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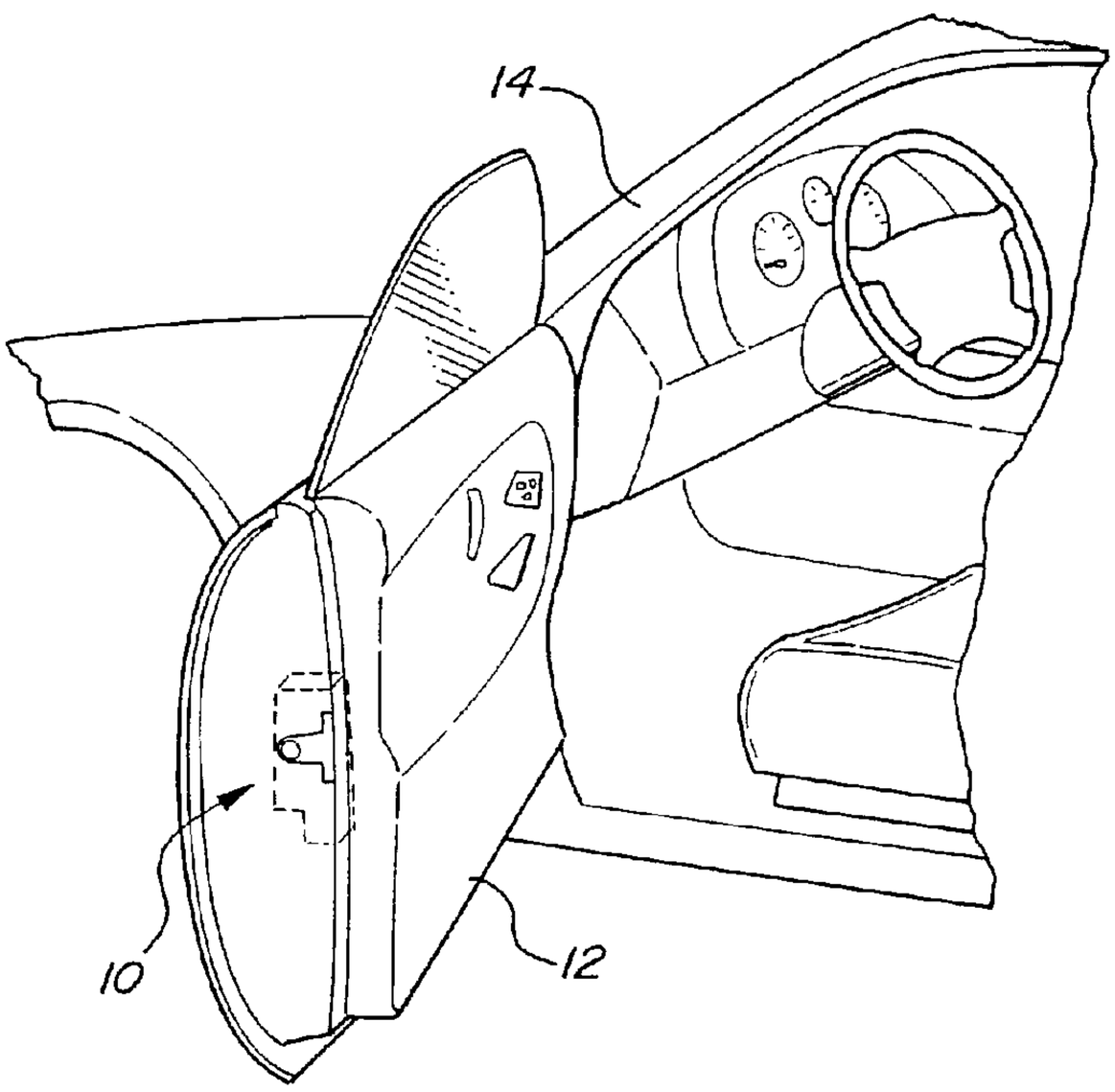

(57) Abrégé/Abstract:
A vehicle door latch assembly is movable between an unlocked condition, a locked condition and a double locked condition. The door latch assembly (10) has a support housing (16) with a cover having a projecting block. A ratchet (18) is mounted to the support housing between a latched position and an unlatched position. A pawl (26) is mounted to the support housing (16) and is movable between a blocking position securing the ratchet (18) in the latched position and a release position permitting the ratchet to pivot toward the unlatched position. A release mechanism (32) is mounted to the support housing (16) for moving the pawl (26) into the release position. A slider (36) is coupled between the pawl (26) and the release mechanism (32). The slider (36) moves between an engaged position aligned with the release mechanism and a disengaged position spaced from the release mechanism. A locking mechanism (42) is pivotally connected to the support housing and pitotally engaging the slider for providing the sliding movement of the slider. An inside lock lever (62) engages the locking mechanism (42) for rotating the locking mechanism, effecting movement of the slider (36) between the unlocked condition and the first locked position.

