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(54) POWER ACTUATOR FOR AUTOMOTIVE CLOSURE LATCH

STELLMOTOR FÜR KRAFTFAHRZEUGVERSCHLUSS

ACTIONNEUR DE SERRURES D'AUTOMOBILES

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Description

FIELD OF THE INVENTION

[0001] This invention generally relates to power actuators for vehicle latches, as for example to a power actuator for releasing a trunk latch or a power actuator for moving a lock lever between a locking and unlocking position.

BACKGROUND OF THE INVENTION

[0002] Cost is an important factor for manufacturing vehicle accessories such as motorized latch release devices. The number of parts which compose a power actuator has a bearing on the cost of the product. Heretofore, known power actuators for automotive closure latches have more parts, and thus likely higher cost, than the present invention.

[0003] US 6,349,983 discloses a device for releasing a latch, as defined in the preamble of claim 1.

[0004] Furthermore, US 5 564 308 discloses a device for releasing a latch, in which the spring for returning the worm gear to its neutral position after the motor being turned off is connected between the worm gear and the housing.

SUMMARY OF THE INVENTION

[0005] A power actuator for automotive closure latches according to the preferred embodiment of the invention has a reduced number of components in comparison to comparable devices currently on the market.

[0006] According to the invention, a power actuator is provided which includes a housing; an electric motor mounted in the housing; a worm operatively coupled to the motor for driving rotation of the worm about an axis in a first rotational direction; a worm gear, in meshing engagement with the worm, and being mounted in the housing for rotation about an axis substantially orthogonal to the worm axis; wherein the worm gear is biased against the rotation in a first direction from a first position to a second position by a spring such that energy is transferred from the motor to the spring as the worm gear rotates from said first position to said second position under control of the motor and, when the motor is powered down, the energy stored in the spring causes the worm gear to rotate in a second direction, opposite to the first direction, from the second position to the first position; and the housing includes a first stop and a second stop; the device further comprising: a camshaft mounted on the worm gear and having a rotation axis coincident with the worm gear axis, the camshaft having a distal end extending to the exterior of the housing; and a cam affixed at the distal end of the camshaft, having a surface for engaging the latch to move the latch from a closed position to a release position as the worm gear rotates in the first direction from the first position to the second position under control of the motor; the housing comprising an injection-molded plastic tubular mount extending into the housing interior, with the worm gear being rotatably mounted thereon; the first and second stops of the housing being unitarily molded therewith; the spring being connected between the worm gear and the housing; and the worm gear including a first stop and a second stop, wherein when the worm gear is in the first position, the first stop of the housing and the first stop of the worm gear are in mutual abutment to preclude rotation in the second direction, and when the worm gear is in the second position, the second stop of the housing and the second stop of the worm gear are in mutual abutment to preclude rotation in the first direction.

[0007] The power actuator may be employed as a latch release device. According to this embodiment, the latch release device includes a housing; an electric motor mounted in the housing; a worm operatively coupled to the motor for driving rotation of the worm about an axis in a first rotational direction; a worm gear, in meshing engagement with the worm, and being mounted in the housing for rotation about an axis substantially orthogonal to the worm axis; a camshaft mounted on the worm gear and having a rotation axis coincident with the worm gear axis, the camshaft having a distal end extending to the exterior of the housing; and a cam affixed at the exterior end of the camshaft, having a surface for engaging a said latch to move the latch from a closed position to a release position as the worm gear rotates in a first direction from a first position to a second position when driven by the motor.

[0008] In a preferred embodiment of the latch release device, the worm has a small diameter worm, efficient for the overall size of the device. The combination of an output cam with a gear reduction stage results in high overall force output as well.

[0009] In the embodiment of the latch release device according to the invention, the worm gear is biased against the rotation from the first position to the second position. The ability to implement a biasing return spring provides repeatable unidirectional force output, and without such a spring, bi-directional torque/force output.

[0010] In a particular embodiment, the device includes electrically conductive contacts embedded into the housing as the housing is molded from plastic resin, to be in electrical contact with the motor and the same time extending to the exterior of the housing for connection to an electric power supply. The integration of an electrical connector is another example how further functionality without additional components or complexity can be obtained by means of the invention described herein.

[0011] The housing of the latch release device can include an injection-molded closure plate, wherein a hollow portion of the housing and the plate have opposing walls shaped to abut a housing of the motor when the hollow portion and the plate are secured together, and the plate further includes protrusions which extend into the housing interior to abut sides of the motor housing to preclude

movement therepast.

[0012] In another preferred aspect, the closure plate and housing include a plurality of holes in communication with each other and located to permit simultaneous fastening of the housing and closure plate together and fastening of the device adjacent a latch with the cam in operable proximity thereto. This arrangement permits utilization of the same fasteners which mount the unit to a host latch or mechanism to also bind the housing components of the device together. The preferred embodiment thus provides a highly versatile, customizable, compact, low-cost mechanism for power release or locking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Detailed embodiments of the invention are described below with reference to the accompanying drawings in which:

Figure 1a is a perspective view of a motorized latch release device of the present invention installed on an automobile, in a closed position;

Figure 1b is similar to Figure 1 a in which the motorized latch release device is in an open position;

Figure 2 is a partially exploded view taken from a vantage point similar to that of the previous figures, having the cover plate of the latch release device removed and partially exploded to reveal the electric motor and worm gear arrangement of the mechanism;

Figure 3 is a more fully exploded view taken from a vantage point similar to that of the previous figures, to reveal the inner housing, worm gear and spring for biasing the worm gear towards the closed position, and the seating area for the motor;

Figure 4 is a plan type of view of the housing, spring and worm gear with the worm gear in the closed position;

Figure 5 is similar to Figure 4, but with the worm gear fully rotated into the open position shown in Figure 1;

Figure 6 is a perspective view of the exterior of the housing opposite of that shown in Figure 1;

Figure 7 is perspective view from a vantage point similar to that of Figure 6, partially exploded to show the motor and cover plate;

Figure 8 is a top plan view of the device, as oriented in Figure 1;

Figure 9 is a bottom plan view of the device, as oriented in Figure 1;

Figure 10 is a right end view elevation of the device, as oriented in Figure 1;

Figure 11 is a left end view elevation of the device, as oriented in Figure 1;

Figure 12 is a rear elevation of the device, as oriented in Figure 1;

Figure 13 is a plan view of the worm gear, as viewed from the left of Figure 7; and

Figure 14 is a sectional elevation of the worm gear showing the cam installed therewith.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Turning to the drawings, a motorized latch release device **20** of the present invention is shown generally in Figures 1 a and 1 b. In the figures, the device is shown installed on an automobile to permit remote-controlled trunk release by a driver. As illustrated in Figure 1a, the trunk is in the closed and locked position. Latch **22,** part of a conventional trunk locking mechanism, is biased in the clockwise direction. Generally speaking, device **20** operates through rotation of an output cam **28** from a closed position shown in Figure 1 a to an open position shown in Figure 1b. This counterclockwise rotation (as viewed in Figures 1 a and 1 b) forces latch **22** rightward from its closed position into a release position, as illustrated by the latch positioned in Figure 1 b. The output cam **28** automatically rotates back to the closed position of Figure 1 a after reaching the fully open position. A detailed description of device **20** and its operation is given below.

[0015] As shown in Figures 2 and 3, the device includes a hollow housing **30** and a closure plate **32.** Each of these members is injection-molded as single piece of plastic in a one-step process. Integrally molded as part of the housing and affixed within the plastic are electrical connectors, described further below, for connecting an electrical motor **34** of the device to an external power supply. The housing and closure are composed of a suitable plastic, in this case a glass and mineral-reinforced nylon resin. The polymers are generally selected for high strength and stiffness, dimensional stability and resistance to temperature extremes.

As can be seen in Figures 2 and 3, the electric motor **34** includes an output shaft **36** which drives a worm **38** mounted to the external end of the shaft. The device includes a worm gear **40** in meshing engagement with the worm, a helical spring **42,** and a cam shaft **44** upon which the output cam **28** is mounted. As described in greater detail below, these components are arranged such that the spring biases the worm gear, and hence the output cam, in the clockwise direction (as viewed in Figures 1a to 3), towards the closed position. The motor operates via the worm to drive the worm gear in the counterclockwise direction, i.e., towards the open position shown in Figure 1b.

[0016] Electric motor **34** is a high-torque output, low cogging torque 200-series motor with integrated thermal protection, EMC protection and a knurled shaft. Such motors are available, for example, from Mabuchi Motor Co., Ltd. or Johnson Electric North American, Inc. The motor is mounted in a fixed position within the housing, being held in place by positive abutment with surfaces of the housing and closure plate. A cylindrical stub **48** (see Fig. 7) of the motor is seated against a concave surface **46** of the housing. The motor housing abuts directly against first and second surfaces **50, 52.** On the inside of closure

plate **32** are two rows of triangular protrusions **54** having facing surfaces **56** located and oriented so as to, with inner surface area **58** of the plate, abut against the motor housing. Cylindrical stub **60** is received between upstanding members **62, 64** of the inner housing of the device, the side surfaces of each member being in abutment to help hold the shaft end of the motor from moving to the right or left, as oriented in Figure 1. The motor includes first and second openings **66, 68** having electrical terminals disposed therein. Contact posts **70, 72** are molded into the housing and received within the openings **66, 68** of the motor each in abutting electrical contact with a terminal of the motor.

