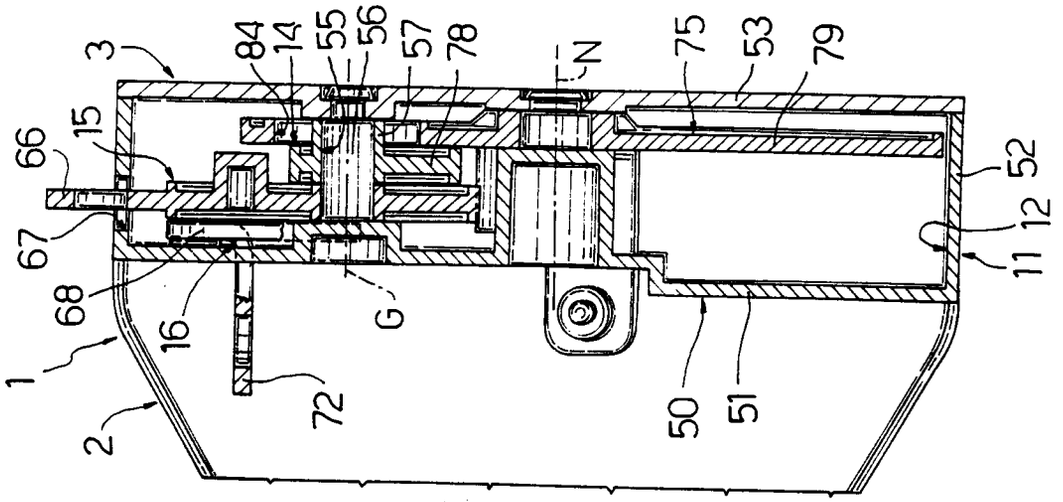


Fig.6

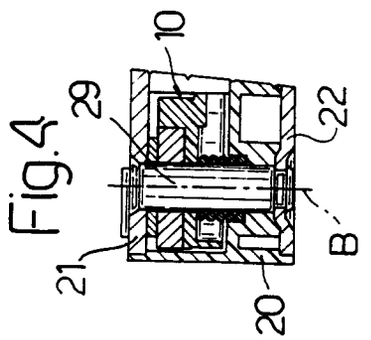


Fig.4

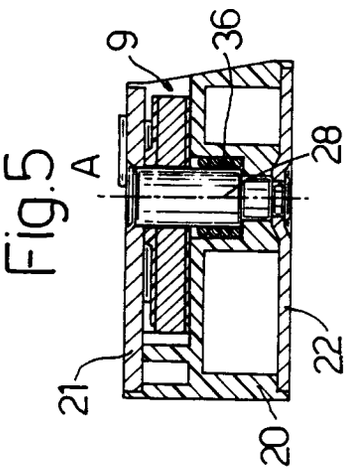


Fig.5

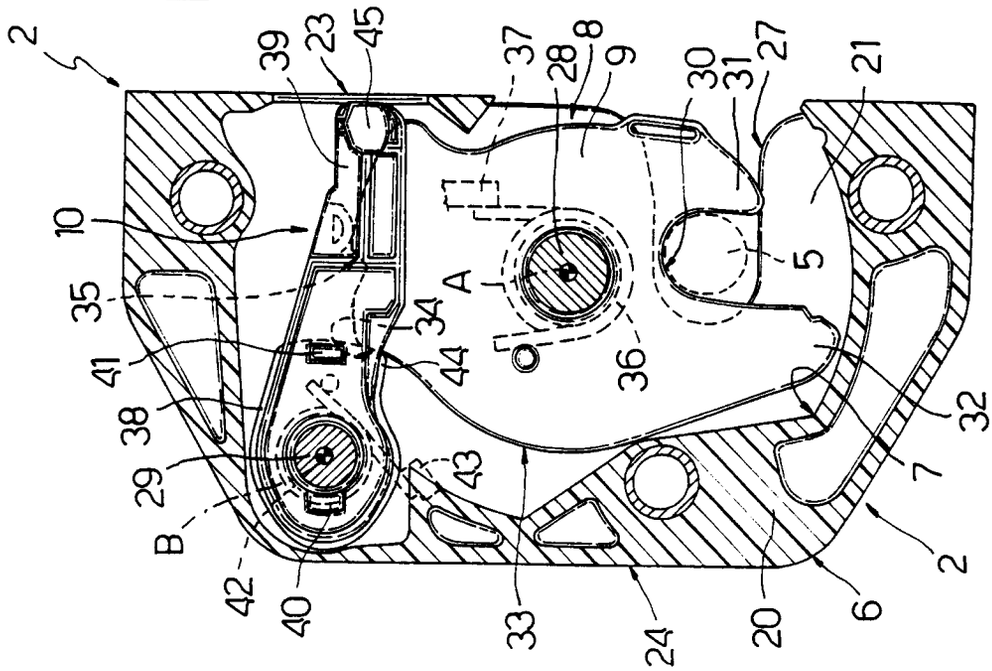
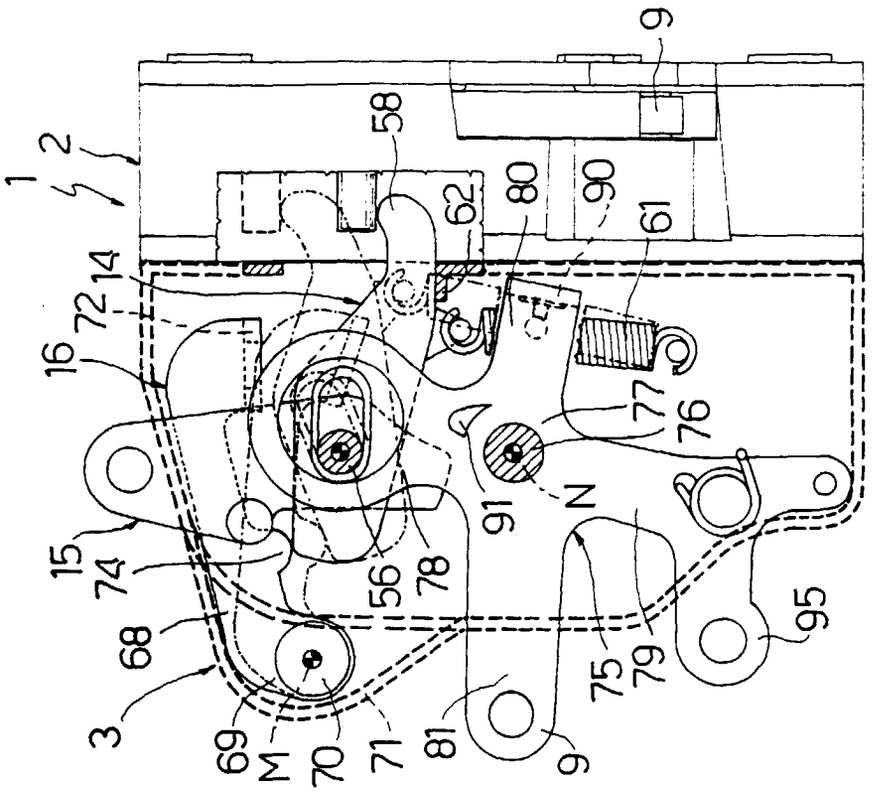


Fig.3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61
14
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16
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M
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71
81
9