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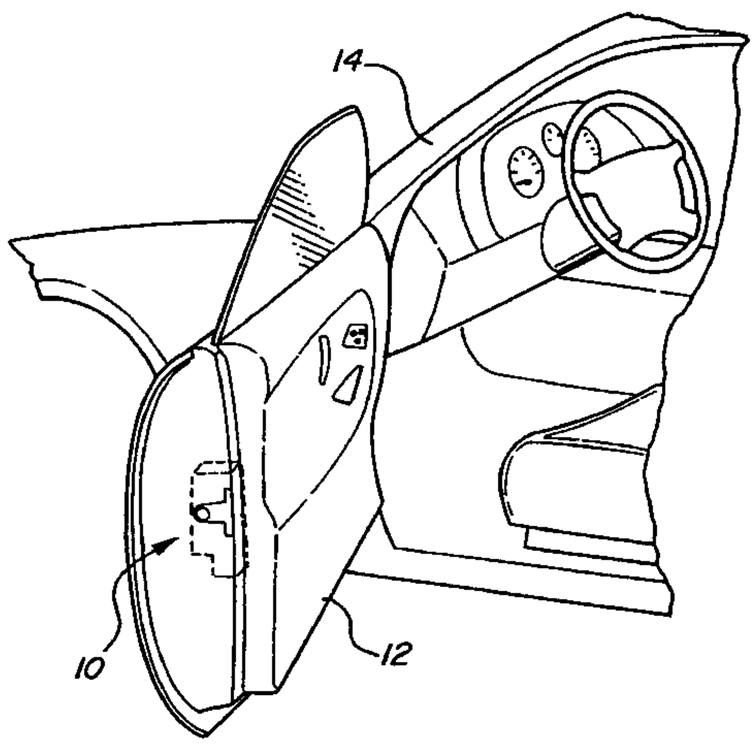

(57) Abstract: A vehicle door latch assembly is movable between an unlocked condition, a locked condition and a double locked condition. The door latch assembly (10) has a support housing (16) with a cover having a projecting block. A ratchet (18) is mounted to the support housing between a latched position and an unlatched position. A pawl (26) is mounted to the support housing (16) and is movable between a blocking position securing the ratchet (18) in the latched position and a release position permitting the ratchet to pivot toward the unlatched position. A release mechanism (32) is mounted to the support housing (16) for moving the pawl (26) into the release position. A slider (36) is coupled between the pawl (26) and the release mechanism (32). The slider (36) moves between an engaged position aligned with the release mechanism and a disengaged position spaced from the release mechanism. A locking mechanism (42) is pivotally connected to the support housing and pitotally engaging the slider for providing the sliding movement of the slider. An inside lock lever (62) engages the locking mechanism (42) for rotating the locking mechanism, effecting movement of the slider (36) between the unlocked condition and the first locked position.

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VEHICLE DOOR LATCH ASSEMBLY

Field of the Invention

The subject invention relates to vehicle door latch assemblies having both manual and power door locking features.

Background of the Invention

Vehicles, such as passenger cars, are commonly equipped with individual door latch assemblies which secure respective passenger and driver side doors to the vehicle. Each door latch assembly is typically provided with manual release mechanisms or lever for unlatching the door latch from the inside and outside of the vehicle, e.g. respective inner and outer door handles. In addition, many vehicles also include an electrically controlled actuator for remotely locking and unlocking the door latches.

As is commonly known, the release mechanisms may be actuated to lock the door latch assembly and prevent release of the outer door handle. However, a thief may break a window of the vehicle and reach inside to manually unlock the latch assembly by actuating the inner door handle. The industry has therefore developed door latch assemblies which have a "double lock" or anti-theft feature which also locks the inner door handle such that neither handle may be actuated to open the door.

The double lock or anti-theft feature is typically accomplished by the electrically controlled actuator and cannot be done manually. This helps ensure that the passengers are outside of the vehicle when the double lock feature is engaged. Examples of prior art door latch assemblies which incorporate a double lock feature are shown in United States Patent Nos. 5,464,260 and 5,474,339. However, the prior art door latch assemblies incorporating the double lock feature have a number of deficiencies.

One primary deficiency relates to the electrical movement of the actuator between an unlocked condition, a locked condition and a double locked condition. A number of elements are actuated within the door latch assembly as the actuator moves between these conditions. The actuator is typically connected to an electric motor which controls the movements. The electric motor must be actuated a predetermined amount in order to move the actuator through the desired conditions. As appreciated, electric motors are susceptible to changes in temperature, moisture, and voltage such that the desired actuation of the electric motor may not be consistently and accurately achieved.