[0017] The housing includes a socket **74** having first and second prongs **75a, 75b** molded externally as part of the rear (as oriented in Figure 1) of the housing. Each of the prongs is electrically connected by an embedded conductor to posts **70, 72.** Preferably, the socket and prongs are designed to receive a standard plug for supplying electrical power to the motor of the latch release device. However, any suitable form of electrical connector will suffice.

[0018] Turning back to the drive mechanism for the device, the drive end of the shaft 36 extends about 1.5 cm beyond the end of cylinder **60** in which it is suitably journaled. The free end of the shaft has knurled ridges (not illustrated), parallel to the lengthwise axis of the shaft, pressed into it for a length of about 7 mm. The worm **38** is tubular, having an inner diameter slightly less than the outer diameter of shaft **36** so that receipt of the worm onto the shaft results in a snug fit sufficiently tight for the expected life of the device. The ridges on the shaft are deformed radially inward slightly during assembly of the worm onto the shaft and the ridges help to ensure that the worm is rigidly affixed to the shaft so as not to rotate with respect to the shaft during operation of the device.

[0019] Worm gear **40** is preferably injection molded in a single step of a homopolymer acetal selected for its low friction, high wear resistance and dimensional stability properties. Alternative materials are possible. The worm gear is molded to include a tubular mounting shaft **80** (see Fig. 7). The shaft 80 is received into the open end of a cylindrical mount **82** that is integrally molded in the housing **30.** Shaft **80** has an external diameter of about 1 cm. The diameter of the shaft **80** and the internal diameter of the cylindrical mount **82** are closely dimensioned to each other so that there is very little play between the two pieces, but at the same time the worm gear is free to rotate with respect to the cylindrical mount **82.** The abutting surfaces are very smooth, of circular cross-section, and present minimal frictional resistance to rotational movement of the worm gear about the central axis of the shafts.

[0020] In the illustrated embodiment the outer diameter of worm gear **40** is about 2.7 cm, and the width of the worm gear rim, i.e., the tooth bearing portion of the worm gear, is about 1.1 cm, with the total height of shaft **80** being about 1.6 cm. A stop **84** is molded as part of the worm gear. The stop **84** protrudes from the toothed rim a distance of about 4 mm and extends around the circumference of the rim a distance of about 45 degrees. This stop can be omitted in the case that full 360 degree output rotation is desired. A stop **86,** molded as part of the housing, is radially spaced from the center of mount **82** a slightly smaller distance than the radial distance between worm gear stop **84** and the center of shaft **80**. Housing stop **86** and worm gear stop **84** together govern the rotational (angular) distance that the worm gear is permitted to travel between the closed Position (Figure 1 a) and the open position (Figure 1b), the rotational distance being about 270°. The length of the arc on which housing stop **86** lies is about 45° and the length of the arc on which the worm gear stop **84** lies is about 45° so that together the two stops together extend about 90° along the common circle on which they together lie. When worm gear **40** is properly mounted and occupying the closed position, abutment surface **90** of the worm gear stop and abutment surface **92** of the housing stop abut each other to preclude clockwise rotation of the worm gear. When the worm gear is rotated counterclockwise to the extreme open position (see Figure 1b) abutment surfaces **94** and **96** of the worm gear stop and housing stop, respectively, come into abutment with each other so as to preclude further counterclockwise movement of the worm gear. Because the combined distance of the two stops is 90° of the common circle on which the two stops lie, the rotation of the worm gear between the closed position and the open position totals 270°. As will be seen further below this is the rotational (angular) distance traveled by cam **28** in operation of the device in releasing the latch.

[0021] Worm gear **40** is biased towards the closed position by the helical spring **42.** Spring **42** is installed within the generally toroidal space located between inner surface **98** of worm gear rim, the outer surface of shaft **80** and inner surface **100** of worm gear wall **102.** Located within the toroidal space is a protrusion **104** which stands out from the worm gear wall and serves as a catch for hooked end **106** of the spring. Protrusion **104** includes overhang **108.** By precluding axial movement of the hooked portion of the spring (as in the direction parallel to the central axis of the worm gear and away from inner wall **102**), overhang **108** aids in the installation of the spring during assembly of the device, and helps to ensure that hook **106** of the spring does not slip past the catch during operation of the device. Spring end **110** is in the shape of a hook to latch onto housing surface **96.** It is noted here that worm gear stop **84** is generally radially spaced outwardly of spring **42,** but that hook **110** protrudes radially outwardly from the remainder of the spring so as to latch onto surface **96,** which is itself radially located to abut surface **94** of the stop of the worm gear. Clearance for travel of stop **84** past hook **110** as the worm gear rotates into the closed position is provided by locating the hook in recess **112** which encircles cylindrical

mount **82** and extends radially outwardly in the neighborhood of stop **86,** as illustrated in Figure **3.** Hook **110** is thus axially spaced from stop **84** (toward the floor of the housing) to provide for travel of stop **84** past hook **110.**

[0022] The spring **42** is installed so as to be under constant tension and is preferably made of spring steel or stainless steel. This results in the worm gear being constantly biased towards the closed position, i.e., in the clockwise direction as viewed in either of Figures 1 a or 1 b, for example. As the worm gear is rotated under force provided by the motor through the worm (described in greater detail below), the tension on the spring increases.

[0023] The motive force of motor **34** is transferred to worm gear **40** by worm **38.** Thread **76** of the worm engages teeth **114,** which have an axial pitch and lead designed to mesh with the axial pitch and lead of the worm thread. Thus activation of motor **34** results in clockwise rotation of worm **38** (as viewed from the left in Figure 1a), which in turn causes rotation of worm gear **40** in the counterclockwise direction, as viewed in Figure 1 a. Activation of motor **34** by application of appropriate electrical current can be instituted as by an appropriately wired button located for access by the driver, or by an activation circuit under remote control, etc. In the position of Figure 4, the torque on the worm gear from the spring is about 330 Nmm, and the torque from the spring is about 380 Nmm when the worm gear is in the position shown in Figure 5.

[0024] Rotation of worm gear **40** will eventually be halted by abutment of stop surfaces **94, 96** when the worm gear has rotated through an angle of about 270° to the fully open position, as previously described. Halting the worm gear rotation prevents the worm from turning, and hence causes motor **34** to stall. The power supplied to the motor is cut off and the stored energy in the coiled spring causes the worm gear to rotate back to the closed position.

[0025] The worm gear **40** has a central aperture **116** which receives a **shaft 44** attached to cam **28.** The cam and shaft are injected molded as a single piece of the same type of plastic as the worm gear. The exterior profile of the cross-section of shaft **44** matches the cross-section of central aperture **116** of the worm gear and the cross-sections are non-circular. Shaft **44** received into the aperture is thus fixed against rotation with respect to the axis of the worm gear. Installed shaft **44** is also centered on the central axis of the worm gear so that when the worm gear rotates about the axis so too does the cam shaft. It will further be noted that the engagement of surfaces of the shaft **44** and aperture serve to orient the cam for operation between the closed and open positions.

[0026] Cam **28** is installed as part of the device after assembly of the closure and housing, described further below. This is accomplished through tabs **150** at the free end of shaft **44.** Each tab is located at the end of finger **152,** the fingers being radially spaced apart from each other on opposite sides of the central axis of shaft **44.** Each tab includes abutment surface **154** which opposes and abuts surface **156** surrounding the central aperture of worm gear **40.** Opposing tab surfaces **154** is surface **158** of shaft **44,** surface **158** being in abutment with surface **160** of the worm gear. Thus, for installation, cam shaft **44** is inserted through aperture **162** and into worm gear aperture **116.** Chamfered lead surfaces **164** of the tabs abut.against inner surfaces of narrowed portion **117** of aperture **116** squeezing the resilient fingers together as they pass through the narrowed passage, eventually springing apart into the installed position shown in Figure 14 in which surfaces **154,156** abut each other, and surfaces **158, 160** abut each other, to affix the cam against axial movement with respect to the worm gear.

[0027] The cross-sectional profile of the cam surface is wing-shaped. Translation of the rotational motion of the cam shaft **44** through the cam surface to move latch **22** from the closed position to the release position is illustrated in Figures 1 a and 1 b. As shaft **44** rotates, the cam surface area generally designated as **118** contacts latch **22.** As this rotation occurs, the radial distance (from the center of shaft **44**) of the contact portion of the cam surface with the latch is in contact increases resulting in forced movement of the latch from the closed position towards the release position. As described above, the worm gear and affixed cam rotate until the fully open position **28a** (Figure 1 b) is reached and motor **34** stalls, which stall leads to the eventual return of the cam to the closed position.

[0028] The cam profile converts the output torque to a linear force pushing against a movable lever, plate or other feature to which one desires a force to be applied. This cam functions as a further gear ratio for the system, where smaller distances pushed by the full rotation of the cam are seen to result in higher applied forces by the cam.

[0029] It is possible that the installed device could be exposed to minor amounts of water from time to time, as when a trunk was opened during a rainstorm, etc. To lessen the possibility of damage from such exposure, a liquid flow path for such liquids is provided around the periphery of the plate closure edge. Ridge **120,** molded as part of housing **30,** and ridge **122,** molded as part of the closure plate **32** are thus shaped to abut against opposing surfaces (of the closure plate and housing, respectively) to provide a limited seal against ingress of water. Further, the ridges are spaced slightly inwardly from the extreme periphery so that a liquid flow passage **124** is defined around the periphery of the ridges.