Fig.8

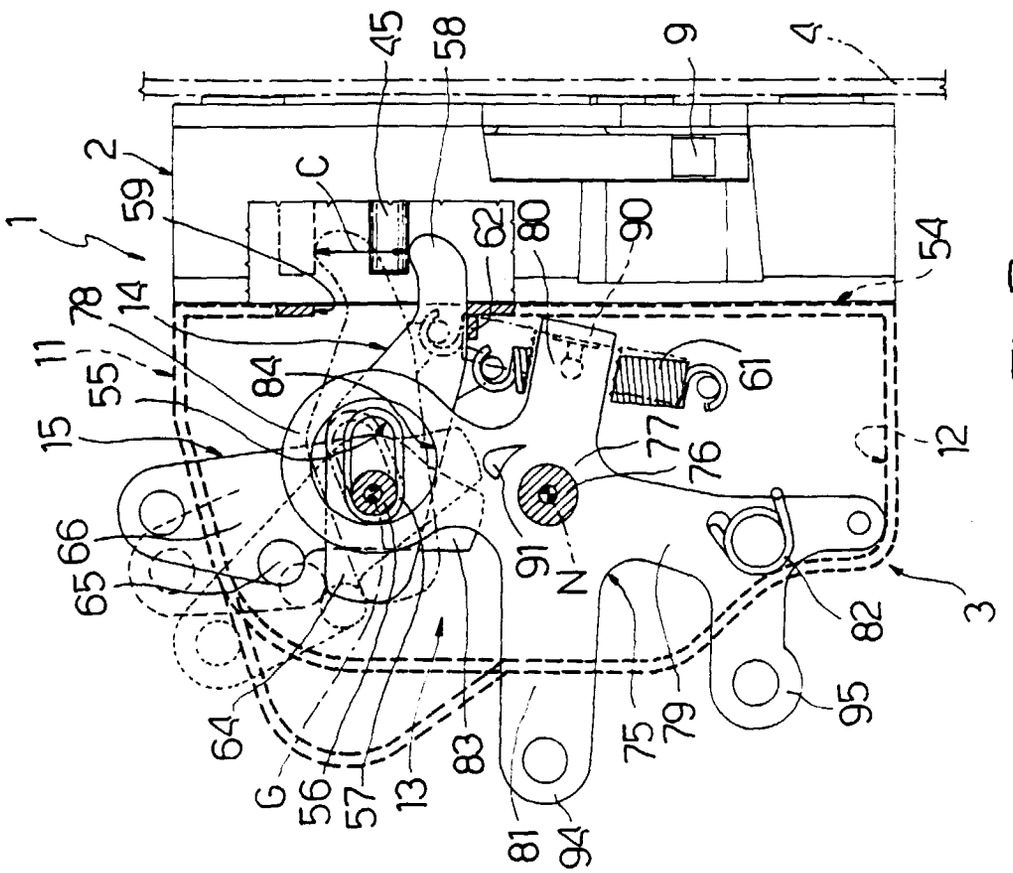
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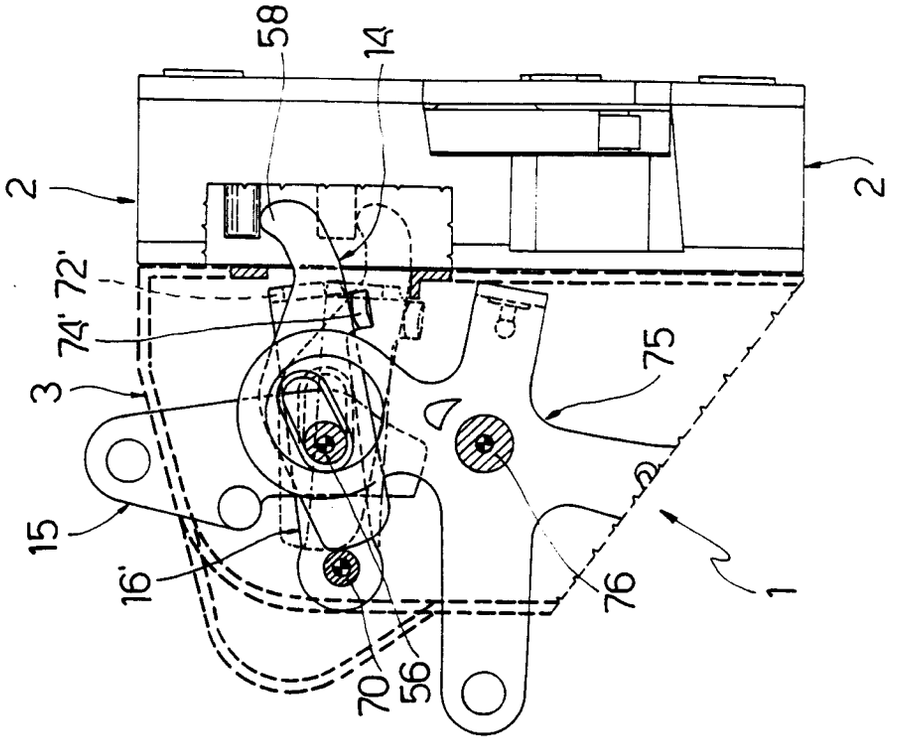
Fig.7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72'
74'
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16'
76
1
70
56