Summary of the Invention

The disadvantages of the prior art may be overcome by providing a vehicle door latch assembly movable between an unlocked condition, a first locked condition and a second

locked condition. The door latch assembly comprises a support housing. A cover is mounted to the support housing and has at least one projecting abutment. A ratchet is pivotally mounted to the support housing and movable or pivotal between a latched position and an unlatched position. A pawl is mounted to the support housing and is movable between a blocking position securing the ratchet in the latched position and a release position permitting the ratchet to pivot toward the unlatched position. A release mechanism is mounted to the support housing for selectively moving the pawl into the release position. A slider is selectively coupled between the pawl and the release mechanism. The slider moves between an unlocked position aligned with the release mechanism, a first locked position and a second locked position spaced from the release mechanism. A locking mechanism is pivotally connected to the support housing and pivotally engaging the slider for providing the sliding movement of the slider. An inside lock lever engages the locking mechanism for rotating the locking mechanism, effecting movement of the slider between the unlocked condition and the first locked position. An outside lock lever engages the locking mechanism for rotating the locking mechanism, effecting movement of the slider between the unlocked condition and the first locked position. An actuator is operatively connected to the locking mechanism for effecting movement of the slider between the unlocked, first locked and second locked positions. When the locking mechanism is in the second lock position, the locking mechanism blocks movement of the inside lock lever. The outside lock lever has a lost motion connection with the locking mechanism so that the outside lock lever is unable to move the locking mechanism when the locking mechanism is in the second lock position.

A cam is rotatably mounted to the cover and includes a camming surface defining at least one stop for selective engagement with the abutment. A transfer element is mounted to the cam and engages the slider for transferring the rotation of the cam into the movement of the slider. A rocker is movably mounted to the cover for selectively engaging the camming surface of the cam. A first motor rotates the cam and moves the transfer element between a first position wherein the stop engages the abutment and the rocker engages the camming surface with the slider engaged with the release mechanism for defining the unlocked condition of the door lock; a second position wherein the rocker engages the stop to prevent further rotation of the cam with the slider disengaged with the release mechanism to define the first locked condition; and a third position wherein the stop engages the abutment and the rocker is released from the camming surface with the slider disengaged further from the release mechanism to define the second locked condition. A second motor rotates the rocker to release the rocker from the camming surface during rotation of the cam from the second position to the third position.

Accordingly, the actuator incorporates at least three separate stops for ensuring that the correct rotation of the cam and transfer element is achieved. The subject invention also

incorporates a novel means of providing the second locked condition or double lock feature for the door lock assembly.

Description of the Drawings

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a perspective view of a vehicle door mounted to a passenger vehicle incorporating the door latch assembly of the present invention;

Figure 2 is a perspective view of a door latch assembly of Figure 1 with an electrically controlled actuator in spaced relationship thereto;

Figure 3 is a perspective view of the door latch assembly of Figure 2;

Figure 4 is a perspective view of the door latch assembly of Figure 2 with a number of exterior covers removed to expose the working components;

Figure 5 is an exploded view of a pawl, slider, release mechanism and outside release lever of the door latch assembly of Figure 2;

Figure 6 is a detailed view of a slider and the release mechanism of the door latch assembly of Figure 2 in an unlocked condition;

Figure 7 is a detailed view of the slider and release mechanism of the door latch assembly of Figure 2 in a first locked condition;

Figure 8 is a detailed view of the slider and release mechanism of the door latch assembly of Figure 2 in a second locked condition;

Figure 9 is an exploded perspective view of the electrically controlled actuator of Figure 2;

Figure 10 is a detailed view of a cam and a rocker of the electrical actuator of Figure 2 in the unlocked condition;

Figure 11 is a detailed view of the cam and rocker of the electrical actuator of Figure 2 in the first locked condition;

Figure 12 is a detailed view of the cam and rocker of the electrical actuator of Figure 2 in the second locked condition;

Figure 13 is a perspective view of an inside surface of an enclosure of the electrical actuator of Figure 2 with the cam in exploded relationship thereto;

Figure 14 is a detailed view of slider and release mechanism of a second embodiment of the door latch assembly of the present invention; and

Figure 15 is an exploded perspective view of an inner release mechanism of the door latch assembly of Figure 14.

Detailed Description of the Preferred Embodiment

Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a vehicle door latch assembly is generally shown at 10 in Figures 1 through 4. The door latch assembly 10 is mounted to a driver's side vehicle door 12 of a passenger vehicle 14 as is known in the art. As appreciated, the door latch assembly 10 may be mounted to the front and rear passenger side doors and may be incorporated into a sliding side door, rear door, a rear hatch or a lift gate.

Referring to Figures 2 through 5, the door latch assembly 10 comprises a support housing 16 of any suitable design or configuration. A ratchet 18 is pivotally mounted to the support housing 16 and movable between a latched position and an unlatched position. For illustrative purposes, the ratchet 18 is shown in the unlatched position in Figure 4. As appreciated, a striker pin 20, shown in phantom, extends from a door jam of the vehicle 14 to engage the ratchet 18. An opening or mouth 22 is provided in the housing 16 for receiving the striker pin 20. The ratchet 18 surrounds the striker pin 20 when in the latched position which secures the door latch assembly 10, and subsequently the door 12, to the vehicle 14. A spring 24 continuously biases the ratchet 18 toward the unlocked position. The design of the ratchet 18 is of any suitable configuration as is known in the art.