[0030] Housing **30** and closure plate **32** are conveniently assembled together during manufacture of device **20** through a single assembly screw **126** received through plate aperture **128,** the screw shaft being received into housing aperture **130.** Aperture **130** is of smaller cross-section than the shaft of the screw so that the threads of the screw become embedded in the plastic wall of the housing during assembly.

[0031] The housing and plate have a further three pairs of communicating apertures **132, 134, 136.** These apertures are used during installation of the device onto the automobile latch by fasteners **138, 140, 142.** Areas **144,**

146, 148 of the external plate surface surrounding the apertures are in positive abutting contact with surfaces of the automobile when installed. (This could equally apply to external areas of the housing surround the apertures). In this way, when the device is installed with the remainder of the latch, compressive forces are further applied to the housing and closure by their being sandwiched between the heads of fasteners **138, 140, 142** and auto surfaces with which plate areas **144, 146, 148** are in positive abutting contact.

[0032] The illustrated embodiment has been described with particularity for the purposes of description. Those skilled in the art will appreciate that a variety of modifications may be made to the embodiment described herein without departing from the scope of the invention, as defined by the appended claims.

Claims

1. A device (20) for releasing a latch (22) comprising:

a housing (30);
an electric motor (34) mounted in the housing (30);
a worm (38) operatively coupled to the motor (34) for driving rotation of the worm (38) about an axis in a first rotational direction;
a worm gear (40), in meshing engagement with the worm (38), and being mounted in the housing (30) for rotation about an axis substantially orthogonal to the worm axis;
wherein the worm gear (40) is biased against the rotation in a first direction from a first position to a second position by a spring (42) such that energy is transferred from the motor (34) to the spring (42) as the worm gear (40) rotates from said first position to said second position under control of the motor (34) and, when the motor (34) is powered down, the energy stored in the spring (42) causes the worm gear (40) to rotate in a second direction, opposite to the first direction, from the second position to the first position; and
the housing (30) includes a first stop (92) and a second stop (96);

characterized in that the device (20) further comprises:

a camshaft (44) mounted on the worm gear (40) and having a rotation axis coincident with the worm gear axis, the camshaft (44) having a distal end extending to the exterior of the housing (30); and
a cam (28) affixed at the distal end of the camshaft (44), having a surface (118) for engaging the latch (22) to move the latch (22) from a closed position to a release position as the worm gear (40) rotates in the first direction from the first position to the second position under control of the motor (34);
said housing (30) comprising an injection-molded plastic tubular mount (82) extending into the housing interior, with the worm gear (40) being rotatably mounted thereon;
said first and second stops (92, 96) of the housing (30) being unitarily molded therewith;
said spring (42) being connected between the worm gear (40) and the housing (30); and
the worm gear (40) including a first stop (90) and a second stop (94), wherein when the worm gear (40) is in the first position, the first stop (92) of the housing (30) and the first stop (90) of the worm gear (40) are in mutual abutment to preclude rotation in the second direction, and when the worm gear (40) is in the second position, the second stop (96) of the housing (30) and the second stop (94) of the worm gear (40) are in mutual abutment to preclude rotation in the first direction.

2. The device of claim 1, wherein the worm gear (40) comprises a shaft (80) rotatably mounted to the housing (30), and an outer rim spaced from the shaft (80), the rim bearing teeth (114) in said meshing engagement with the worm (38), and said spring is a helical spring (42) located between the shaft (80) and the rim.

3. The device of claim 1, wherein the device further comprises an injection-molded closure plate (32), and the housing (30) includes a hollow portion and the housing (30) and plate (32) have opposing walls shaped to abut a housing of the motor (34) when the hollow portion and the plate (32) are secured together, and the plate (32) further includes protrusions (54) which extend into the housing interior to abut sides of the motor housing to preclude movement therepast.

4. The device of claim 3, wherein the hollow portion includes an upstanding peripheral ridge (120) unitarily molded therewith, and shaped to abut an inner surface of the plate (32), and the plate of the housing (30) includes an upstanding peripheral ridge (122) unitarily molded therewith and shaped to abut an inner surface of the housing (30), to protect against the egress of water into the interior of the housing (30), and wherein the ridges (120, 122) are located to provide a water flow path around the outer periphery thereof.

5. The device of claim 4, wherein the tubular mount (82) of the housing (30) has an open end and the worm gear (40) is rotatably mounted therein by

means of a shaft (80) extending from the worm gear (40) that is received in said open end, the worm gear (40) including a rim spaced from the shaft (80), and the spring (42) is located between the rim and the tubular mount (82) of the housing (30).

6. The device of claim 5, wherein the housing plate (32) includes an aperture (162) in communication with the central aperture (116) of the worm gear (40), to permit passage of the camshaft (44) therethrough, and wherein the distal end of the camshaft (44) includes at least one resilient finger (152) received through the communicating apertures (116, 162) and having a surface (154) in abutting contact with an opposing surface (156) of the worm gear (40) to preclude axial withdrawal of the camshaft (44) from the worm gear aperture (116).

7. The device of claim 6, wherein said cam surface (118) for engaging the latch (22) is oriented to move the latch (22) in a direction having a vectorial component non-parallel to the direction of rotation of the worm gear shaft (80) as the worm gear (40) rotates in said first direction.

8. The device of claim 1, further comprising electrically conductive contacts (75a, 75b) embedded into the housing (30) as the housing (30) is molded, in electrical contact with the motor (34), and extending to the exterior of the housing (30) for connection to an electric power supply.

9. The device of claim 1, wherein the housing (30) and the closure plate (32) include a plurality of holes (132, 134, 136) in communication with each other and located to permit simultaneous fastening of the housing (30) and closure plate (32) together and fastening of the device (20) adjacent said latch (22) with the cam (28) in operable proximity thereto.

Patentansprüche

1. Vorrichtung (20) zum Freigeben eines Riegels (22), mit:

einem Gehäuse (30);
einem im Gehäuse (30) montierten Elektromotor (34);
einer Schnecke (38), die mit dem Motor (34) gekoppelt ist, um die Schnecke (38) in eine erste Drehrichtung um eine Achse drehbar anzutreiben;
einem Schneckenrad (40), das mit der Schnecke (38) kämmt und im Gehäuse (30) für eine Drehbewegung um eine sich im Wesentlichen senkrecht zur Schneckenachse erstreckenden Achse montiert ist;
wobei das Schneckenrad (40) durch eine Feder (42) gegen eine Drehbewegung in eine erste Richtung von einer ersten Position zu einer zweiten Position vorgespannt ist, so dass Energie vom Elektromotor (34) zur Feder (42) übertragen wird, wenn das Schneckenrad (40) sich unter Einfluss des Motors (34) von der ersten Position zur zweiten Position dreht, und wenn der Motor (34) abgeschaltet wird, die in der Feder (42) gespeicherte Energie veranlasst, dass das Schneckenrad (40) sich von der zweiten Position zur ersten Position in eine der ersten Richtung entgegengesetzte zweite Richtung dreht, und das Gehäuse (30) einen ersten Anschlag (92) und einen zweiten Anschlag (96) aufweist;

dadurch gekennzeichnet, dass die Vorrichtung (20) ferner aufweist:

eine Nockenwelle (44), die am Schneckenrad (40) montiert ist und eine mit der Schneckenradachse übereinstimmende Drehachse aufweist, wobei sich das distale Ende der Nockenwelle (44) zur Außenseite des Gehäuses (3) erstreckt;
eine am distalen Ende der Nockenwelle (44) befestigte Nocke (28) mit einer Fläche (118), die dafür vorgesehen ist, mit dem Riegel (22) in Eingriff zu kommen, um den Riegel (22) von einer geschlossenen Position zu einer Freigabeposition zu bewegen, wenn sich das Schneckenrad (40) unter Einfluss des Motors (34) von der ersten Position zur zweiten Position in die erste Richtung bewegt,
wobei das Gehäuse (30) eine spritzgegossene Kunststoffrohrhalterung (82) aufweist, die sich in den Gehäuseinnenraum erstreckt, wobei das Schneckenrad (40) darauf drehbar montiert ist, der erste und der zweite Anschlag (92, 96) des Gehäuses (30) damit integral ausgeformt sind, die Feder (42) zwischen dem Schneckenrad (40) und dem Gehäuse (30) verbunden ist, und das Schneckenrad (40) einen ersten Anschlag (90) und einen zweiten Anschlag (94) aufweist, wobei, wenn das Schneckenrad (40) sich in der ersten Position befindet, der erste Anschlag (92) des Gehäuses (30) und der erste Anschlag (90) des Schneckenrades (40) aneinander anliegen, um eine Drehbewegung in die zweite Richtung zu verhindern, und, wenn das Schneckenrad (40) sich in der zweiten Position befindet, der zweite Anschlag (96) des Gehäuses (30) und der zweite Anschlag (94) des Schneckenrades (40) aneinander anliegen, um eine Drehbewegung in die erste Richtung zu verhindern.

2. Vorrichtung nach Anspruch 1, wobei das Schneckenrad (40) eine am Gehäuse (30) drehbar mon-

tierte Welle (80) und einen von der Welle (80) beabstandeten Außenkranz aufweist, wobei der Außenkranz Zähne (114) trägt, die mit der Schnecke (38) kämmen, und wobei die Feder eine zwischen der Welle (80) und dem Außenkranz angeordnete Schraubenfeder (42) ist.