Fig.10

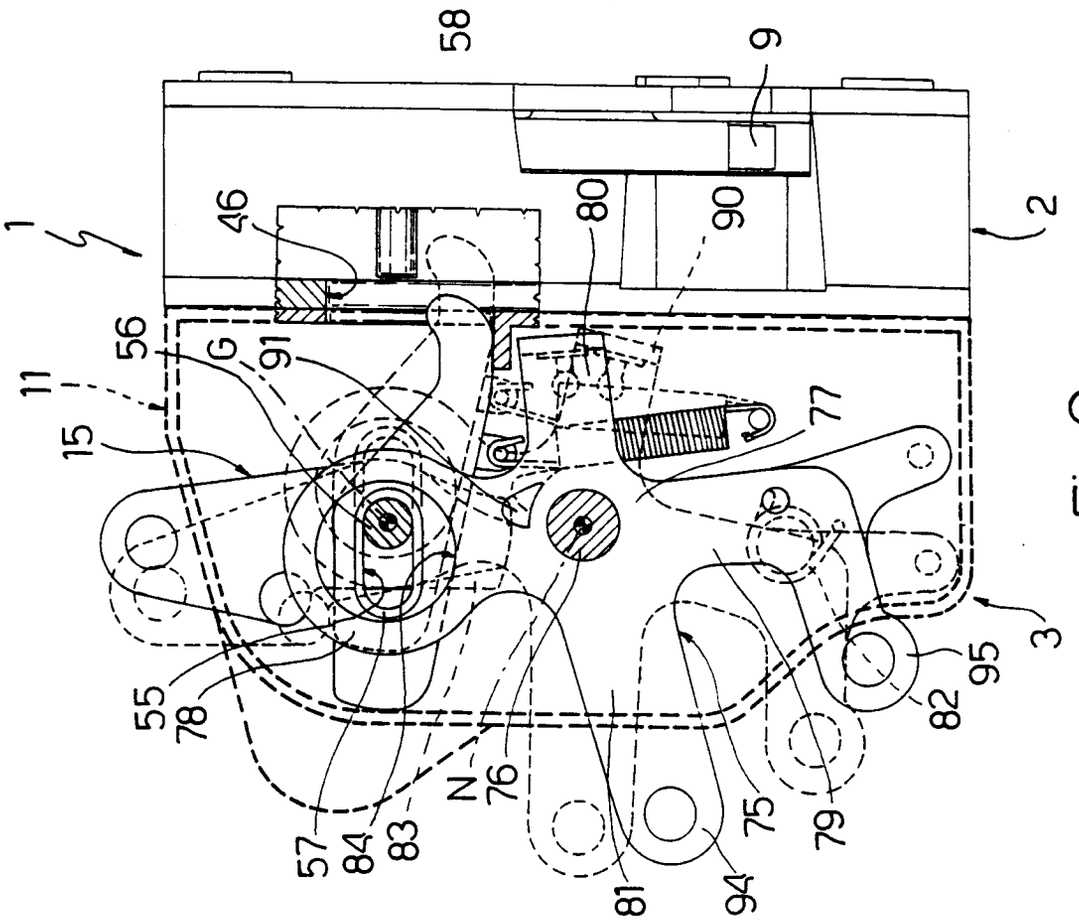
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Fig.9

