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(54) **Vehicle door latch system**

Fahrzeugtürverschlusssystem

Système de fermeture de porte de véhicule

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Description

[0001] The present invention relates generally to a vehicle door latch system or latch..

[0002] A vehicle closure, such as a door for a vehicle passenger compartment, is hinged to swing between open and closed positions (e.g., passenger and driver side doors, lift gates, etc.) or slide between an open and closed position along a guide track (e.g., sliding doors for vans) and conventionally includes a door latch. The door latch functions in a well-known manner to latch the door when it is closed and to lock the door in the closed position or to unlock and unlatch the door so that the door can be opened manually or powered.

[0003] The door latch can be operated remotely from the exterior of the automobile by at least two distinct operators, a key cylinder that controls the lock mechanism and an outside door handle or push button that controls the release mechanism.

[0004] The door latch can also be operated remotely from inside the passenger compartment by at least two distinct operators, a sill button that controls the lock mechanism and an inside door handle that controls the release mechanism. Vehicle door latches may also include power door locks in which the lock mechanism is motor driven and/or a keyless entry in which a key fob transmitter sends a signal to a receiver in the vehicle to operate a motor driven lock mechanism.

[0005] EP 0 743 413 A1 discloses a passenger vehicle door latch assembly including a cam rotating in common with a latching claw which is retained by a pawl at safety and at fully closed positions of the vehicle. The shape of the cam controls a locking mechanism of the assembly. The claw is pivotally mounted on a claw post and is capable of movement between open and closed positions. The pawl is also mounted on the retention plate for movement between an engaged state with the pawl and a release position where is does not engage the pawl.

[0006] WO 2008/064234 A2 discloses a rotary pawl latch assembly including closure member provided with a striker in a latch housing. A pawl engages or disengages with a trigger or catch for moving the latch to an open position or a closed position. An electrically operated actuator is capable of selectively moving the trigger out of engagement with the pawl, so that the latch can be engaged with the striker.

[0007] However, there is a desire to make further improvements in such latches wherein multiple operations are performed in a single latch. Still further it is also desirable to provide numerous features will also simplifying the complexity of the components used in the latch.

SUMMARY OF THE INVENTION

[0008] According to the present invention there is provided a vehicle door latch, as defined in claim 1. The door latch includes a claw pivotally mounted to the latch, the claw being capable of movement between an open position and a closed position; a pawl pivotally mounted to the latch for movement from an engaged position with the claw to a released position wherein the pawl does not engage the claw and the claw is free to move to the open position; and at least one dual function component.

[0009] The latch further includes a pawl lifter configured to transmit forces to the pawl, wherein the pawl lifter engages the pawl a top and bottom feature and the pawl is not over molded, wherein the top and bottom features prevent metal contact of the pawl with a retention plate of the latch

[0010] In another embodiment, the latch includes a striker buffer, the striker buffer comprising an elastomeric material configured to be compressed between a back plate and a housing of the latch when the back plate is secured to the housing, the striker buffer is also configured to have an opening configured to engage a striker as it is inserted into an opening of the latch;

[0011] In another embodiment, the latch includes a claw spring configured to provide a biasing force to the claw for an opening movement and an ajar lever for movement away from a door ajar switch, the door ajar switch being configured to be actuated by the ajar lever when the claw moves into the closed position, wherein the claw is configured to have a cam surface configured to contact the ajar lever when the claw moves into the closed position.

[0012] In another embodiment, the latch includes a single lock/unlock spring configured to move a release link of the latch between a first position wherein the release link will not contact the pawl lifter when an outside release lever is moved and a second position wherein the release link will contact the pawl lifter when the outside release lever is moved and thus move the pawl into the released position and a lock link between a lock position wherein the inside release lever will not contact the lock link and transfer forces to the pawl lifter and the pawl and an unlock position wherein the inside release lever will contact the lock link and transfer forces to the pawl lifter and the pawl.

[0013] In another embodiment, the latch includes a child barrel that is rotationally mounted to the latch, wherein rotational movement of the child barrel will contact the lock link and move it upward and thus disconnect it from the inside release lever so that movement of the inside release lever will not be translated to the pawl lifter and thus the latch will not be become unlatched and a lock/unlock function of the lock link will also be disabled when the child barrel is rotated into a "child on" position.

[0014] In another embodiment, the latch includes a release link and outside release lever capable of being used in both a right handed latch and a left handed latch.

[0015] In another embodiment, the latch includes a key lever configured to lock/unlock the latch based upon movement from an external key cylinder connected to the key lever by a rod, wherein the key lever symmetrical on either side and is configured to be used in either a left hand (LH) door latch or a right hand by simply rotating

the key lever about its center line.

[0016] In another optional embodiment, the latch includes a child safety function which disables an inside release lever of the latch by simply adding one component namely, a child barrel that is rotationally mounted to the latch.

[0017] In another optional embodiment, an actuator package of the latch is located in a free space area of an engagement function area of the latch.

[0018] In another optional embodiment, the latch has an electric function zone a mechanical operation zone and engagement function zone and each of these zones are optimized to use space for a compact latch size.

[0019] In another optional embodiment, a latch has a lock/unlock switch located in close proximity to an ajar switch of the latch such that common terminals may be utilized by both the lock/unlock switch and the ajar switch.

[0020] In another optional embodiment, a terminal design is provided here the terminal is stripped when it is straight to minimize material loss and to provide a notch in the terminal in order to allow it to be bent in one direction or the other.

[0021] In another optional embodiment, a lock link of the latch is configured to have a small profile or stroke so that the only a slight movement is necessary to transition the lock link from a locked position to an unlocked position.

[0022] In another optional embodiment, a lock link of the latch is configured to provide at least the following functions: lock/unlock, wherein coupling of an inside release lever to the lock link is either enabled or disabled; child on and child off wherein movement of a child barrel moves the lock link and enables or disables both a release function and lock functions of the latch with a single configuration.

[0023] In another optional embodiment, a housing or actuator support of the latch are manufactured using engineering plastic such as polybutylene terephthalate (PBT) a thermoplastic engineering polymer PBT or polyoxymethylene (POM), also known as acetal, polyacetal and polyformaldehyde and other housing components of the latch not requiring additional reinforcement in the plastic housing are formed with a thermoplastic such as polypropylene (PP).

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is an exploded view of a door latch constructed in accordance with one non-limiting exemplary embodiment;

FIG. 2 is a perspective view of portions of the latch retention system of a door latch in accordance with an exemplary embodiment of the present invention;

FIGS. 3 and 4 are views of the latch housing in accordance with one non-limiting exemplary embodiment;

FIG. 5 is a perspective view of an inside and outside release mechanism of the latch in accordance with one non-limiting exemplary embodiment;

FIGS. 6 and 7 illustrate a release and lock mechanism of the latch in accordance with one non-limiting exemplary embodiment;

FIG. 8 is a perspective view of the housing of the latch in accordance with one non-limiting exemplary embodiment;

FIG. 9 illustrates additional components of the latch in accordance with one non-limiting exemplary embodiment;

FIG. 10 illustrates an actuator mechanism of the latch in accordance with one non-limiting exemplary embodiment;

FIGS. 11-14 illustrate additional components of the latch in accordance with one non-limiting exemplary embodiment;

FIGS. 15-15B illustrate additional components of the latch in accordance with one non-limiting exemplary embodiment;

FIGS. 16A and 16B illustrate additional components of the latch in accordance with one non-limiting exemplary embodiment;

FIGS. 17A-17D illustrate one non-limiting exemplary embodiment of the present invention;

FIGS. 18A-18J illustrate another non-limiting exemplary embodiment of the present invention;

FIGS. 19A-20D illustrate other non-limiting exemplary embodiments of the present invention;

FIGS. 21A-22C illustrate yet another non-limiting exemplary embodiment of the present invention;

FIGS. 23A-23F illustrate yet another non-limiting exemplary embodiment of the present invention;

FIGS. 24A-24C illustrate still another non-limiting exemplary embodiment of the present invention;

FIGS. 25A-25C illustrate still another non-limiting exemplary embodiment of the present invention;

FIGS. 26A-27B illustrate still additional non-limiting exemplary embodiments of the present invention;

FIGS. 28A-28C illustrate yet another non-limiting exemplary embodiment of the present invention;

FIG. 30 illustrates still another non-limiting exemplary embodiment of the present invention; and

FIGS. 31A-31E illustrate yet another non-limiting exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0025] Referring now to FIG. 1, an exploded view of a latch or vehicle door latch or vehicle door latch system 10 in accordance with an exemplary embodiment of the present invention is provided. The vehicle door latch system or latch 10 in one embodiment may be used with a side door of a vehicle wherein the latch is mounted either to the door or a frame proximate to a door opening and is configured to releasably receive and retain a striker 9 that is secured to either the door or a frame proximate to the door opening depending on where the latch 10 is mounted. Of course, it is also contemplated that embodiments of the present invention can be incorporated into other latches or latch assemblies which are used in other applications (e.g., lift gates, trunks, etc.).

[0026] As illustrated, the latch 10 has a plate or retention plate 12. A claw 14 and a pawl 16 are each being pivotally or rotationally mounted to the latch 10 or the retention plate 12 of the latch. In one embodiment, the claw 14 is made from metal over molded in plastic. The claw 14 and the pawl 16 are pivotally mounted to the latch 10 and in particular the retention plate 12 by studs 18 and 20 respectively. In one embodiment, the claw 14 is biased in the direction indicated by arrow 22 by a spring 24 and the pawl 16 is biased in the direction indicated by arrow 26 into engagement with the claw 14 by a spring 28.

[0027] The claw 14 has slot or throat 30 configured for receiving and retaining a striker 9 located on a complementary vehicle component, such as a door or a frame proximate to an opening for the door. The claw 14 additionally includes a primary shoulder 32 and an intermediate secondary shoulder 34. The pawl 16 has a feature or catch 35 configured to positively engage each of the primary and secondary latch shoulders 32 and 34 to hold the claw 14 against the bias of the spring 24 in either a primary or closed position and a secondary or intermediate latched position respectively.

[0028] During operation, the claw 14 is configured to transition from an open position, wherein the slot or opening 30 allows a striker 9 to be released from an opening in the latch, as well as receive the striker from the opening in the latch and transition from the open position to the primary or closed position. As such, the intermediary position or secondary position is a position between the primary or closed position and the open position, wherein the pawl 16 engages the claw 14. In addition, the pawl 16 will also be configured to move from a first position or engagement positions, wherein feature or catch 35 engages the primary and secondary latch shoulders 32 and 34 to a second or released position, wherein the feature or catch 35 no longer engages the primary and secondary latch shoulders 32 and 34.

[0029] The latch or door latch 10 will further comprise a variety of mechanisms in order to transition the claw 14 between the primary, secondary and open positions as well as preventing movement therefrom. In addition, these mechanisms may also be configured to inhibit or cause movement of the pawl 16. Each of these mechanisms are optional features in that the latch 10 may comprise only one of the disclosed mechanisms, any combination of the disclosed mechanism including but not limited to all of the disclosed mechanisms. In addition many of these mechanisms are configured as a dual purpose mechanism or dual function component in that the single mechanism or component is capable of being used in two features of the latch or provides two functions in the latch.

[0030] Also shown in at least FIG. 1 is a pawl lifter 36 that is mounted to the pawl 16 and pawl stub 20. In addition, a housing 38 and cover 40 are also illustrated. Additional components of a key lever 42, a release link 44, a sleeve 46, an actuator screw 48, a striker buffer 50, a release spring 52, a lock/unlock spring 54, an outside release lever 56, a back plate 58, a locking lever 60, a lock link inside handle (IH) 62, an ajar lever 64, a child barrel 68, a clip 70, terminals 72, foam 74, a connector 76, an actuator base 78, an ajar switch 80, a lock switch 82, an assist spring 84, a worm wheel 86, a motor 88, a worm gear 90, a master lock link 92, a sill lever 94, an inside release lever 96, an inside release spring 98, an actuator support 100, an inside cable 102, a rivet 104 and a screw 106 are illustrated in at least FIG. 1.

[0031] Referring now to FIG. 2 components of a general retention mechanism 108 of the latch 10 are illustrated. As illustrated in FIG. 2, the claw 14 is in the closed or primary position and the pawl 16 is engaging the claw in order to prevent the claw from rotating in the direction of arrow 22.

[0032] FIGS. 3 and 4 illustrate the housing 38 with the retention mechanism 108 installed therein. FIG. 3 is a top perspective view while FIG. 4 is a bottom perspective view. Also shown is the opening, engagement area or fish mouth opening 110 that is configured to receive the striker therein for engagement with the claw 18.

[0033] FIG. 5 illustrates components of an inside and outside release mechanism 112 while FIGS. 6 and 7 illustrate the release mechanism 112 and a lock mechanism 114 on the housing 38. As illustrated in at least FIGS. 6 and 7, the outside release lever 56 is at least operatively coupled to an outside handle 57 illustrated schematically. Coupling of the outside handle 57. The outside release lever 56 and be facilitated by any suitable linkage such as a cable or rod etc. In addition, the inside release lever 96 is also at least operatively coupled to an inside release handle 59 illustrated schematically via the inside cable 102 for example. Outside release lever 56

is rotationally or pivotally mounted to the housing 38 as well as operatively coupled to the release link 44 such that rotational movement of outside release lever 56 via actuation of outside handle 57 will cause linear movement of release link 44, which depending on the position of the lock/unlock spring 54 will be translated to the pawl lifter 36 and cause rotational movement of the pawl lifter 36 and the pawl 16 so that claw 14 can be rotated or move into the open position. It is also understood that the release link 44 is also movably mounted to the housing such that movement of the lock/unlock spring 54 will cause a distal end (opposite inside release lever 56) of the release link 44 to be moved such that coupling a decoupling of the release link 44 to the pawl lifter 36 can be facilitated.

[0034] The inside release lever 96 is rotatably or movably or pivotally mounted to the actuator support 100 in the direction of arrows 71 while the lock link 62 is slidably mounted to the housing for movement in the direction of arrow 73, as well as rotational movement in the direction of arrow 75. As lock link 62 moves in the directions of arrows 73, due to the movement of lock/unlock spring 54. The inside release lever 96 may or may not make contact with the lock link 62 as it rotated with respect to the housing 38. If the lock/unlock spring 54 is in the unlocked position, the lock link 62 will be positioned to be rotated when the inside release lever 96 is rotated. The lock link 62 is also operatively coupled to pawl lifter 36 such that rotational movement of the lock link 62 will cause movement of the pawl lifter 36 and ultimately the pawl 16 such that the claw 14 will be capable of movement from the closed position to the open position.

[0035] When the lock link 62 is in the corresponding lock position movement of the inside release lever 96 will not transferred to the lock link 62 and thus, it will not be rotated when the inside release lever 96 is moved via actuation of the inside release handle 59.

[0036] FIG. 8 shows the housing 38 with the back plate 58 secured thereto.

[0037] FIG. 9 illustrates the electrical connection to the motor 88 of an actuator or actuator mechanism 116 of the latch 10. FIG. 10 also illustrates the actuator mechanism 116. FIG. 11 shows the actuator support 100 and the inside release lever 96 secured thereto while FIG. 12 shows the actuator, actuator mechanism 116 secured to the actuator support 100 to provide an actuator module 118.

[0038] FIG. 13 illustrates the housing 38 with the retention mechanism 108 installed therein without the retention plate 12. Also, shown is a slot 120 for a backup lock and a hole or opening 122 to rotationally receive the child barrel 68 therein. FIG. 14 shows the assembled latch 10.

[0039] FIGS. 15, 15A and 15B illustrate the pawl lifter 36 assembled to the pawl 16. The function of the pawl lifter 36 is to transmit release operations from the inside and outside of the vehicle to the latch 10 via operator handles and to keep engagement with the pawl 16 via engagement with a top 124 and bottom 126 feature. One advantage of this configuration is that is allows for the use of a non-overmolded pawl 16 since the pawl lifter 36 via the top and bottom features 124 and 126 prevent metal contact of the pawl 16 with the retention plate 12. In addition, the pawl lifter 36 is easily installed by placing the same on the pawl stud 20 as well as the pawl 16.

[0040] FIGS. 16A and 16B illustrate the housing 38 with the striker buffer 50 installed therein. The striker buffer comprises an elastomeric material or other equivalent material of a suitable durometer configured to be compressed between the back plate 58 and the housing 38 when the back plate 58 is secured to the housing 38. In other words, the striker buffer is slightly larger than the space it is placed in and the back plate 58 compresses it when it is secured to the housing 38. An advantage provided by the striker buffer is that it prevents vibration of the housing 38 and the back plate 58 during door slam events wherein the latch 10 experiences high forces. In addition, the striker buffer 50 is also configured to have a surface or opening 51 configured to engage the striker as it is inserted into opening 110 of the latch 10. Accordingly, the striker buffer 50 serves the dual purpose of absorbing contact forces of the striker as it enters the latch 10, as well as the above mentioned vibration prevention of the housing 38 and the back plate 58.

[0041] Referring now to FIGS. 17A-17D another non-limiting embodiment of the present invention is illustrated. Here a single spring, the claw spring 28, is used for both the claw 14 (for an opening movement) and the ajar lever 64 (providing a biasing force to the ajar lever 64). When the door ajar switch 80 (a micro switch operably couple to a controller 81 of the latch system) is actuated a signal is sent to the controller 81 to indicate the state of the latch. During operation, the ajar lever 64 is pushed by a cam surface 128 of the claw 14 for example and when the claw rotates into the closed position, in the direction opposite of arrow 22 the cam surface or cam profile 128 makes contact with the ajar lever 64 and pushes it in the direction of arrow 129 into the door ajar switch 80 in order to change the state of the switch (AJAR On). In the illustrated embodiment, the ajar lever 64 is rotationally or pivotally mounted to the latch 10 for movement about an axis 131. Also shown is that the cam surface 128 is positioned along a peripheral edge of the claw 14 such that as the claw rotates about claw stud 18 cam surface 128 will make contact with a portion of ajar lever 64.

[0042] If the claw 14 is operated in the open direction (arrow 22), the cam profile 128 is pulled away from the ajar lever 64 and the door ajar lever returns to a home position (Off) by a biasing force of a leg of the claw spring 28 while another leg of the claw spring 28 secured to the claw 14 biases the claw into the open position. See the spring force arrows 130 in at least FIGS. 17B and 17D.

[0043] In other words, the two legs of the single spring 28 illustrated in FIGS. 17A-17D are each secured to one of the claw 14 and a portion of the ajar lever 64 in order to serve the dual purpose of 1) biasing the claw 14 in the

open direction while simultaneously biasing the ajar lever 64 away from the ajar switch 80. The use of this single spring 28 eliminates the need for a separate additional spring for either the claw 14 or the ajar lever 64. During closing movements of the claw 14, the cam surface 128 overcomes the biasing force of the spring 28 and pushes the ajar lever 64 into contact with the ajar switch 80 and actuate the same in order to indicate the change of state of the latch 10.

[0044] Referring now to FIGS. 18A-18J, another exemplary embodiment of the present invention is provided. Here a single lock/unlock spring 54 is provided for serving the dual purpose of moving the release link 44 between a first position wherein the release link 44 will not contact the pawl lifter 36 when the outside release lever 56 is moved and a second position wherein the release link 44 will contact the pawl lifter 36 when the outside release lever 56 is moved and thus actuate the pawl 16.

[0045] As shown, the lock/unlock has a pair of ends 55 and 57 that move up and down in the direction of arrows 59 as the spring 54 moves between a unlock position (See at least FIG. 18D) and a lock position (See at least FIG. 18C). As the ends 55 and 57 move up and down so do the release link 44 and the lock link 62. When the spring 54 is in the unlock position both the lock link 62 and the release link 44 are positioned to transfer movement to the pawl 16 and thus open the latch 10. However and when the spring 54 is in the lock position both the lock link 62 and the release link 44 are moved upward and positioned so that movement thereof will not be transferred to the pawl 16 and thus latch 10 will not open. In one embodiment, the spring 54 is a butterfly spring and movement of a central portion 61 of the butterfly spring up and down as well as ends 55 and 57 is facilitated by movement of the lock link 62, which is facilitated by rotational movement of the locking lever 60 or alternatively the child barrel 68. Central portion 61 is slidably received within a corresponding cavity 63 of the housing 38.