3. Vorrichtung nach Anspruch 1, wobei die Vorrichtung eine spritzgegossene Verschlussplatte (32) aufweist, und wobei das Gehäuse (30) einen hohlen Abschnitt aufweist, und wobei das Gehäuse (30) und die Platte (32) gegenüberliegende Wände aufweisen, die derart geformt sind, dass sie an einem Gehäuse des Motors (34) anliegen, wenn der hohle Abschnitt und die Platte (32) aneinander gesichert sind, und wobei die Platte (32) ferner Vorsprünge (54) aufweist, die sich in den Gehäuseinnenraum erstrecken und an Seiten des Motorgehäuses anliegen, um eine Bewegung daran vorbei zu verhindern.

4. Vorrichtung nach Anspruch 3, wobei der hohle Abschnitt einen damit einstückig ausgebildeten, aufrecht stehenden Umfangsgrat (120) aufweist, der derart geformt ist, dass er an einer Innenfläche der Platte (32) anliegt, und wobei die Platte des Gehäuses (30) einen aufrecht stehenden Umfangsgrat (122) aufweist, der damit einstückig ausgebildet und derart geformt ist, dass er an einer Innenfläche des Gehäuses (30) anliegt, um zu verhindern, dass Wasser in das Innere des Gehäuses (30) eindringt, und wobei die Grate (120, 122) derart angeordnet sind, dass ein Wasserströmungspfad um ihren Außenumfang herum bereitgestellt wird.

5. Vorrichtung nach Anspruch 4, wobei die rohrförmige Halterung (82) des Gehäuses (30) ein offenes Ende aufweist und das Schneckenrad (40) durch eine sich vom Schneckenrad (40) erstreckende Welle (80), die im offenen Ende aufgenommen ist, drehbar darin monitert, und wobei das Schneckenrad (40) einen von der Welle (80) beabstandeten Rand aufweist, und wobei die Feder (42) zwischen dem Rand und der rohrförmigen Halterung (82) des Gehäuses (30) angeordnet ist.

6. Vorrichtung nach Anspruch 5, wobei die Gehäuseplatte (32) eine Öffnung (162) aufweist, die mit der Mittenöffnung (116) des Schneckenrades (40) kommuniziert, um einen Durchgang der Nockenwelle (44) durch die Öffnung zu ermöglichen, und wobei das distale Ende der Nockenwelle (44) mindestens einen elastischen Finger (152) aufweist, der durch die kommunizierenden Öffnungen (116, 162) aufgenommen ist und eine Fläche (154) aufweist, die mit einer gegenüberliegenden Fläche (156) des Schneckenrades (40) in Stoßkontakt steht, um eine axiale Rückziehbewegung der Nockenwelle (44) aus der Schneckenradöffnung (116) zu verhindern.

7. Vorrichtung nach Anspruch 6, wobei die Nockenfläche (118), die dafür vorgesehen ist, mit dem Riegel (22) in Eingriff zu kommen, ausgerichtet ist, den Riegel (22) in eine Richtung zu bewegen, die eine Vektorkomponente hat, die sich zur Drehrichtung der Schneckenradwelle (80) nicht parallel erstreckt, wenn das Schneckenrad (40) sich in die erste Richtung dreht.

8. Vorrichtung nach Anspruch 1, ferner mit elektrisch leitfähigen Kontakten (75a, 75b), die in das Gehäuse (30) eingebettet werden, wenn das Gehäuse (30) gegossen wird, wobei die elektrisch leitfähigen Kontakte mit dem Motor (34) in elektrischem Kontakt stehen und sich für eine Verbindung mit einer elektrischen Stromversorgung zu einer Außenseite des Gehäuses (30) erstrecken.

9. Vorrichtung nach Anspruch 1, wobei das Gehäuse (30) und die Verschlussplatte (32) mehrere Löcher (132, 134, 136) aufweisen, die miteinander kommunizieren und derart angeordnet sind, dass ein gleichzeitiges Befestigen des Gehäuses (30) und der Verschlussplatte (32) aneinander und der Vorrichtung (20) benachbart zum Riegel (22) mit der in betrieblicher Nähe dazu angeordneten Nocke (28) ermöglicht wird.

Revendications

1. Dispositif (20) pour libérer un verrou (22) comprenant :

un boîtier (30) ;
un moteur électrique (34) monté dans le boîtier (30) ;
une vis sans fin (38) couplée de manière opérationnelle au moteur (34) pour entraîner la rotation de la vis sans fin (38) autour d'un axe dans une première direction de rotation ;
un pignon à vis sans fin (40), en mise en prise d'engrènement avec la vis sans fin (38) et étant monté dans le boîtier (30) pour tourner autour d'un axe sensiblement orthogonal par rapport à l'axe de vis sans fin ;
dans lequel le pignon à vis sans fin (40) est sollicité contre la rotation dans une première direction, d'une première position à une seconde position, par un ressort (42) de sorte que l'énergie est transférée du moteur (34) au ressort (42) lorsque le pignon à vis sans fin (40) tourne de ladite première position à ladite seconde position sous la commande du moteur (34) et lorsque le moteur (34) est arrêté, l'énergie stockée dans le ressort (42) amène le pignon à vis sans fin (40) à tourner dans une seconde direction opposée à la première direction, de la seconde

position à la première position ; et
le boîtier (30) comprend une première butée (92) et une seconde butée (96) ;

caractérisé en ce que le dispositif (20) comprend en outre :

un arbre à cames (44) monté sur le pignon à vis sans fin (40) et ayant un axe de rotation qui coïncide avec l'axe de pignon à vis sans fin, l'arbre à cames (44) ayant une extrémité distale s'étendant vers l'extérieur du boîtier (30) ; et
une came (28) fixée au niveau de l'extrémité distale de l'arbre à cames (44), ayant une surface (118) pour mettre en prise le verrou (22) pour déplacer le verrou (22) d'une position fermée à une position de libération lorsque le pignon à vis sans fin (40) tourne dans la première direction, de la première position à la seconde position sous la commande du moteur (34) ;
ledit boîtier (30) comprenant un support tubulaire en plastique moulé par injection (82) s'étendant dans l'intérieur du boîtier, avec le pignon à vis sans fin (40) qui est monté en rotation sur ce dernier ;
lesdites première et seconde butées (92, 96) du boîtier (30) étant moulées de manière unitaire avec ce dernier ;
ledit ressort (42) étant raccordé entre le pignon à vis sans fin (40) et le boîtier (30) ; et
le pignon à vis sans fin (40) comprenant une première butée (90) et une seconde butée (94), dans lequel lorsque le pignon à vis sans fin (40) est dans la première position, la première butée (92) du boîtier (30) et la première butée (90) de le pignon à vis sans fin (40) sont en butée mutuelle pour empêcher la rotation dans la seconde direction, et lorsque le pignon à vis sans fin (40) est dans la seconde position, la seconde butée (96) du boîtier (30) et la seconde butée (94) du pignon à vis sans fin (40) sont en butée mutuelle pour empêcher la rotation dans la première direction.

2. Dispositif selon la revendication 1, dans lequel le pignon à vis sans fin (40) comprend un arbre (80) monté de manière rotative sur le boîtier (30), et un rebord externe espacé de l'arbre (80), les dents de palier de rebord (114) dans ladite mise en prise d'engrènement avec la vis sans fin (38) et ledit ressort est un ressort hélicoïdal (42) positionné entre l'arbre (80) et le rebord.

3. Dispositif selon la revendication 1, dans lequel le dispositif comprend en outre une plaque de fermeture moulée par injection (32) et le boîtier (30) comprend une partie creuse et le boîtier (30) et la plaque (32) ont des parois opposées formées pour venir en butée contre un boîtier du moteur (34) lorsque la partie creuse et la plaque (32) sont fixées ensemble, et la plaque (32) comprend en outre des saillies (54) qui s'étendent à l'intérieur du boîtier pour venir en butée contre les côtés du boîtier de moteur pour empêcher le mouvement au-delà de ce dernier.

4. Dispositif selon la revendication 3, dans lequel la partie creuse comprend une crête périphérique droite (120) moulée de manière unitaire avec cette dernière, et formée pour venir en butée contre une surface interne de la plaque (32), et la plaque du boîtier (30) comprend une crête périphérique droite (122) moulée de manière unitaire avec cette dernière et formée pour venir en butée contre une surface interne du boîtier (30) afin de protéger contre la sortie de l'eau de l'intérieur du boîtier (30), et dans lequel les crêtes (120, 122) sont positionnées pour fournir une trajectoire d'écoulement d'eau autour de sa périphérie externe.

5. Dispositif selon la revendication 4, dans lequel le support tubulaire (82) du boîtier (30) a une extrémité ouverte et le pignon à vis sans fin (40) est monté en rotation à l'intérieur de ce dernier au moyen d'un arbre (80) s'étendant à partir du pignon à vis sans fin (40) qui est reçu dans ladite extrémité ouverte, le pignon à vis sans fin (40) comprenant un rebord espacé de l'arbre (80) et le ressort (42) est positionné entre le rebord et le support tubulaire (82) du boîtier (30).

6. Dispositif selon la revendication 5, dans lequel la plaque de boîtier (32) comprend une ouverture (162) en communication avec l'ouverture centrale (116) du pignon à vis sans fin (40), pour permettre le passage de l'arbre à cames (44) à travers cette dernière, et dans lequel l'extrémité distale de l'arbre à cames (44) comprend au moins un doigt résilient (152) reçu à travers les ouvertures de communication (116, 162) et ayant une surface (154) en contact de butée avec une surface opposée (156) du pignon à vis sans fin (40) pour empêcher le retrait axial de l'arbre à cames (44) de l'ouverture de pignon à vis sans fin (116).