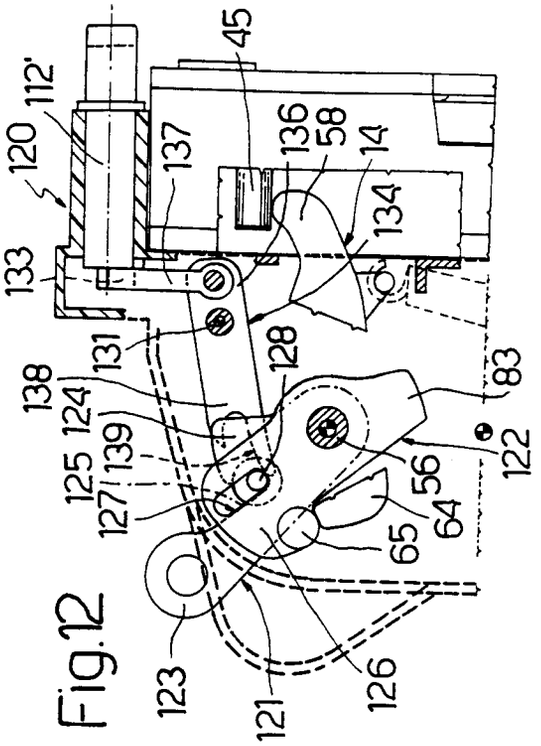

Fig.12

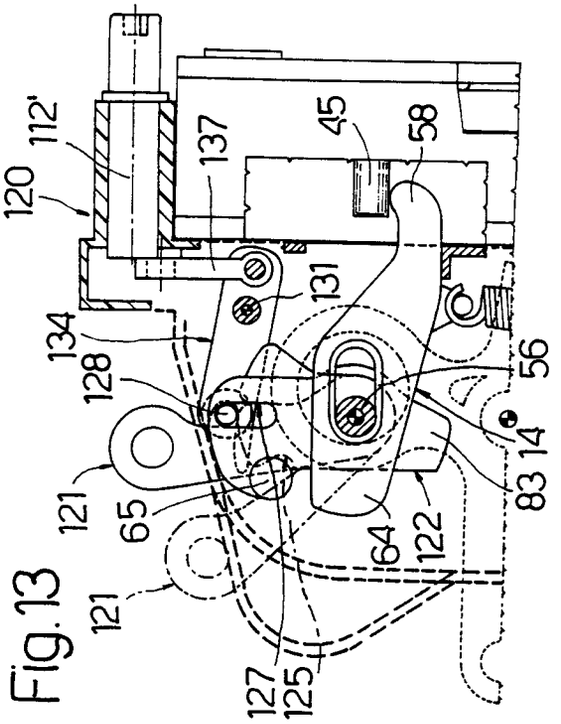

Fig.13