[0046] See also FIGS. 18E-18J, wherein movement of the spring 54 between a position corresponding to a lock position FIGS. 18E-18G and an unlocked position FIGS. 18H-18J is illustrated. FIG. 18F illustrates that the lock spring 54 is in the locked position and the outside release link or release link 44 will not contact the pawl lifter 36 when the outside release lever 56 is actuated. It being understood that the outside release lever 56 is operatively coupled to outside handle 57 and release link 44 is operatively coupled to outside release lever 56 as well as being mounted to the housing 38 and operatively coupled to end 55 of the lock spring 54. FIG. 18G also illustrates that the lock spring is in the locked position and the inside release lever 96 will not contact the lock link 62. Due to its movement upward via movement of spring 54 in particular, end 57. It being understood that the lock link 62 is movably mounted to the housing 38 and is configured to operatively couple or operatively be couple the inside release lever 96 to the pawl lifter 36.

[0047] The use of this single spring 54 eliminates the need for a separate additional spring for either the release link 44 or the lock link 62. This single spring 54 can operate the outside and inside locking features independently or simultaneously. In addition, the single spring 54 can be used to operate with a single pull open (SPO) latch, wherein the lock link 62 is always an unlocked position, as well as being used with a double pull open (DPO) wherein the first pull transition the lock link from a locked position to a unlocked position such that the second pawl will then open the latch 10. In addition and as will be described in at least FIGS. 19A-19H, the single spring 54 can also be used with a child safety feature.

[0048] Referring now to FIGS. 19A-19H another exemplary embodiment of the present invention is illustrated. Here it is proposed to add a child safety function the disables the inside release lever 96 by simply adding one component namely, a child barrel 68 that is rotationally mounted to the latch 10. In one embodiment, the child barrel 60 is rotatably received within opening 122 of housing 38. Here rotational movement of the child barrel 68 in a first plane will contact the lock link 62 and move it upward in a second plane in the direction of arrow 79 and thus disconnect it from the inside release lever 96 so that movement of the inside release lever 96 will not be translated to the pawl lifter 36 and thus the latch will not be become unlatched. In one non-limiting or optional embodiment, the first plane is perpendicular to the second plane. In addition, the lock/unlock function of the lock link 62 will also be disabled when the child barrel 68 is in a "child on" position, see at least (FIGS. 19A, 19B, 19E and 19F). When the child barrel 68 is in a "child off" position, the child barrel 68 no longer makes contact with the lock link 62 and thus allows movement of the same in the direction of arrows 81. In one non-limiting embodiment, the child barrel 68 is rotationally received within opening 122 of the housing 38 and has a knob surface 83 that is easily grasped by a user in order to impart the rotational movement of the child barrel 68. As illustrated in the attached FIGS. the child barrel 68 has a leg portion 85, with a distal and 87, that has a cam surface or other equivalent feature configured to make contact with an arm member or surface 89 of the lock link 62. Also shown is an arm member 97 that provides a detent feature to the child barrel 68 or child safety feature in the "child on" and "child off' positions, which also provides a switch feeling to the child barrel or child safety feature as it is rotated.

[0049] Accordingly, actuation of the child safety feature of the latch 10 repositions or holds the lock link 62 in a position so that actuation of the inside release lever 96 will not be transferred to the pawl 16 of the latch 10 and thus, the latch 10 remains in a closed or latched state. Still further and in yet another embodiment, the child safety feature of the latch is also configured to prevent unlocking of the latch 10, so that actuation of the inside release lever 96 will not be transferred to the pawl 16 of the latch 10.

[0050] FIG. 20 shows a latch 10 without the child safety

feature (e.g., child barrel 68 not installed into opening 122) while FIG. 20A shows the latch 10, with the child safety feature installed (e.g., child barrel 68 rotationally received within opening 122).

[0051] FIGS. 20B-20D illustrate an alternative embodiment wherein the child safety feature is provided via a lever type mechanism 91 pivotally mounted to the housing 38 of latch 10. Here pivotal movement of the lever in the direction of arrow 93 will cause the lock link 62 to move upward in the direction of arrow 95 and thus position the lock link 62 in the "child on" position such that actuation of the inside release lever 96 will not be transferred to the pawl 16 thus, the latch 10 remains in a latched state (See FIG. 20C). In order to transition the latch 10 into the "child off" state, the lever 91 is moved in a direction opposite to arrow 93 and thus the lock link 62 to move downward in a direction opposite to arrow 95 such that opening forces can be found transferred to pawl 16 for example, actuation of the inside release lever 96 (See FIG. 20D.

[0052] Referring now to FIGS. 21A and 21B another exemplary embodiment of the present invention is illustrated. Here an improved key lever 42 is provided. Typically the key lever's function is to lock/unlock the latch based upon movement from an external key cylinder 43 (illustrated schematically) connected to the key lever by a rod 45 (illustrated schematically). The key lever is operatively coupled to the locking lever 60 and in some embodiments, a key switch position to be actuated by the key lever and thus provide a signal indicating the state (lock/unlock) of the latch 10.

[0053] Here, a left hand (LH) door latch 10 is illustrated in FIG. 21A while a right hand (RH) door latch is illustrated in FIG. 21B. Typically, a latch on the driver's side of the vehicle will be equipped with a key lever rotationally mounted or movably mounted to the latch 10 and is configured to transfer movement of an external key cylinder (in the driver's side door) to the latch 10 via a rod (not shown) that couples the external key cylinder to the key lever so that movement of the external key cylinder can be transferred to the key lever movement of the key lever then places the latch 10 in a lock or unlock state.

[0054] Depending on the country where the vehicle is sold the driver's side may be on either side of the vehicle and thus may utilize a left hand or alternatively a right hand latch 10. In order to accommodate this, typically two distinctly separate key levers where required.

[0055] In this implementation, a single key lever 42 or no handed key lever 42 is used. Here the key lever 42 is symmetrical on both sides (see FIGS. 22A-22C) and thus if it is required for a left hand latch the key lever 42 is installed in one orientation and if a right hand latch is required the key lever 42 is simply inverted (See FIGS. 21A and 21B as well as FIGS. 22A-22C) wherein the key lever 42 is simply inverted depending on the latch 10 it is used in.

[0056] As illustrated, the key lever 42 is symmetrical at the center line 99, this design allows the same component to be used in two sides of the vehicle door latch 10 (e.g., left hand and right hand). Another advantage is the use of a single mold to mold the key lever 42, reducing the cost of the tooling and the component. In addition, the key lever 42 typically used in a driver's side door normally however, right hand and left hand latch volumes are not same world wide and thus the symmetrical design allows for the same components to be used. FIGS. 21A and 21B show the same key lever 42 being movably mounted to both a right-hand latch 10 and a left hand latch 10, wherein the key lever 42 is simply inverted about its center line 99.

[0057] Referring now to FIGS. 23A-23F, another exemplary embodiment of the present invention is illustrated. Here the outside release lever 56 and the release link 44 are also designed to be no-handed or in other words capable of being used in both a right handed latch 10 (FIG. 23A, 23D) and a left handed latch 10 (FIG. 23B, 23C). As mentioned above, this reduces tooling costs and allows for elimination of parts as there is a single part instead of two. Here, the outside release lever 56 similar to the key lever 42 is simply inverted and secured to the latch 10 depending on whether the latch is a right-handed latch or left-handed latch.

[0058] Referring now to FIGS. 24A-24C yet another embodiment of the present invention is illustrated. In this embodiment, a method of packaging or adaptation of the latch 10 to a vehicle is provided. In this embodiment, the worm wheel 84 of the actuator 116 is located on fish mouth or opening 110 of the latch 10 and the motor 88 is located in a top area of the latch 10. The motor housing is located on the retention side of the latch 10 (further away from the opening 110) and the sill lever 94 and the inside release lever 96 are located below the worm wheel 86 and the cable output is also at the bottom so that the top and bottom of the fish mouth 110 has space or can be enlarged. In accordance with one embodiment, the design uses this free space for the motor housing and the levers and accordingly, the total packaging size can be minimized. FIG. 24A show portions of the cover 40 removed while FIG. 24B shows portions of the cover 40 and the housing 38 removed.

[0059] As illustrated, the actuator package is located in the free space of the engagement function area. The three illustrated zones electric function 140, mechanical operation 142 and engagement function 144 are optimized to use space for compact packaging within retention size.

[0060] Referring now to FIGS. 25A-25C yet another alternative embodiment of the present invention is illustrated. FIG. 25A is a view from the actuator side of the latch 10 while FIG. 25 is a view from the housing side of the latch 10. In this embodiment, the lock/unlock switch 80 is located in close proximity to the ajar switch 82. By locating these switches in close proximity, common terminals 72 may be utilized and thus the terminal layout is simplified as illustrated in FIGS. 25A-25C and the package of the switches is also minimized. See in particular

FIG. 25C wherein common terminals are utilized. In addition another feature of this embodiment is that the pins of the switches are shifted and the terminals merely need only one step 101 as well as being space from each other due to the switch off setting. (See also at least FIG. 9)

[0061] Referring now to FIGS. 26A-27B yet another alternative embodiment is illustrated. Here a terminal design is implemented. First the terminal 72 is stripped when it is straight to minimize material loss and provide a notch 146 in order to allow for bending of the terminal 72 in one direction or the other. Once again, this allows for use in both left hand and right hand latch applications.

[0062] Referring now to FIGS. 28A-28C yet another embodiment of the present invention is illustrated. Here the lock link 62 is formed with a small profile or stroke 150 so that the function of enable and disable of the connection between the inside release lever 96 and the pawl 16 via the lock link 62 is ensured. See the cut away view in FIG. 28B wherein the small profile 150 of the lock link 62 is illustrated. As such, and as illustrated in FIG. 28C only a slight movement in the direction of arrow 152 is necessary. In order to transition the lock link 62 from the locked position to the unlocked position.

[0063] The lock link 62 function is to enable and disable inside release connection such that the lock link 62 has contact with inside release lever 96 when release operation at unlock and to keep unlock condition during release operation.

[0064] Referring now to FIGS. 29A-29C yet another embodiment is illustrated. Here, the lock link 62 is configured to provide multiple functions for example operation with the inside release 96, wherein movement of an inside handle opens the latch 10 (see arrows 150) wherein movement of the inside release lever 96, rotates the lock link 62 which in turn rotates the pawl lifter 36, which in turn move the pawl 16. This occurs at a contact area 152 between the inside release lever 96 and the lock link 62. However and as the lock link 62 moves up and down as illustrated in the arrows of FIG. 29C, the contact between the inside release lever 96 and the lock link 62 may not occur (e.g., lock condition or child on condition). In one embodiment, the lock link 62 is used in three functions, 1) lock/unlock, wherein coupling of the inside release lever 96 to the lock link is either enabled or disabled 2) child on and child off wherein movement of a child barrel 68 moves the lock link and enables or disables both a release function (e.g., pulling of the inside handle) and lock functions unlocking of the latch. Accordingly, all three of these functions are provided by a single configuration.

[0065] In another embodiment and as illustrated in FIG. 30 the child barrel 68 is located in an opening 122 in the fish mouth or area 110 configured to receive the striker. This feature will not require a child safety on an inner panel of the latch 10. The rotational movement of the child barrel 68 operated to cancel or disable the inside release operation. One advantage of this design is a much easier layout for a rear door latch and the same provides for easy assembly without damage, no logistic damage and/or unintended actuator or operation. Alternatively and wherein the lever 91 is utilized for the child safety feature, the location of lever 91 is illustrated in FIG. 30. It will be understood that either lever 91 or child barrel 68 is contemplated.

[0066] Referring now to FIGS. 31A-31D yet another embodiment is illustrated here the housing 38 or actuator support 100 are manufactured using limited engineering plastic such as polybutylene terephthalate (PBT) a thermoplastic engineering polymer PBT or polyoxymethylene (POM), also known as acetal, polyacetal and polyformaldehyde, an engineering thermoplastic on focused mechanical functions or areas of the housing. For example, the motor and gear engagement area and the cable support area of the housing. By using discreetly located engineering plastics it is possible to reduce the required material and minimize tooling size, while also improving the molding conditions of these components.

[0067] Then other components not requiring additional reinforcement in the plastic housing can be formed with a thermoplastic such as polypropylene (PP). For example, the cover or cover portion 40 main function is to prevent water and dust from entering into the latch 10 and has no contact with the mechanical components and thus can be formed from polypropylene well the actuator support 100 and the housing 38 can be formed from other materials such as the aforementioned PBT or POM or equivalents thereof so that localized areas of reinforcement can be provided without requiring the entire housing and cover components of the latch to the formed from these materials.

[0068] Other embodiments include, a vehicle door latch comprising: a lock/unlock switch, wherein the lock/unlock switch is located in close proximity to an ajar switch of the latch such that common terminals may be utilized by both the lock/unlock switch and the ajar switch, or a vehicle door latch, wherein terminals of the latch are provides with a notch when they are straight in order to allow it to be bent in one direction or another, or a vehicle door latch, comprising: a lock link, wherein the lock link of the latch is configured to have a small profile or stroke so that only a slight movement is necessary to transition the lock link from a locked position to an unlocked position.

[0069] Further embodiments include a vehicle door latch, comprising: a lock link, wherein the lock link of the latch is configured to provide at least the following functions: lock/unlock, wherein coupling of an inside release lever to the lock link is either enabled or disabled; child on and child off wherein movement of a child barrel moves the lock link and enables or disables both a release function and lock functions of the latch with a single configuration.

[0070] Another embodiment includes a vehicle door latch, wherein a housing or actuator support of the latch are manufactured using engineering plastic such as polybutylene terephthalate (PBT) a thermoplastic engineer-

ing polymer PBT or polyoxymethylene (POM), also known as acetal, polyacetal and polyformaldehyde and other housing components of the latch not requiring additional reinforcement in the plastic housing are formed with a thermoplastic such as polypropylene (PP).

Claims

1. A vehicle door latch, comprising:

a retention plate (12)
a claw (14) pivotally mounted to the retention plate of the latch by a claw stud (18), the claw (14) being capable of movement between an open position and a closed position;
a pawl (16) pivotally mounted to the retention plate of the latch by a pawl stud (20) for movement from an engaged position with the claw (14) to a released position wherein the pawl (16) does not engage the claw and the claw (14) is free to move to the open position;
characterized in that a pawl lifter (36) is mounted to the pawl (16) and the pawl stud (20), the pawl lifter configured to transmit forces to the pawl, wherein the pawl lifter (36) engages the pawl (16) via engagement with a top (124) and a bottom (126) feature and the pawl is not over moulded and wherein the top and bottom features prevent metal contact of the pawl (16) with the retention plate (12) of the latch; and
at least one dual function component.

2. The vehicle door latch as in claim 1, wherein the dual function component is a striker buffer, the striker buffer (50) comprising an elastomeric material configured to be compressed between a back plate (58) and a housing (38) of the latch when the back plate is secured to the housing, the striker buffer is also configured to have an opening (51) configured to engage a striker (9) as it is inserted into an opening (110) of the latch.

3. The vehicle door latch as in any of the preceding claims, wherein the dual function component is a claw spring (28) configured to provide a biasing force to the claw (14) for an opening movement and an ajar lever (64) for movement away from a door ajar switch (80), the door ajar switch being configured to be actuated by the ajar lever (64) when the claw (14) moves into the closed position, wherein the claw (14) is configured to have a cam surface (128) configured to contact the ajar lever when the claw (14) moves into the closed position.

4. The vehicle door latch as in any of the preceding claims, wherein the dual function component is a single lock/unlock spring (54) configured to move a release link (44) of the latch between a first position wherein the release link (44) will not contact the pawl lifter (36) when an outside release lever (56) is moved and a second position wherein the release link (44) will contact the pawl lifter (36) when the outside release lever is moved and thus move the pawl (16) into the released position and a lock link (62) between a lock position wherein the inside release lever (96) will not contact the lock link (62) and transfer forces to the pawl lifter (36) and the pawl (16) and an unlock position wherein the inside release lever (96) will contact the lock link (62) and transfer forces to the pawl lifter and the pawl.

5. The vehicle door latch as in claim 4, wherein the dual function component is a child barrel (68) that is rotationally mounted to the latch, wherein rotational movement of the child barrel will contact the lock link (62) and move it upward and thus disconnect it from the inside release lever (96) so that movement of the inside release lever will not be translated to the pawl lifter (36) and thus the latch will not be become unlatched and a lock/unlock function of the lock link will also be disabled when the child barrel (62) is rotated into a "child on" position.

6. The vehicle door latch as in claim 4, wherein the release link (44) and the outside release lever (56) are capable of being used in both a right handed latch and a left handed latch.

7. The vehicle door latch as in any of the preceding claims, wherein the dual function component is a key lever (42) configured to lock or unlock the latch based upon movement from an external key cylinder (43) connected to the key lever by a rod (45), wherein the key lever (42) is symmetrical on either side and is configured to be used in either a left hand (LH) or a right hand (RH) door latch by rotating the key lever (42) about its center line.

8. The vehicle door latch as in claim 5, wherein the child barrel (68) is rotationally received within an opening (122) of a housing (38) of the latch, and wherein the opening is located in a fish mouth opening (110) if the housing.

Patentansprüche

1. Fahrzeugtürschließvorrichtung, umfassend:

eine Halteplatte (12),
eine Klaue (14), die an der Halteplatte der Schließvorrichtung durch einen Klauenstift (18) angelenkt ist, wobei die Klaue (14) in der Lage ist, sich zwischen einer offenen Position und einer geschlossenen Position zu bewegen;

eine Klinke (16), die an der Halteplatte der Schließvorrichtung durch einen Klinkenstift (20) angelenkt ist, um sich aus einer Eingriffnahmeposition mit der Klaue (14) in eine gelöste Position zu bewegen, in der die Klinke (16) die Klaue nicht in Eingriff nimmt und die Klaue (14) sich frei in die offene Position bewegen kann;
dadurch gekennzeichnet, dass ein Klinkenheber (36) an der Klinke (16) und dem Klinkenstift (20) gelagert ist, wobei der Klinkenheber dafür ausgebildet ist, Kräfte zu der Klinke zu übertragen, wobei der Klinkenheber (36) die Klinke (16) über die Eingriffnahme eines obersten (124) und eines untersten (126) Strukturelements in Eingriff nimmt und die Klinke nicht überformt ist, und wobei das oberste und das unterste Strukturelement einen metallischen Kontakt der Klinke (16) mit der Halteplatte (12) der Schließvorrichtung verhindern; und
mindestens eine Doppelfunktionskomponente.

2. Fahrzeugtürschließvorrichtung nach Anspruch 1, wobei die Doppelfunktionskomponente ein Anschlagpuffer ist, wobei der Anschlagpuffer (50) ein elastomeres Material umfasst, das dafür ausgebildet ist, zwischen einer rückseitigen Platte (58) und einem Gehäuse (38) der Schließvorrichtung zusammengedrückt zu werden, wenn die rückseitige Platte an dem Gehäuse befestigt wird, wobei der Anschlagpuffer des Weiteren dafür ausgebildet ist, eine Öffnung (51) zu haben, die dafür ausgebildet ist, einen Haltebügel (9) in Eingriff zu nehmen, wenn er in eine Öffnung (110) der Schließvorrichtung eingeführt wird.

3. Fahrzeugtürschließvorrichtung nach einem der vorangehenden Ansprüche, wobei die Doppelfunktionskomponente eine Klauenfeder (28) ist, die dafür ausgebildet ist, eine Vorspannkraft an die Klaue (14) für eine Öffnungsbewegung und an einen Kontakthebel (64) für eine Bewegung von einem Türkontaktschalter (80) fort anzulegen, wobei der Türkontaktschalter dafür ausgebildet ist, durch den Kontakthebel (64) betätigt zu werden, wenn die Klaue (14) sich in die geschlossene Position bewegt, wobei die Klaue (14) dafür ausgebildet ist, eine Nockenfläche (128) zu haben, die dafür ausgebildet ist, den Kontakthebel zu kontaktieren, wenn sich die Klaue (14) in die geschlossene Position bewegt.

4. Fahrzeugtürschließvorrichtung nach einem der vorangehenden Ansprüche, wobei die Doppelfunktionskomponente eine einzelne Verriegelungs-/Entriegelungsfeder (54) ist, die dafür ausgebildet ist, ein Löseglied (44) der Schließvorrichtung zu bewegen zwischen: einer ersten Position, in der das Löseglied (44) nicht den Klinkenheber (36) kontaktiert, wenn ein äußerer Lösehebel (56) bewegt wird, und einer zweiten Position, in der das Löseglied (44) den Klinkenheber (36) kontaktiert, wenn der äußere Lösehebel bewegt wird, und somit die Klinke (16) in die gelöste Position bewegt, und ein Verriegelungsglied (62) zu bewegen zwischen: einer Verriegelungsposition, in der der innere Lösehebel (96) nicht das Verriegelungsglied (62) kontaktiert und Kräfte zu dem Klinkenheber (36) und der Klinke (16) überträgt, und einer Entriegelungsposition, wobei der innere Lösehebel (96) das Verriegelungsglied (62) kontaktiert und Kräfte zu dem Klinkenheber und der Klinke überträgt.