7. Dispositif selon la revendication 6, dans lequel ladite surface de came (118) pour mettre en prise le verrou (22) est orientée pour déplacer le verrou (22) dans une direction ayant un composant vectoriel non parallèle à la direction de rotation de l'arbre de pignon à vis sans fin (80) lorsque le pignon à vis sans fin (40) tourne dans ladite première direction.

8. Dispositif selon la revendication 1, comprenant en outre des contacts électriquement conducteurs (75a, 75b) encastrés dans le boîtier (30) lorsque le boîtier (30) est moulé, en contact électrique avec le

moteur (34) et s'étendant vers l'extérieur du boîtier (30) pour le raccordement à une alimentation de courant électrique.

9. Dispositif selon la revendication 1, dans lequel le boîtier (30) et la plaque de fermeture (32) comprennent une pluralité de trous (132, 134, 136) en communication entre eux et positionnés pour permettre la fixation simultanée du boîtier (30) et de la plaque de fermeture (32) ensemble et la fixation du dispositif (20) adjacent audit verrou (22) avec la came (28) à proximité, du point de vue opérationnel avec ce dernier.

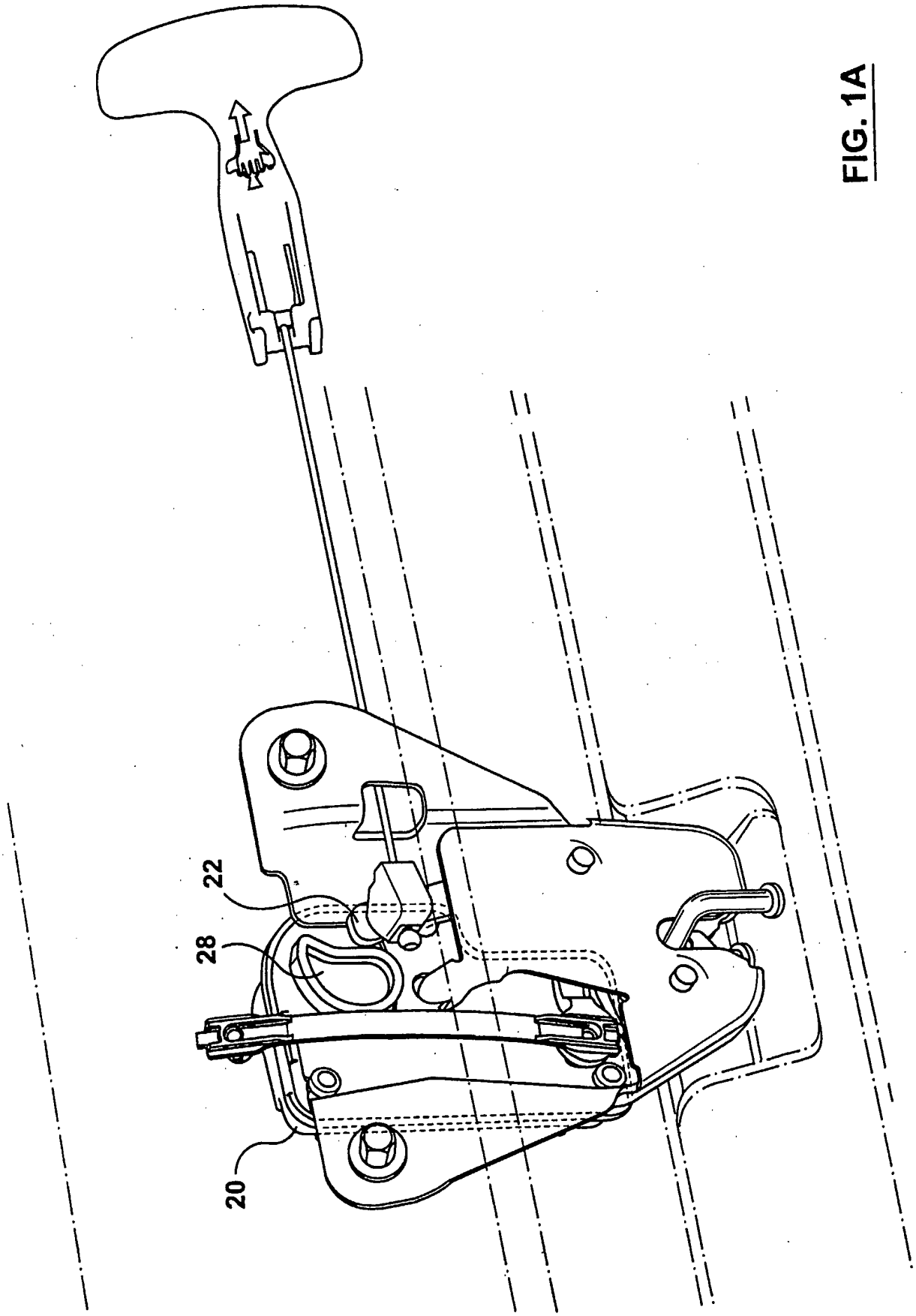

FIG. 1A

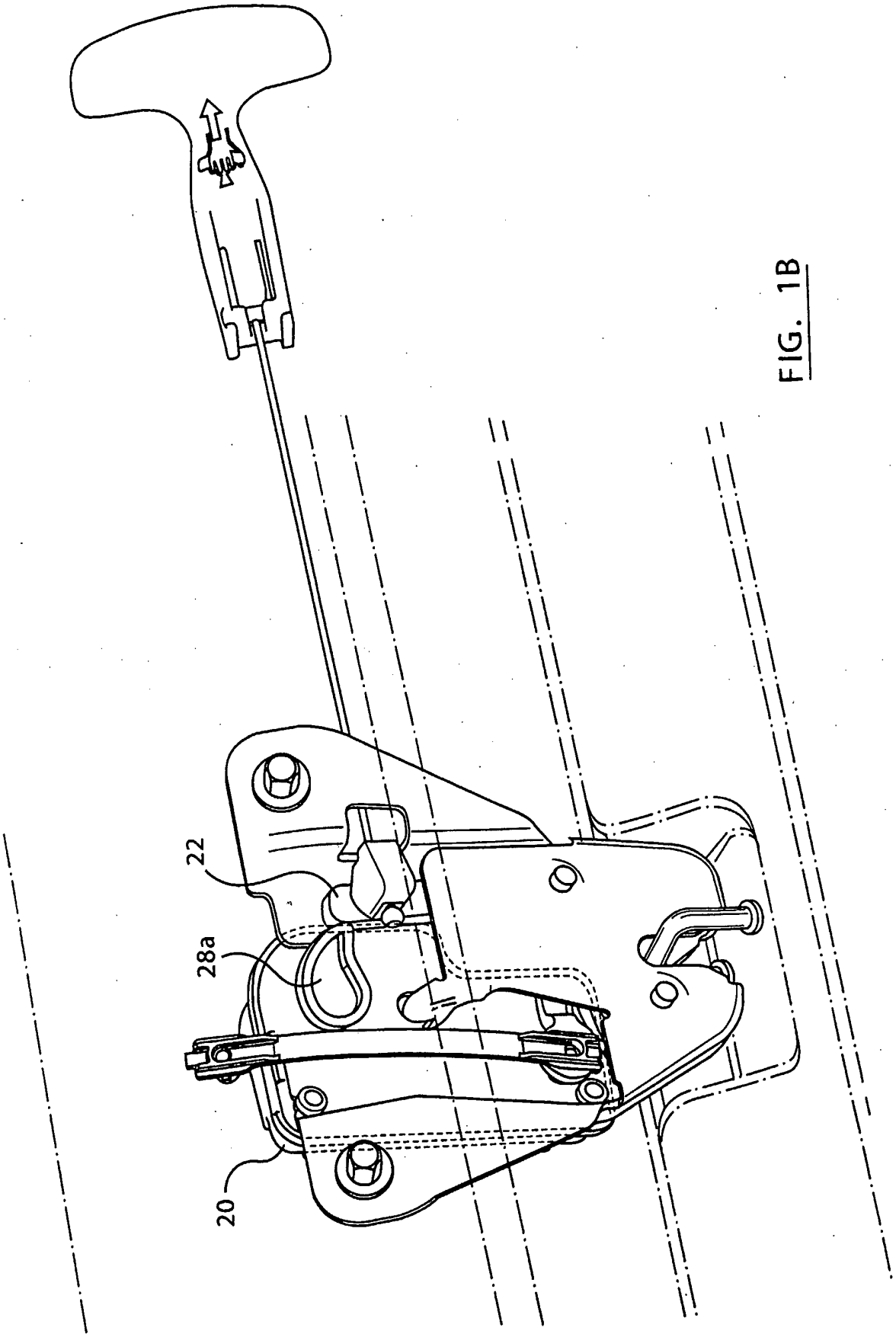

FIG. 1B

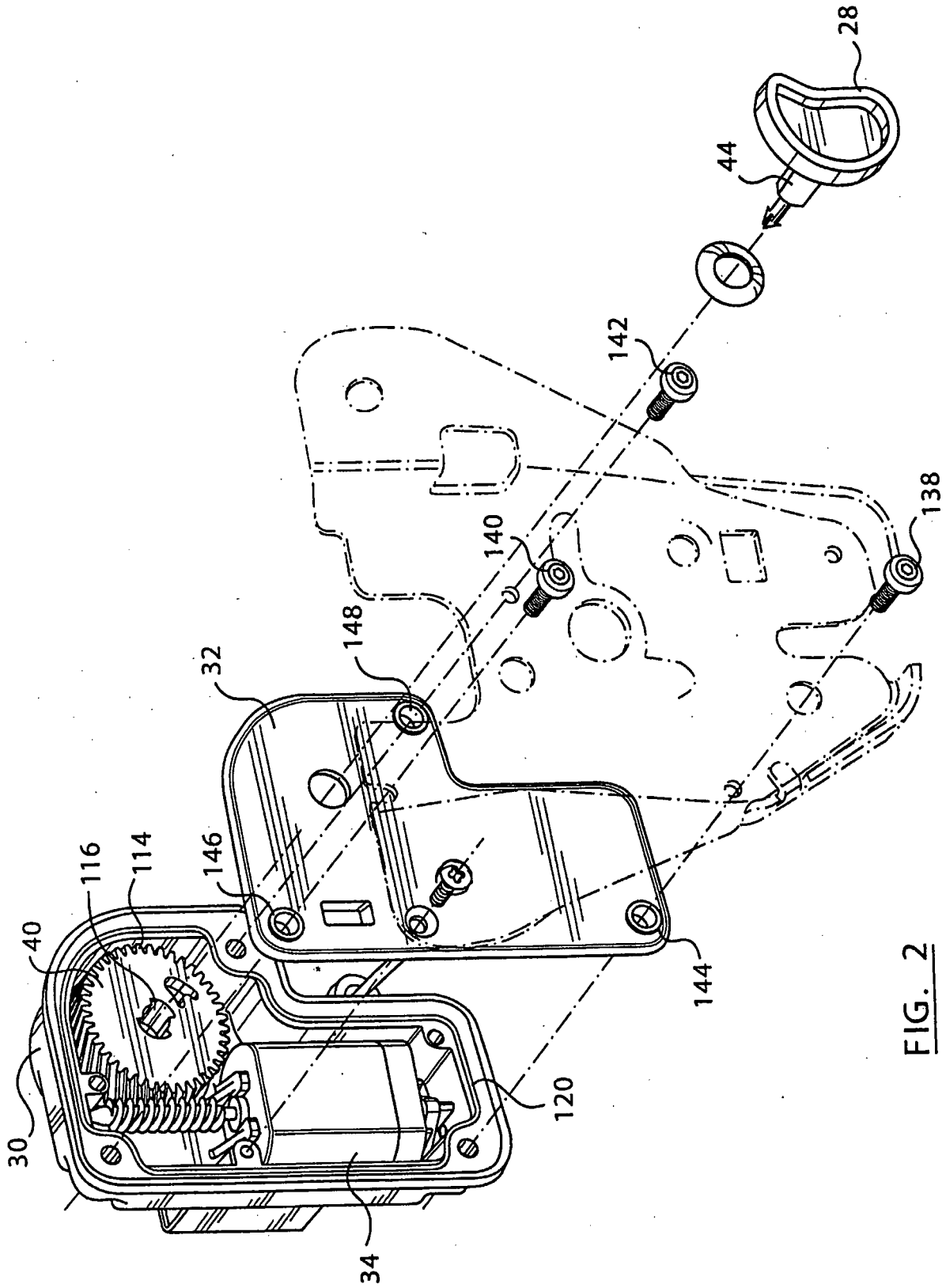

FIG. 2

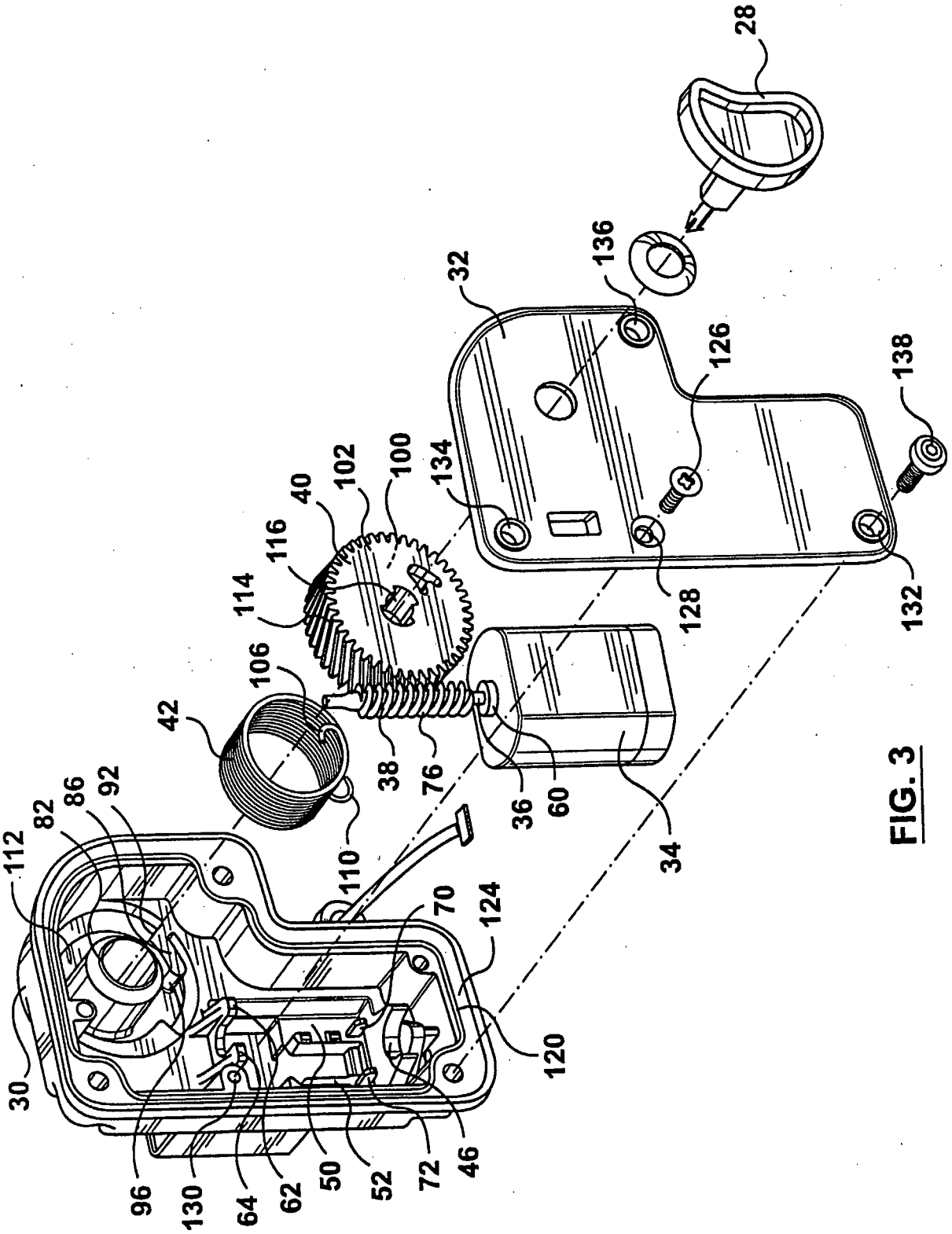
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FIG. 3