A pawl 26 is pivotally mounted to the support housing 16. The pawl 26 has first 28 and second 30 arms extending from a central pivot point in a generally L-shaped configuration. First arm 28 has a locking face which engages a complementary locking face on ratchet 18 such that the two faces engage each other during the blocking of the pawl 26 with the ratchet 18. The pawl 26 moves between a blocking or latching position wherein the first end 28 abuts the ratchet 18 to secure the ratchet 18 in the latched position and a release position wherein the first end 28 disengages the ratchet 18 permitting the ratchet 18 to pivot toward the unlatched position.

A release mechanism 32 is pivotally mounted to the support housing 16 for selectively moving the pawl 26 into the release position. The release mechanism 32 includes a coupling surface 44 for selectively engaging the pin 38 of the slider 36. Coupling surface 44 is radially and axially spaced from the pivot point of release mechanism 32. The release mechanism 32 includes a first engaging surface 46 radially and circumferentially spaced from the coupling surface 44. Release mechanism has an axially extending tab defining a second engaging surface 48 spaced oppositely from the first engaging surface 46.

A coupler 34 selectively couples the second end 28 of the pawl 26 and the release mechanism 32. The pawl 26, release mechanism 32 and coupler 34 are illustrated best in Figures 4 and 5.

The coupler 34 includes a slider 36. Slider 36 has a generally elongate body having a projecting pin 38 extending transversely thereto.

A guide arm 40 is commonly mounted to the support housing 16 adjacent the pawl 26 to cooperate therewith. Guide arm 40 is generally club-shaped and cooperates with arm 30 of the pawl 26 to define a channel (not numbered) for receiving the pin 38 of the slider 36 to guide the sliding movement thereof. Alternatively, guide arm 40 could be integrated with the pawl 26.

An outside release lever 50 is pivotally mounted at one end thereof to the support housing 16. Preferably, release lever 50 is commonly mounted with release mechanism 32 and pawl 26. The opposite end of release lever 50 extends out of the housing 16. Release arm 50 has an axially extending tab 51 which is positioned to selectively engage the first engaging surface 46 of the release mechanism 32. A retaining spring 52 (see Figure 4) hooks about the shaft around both the release mechanism 32 and the outside release lever 50 to continuously bias the outside release lever 50 against the first engaging surface 46 of the release mechanism 32. A coil spring 53 extends between the housing 16 and release lever 50 to bias the release lever 50 to the standby position.

The coupler 34 includes a locking mechanism 42 pivotally connected to the support housing 16 by pin 43. Locking mechanism has hub and an outwardly extending flange 45. Slider 36 is pivotally mounted on a sector portion of the flange 45. The sector portion has a radially extending finger 68 and a circumferentially extending slot 116. The locking mechanism 42 includes a cam surface 60 defining rotational limits.

The coupler 34 has an unlocked position wherein the release mechanism 32 is coupled to the pawl 26 through pin 38 of slider 36. Movement of the release mechanism 32 moves the pawl 26 to the release position. This coupled position creates an unlocked condition as shown in Figure 6. The coupler 34 can move to a disengaged or first locked position wherein the slider 36 is moved radially towards the release mechanism 32 moving the pin 38 out of radial alignment with coupling surface 44, uncoupling the pawl 26 from the release mechanism 32. Movement of the release lever 50 will not effect rotation of the pawl 26. The coupler 34 can move to a further disengaged or second locked position spaced farther from the release mechanism 32 which creates a second locked condition or a double lock as shown in Figure 8.

An outside lock lever 58 is pivotally connected at one end thereof to the housing 16 on pin 43, common with the locking mechanism 42. The opposite end of outside lock lever 58 extends out of the housing 16. The outside lock lever 58 has a pin 59 extending radially and positioned to slidingly engage cam surface 60. The outside lock lever 58 has a lost motion connection with the locking mechanism 42 to move the locking mechanism 42 between the unlocked condition (Figure 6) and the first locked condition (Figure 7). The lost motion connection allows the locking mechanism 42 to be moved to the double locked condition (Figure 8) and prevents the outside lock lever from effecting movement of the

locking mechanism 42 back to the unlocked condition.

An inside release lever 54 is pivotally mounted to the support housing 16 on a plane generally orthogonal from the housing 16. Inside release lever 54 has a generally F-shaped configuration. Inside release lever 54 is pivotally connected to the housing 16 by pin 157. The second arm of the inside release lever 54 has a tab 61 positioned to engage second engaging surface 48. The second arm has a tab 63 extending towards the first arm 55. A return spring 56 mounted on pin 159 engages pin 57 for continuously biasing the inside release lever 54 toward a non-actuated or stand-by position.