5. Fahrzeugtürschließvorrichtung nach Anspruch 4, wobei die Doppelfunktionskomponente eine Kindersicherung (68) ist, die drehbar an der Schließvorrichtung gelagert ist, wobei die Drehbewegung der Kindersicherung das Verriegelungsglied (62) kontaktiert und es aufwärts bewegt und somit von dem inneren Lösehebel (96) trennt, so dass eine Bewegung des inneren Lösehebels nicht zu dem Klinkenheber (36) translatiert wird und die Schließvorrichtung daher nicht entriegelt wird und eine Verriegelungs-/Entriegelungsfunktion des Verriegelungsgliedes ebenfalls deaktiviert wird, wenn die Kindersicherung (62) in eine "Kind Ein"-Position gedreht wird.

6. Fahrzeugtürschließvorrichtung nach Anspruch 4, wobei das Löseglied (44) und der äußere Lösehebel (56) sowohl in einer rechtshändigen Schließvorrichtung als auch in einer linkshändigen Schließvorrichtung verwendet werden können.

7. Fahrzeugtürschließvorrichtung nach einem der vorangehenden Ansprüche, wobei die Doppelfunktionskomponente ein Schlüsselhebel (42) ist, der dafür ausgebildet ist, die Schließvorrichtung auf der Grundlage einer Bewegung von einem äußeren Schließzylinder (43), der mit dem Schlüsselhebel durch eine Stange (45) verbunden ist, zu verriegeln oder zu entriegeln, wobei der Schlüsselhebel (42) auf jeder Seite symmetrisch ist und dafür ausgebildet ist, entweder in einer linkshändigen (LH) oder in einer rechtshändigen (RH) Türschließvorrichtung verwendet zu werden, indem der Schlüsselhebel (42) um seine Mittelachse gedreht wird.

8. Fahrzeugtürschließvorrichtung nach Anspruch 5, wobei die Kindersicherung (68) drehbar in einer Öffnung (122) eines Gehäuses (38) der Schließvorrichtung aufgenommen ist und wobei sich die Öffnung in einer Fischmaulöffnung (110) in dem Gehäuse befindet.

Revendications

1. Moyen de fermeture de portière de véhicule,

comprenant :

une plaque de retenue (12) ;
une griffe (14) qui est montée à pivotement sur la plaque de retenue du moyen de fermeture par une goupille de griffe (18), la griffe (14) étant apte à se déplacer entre une position ouverte et une position fermée ;
un cliquet (16) qui est monté à pivotement sur la plaque de retenue du moyen de fermeture par une goupille de cliquet (20) pour un mouvement depuis une position d'engagement avec la griffe (14) vers une position libérée dans laquelle le cliquet (16) n'engage pas la griffe et la griffe (14) peut se déplacer librement vers la position ouverte ;
caractérisé en ce qu'un moyen de soulèvement de cliquet (36) est monté sur le cliquet (16) et sur la goupille de cliquet (20), le moyen de soulèvement de cliquet étant réalisé de manière à transmettre des forces au cliquet, le moyen de soulèvement de cliquet (36) engageant le cliquet (16) par un engagement avec un élément supérieur (124) et un élément inférieur (126), et le cliquet n'étant pas surmoulé, et l'élément supérieur et l'élément inférieur empêchant un contact métallique entre le cliquet (16) et la plaque de retenue (12) du moyen de fermeture ; et
au moins un composant à double fonction.

2. Moyen de fermeture de portière de véhicule selon la revendication 1, le composant à double fonction étant un amortisseur de gâche, l'amortisseur de gâche (50) comprenant une matière élastomère qui est réalisée de manière à être comprimée entre une plaque arrière (58) et un boîtier (38) du moyen de fermeture lorsque la plaque arrière est fixée au boîtier, l'amortisseur de gâche étant également réalisé de manière à présenter une ouverture (51) réalisée pour engager une gâche (9) lors de son insertion dans une ouverture (110) du moyen de fermeture.

3. Moyen de fermeture de portière de véhicule selon l'une des revendications précédentes, le composant à double fonction étant un ressort de griffe (28) réalisé de manière à fournir une force de sollicitation à la griffe (14) pour un mouvement d'ouverture et à un levier d'entrebâillement (64) pour un mouvement en éloignement d'un commutateur d'entrebâillement de portière (80), le commutateur d'entrebâillement de portière étant réalisé de manière à être activé par le levier d'entrebâillement (64) lorsque la griffe (14) se déplace dans la position fermée, la griffe (14) étant réalisée de manière à présenter une surface de came (128) réalisée de manière à contacter le levier d'entrebâillement lorsque la griffe (14) se déplace dans la position fermée.

4. Moyen de fermeture de portière de véhicule selon l'une des revendications précédentes, le composant à double fonction étant un ressort (54) individuel de verrouillage/déverrouillage qui est réalisé de manière à déplacer une pièce de libération (44) du moyen de fermeture entre une première position dans laquelle la pièce de libération (44) ne contacte pas le moyen de soulèvement de cliquet (36) lorsqu'un levier de libération extérieur (56) est déplacé, et une deuxième position dans laquelle la pièce de libération (44) contacte le moyen de soulèvement de cliquet (36) lorsque le levier de libération extérieur est déplacé, et déplace ainsi le cliquet (16) dans la position libérée, et de manière à déplacer une pièce de verrouillage (62) entre une position de verrouillage dans laquelle le levier de libération intérieur (96) ne contacte pas la pièce de verrouillage (62) et transmet des forces au moyen de soulèvement de cliquet (36) et au cliquet (16), et une position de déverrouillage dans laquelle le levier de libération intérieur (96) contacte la pièce de verrouillage (62) et transmet des forces au moyen de soulèvement de cliquet et au cliquet.

5. Moyen de fermeture de portière de véhicule selon la revendication 4, le composant à double fonction étant un barillet de sécurité enfant (68) qui est monté rotatif sur le moyen de fermeture, le mouvement de rotation du barillet de sécurité enfant contactant la pièce de verrouillage (62) et la déplaçant vers le haut et la détachant ainsi du levier de libération intérieur (96), de sorte que le mouvement du levier de libération intérieur n'est pas transféré au moyen de soulèvement de cliquet (36), grâce à quoi le moyen de fermeture n'est pas déverrouillé et une fonction de verrouillage/déverrouillage de la pièce de verrouillage est également désactivée lorsque le barillet de sécurité enfant (62) est tourné dans la position « enfant activé ».

6. Moyen de fermeture de portière de véhicule selon la revendication 4, la pièce de libération (44) et le levier de libération extérieur (56) étant aptes à être utilisés tant dans un moyen de fermeture droit que dans un moyen de fermeture gauche.

7. Moyen de fermeture de portière de véhicule selon l'une des revendications précédentes, le composant à double fonction étant un levier de clé (42) qui est réalisé de manière à verrouiller ou déverrouiller le moyen de fermeture sur la base d'un mouvement depuis un cylindre de clé externe (43) relié au levier de clé par une tige (45), le levier de clé (42) étant symétrique de chaque côté et étant réalisé de manière à être utilisé dans un moyen de fermeture de portière gauche (LH) ou droit (RH) par une rotation du levier de clé (42) autour de son axe médian.

8. Moyen de fermeture de portière de véhicule selon la revendication 5, le barillet de sécurité enfant (68) étant reçu de manière rotative dans une ouverture (122) d'un boîtier (38) du moyen de fermeture, et l'ouverture étant agencée dans une ouverture (110) en bouche de poisson dans le boîtier.