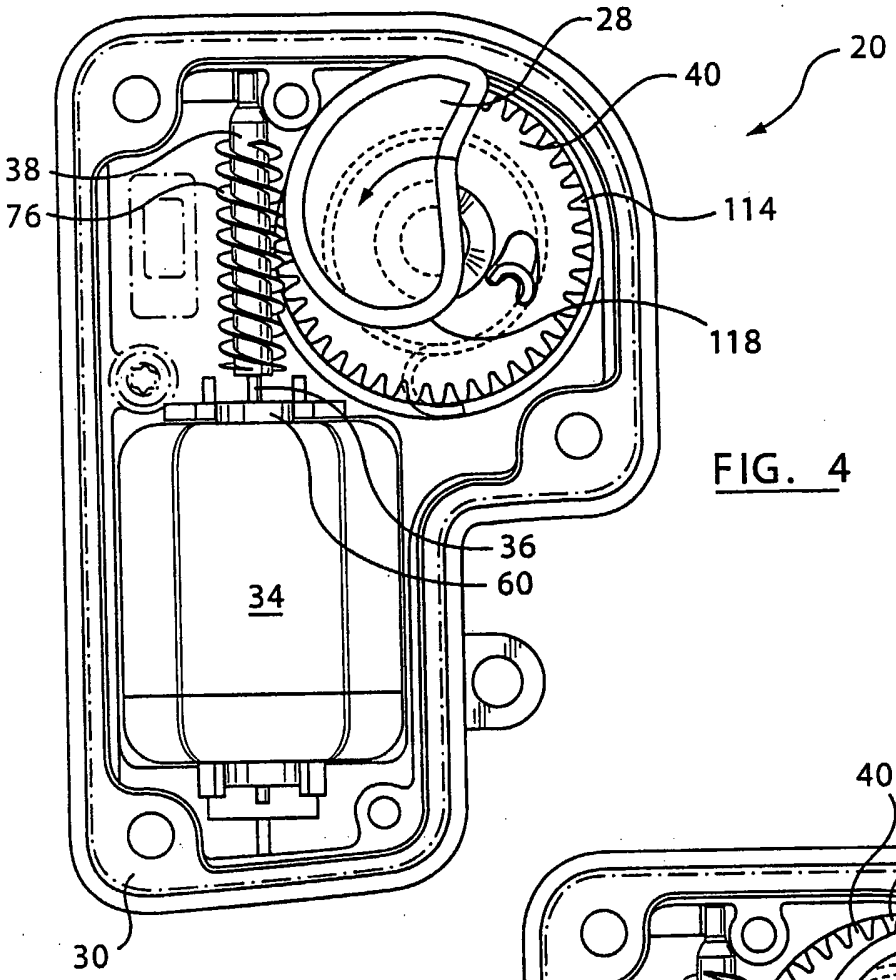


FIG. 4

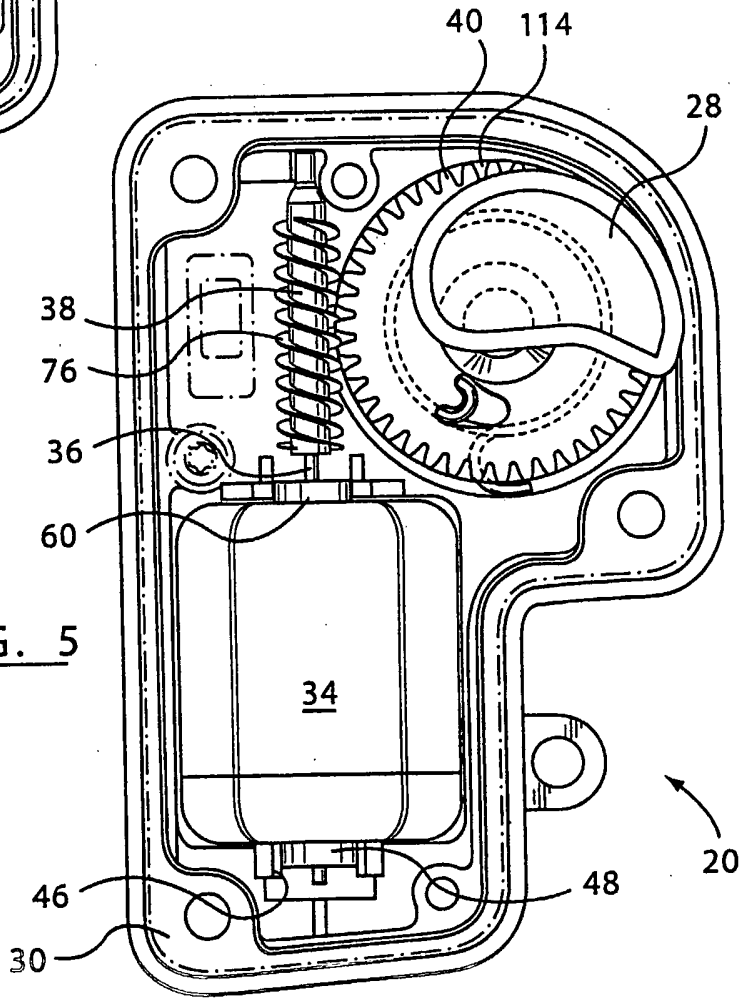
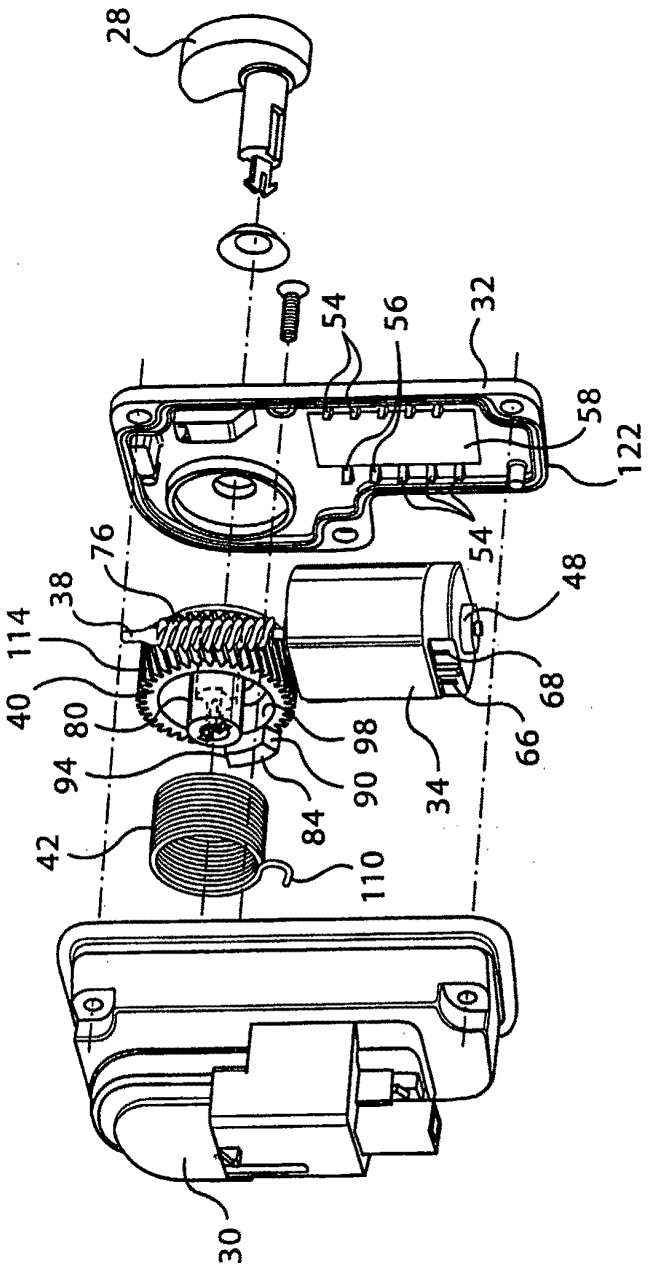


FIG. 5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30

FIG. 7

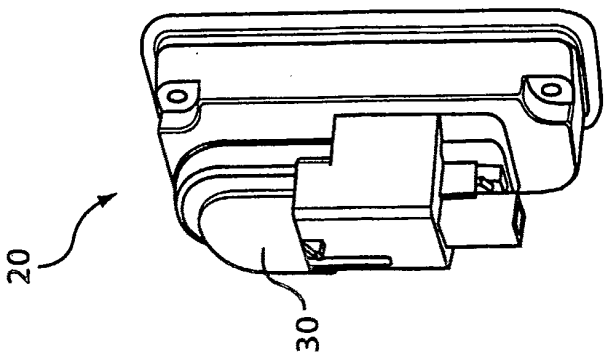
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FIG. 6