An inside lock lever 62 is pivotally mounted on pin 159 for cooperation with the inside release lever 54. Inside lock lever 62 has a C-shaped end which extends into the general plane of the housing 16. An over-the-center spring 70 extends between the housing 16 and inside lock lever 62, which spring 70 toggles the inside lock lever 62 in either the unlocked or locked condition.

An interior locking segment 64 is pivotally mounted to the support housing 16 at pin 65 and interconnects the inside lock lever 62 to the locking mechanism 42. As best illustrated in Figures 6 through 8, the interior locking segment 64 is generally Y-shaped defining an integral catch 66. Preferably locking segment 64 has first leg 72 and second 74 leg. Extending oppositely from legs 72, 74 is head 75. Legs 72, 74 receive finger 68 of locking mechanism 42, which head 75 engages inside lock lever 62. Locking segment 64 operatively engages inside locking lever 62 with the locking mechanism 42.

Referring to Figures 6 through 8, the unlocked condition of the inside lock lever 62 positions the finger 68 near the first leg 72 of the catch 66 (Figure 6). The first locked condition of the inside lock lever 62 has the finger 68 positioned near the second leg 74 of the catch 66 (Figure 7). The locking segment 64 is toggled to the locked condition as the inside lock lever 62 pivots from the unlocked position to the locked position. Pivotal movement of the locking segment 64 back to the unlocked condition engages the first leg 72 with the finger 68 which also moves the locking mechanism 42 back to the unlocked condition. The double locked condition of the inside lock lever 62 aligns the finger 68 with the tip of the second leg 74 such that if the locking segment 64 begins to pivot, the second leg 74 engages the finger 68 which blocks rotational movement of the locking segment 64 (Figure 8). Hence, in the double locked condition, the locking mechanism 42 cannot be manually moved back into the unlocked condition by the inside lock lever 62.

The outside release lever 50 is interconnected to an outer door handle (not shown) and the inside release lever 54 is similarly interconnected to an inner door handle (not shown). The outside lock lever 58 and the inside lock lever 62 are similarly interconnected with outside and inside locks. The release levers 50, 54 and locking levers 58, 62 may be connected to the door handles and locks or buttons by any suitable device, such as a Bowden

wire cable (not shown) or rod, as is known in the art.

The general operation of the door latch assembly 10 is now discussed in detail. As discussed above, the door latch assembly 10 has an unlocked condition, a first locked condition and a second locked condition. The unlocked condition is best shown in Figures 4 and 6. In this condition, the inside 54 and outside 50 release levers may release the ratchet 18 from the latched position. The locking mechanism 42 is rotated to a rearward most position which retracts the slider 36 to align or couple the pin 38 with the coupling surface 44 of the release mechanism 32. During actuation of the outer door handle, the outside release lever 50 pivots in unison with the release mechanism 32. This in turn moves the coupling surface 44 of the release mechanism 32 into engagement with the pin 38. The pin 38 and slider 36 are then pushed against the second end 30 of the pawl 26. The pivoting of the second end 30 of the pawl 26 pivots the first end 28 out of engagement with the ratchet 18 such that the ratchet 18 may rotate to the unlatched position.

During actuation of the inner door handle, the inside release lever 54 pivots in a releasing direction toward the release mechanism 32 and engages the second engaging surface 48 of the release mechanism 32. This in turn also moves the coupling surface 44 of the release mechanism 32 into engagement with the pin 38. As stated above, the pin 38 and slider 36 are then pushed against the second end 30 of the pawl 26. The pivoting of the second end 30 of the pawl 26 pivots the first end 28 out of engagement with the ratchet 18 such that the ratchet 18 may rotate to the unlatched position. The inside lock lever 62, as well as the locking segment 64, do not operate when the door latch assembly 10 is in the unlocked condition.

The first locked condition is shown in Figure 7. In this condition, the inside release lever 54 may release the ratchet 18 from the latched position but the outside release lever 50 is non-operable. The locking mechanism 42 is rotated to a midway position which moves the slider 36 and positions the pin 38 out of alignment with the coupling surface 44 of the release mechanism 32. The finger 68 of the locking mechanism 42 is also moved to a position adjacent the second leg 74. Specifically, the locking segment 64 is toggled to the locked condition which also slides the inside lock lever 62. The rotational movement of the locking mechanism 42, and subsequent movement of the slider 36 and locking segment 64, may be done manually or remotely. To manually move the locking mechanism 42, the outside lock lever 58 is actuated and engages one end of the cam surface 60.

During actuation of the outer door handle, the outside release lever 50 pivots in unison with the release mechanism 32. This in turn moves the coupling surface 44 of the release mechanism 32 toward the slider 36. However, the pin 38 of the slider 36 is now out of alignment with the coupling surface 44. Hence, the coupling surface 44 simply pivots about the slider 36 and does not engage the slider 36. Accordingly, the pawl 26 is not actuated and

the ratchet 18 remains locked in the latched position.