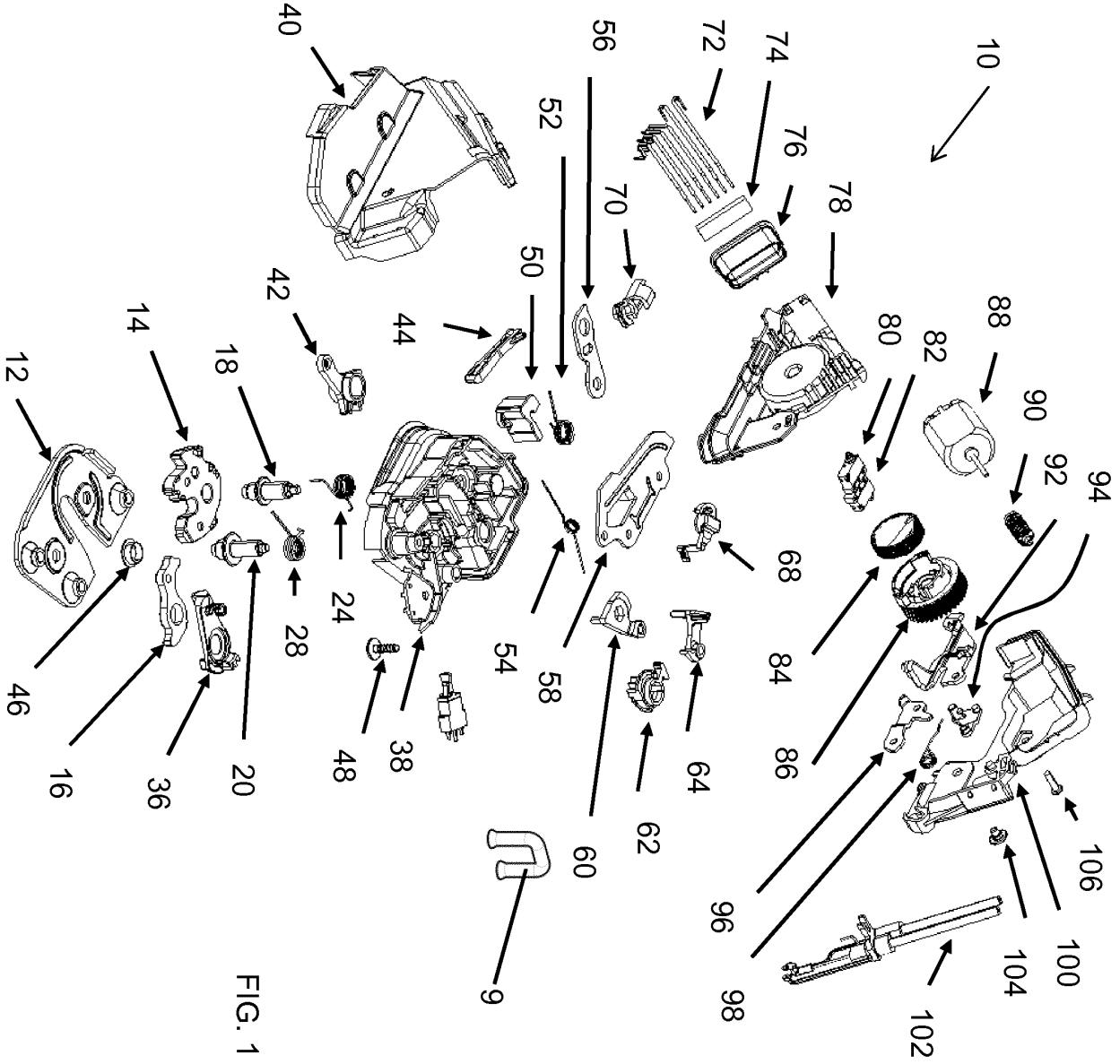

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FIG. 1

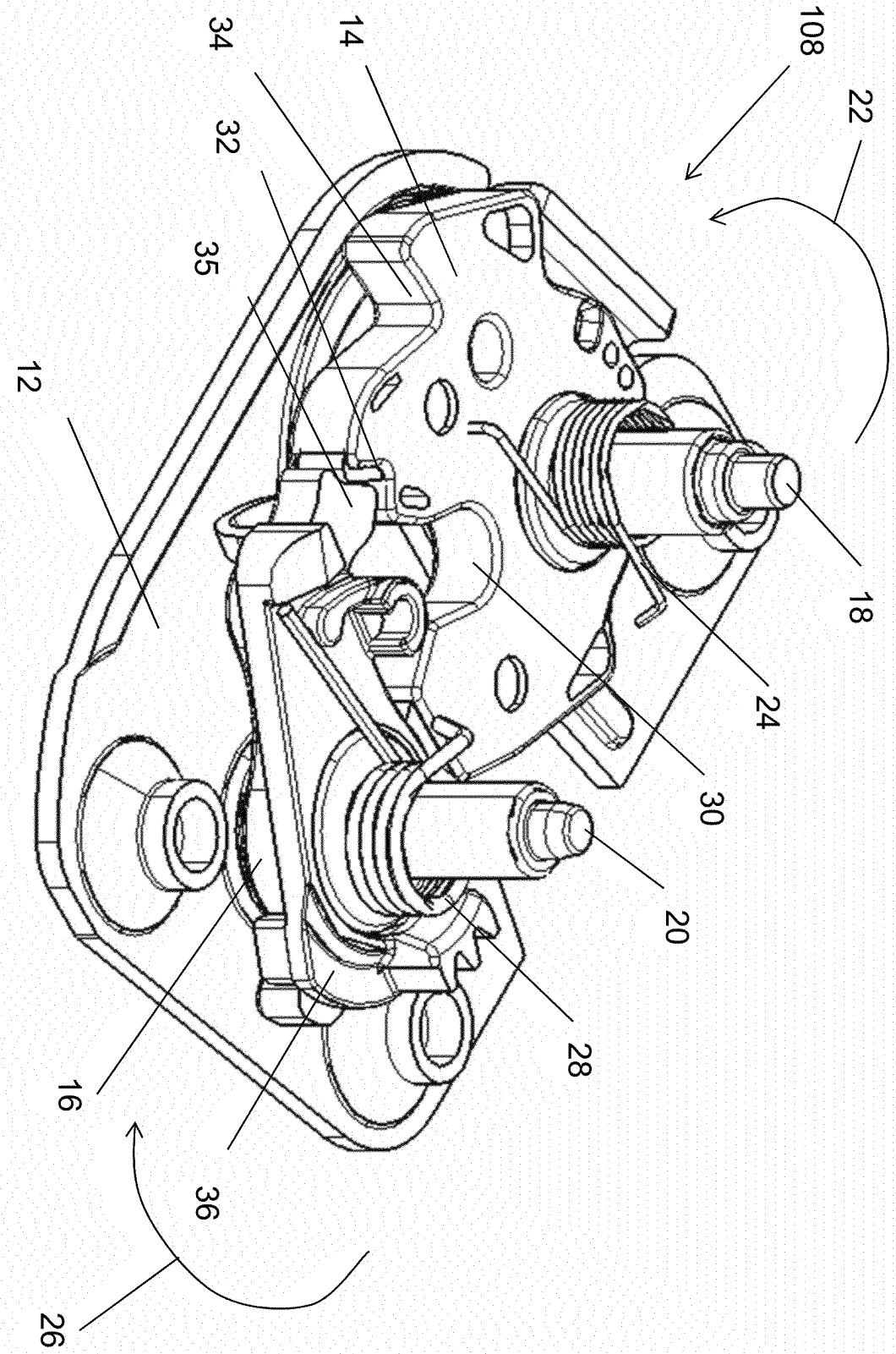


FIG. 2

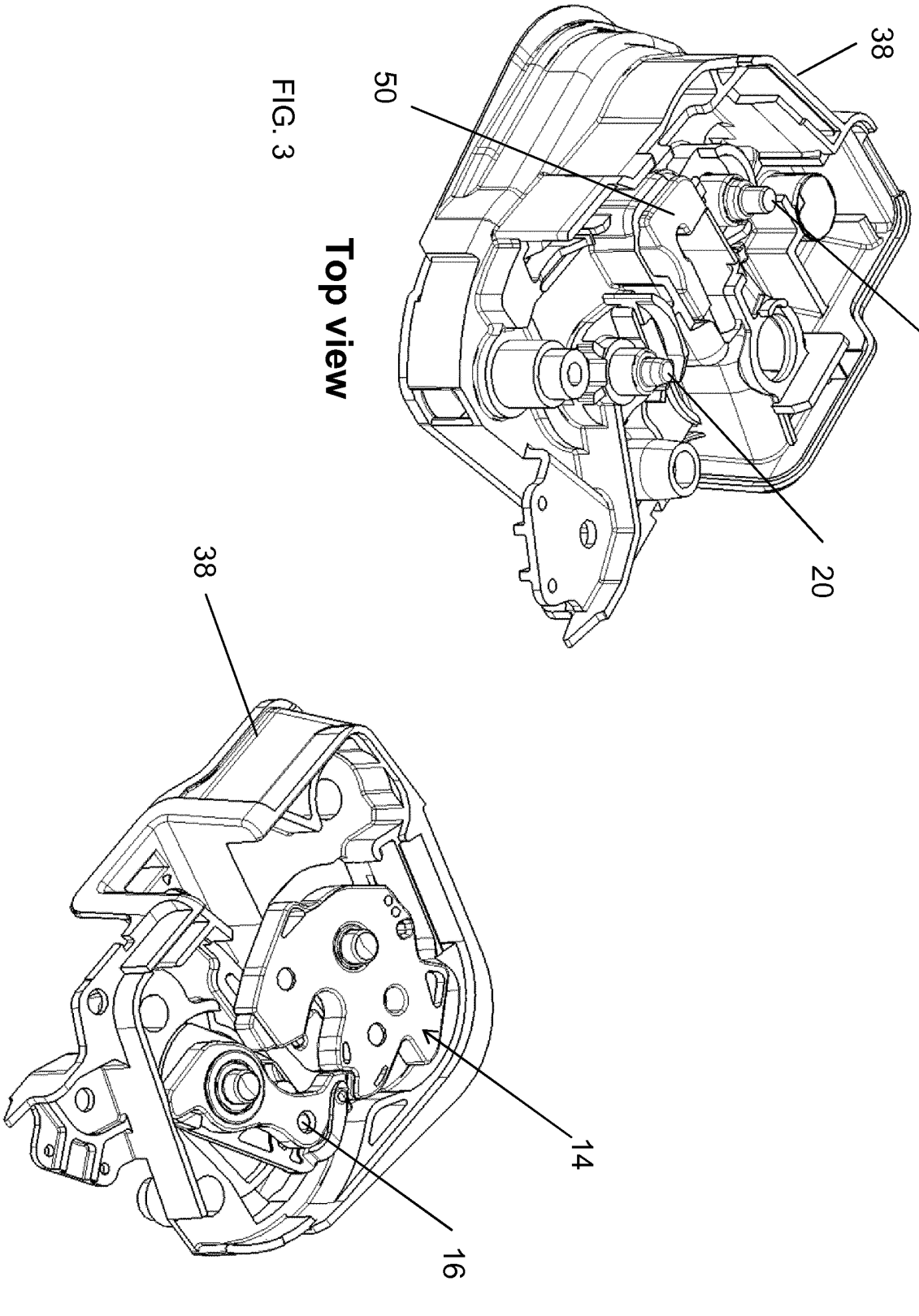


FIG. 3

FIG. 4

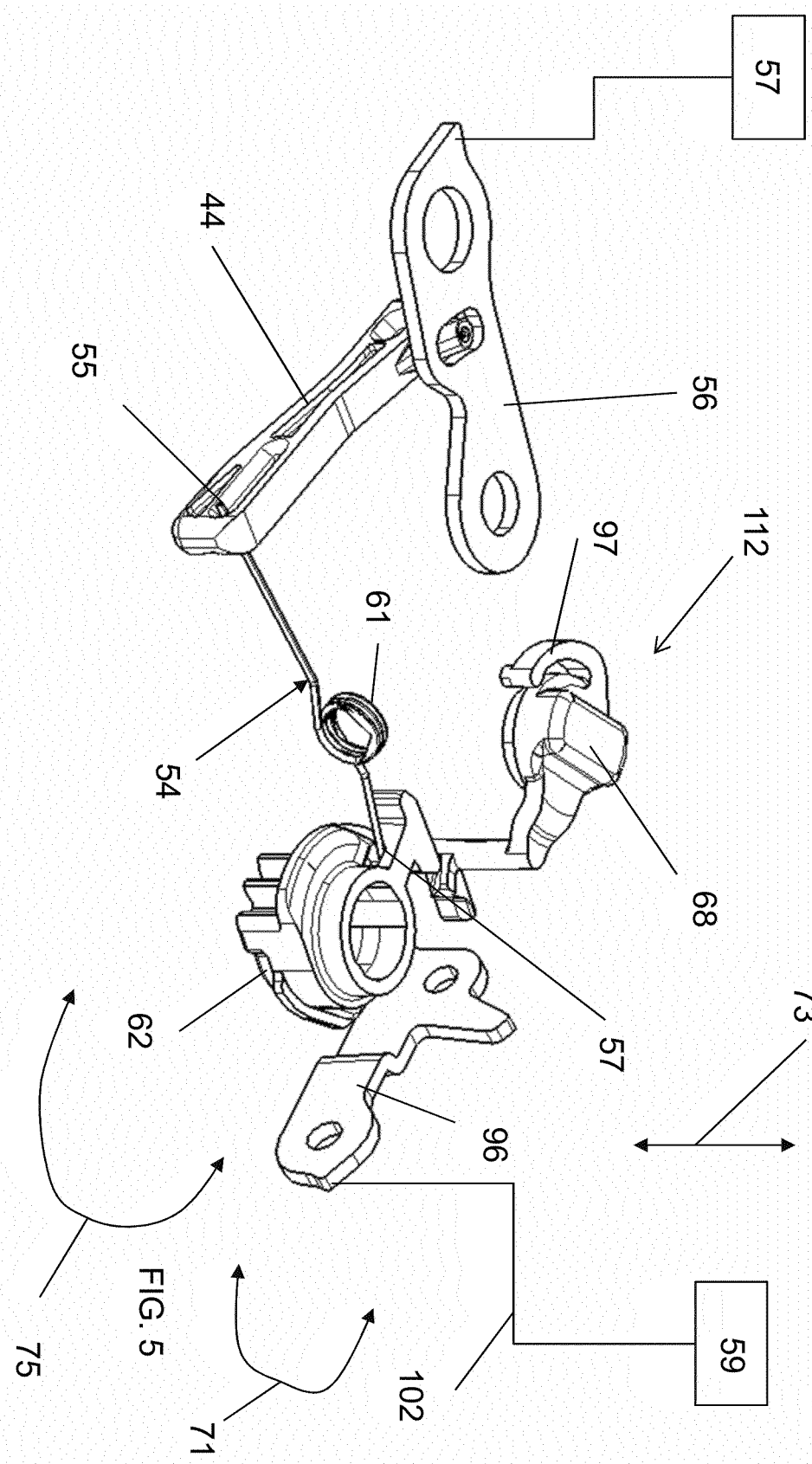


FIG. 5

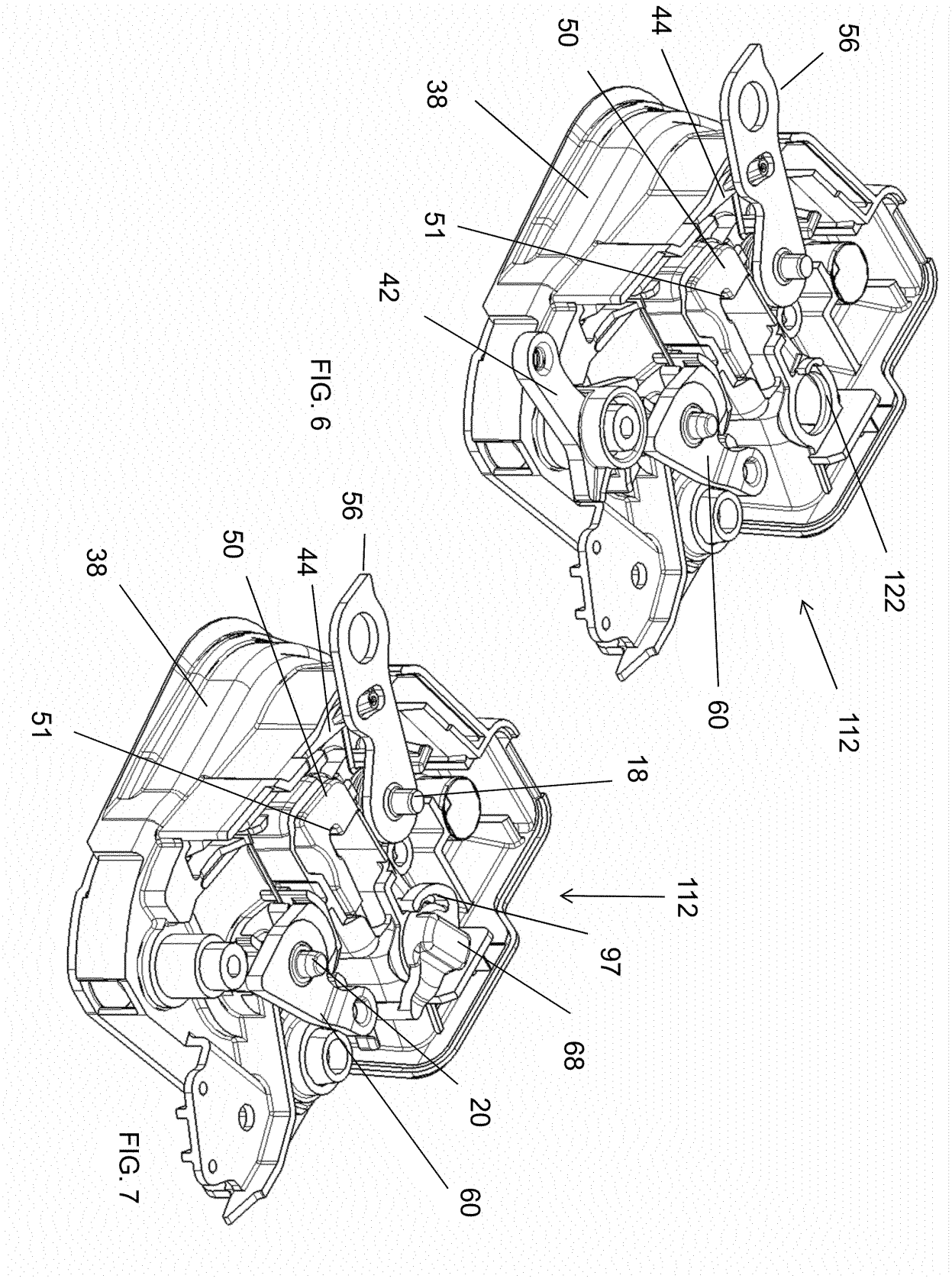


FIG. 6

FIG. 7

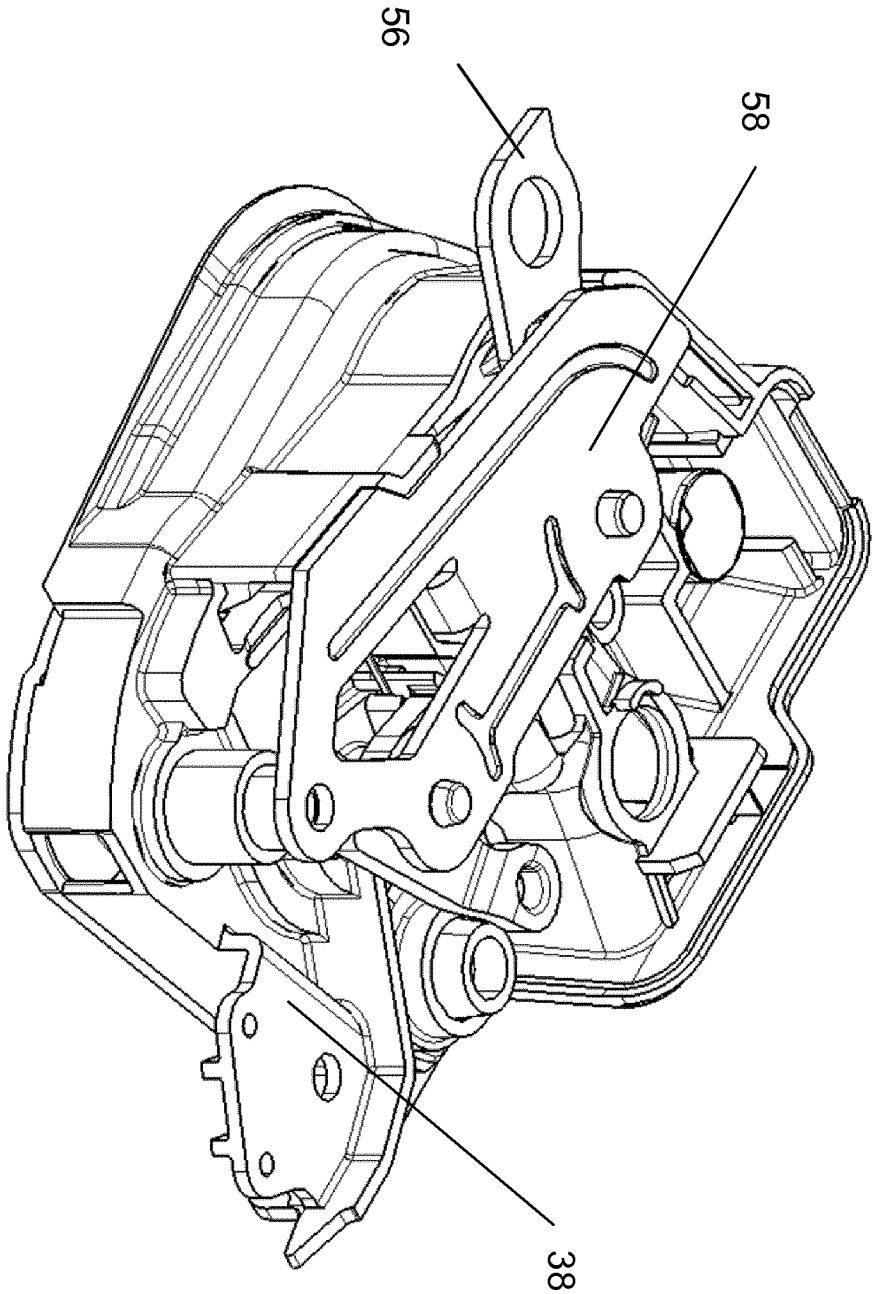


FIG. 8

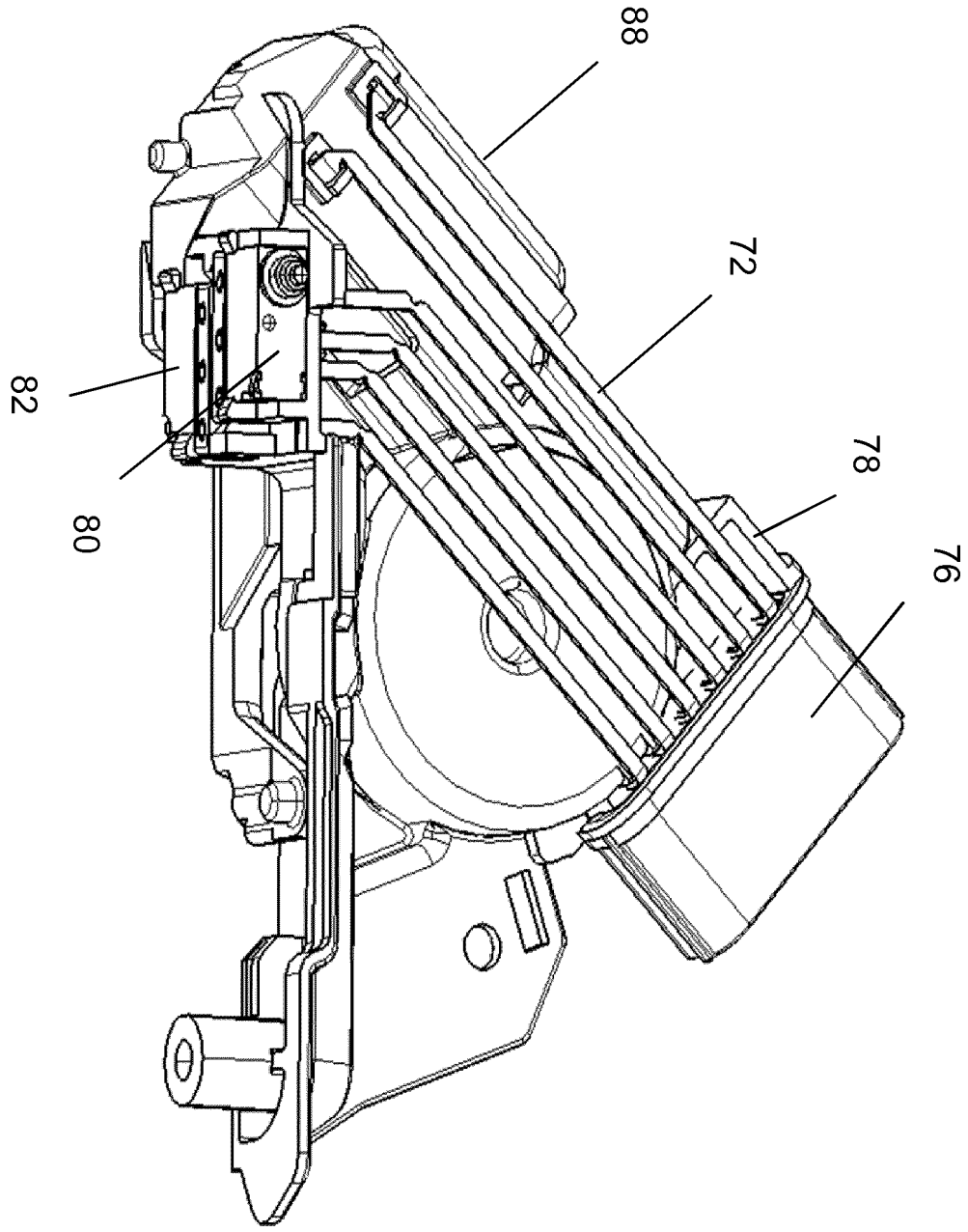


FIG. 9

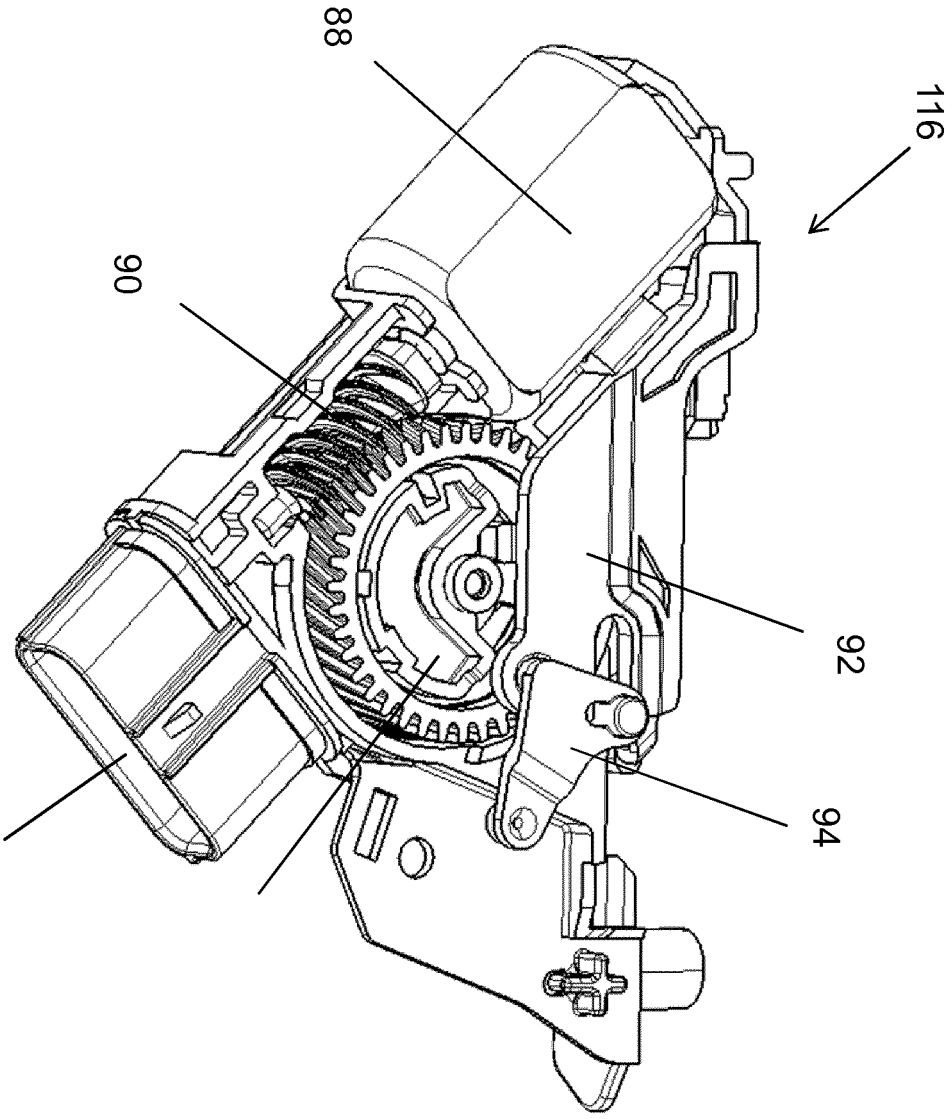


FIG. 10