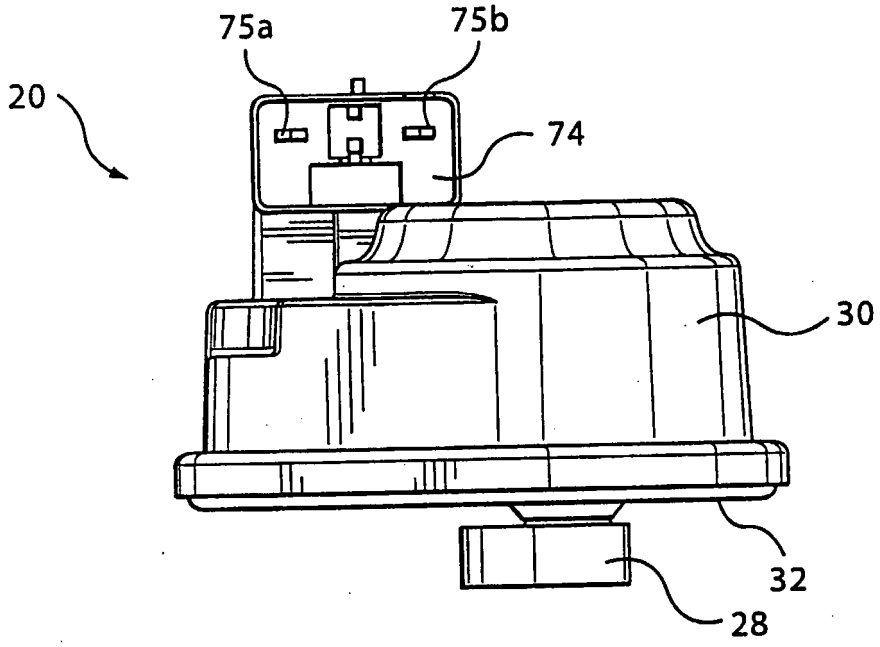

FIG. 8

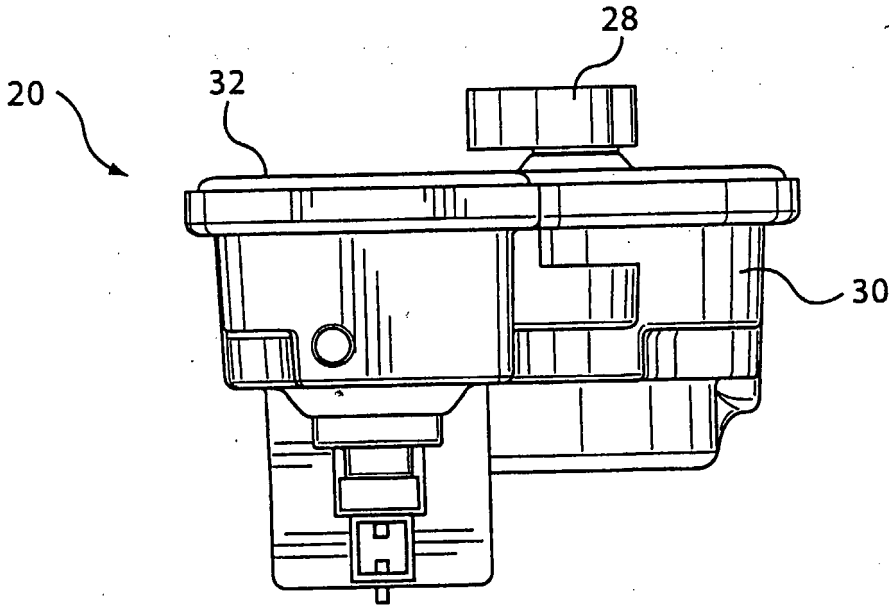

FIG. 9

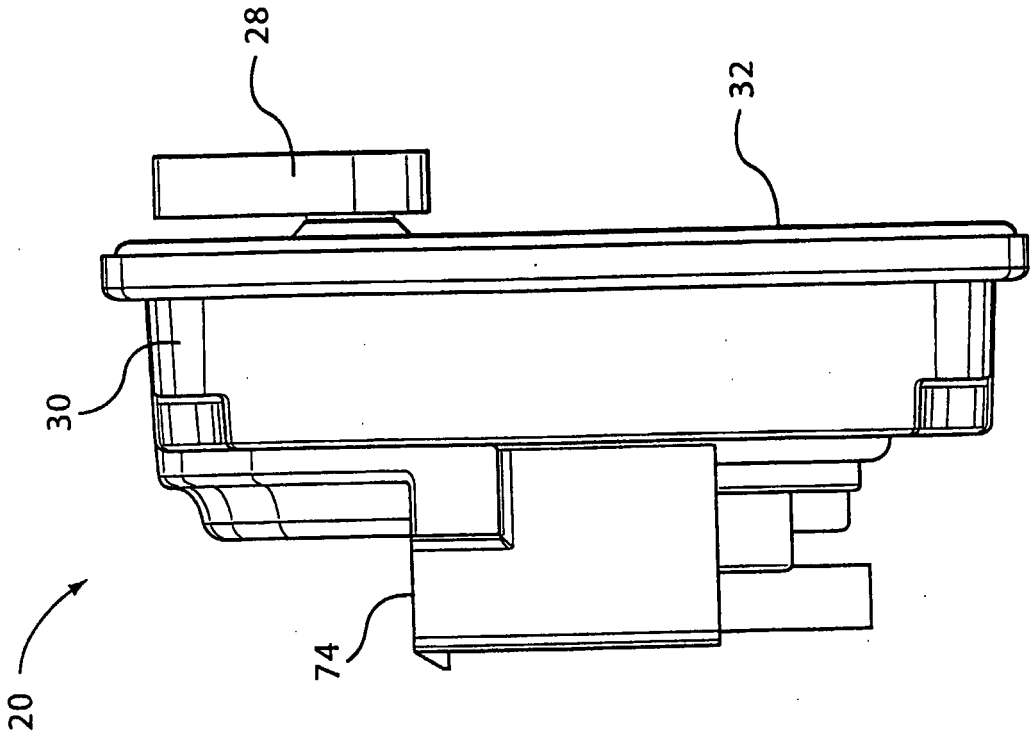

FIG. 11

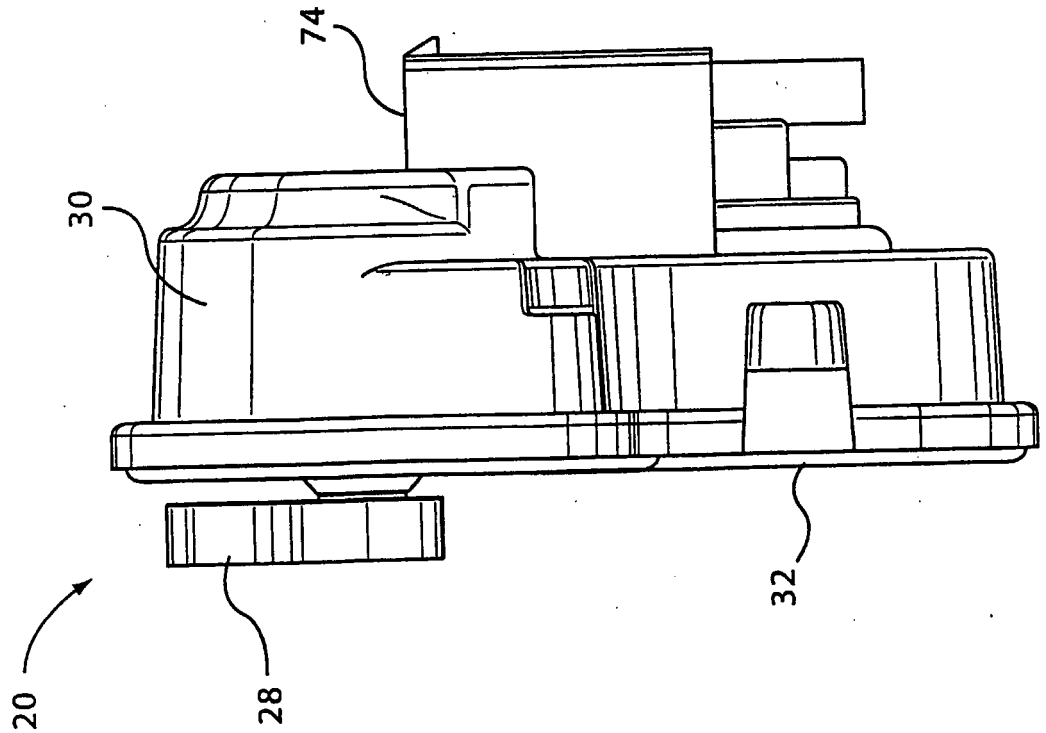

FIG. 10

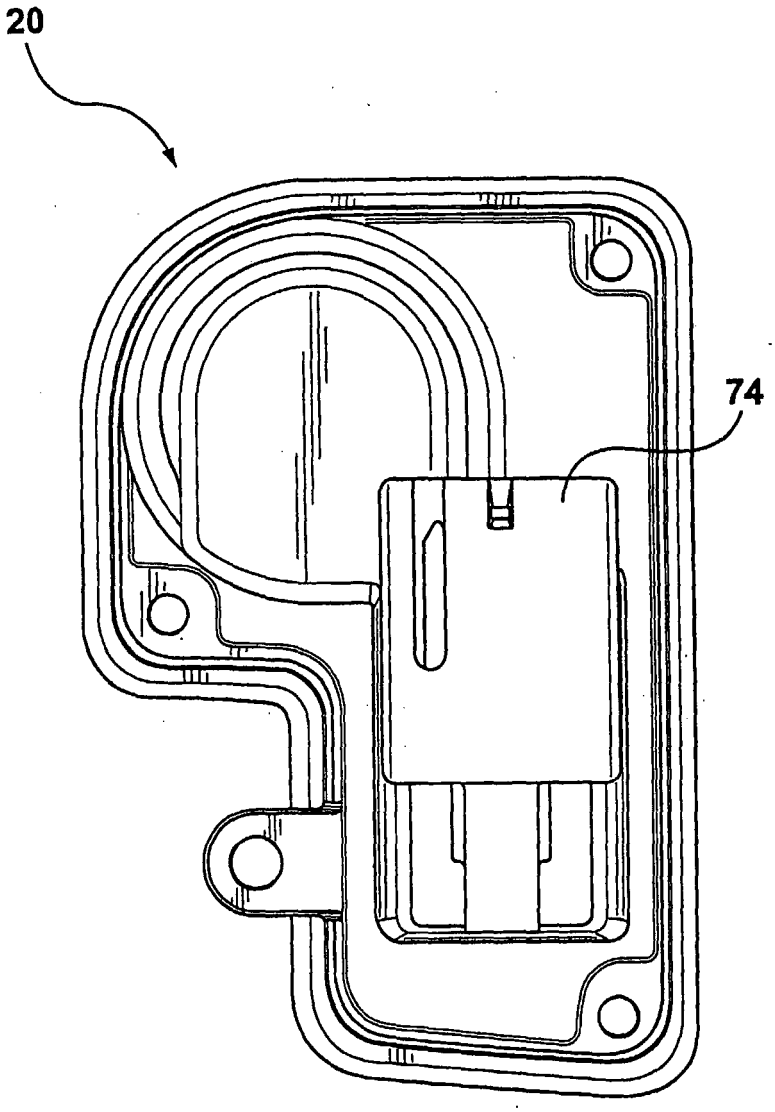

FIG. 12

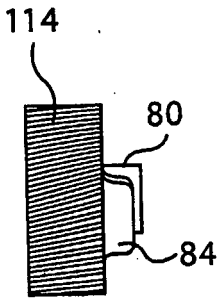
114
80
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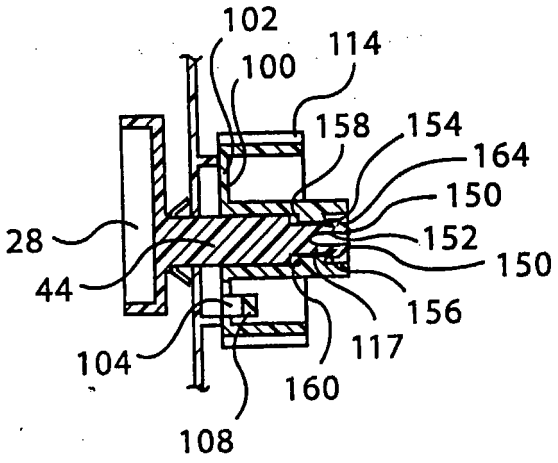
FIG. 13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164
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117
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108

FIG. 14

REFERENCES CITED IN THE DESCRIPTION

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