During actuation of the inner door handle, the inside release lever 54 pivots toward the release mechanism 32 and engages the second engaging surface 48 of the release mechanism 32. Tab 63 of inside release arm 54 abuts the inside lock lever 62. A rotation counter to a releasing rotation will toggle locking segment 64 and rotate locking mechanism 42 from the first lock position to the unlocked position. A subsequent releasing rotation will be enabled to unlatch the latch assembly 10. Accordingly, the first leg 72 of the locking segment 64 engages the finger 68 of the locking mechanism 42 and rotates the locking mechanism 42 back to the unlocked condition. The rotating of the locking mechanism 42 pulls the slider 36 back and re-aligns the pin 38 with the coupling surface 44 of the release mechanism 32. The continued pivoting of the inside release lever 54 moves the coupling surface 44 of the release mechanism 32 into engagement with the pin 38. As stated above, the pin 38 and slider 36 are then pushed against the second end 30 of the pawl 26. The pivoting of the second end 30 of the pawl 26 pivots the first end 28 out of engagement with the ratchet 18 such that the ratchet 18 may rotate to the unlatched position.

The second locked, or double locked, condition is shown in Figure 8. In this condition, both the inside 54 and outside 50 release levers are non-operable. The locking mechanism 42 is rotated to a forward most position which moves the slider 36 and positions the pin 38 out of further alignment with the coupling surface 44 of the release mechanism 32. The finger 68 of the locking mechanism 42 is moved further to a position aligned with the tip of the first leg 72. The rotational movement of the locking mechanism 42, and subsequent movement of the slider 36, may only be done remotely. The remote actuation of the locking mechanism 42 is done by the electrical actuator 76 and is discussed in greater detail below.

During actuation of the outer door handle, the outside release lever 50 pivots in unison with the release mechanism 32. This in turn moves the coupling surface 44 of the release mechanism 32 toward the slider 36. However, the pin 38 of the slider 36 is still out of alignment with the coupling surface 44. Hence, the coupling surface 44 simply pivots about the slider 36 and does not engage the slider 36. Accordingly, the pawl 26 is not actuated and the ratchet 18 remains locked in the latched position.

During actuation of the inner door handle, the inside release lever 54 pivots toward the release mechanism 32 and engages the second engaging surface 48 of the release mechanism 32. Simultaneously, the inside release lever 54 engages the inside lock lever 62. Specifically, the inside release lever 54 pushes against the inside lock lever 62 which attempts to slide the inside lock lever 62 and toggle the locking segment 64 back to the unlocked condition. Due to the position of the finger 68 in relation to the tip of the first leg 72, the locking segment 64 cannot pivot back to the unlocked position and the locking mechanism 42 remains in the double locked condition. The continued pivoting of the inside release lever 54

moves the coupling surface 44 of the release mechanism 32 toward the slider 36. However, as above, the pin 38 of the slider 36 is still out of alignment with the coupling surface 44. Hence, the coupling surface 44 simply pivots about the slider 36 and does not engage the slider 36. Accordingly, the pawl 26 is not actuated and the ratchet 18 remains locked in the latched position.

The remote actuation of the door latch assembly 10 is now discussed in greater detail with reference to Figures 9 through 13. Specifically, the electronically controlled actuator is generally shown at 76 in Figures 2 and 9. The electrical actuator 76 moves the components of the door latch assembly 10 between the unlocked condition, the first locked condition and the second locked condition.

Referring to Figure 13, the actuator 76 comprises an enclosure 90 having at least one projecting trapezoidally shaped abutment 80 on an inner face thereof. The abutment 80 has two opposing abutting surfaces 88.

A cam 82 is rotatably mounted to the enclosure 90. The cam 82 includes a circumferentially extending camming surface 84 having stops 86 for selective engagement with the abutment 80. The projecting abutment 80 includes at least a pair of spaced abutting surfaces 88. The cam 82 further includes a second circumferentially extending camming surface 94. Preferably, camming surfaces 84 and 94 are at different radial extents from the axis of rotation of the cam 82.

A sector gear 92 is commonly mounted with the cam 82. The sector gear 92 is seated within the second camming surface 94. Although not illustrated, there is preferably a 15° gap between the sector gear 92 and the cam 82 to define a lost motion connection therebetween.

A cam return spring 96, having first and second ends, has the first end mounted to the sector gear 92 for continuously biasing the cam 82 to an unlocked condition.

A bottom plate 98 has a hub designed to receive the second end of the cam return spring 96. A tang 99 extends radially from the bottom plate 98.

The cover 78 has a well 79 which nestingly receives the various components. A pair of spaced projections 100 with one of the projections engaging the bottom plate 98 at tang 99 to secure the bottom plate 98 in a desired rotational position and the other projection 100 engages the first end of the cam return spring 96 to limit the rotation of the cam return spring 96.

A rocker 102 is pivotally mounted to the cover 78 and positioned to selectively engage the camming surface 84 of the cam 82. The rocker 102 has a first end having a series of teeth 103 and a cam follower 105 at an opposite end. Rocker 102 is pivots intermediate the ends thereof. A rocker return spring 104 is mounted to the rocker 102 for continuously biasing the cam follower 105 to engage the cam 82.