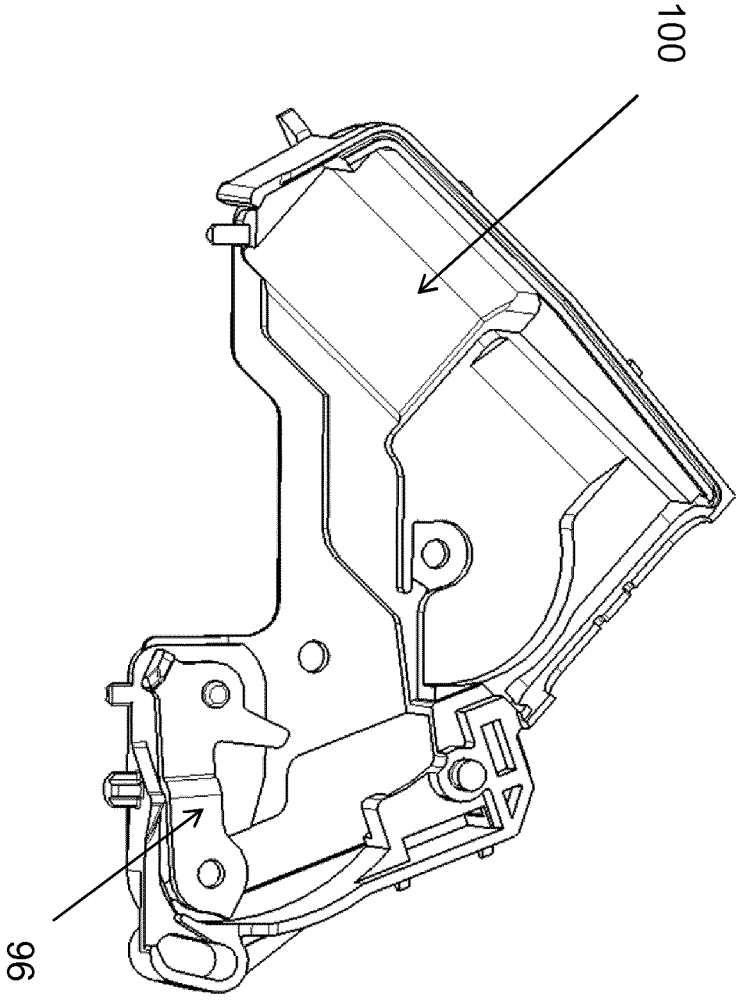


FIG. 11

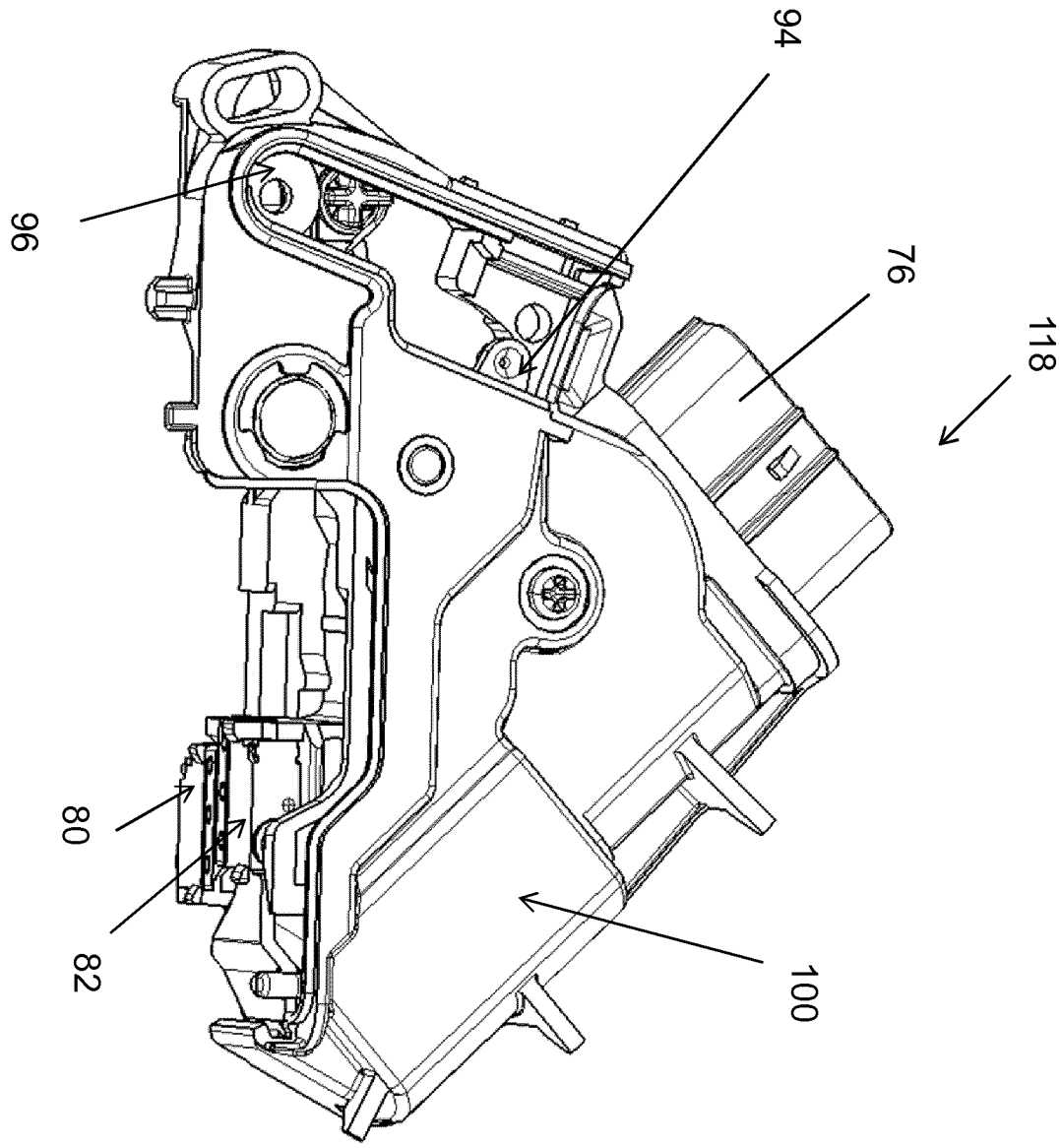


FIG. 12

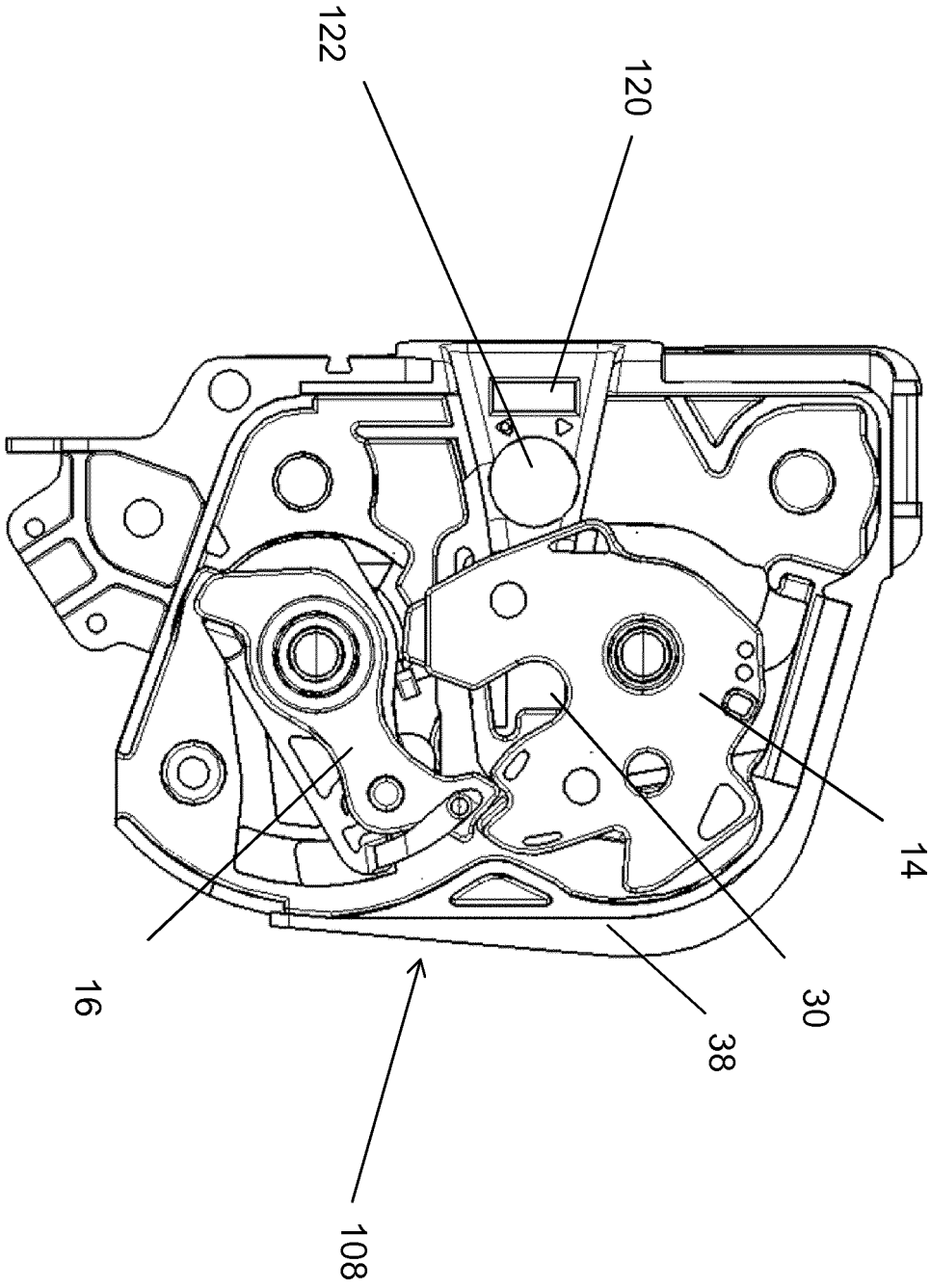


FIG. 13

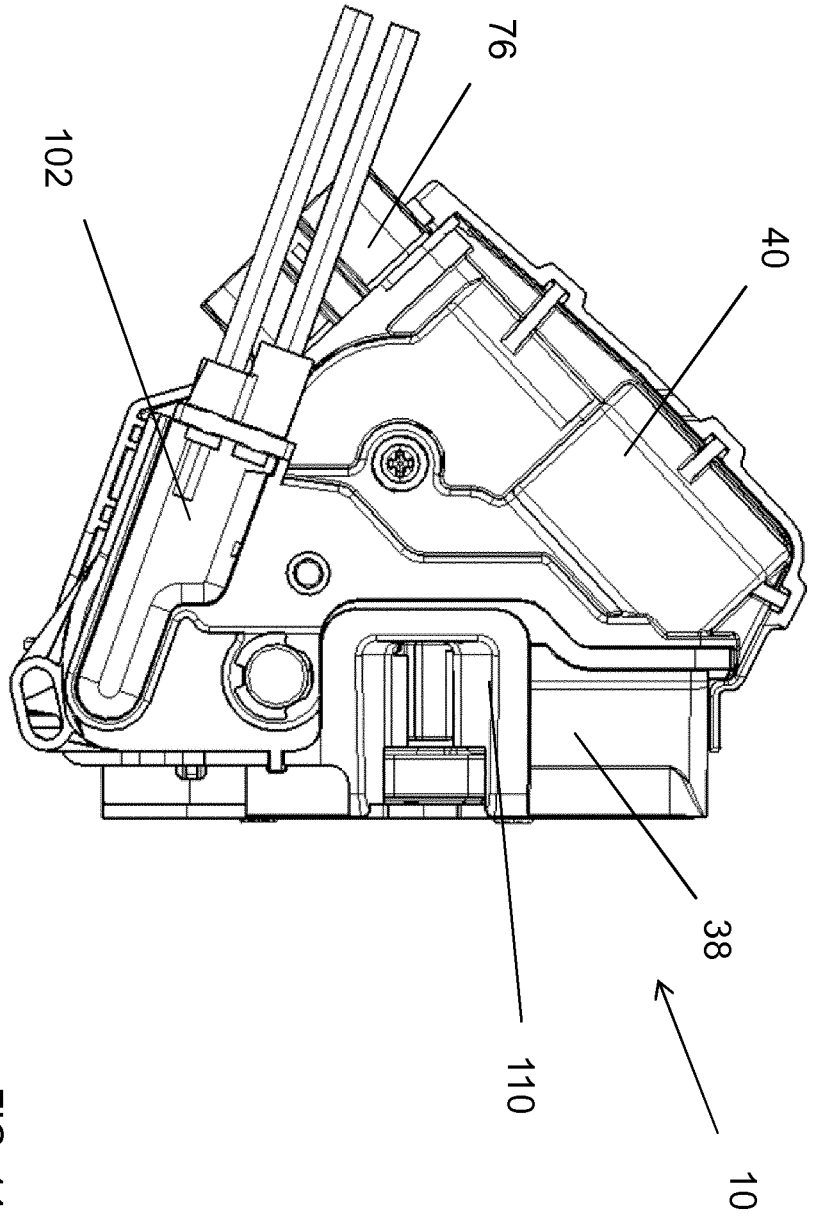


FIG. 14

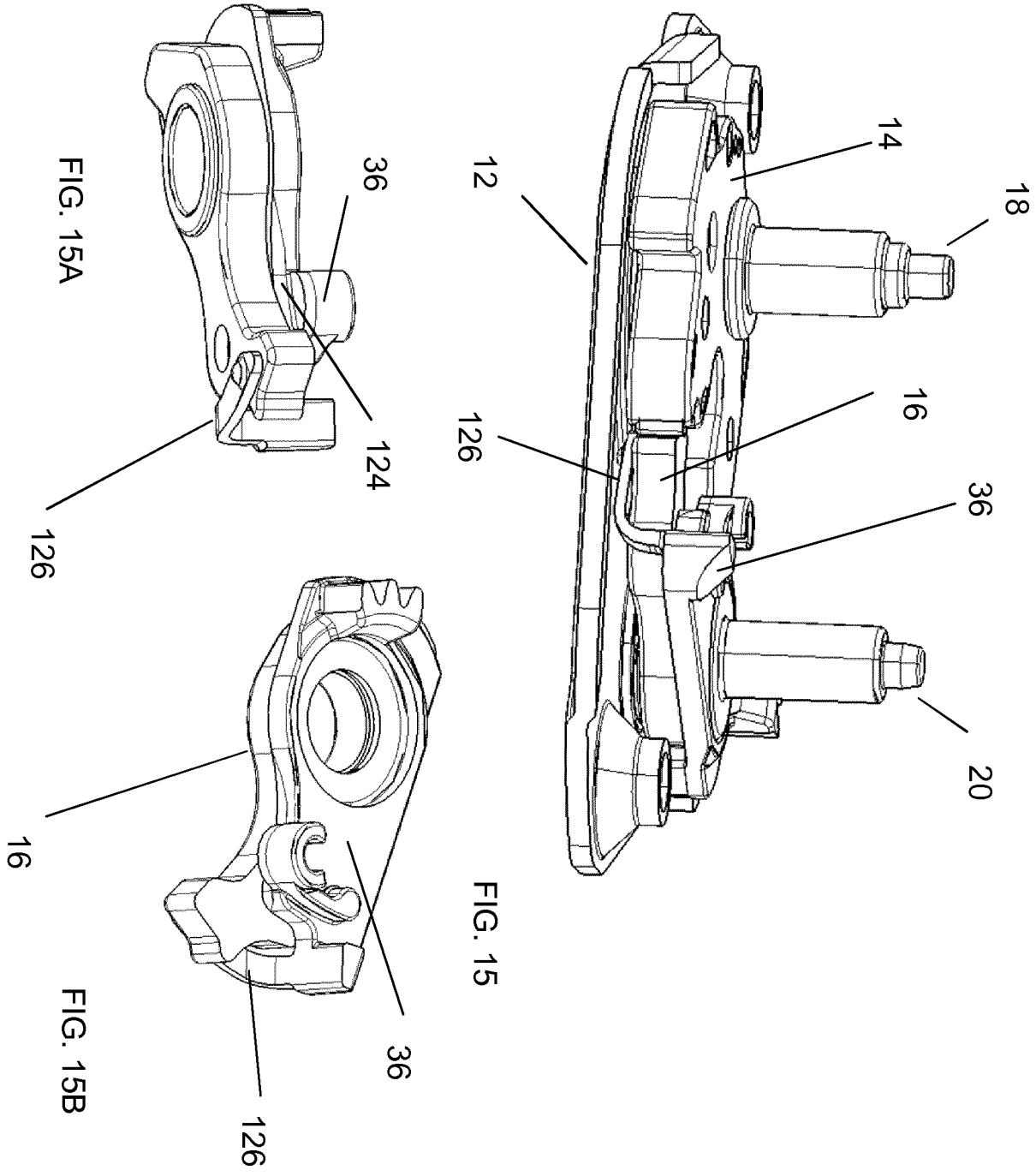


FIG. 15

FIG. 15A

FIG. 15B

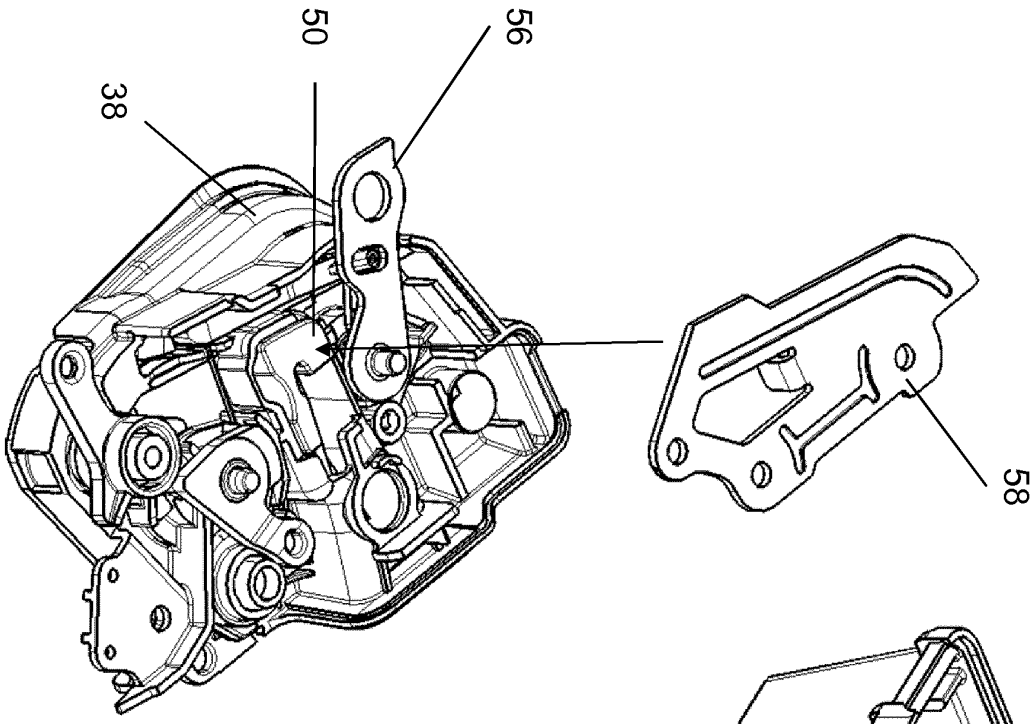


FIG. 16A

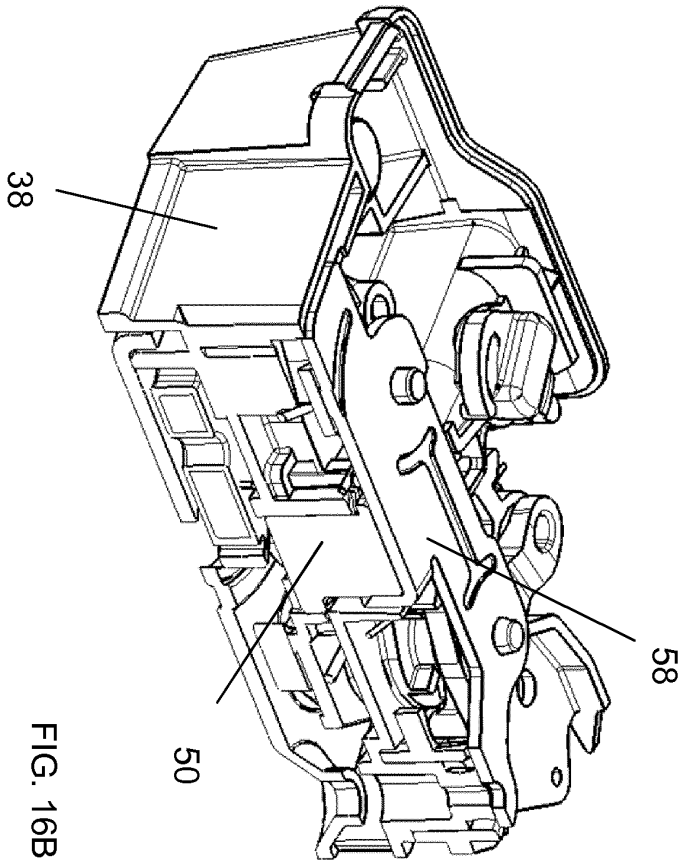


FIG. 16B

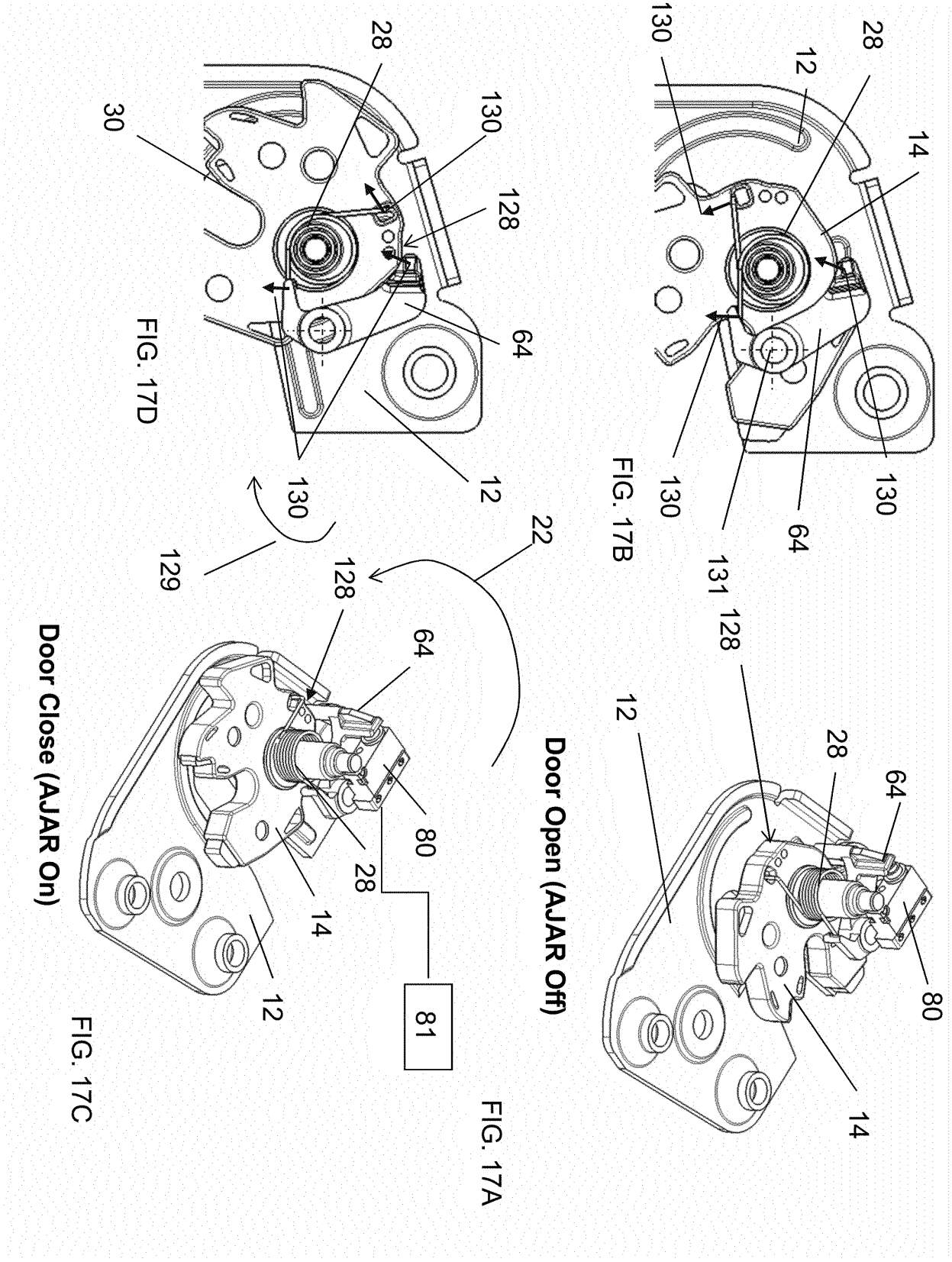


FIG. 17A

FIG. 17B

FIG. 17C

FIG. 17D

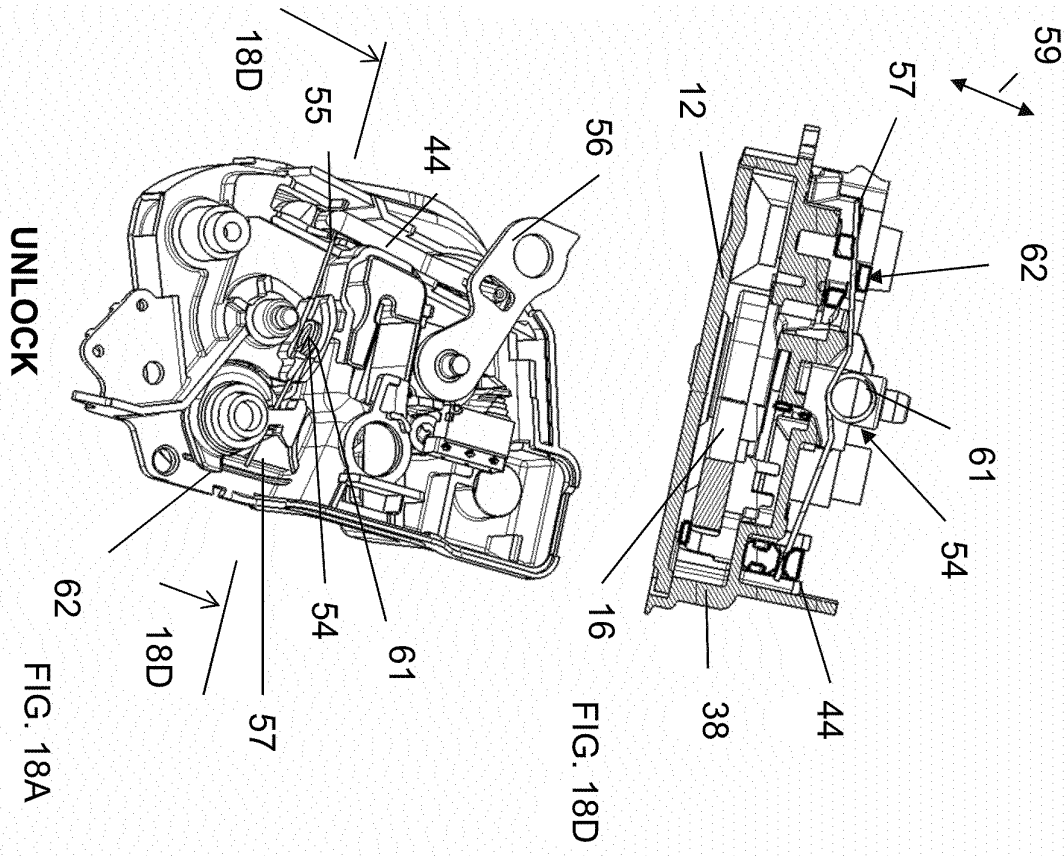