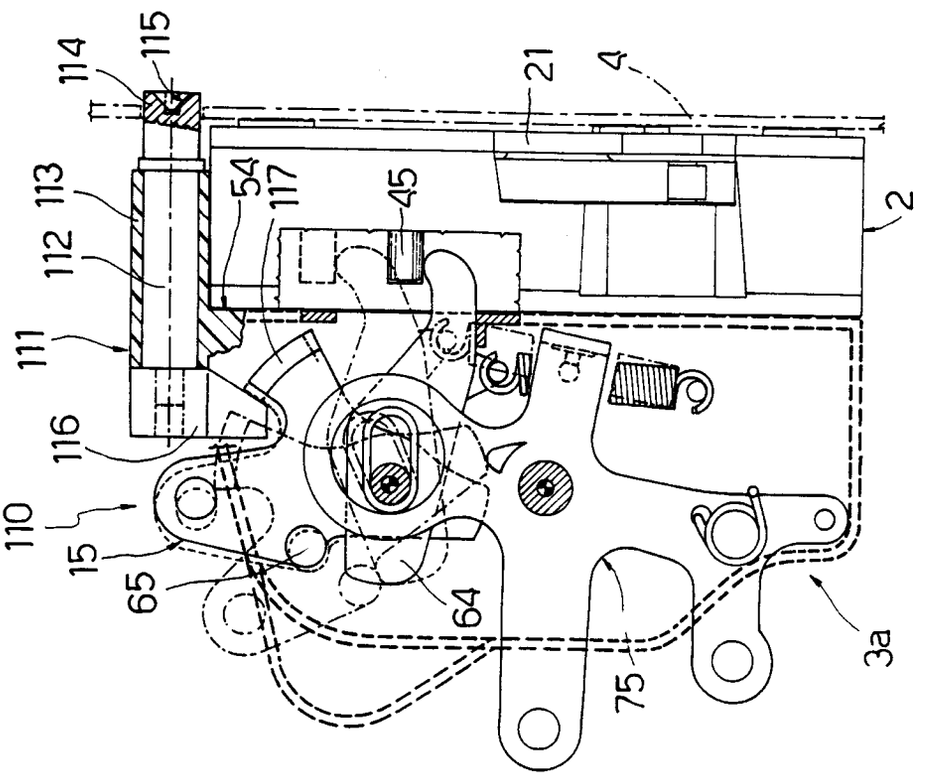

Fig.11

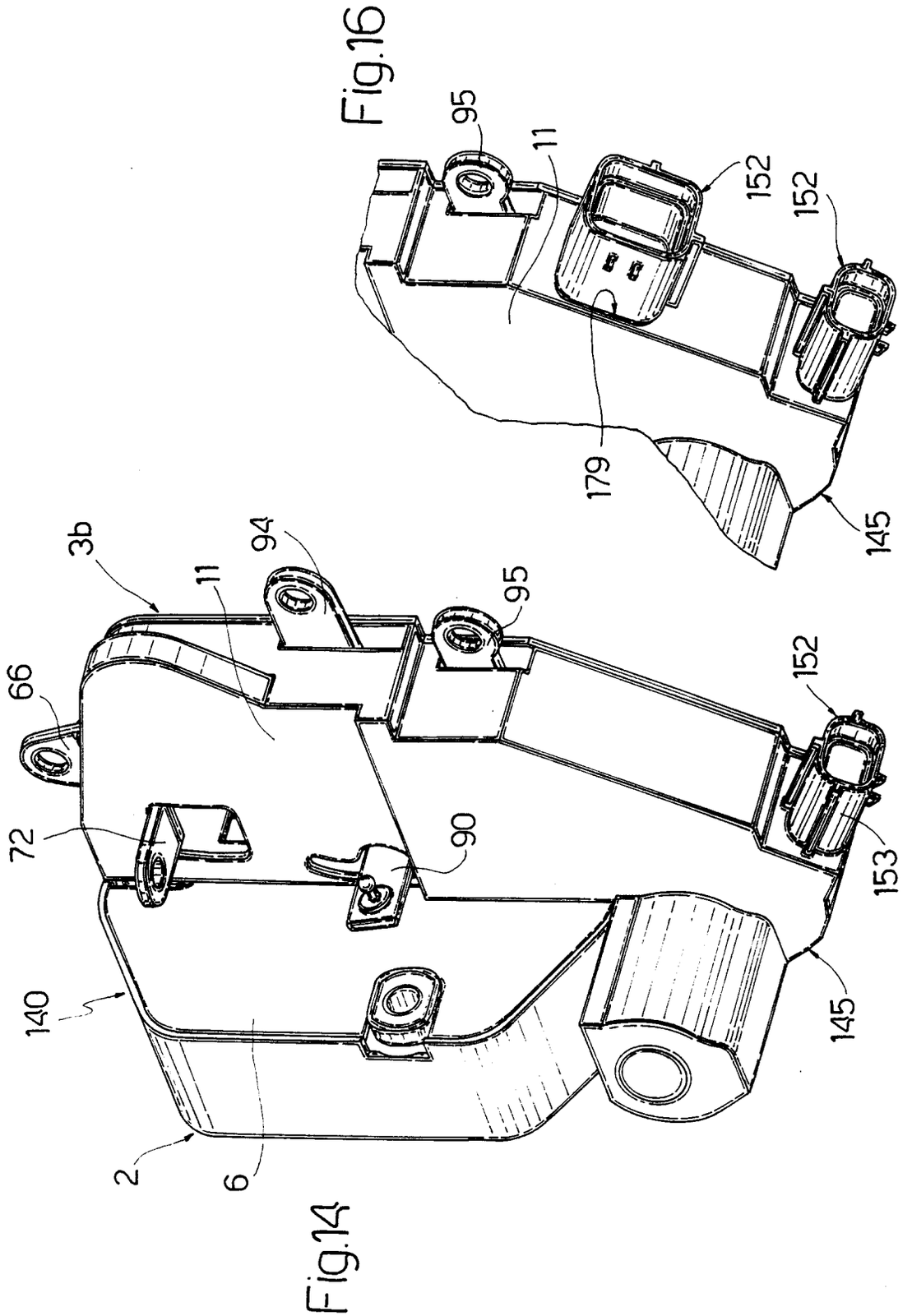

Fig.16

Fig.14

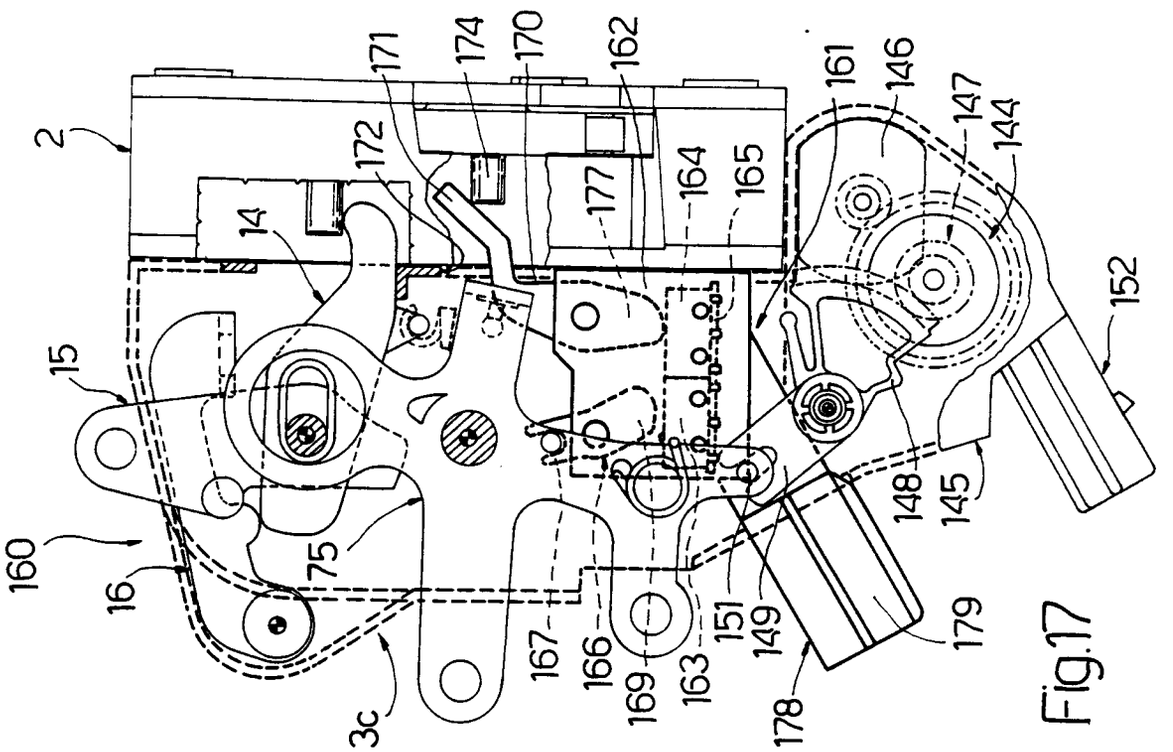