Cam 82 rotates to a first position wherein the stop 86 engages the abutment 80 and the

cam follower 105 of rocker 102 engages the camming surface 84, defining the unlocked condition of the door lock assembly 10. One of the stops 86 engages one of the abutting surfaces 88 of the block 80 as shown in Figure 10. The first gear 106 can then move the cam 82 to a second position wherein the end of cam follower 105 of rocker 102 engages the stop 86 to prevent further rotation of the cam 82, defining the first locked condition. The rocker 102 engages the opposing stop 86 within the camming surface 84 as shown in Figure 11. Finally, the first gear 106 can rotate the cam 82 to a third position wherein the stop 86 engages the abutment 80 and the cam follower 105 of rocker 102 is released from the camming surface 84 to define the second locked condition. The opposing stop 86 of the camming surface 84 engages the other abutting surface 88 of the block 80 and the rocker 102 is pivoted out of the camming surface 84 as shown in Figure 12. A second gear 108 engages the teeth 103 to rotate the rocker 102 to release the rocker 102 from the camming surface 84 during rotation of the cam 82 from the second position to the third position. This design incorporates two gears for providing a three stop position operation.

As shown the preferred embodiment, a pair of stops 86 are formed within the cam 82 and a pair of abutting surfaces 88 are formed within the enclosure 90 of the cover 78. There may be any number of stops 86 and/or abutting surfaces 88 so long as three physical stops are created for the cam 82. In fact there may be only one stop 86 and one abutment 80 such that the cam 82 rotates a full 360°. In addition, the stop or stops 86 may be formed on the cover 78 and the abutting surface or surfaces 88 may be formed on the cam 82 without deviating from the overall scope of the subject invention. The cam 82, rocker 102 and gearing arrangement may be of any suitable design in order to accommodate a particular abutment/stop arrangement.

The first gear 106 is operatively connected to an electric motor 110 for providing the rotational motion of the cam 82. The first gear 106 also includes a series of sprocket gears 112 interengaging the motor 110 with the sector gear 92 of the cam 82. Hence, the motor 110 is geared down through the sprocket gears 112 in order to rotate the cam 82. The second gear 108 similarly includes an electric motor 107 for providing the movement of the rocker 102. The electric motor 107 is preferably connected directly to the rocker 102.

A transfer element 114 is mounted to the cam 82 for rotation therewith on the outside of enclosure 90. Transfer element has a tab 118 which engages the coupler 34 for transferring the rotation of the cam 82 into the movement of the coupler 34. In other words, the transfer element 114 interconnects the electrical actuator 76 to the door latch assembly 10. The aperture 116 of locking mechanism 42 receives tab 118 such that rotation of the transfer element 114 between the unlocked, first locked and second locked conditions rotates the locking mechanism 42 and moves the slider 36 between the respective engaged first lock and second locked positions.

The cam 82 also includes a plurality of undulations 120 disposed about an outer surface thereof between the camming surfaces 84, 94. A cam control switch 122 engages the undulations 120 of the cam 82 such that the rotational movement of the cam 82 may be monitored by movement of the cam control switch 122. The cam control switch 122 may be used to set and reset the positions of the various parts of the electrical actuator 76. A central lock switch 124 is also mounted to the cover 78 and engages the coupler 34 such that the movement of the coupler 34 may be monitored by movement of the central lock switch 124. Specifically, the central lock switch 124 engages the locking mechanism 42 for sending a signal to the other lock assemblies in the vehicle 14 to operate. Finally, a latch control switch 126 is mounted to the cover 78 and engages the ratchet 18 such that the movement of the ratchet 18 may be monitored by movement of the latch control switch 126. The latch control switch 126 primarily monitors whether the ratchet 18 and door 12 is fully latched against the vehicle 14.

Each of the switches 122, 124, 126 generate a respective signal which is sent to a central processor.

Referring to Figure 14, a second embodiment of the coupler and release mechanism is illustrated. In this embodiment, the locking mechanism 142 has a flange 145 with a head 175 extending radially therefrom. Head 175 engages inside locking lever 62. Flange 145 has a house 147 extending therefrom which houses a detent plunger 149 and a spring 151. Spring 151 biases plunger 149 to slide radially outwardly. Housing 16 has a guide slot 153 which receives plunger 149 in sliding engagement. Slot 153 has three detents or notches 155, 157, 159 which correspond to the second lock, first lock and unlocked positions, respectively. Detents 155, 157, 159 are shaped to retain the plunger 149 in one of the three positions. However, the shaped must enable the actuator 76, inside and outside locking levers 58, 62 to be able to rotate locking mechanism 142 and overcome the bias of the engagement of the plunger 149 within the slot 153.