FIG. 18A

FIG. 18D

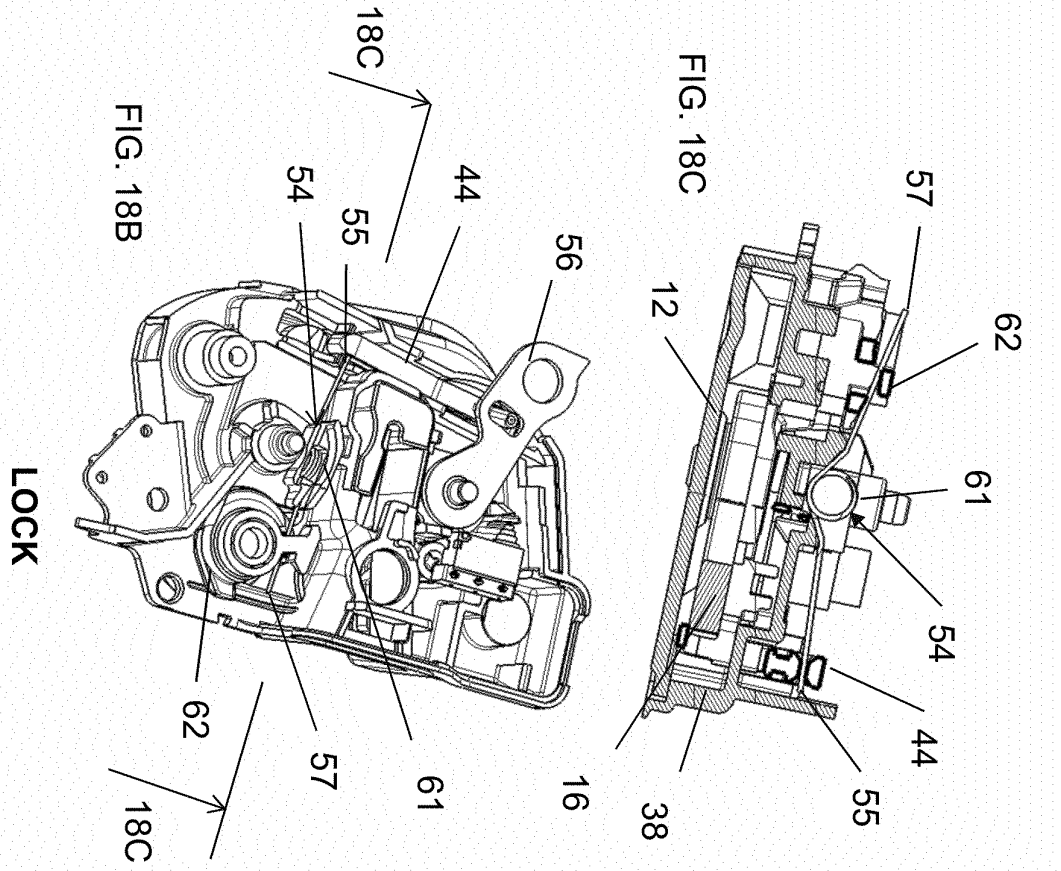
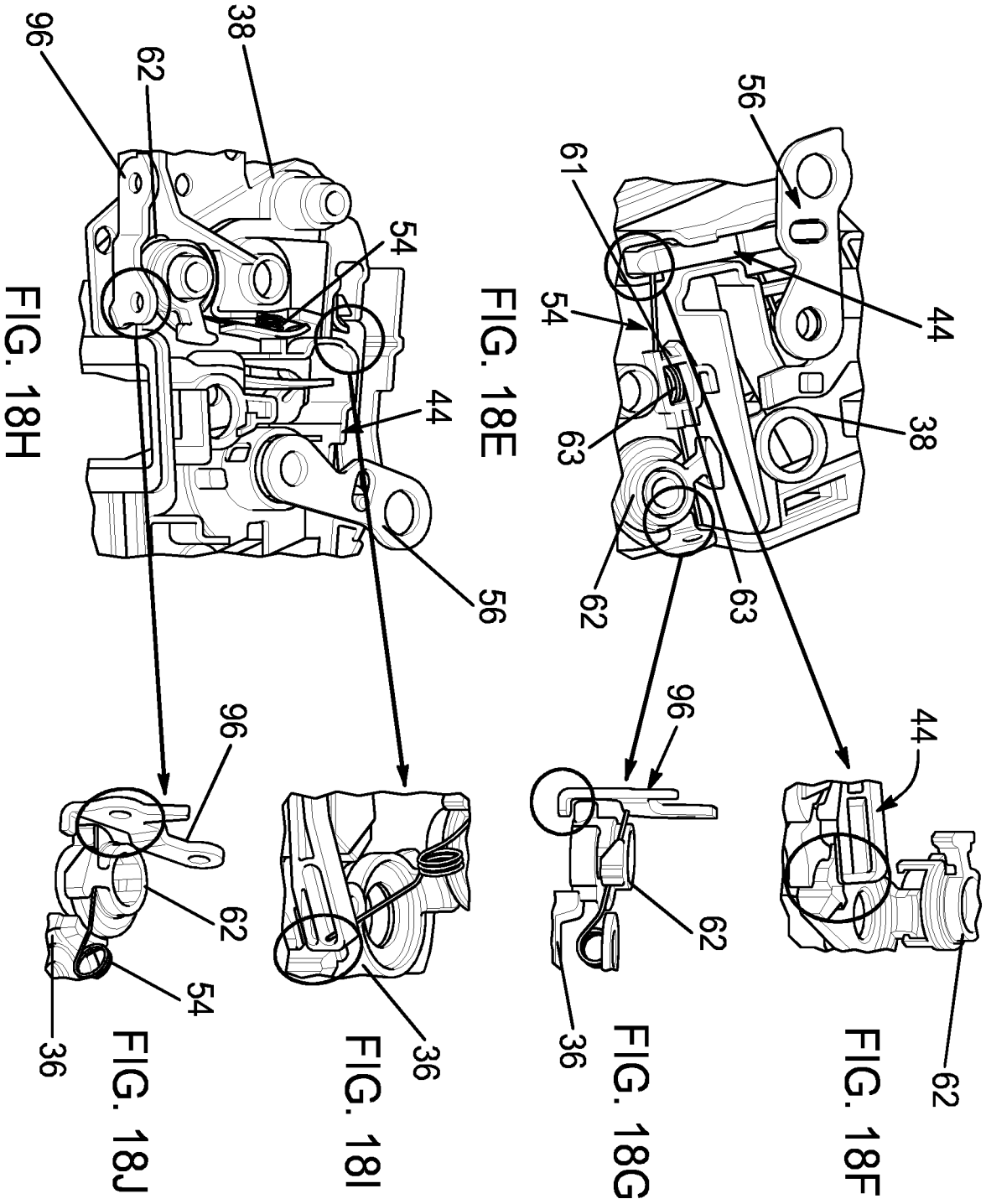


FIG. 18B

FIG. 18C


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FIG. 18E
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FIG. 18F
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FIG. 18G
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FIG. 18J
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FIG. 18I
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FIG. 18H