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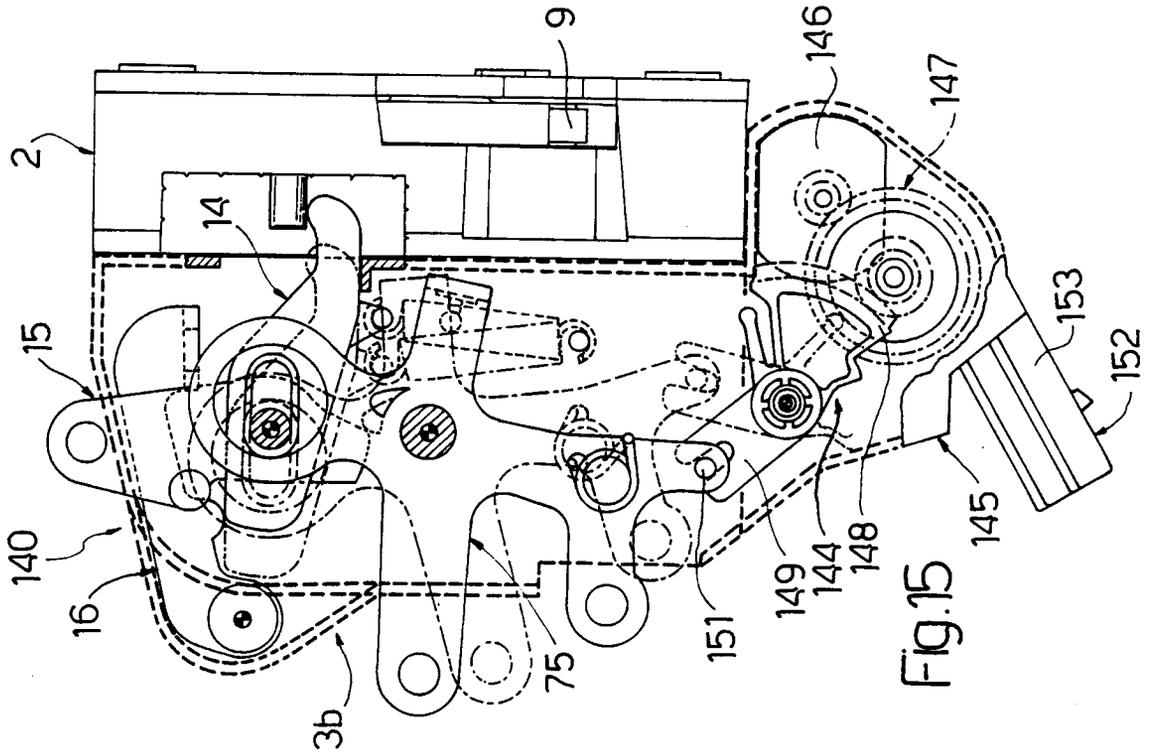
Fig.17