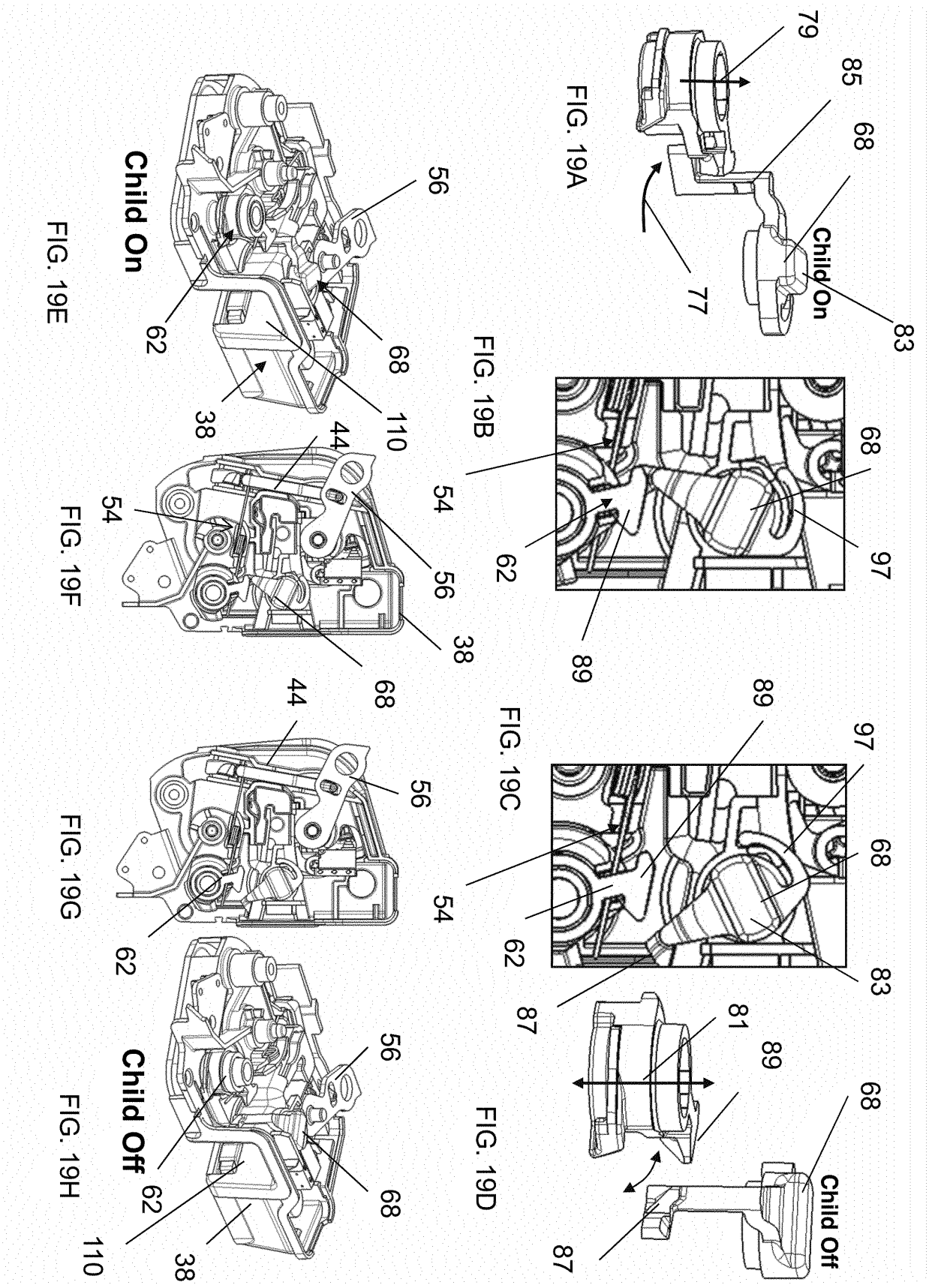


FIG. 19A FIG. 19B FIG. 19C FIG. 19D FIG. 19E FIG. 19F FIG. 19G FIG. 19H

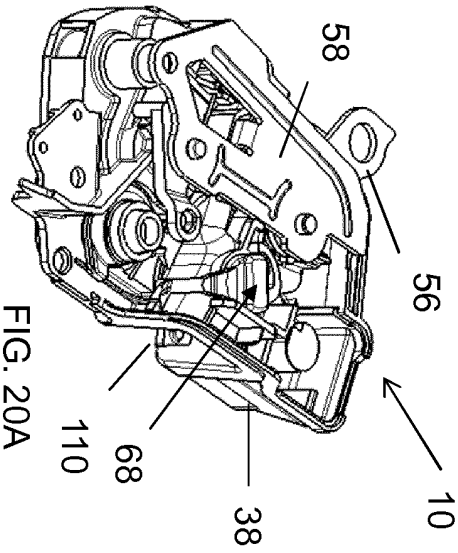


FIG. 20A

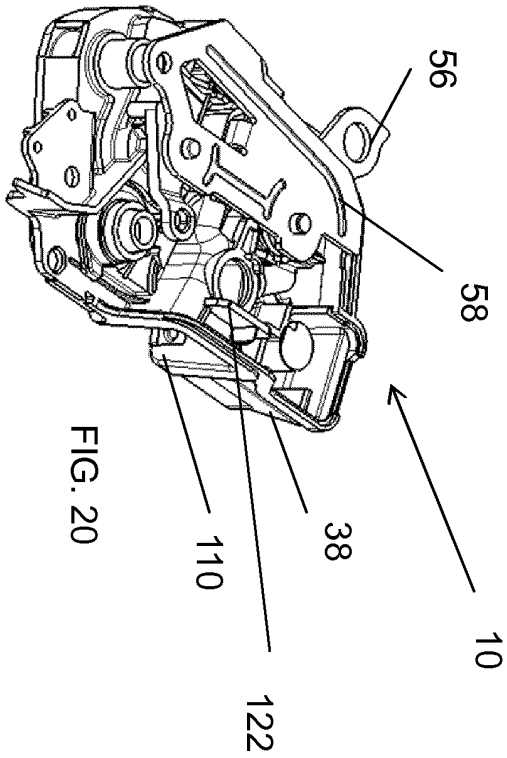


FIG. 20

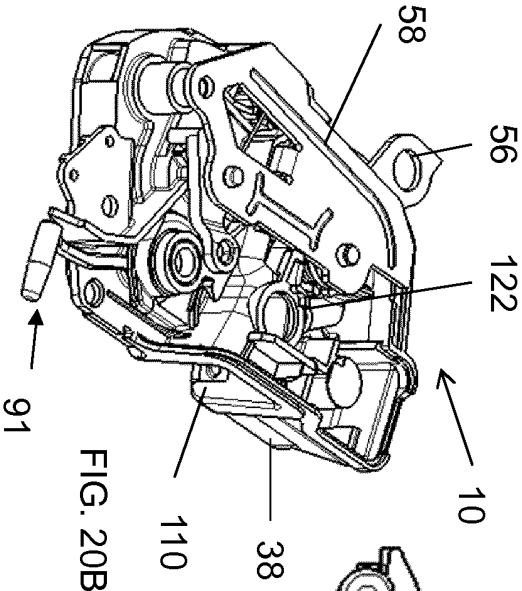


FIG. 20B

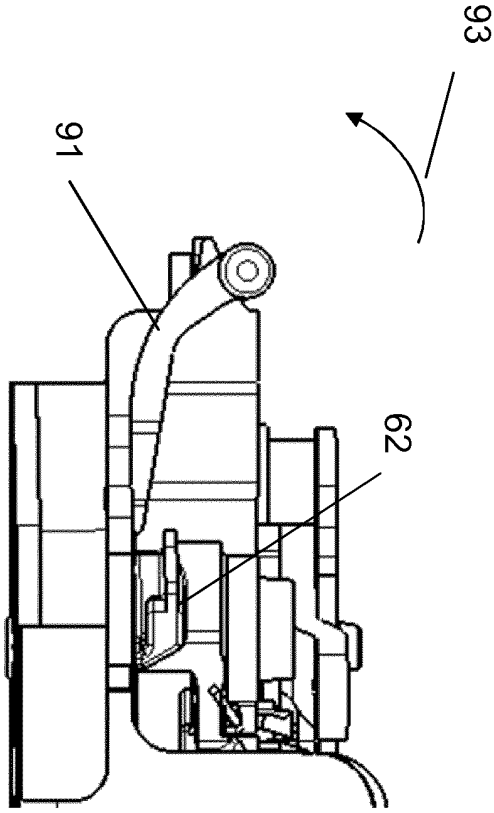


FIG. 20D

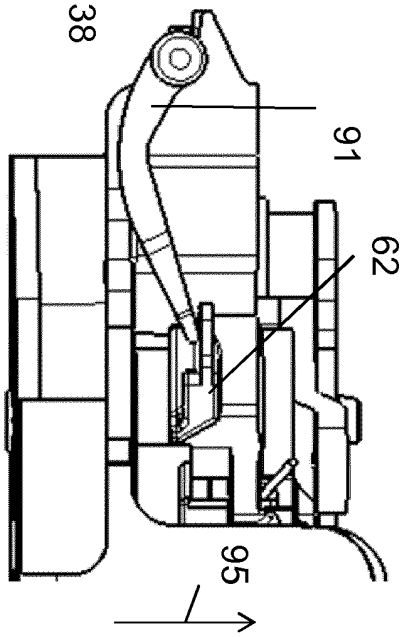


FIG. 20C

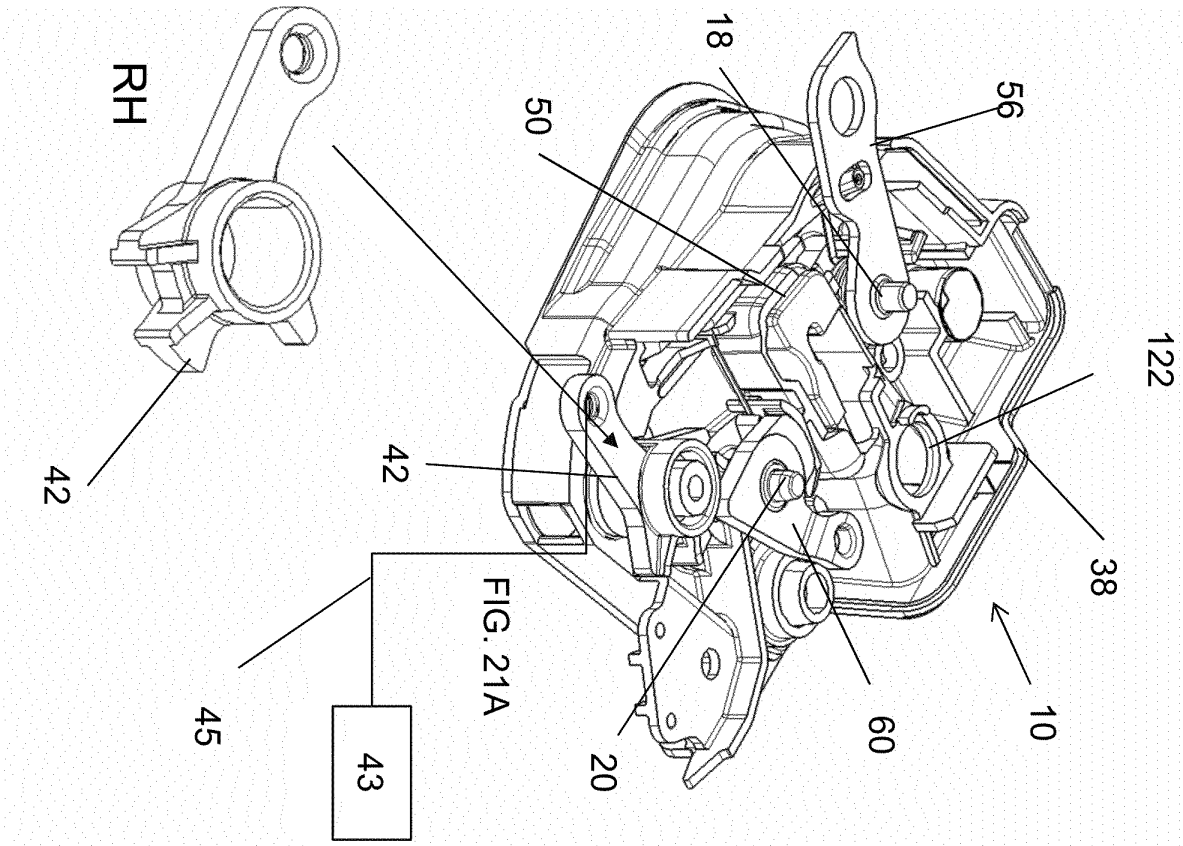


FIG. 21A

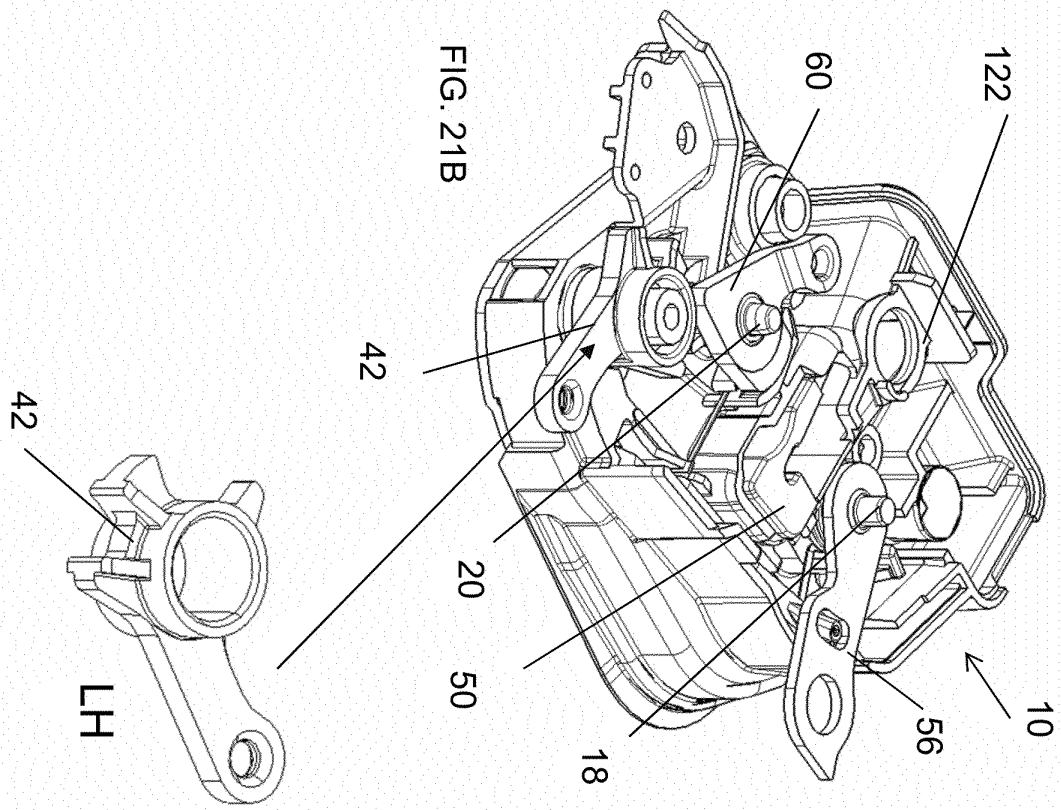


FIG. 21B

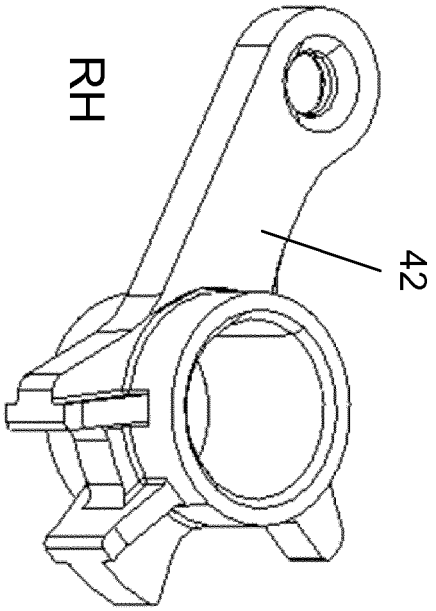


FIG. 22A

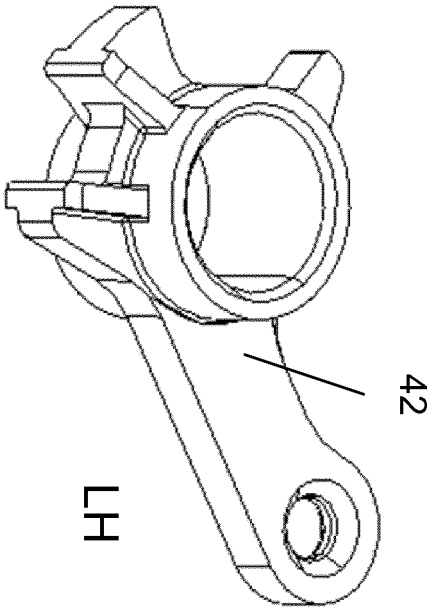


FIG. 22B

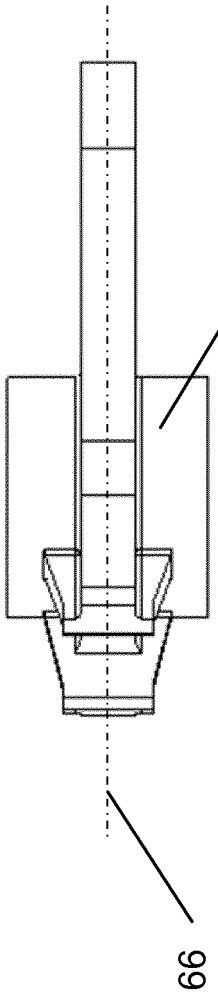
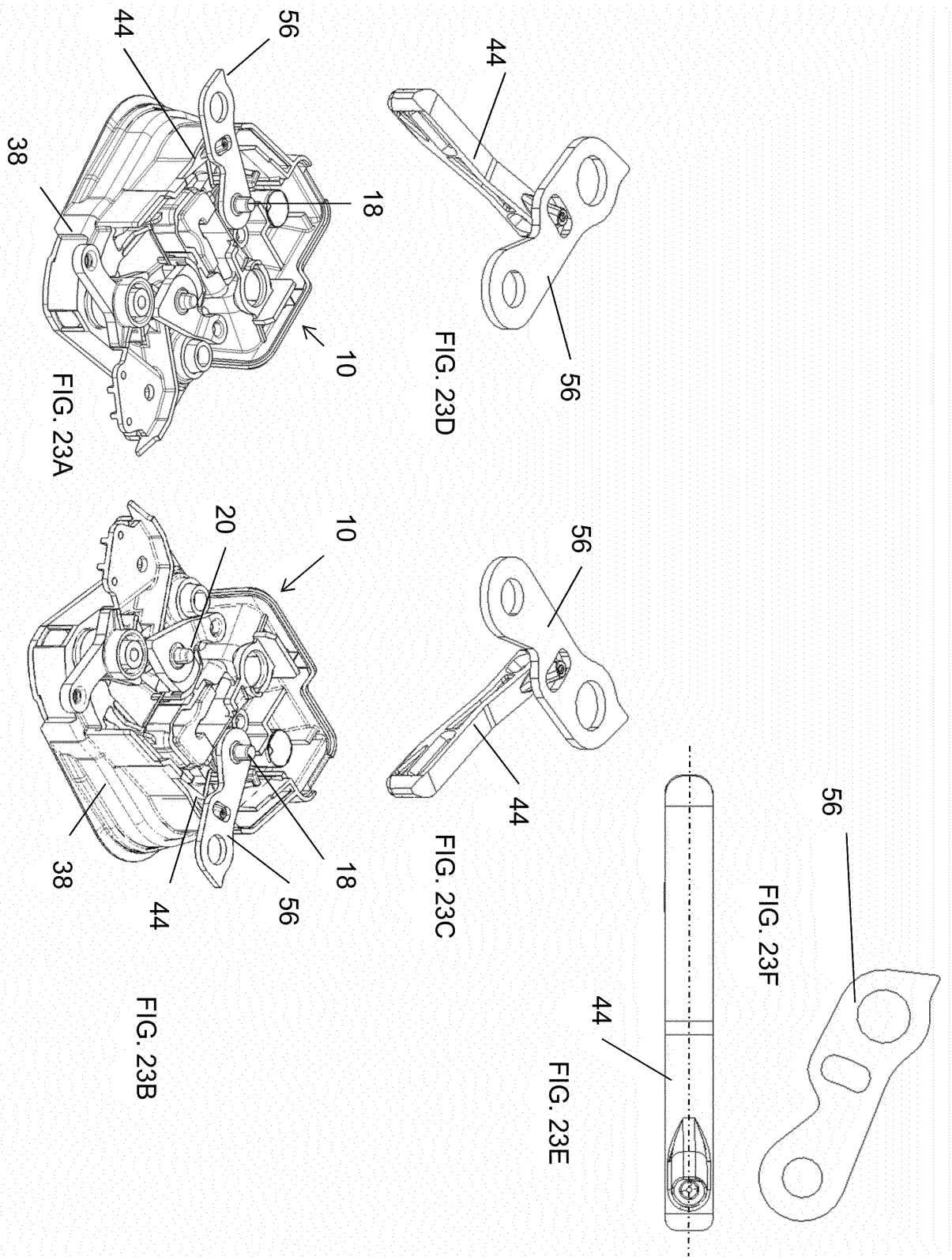
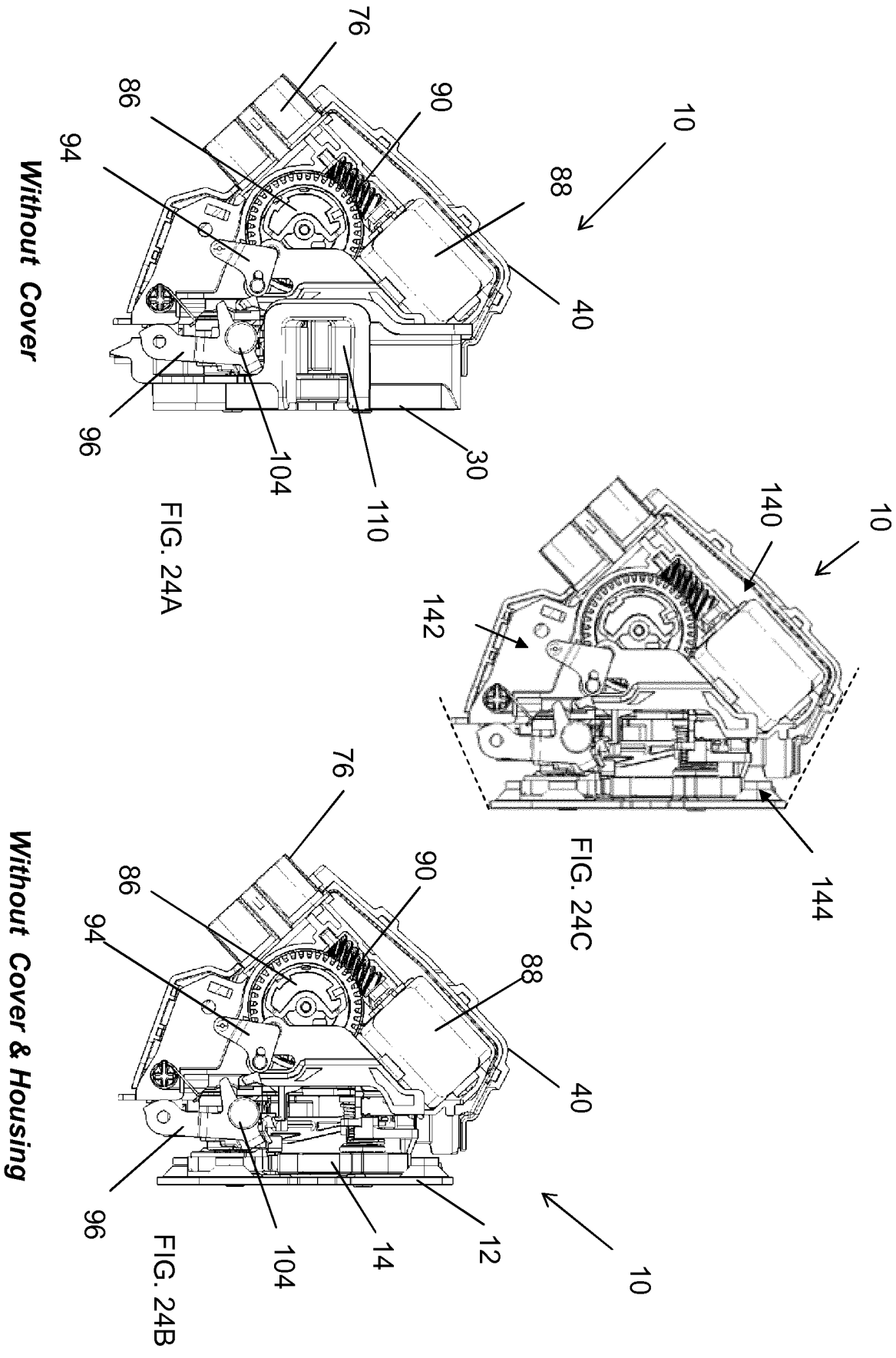


FIG. 22C


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FIG. 23A
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FIG. 23B
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FIG. 23C
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FIG. 23D
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FIG. 23E
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FIG. 23F


Without Cover
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110
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FIG. 24A
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144
FIG. 24C
Without Cover & Housing
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104
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FIG. 24B