9
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3b
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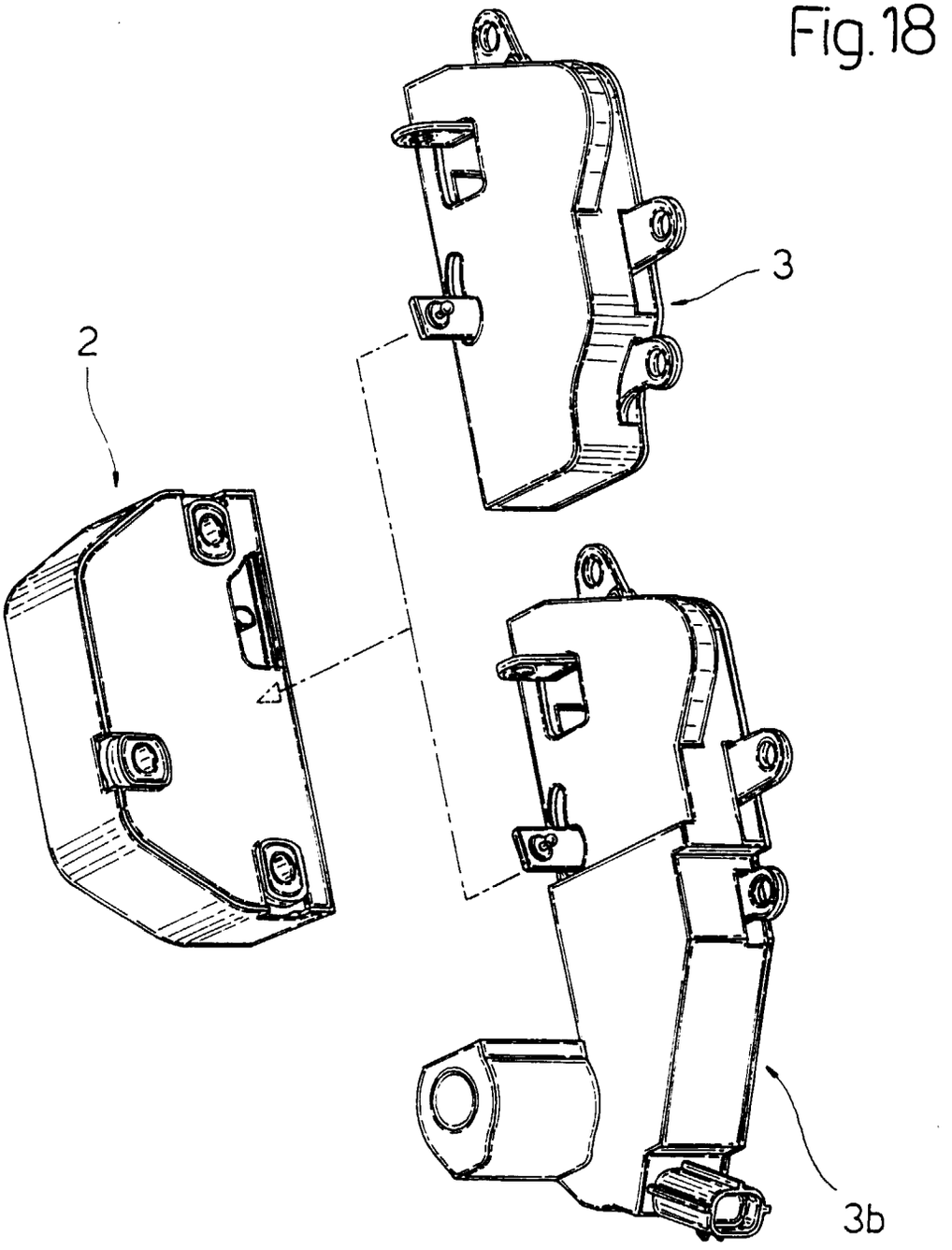
144
148

Fig.15

Fig. 18



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 4293

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.6)
X Y	US 4 647 092 A (NAKAMURA HITOSHI) 3 March 1987 * column 2, line 59 - column 11, line 66; figures *	1-5 6-9	E05B65/32
X	US 4 575 138 A (NAKAMURA HITOSHI ET AL) 11 March 1986 * column 2, line 23 - column 9, line 46; figures *	1,3-6	
X	GB 2 178 475 A (KIEKERT GMBH CO KG) 11 February 1987 * page 1, line 53 - page 2, line 127; figures *	1,3,4,6,9	
X	US 4 904 004 A (BARTCZAK ANDRZEJ) 27 February 1990 * column 2, line 6 - column 12, line 34; figures *	1,3,4,6	
X	US 5 360 351 A (PERIOU PIERRE ET AL) 1 November 1994 * column 2, line 26 - column 3, line 16; figures *	1,4,6-8	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E05B
Y	EP 0 686 745 A (GEN MOTORS CORP) 13 December 1995 * column 2, line 33 - column 7, line 13; figures *	6-9	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 November 1998	Westin, K

CATEGORY OF CITED DOCUMENTS

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