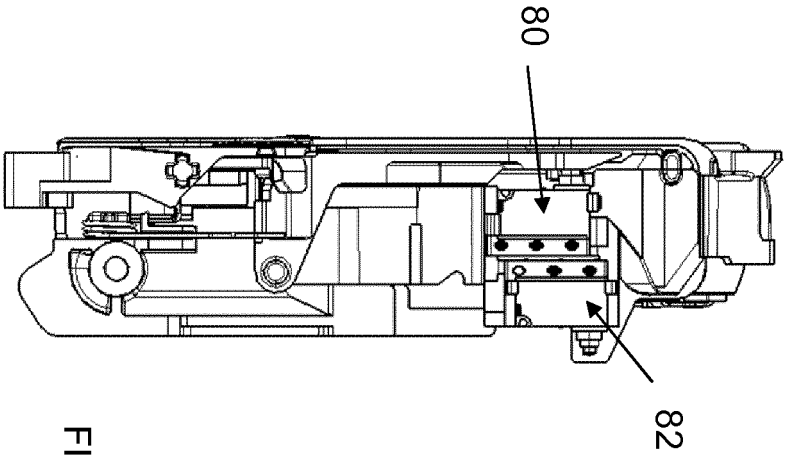


FIG. 25A

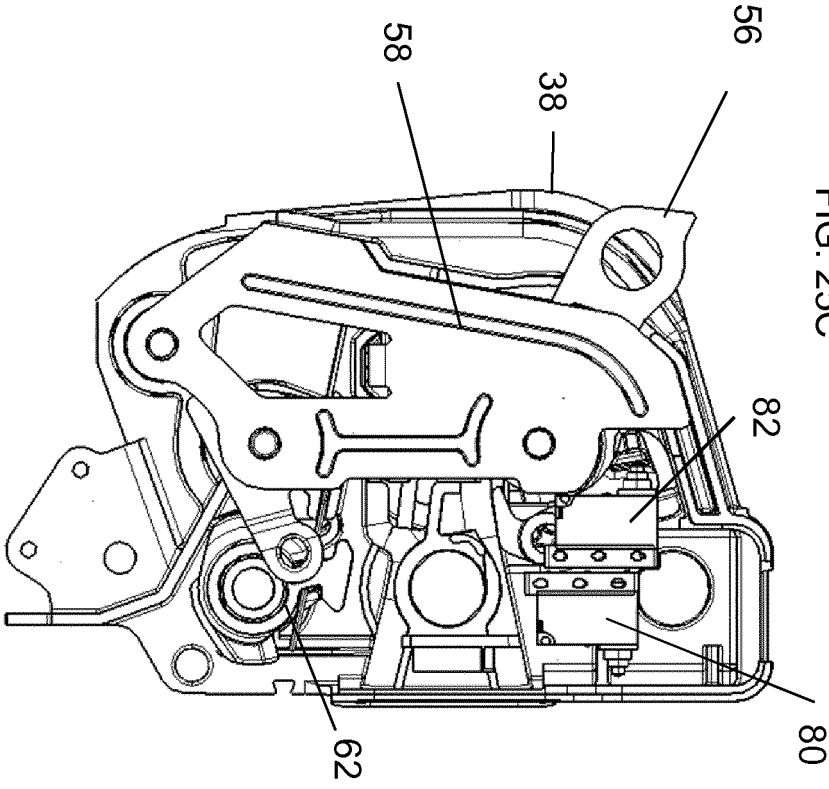


FIG. 25B

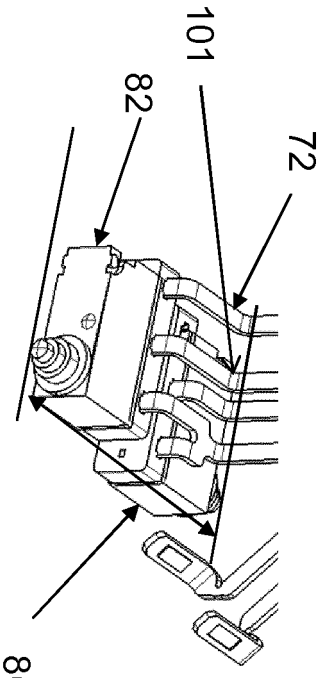


FIG. 25C

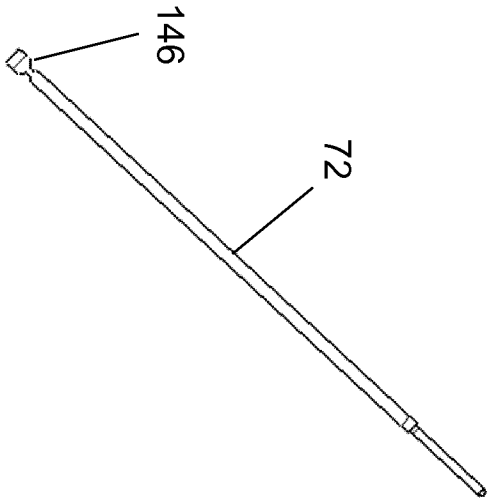


FIG. 26A

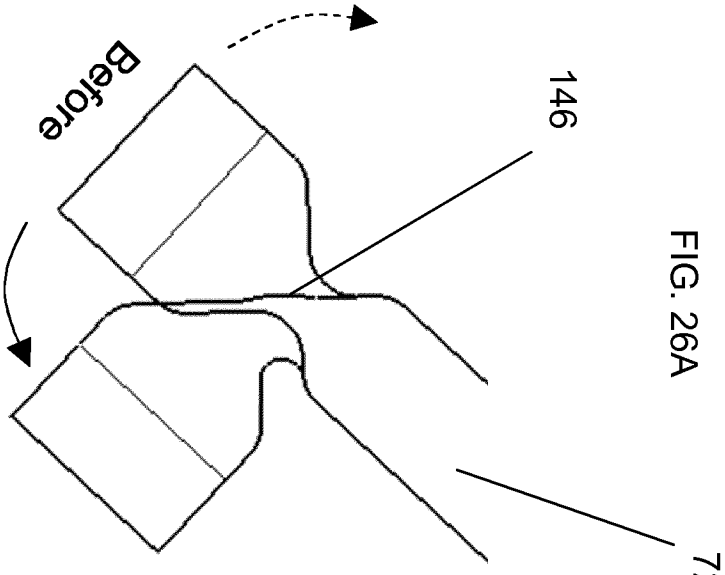


FIG. 26B

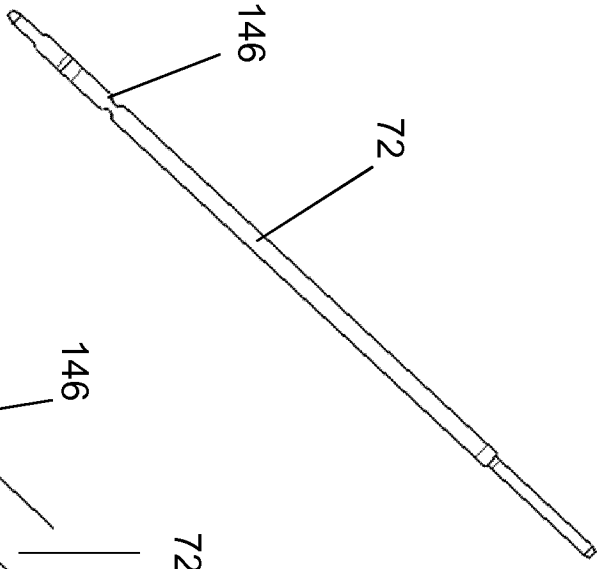


FIG. 27A

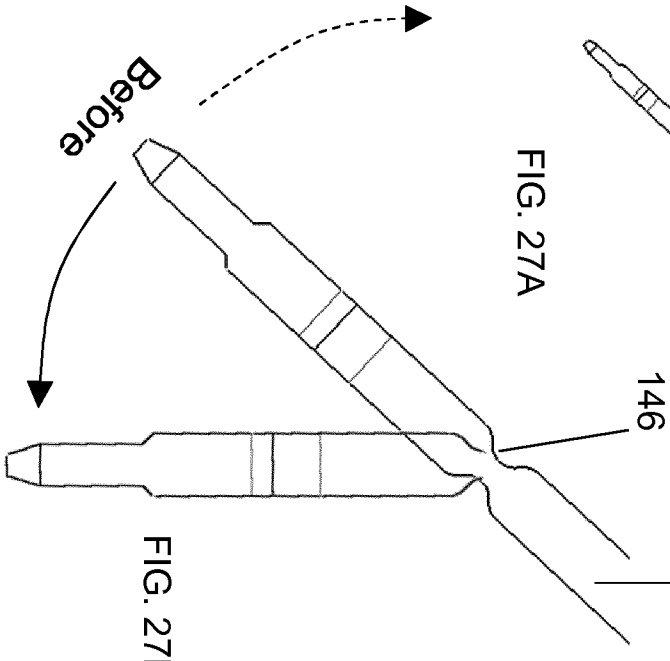


FIG. 27B

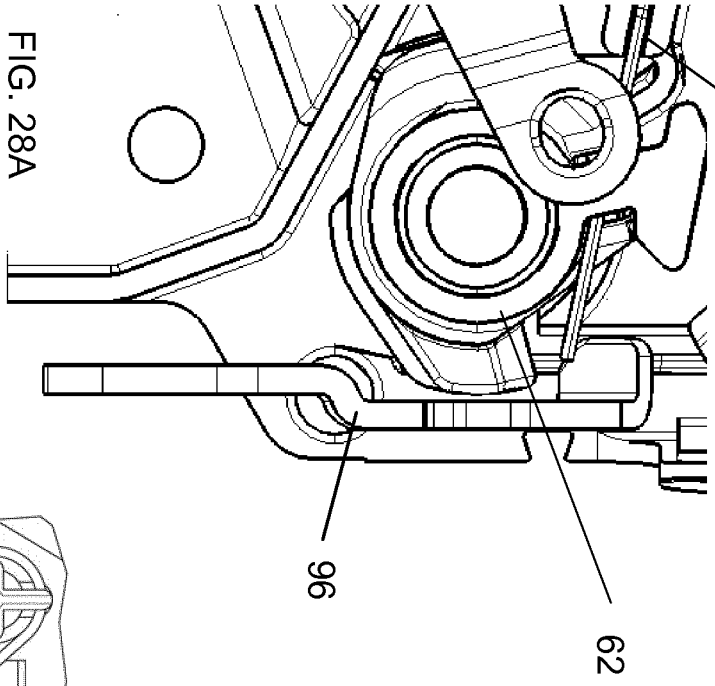


FIG. 28A

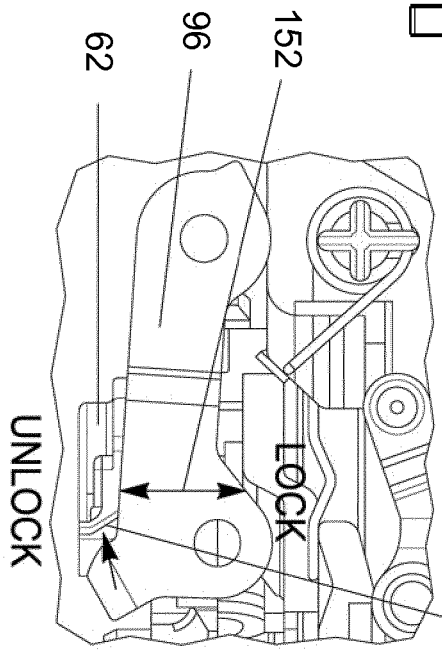


FIG. 28C

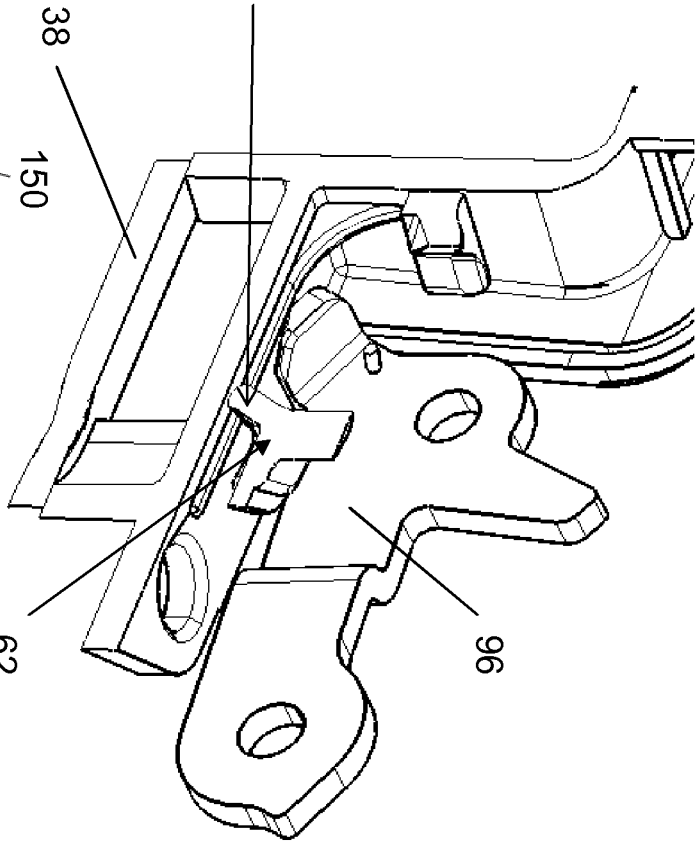


FIG. 28B

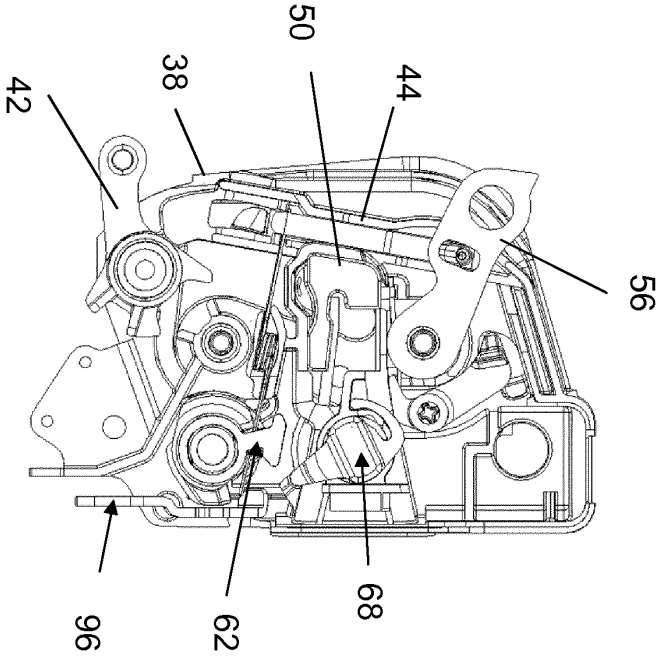


FIG. 29A

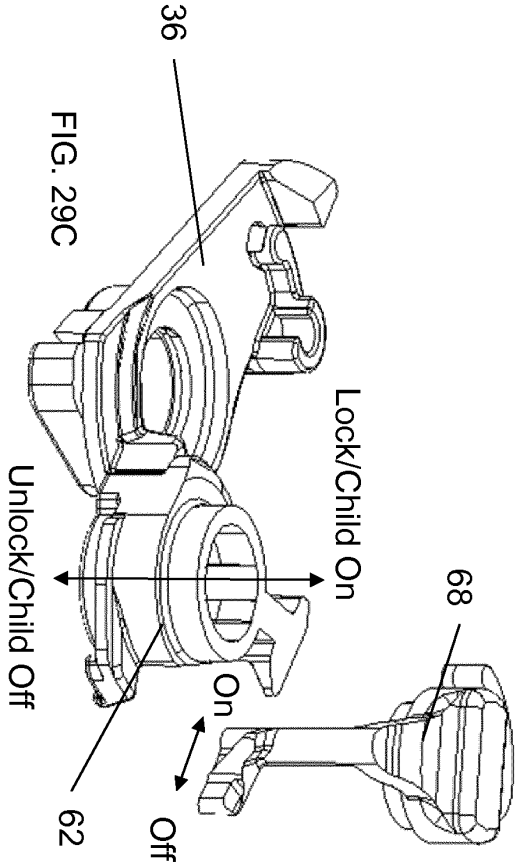


FIG. 29C

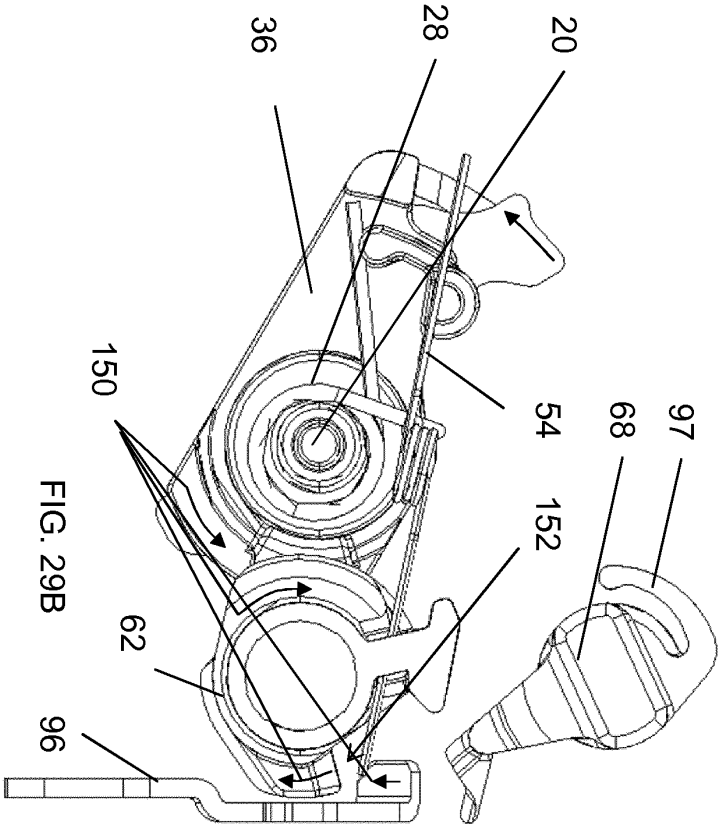


FIG. 29B

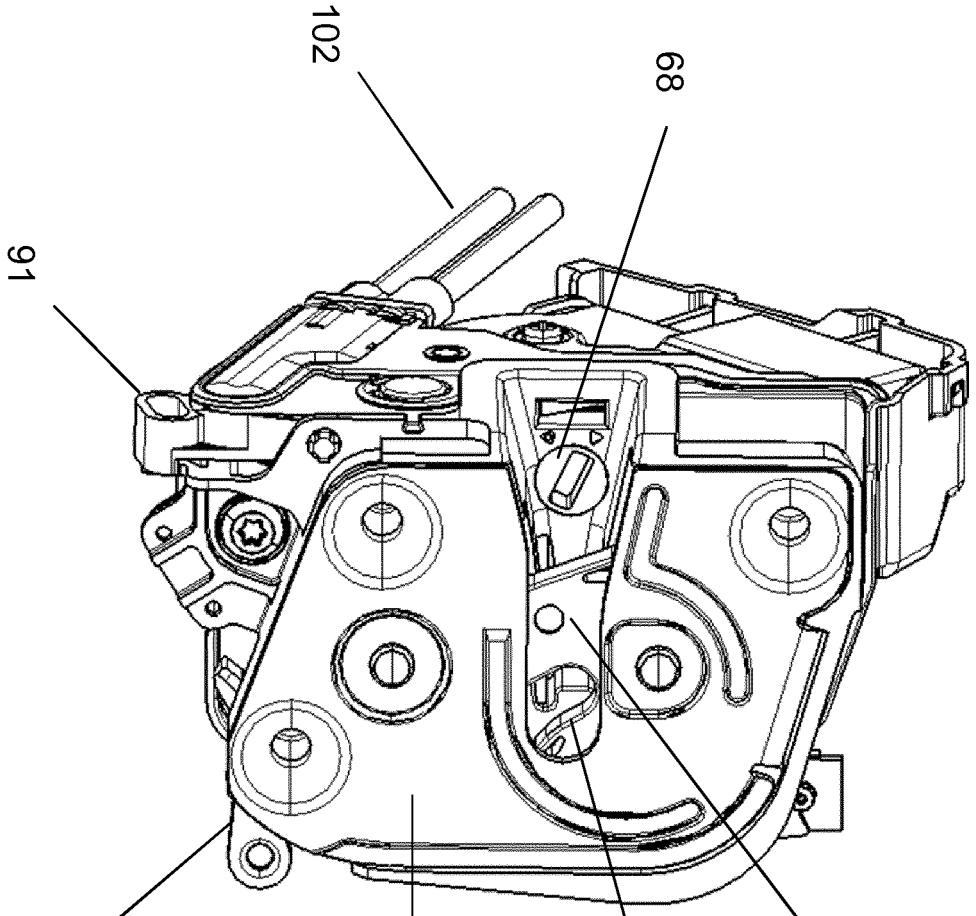


FIG. 30

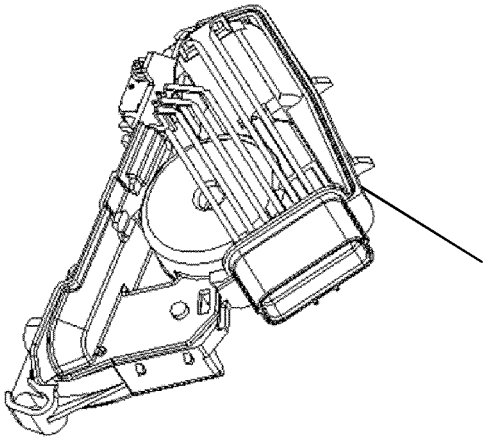


FIG. 31C

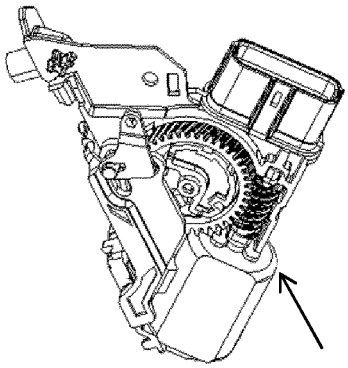


FIG. 31D

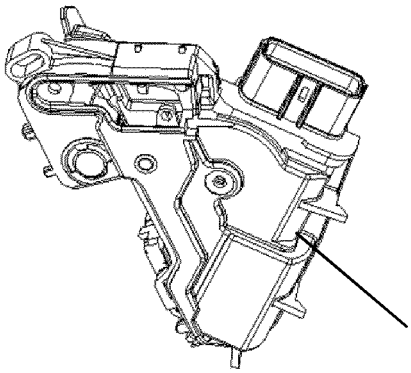


FIG. 31E

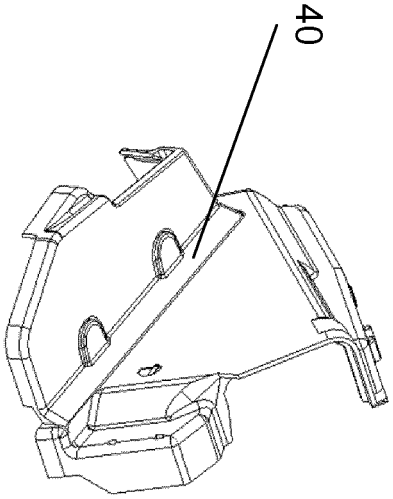


FIG. 31A

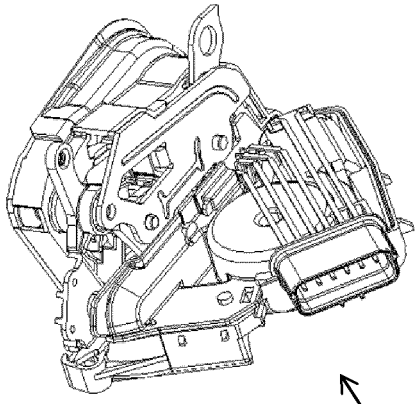


FIG. 31B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0743413 A1 **[0005]**
- WO 2008064234 A2 **[0006]**