Locking mechanism 142 is provided with a pin 161 and a spring 163. Spring 163 has a base coil 165 mounted on a pin 165 on housing 16. Spring 163 has a straight leg and a detented leg having three detents corresponding to the second lock, first lock and unlocked positions, respectively. Spring 163 is shaped to urge the locking mechanism 142 to one of the three positions and assist in holding the locking mechanism therein.

The engagement of the locking mechanism 142 in the second lock position should be sufficiently robust to prevent movement thereof by the inside lock lever 62, 162 but still allow the actuator 76 to rotate the locking mechanism 142 from the second lock position to the first lock position.

Referring to Figure 15, an alternative embodiment of the inside release mechanism is illustrated. An inside release lever 154 is pivotally mounted to the support housing 16 on a

plate 114 extending generally orthogonal from the housing 16. The inside release lever 154 is pivotally connected to the plate 114 by pin 157. The inside release lever 154 has a tab 160 positioned to engage second engaging surface 48 and a tab 164.

An inside lock lever 162 is pivotally mounted on pin 159 for cooperation with the inside release lever 154. Inside lock lever 162 extends into the general plane of the housing 16 and has a slot which engages locking mechanism 142. Inside lock lever 162 has a tab174 defining a generally L-shape.

A swing arm 164 is pivotally mounted to lock lever 162 by pin 166. Swing arm 164 has three radially extending arms. One of the arms receives spring 168. Spring 168 extends between swing arm 168 and inside lock lever 162 to bias swing arm 168 to extend outwardly and engage inside release lever 162 at tab 176. An L-shaped guide slot is provided on flange 114 to receive pin 178 of swing arm 164 to guide swing arm 164 and prevent the swing arm 164 from deploying when the latch is not in the second or double lock position.

In the unlocked position, lock lever 162 will be position such that tab 176 does not interfere with the travel of release lever 154.

In the single or first locked position, inside lock lever 162 will be rotated such that tab 176 interferes with the travel of inside release lever 154. Rotation of inside release lever 154 will cause rotation of the swing arm 164 which will in turn cause rotation of the inside lock lever 162 to rotate from the first locked position to the unlocked position and allowing unlatching.

In the double or second locked position, the inside lock lever 162 will be rotated a further extent such that swing arm 164 will engage abutment 170 formed on flange 114. The movement to the double or second lock position will rotate swing arm 164 about pin 166 and out of the path of release lever 154. Thus, inside release lever 154 will rotate freely.

The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

WHAT IS CLAIMED IS:

1. A vehicle door latch assembly comprising;

a support housing,

a ratchet pivotally mounted to said support housing and movable between a latched position and an unlatched position, said ratchet biased to the unlatched position,

a pawl mounted to said support housing and movable between a blocking position wherein said pawl engages said ratchet to secure said ratchet in said latched position and a release position wherein said pawl disengages said ratchet to permit said ratchet to pivot toward said unlatched position, and

a release mechanism pivotally mounted to said support housing for selectively moving said pawl into said release position, an inside release lever and an outside release lever, each pivotally mounted on said support housing and operatively engaging said release mechanism to effect said selective movement,

a locking mechanism pivotally connected to said support housing,

a slider selectively coupling said pawl with said release mechanism,

an inside lock lever and an outside lock lever, each pivotally mounted on said housing and engaging said locking mechanism for rotating said locking mechanism, and

an actuator operatively connected to said locking mechanism,

characterized by

said slider rotatably mounted on said locking mechanism and slidably engaging said pawl, said slider movable between an unlocked position aligned with said release mechanism for coupling said pawl to said release mechanism wherein movement of said release mechanism moves said pawl to said release position, a first locked position spaced from said release mechanism for uncoupling said pawl from said release mechanism wherein said pawl remains in said blocking position during said movement of said release mechanism to retain said ratchet in said latched position, and a second locked position,

said inside lock lever effecting movement of the slider between said unlocked condition and said first locked position,

said outside lock lever effecting movement of the slider between said unlocked condition and said first locked position,

said actuator effecting movement of the slider between said unlocked, first locked and second locked positions, when said slider is in said second locked position, said locking mechanism blocks movement of said inside lock lever.

2. The assembly as set forth in claim 1 wherein said locking mechanism has a lost motion connection with said outside lock lever, preventing said outside lock lever from effecting movement of said locking mechanism when said slider is in said second lock position.

3. The assembly as set forth in claim 2 further including an interior locking segment

pivotally mounted to said support housing and interconnecting said inside lock lever to said locking mechanism.

4. The assembly as set forth in claim 3 wherein said interior locking segment includes an integral catch and said locking mechanism includes an engagement finger, said engagement finger selectively engaging said catch such that pivotal movement of said inside lock lever toggles said locking segment and effects movement of said locking mechanism between said unlocked and first locked positions.

5. The assembly as set forth in claim 4 wherein said actuator has a rotatable cam movable between an unlocked condition, a first locked condition and a second locked condition, said cam operatively engaging said locking mechanism for transferring said rotation of said cam thereto.

6. The assembly as set forth in claimsl, 3 or 5, wherein said locking mechanism slidingly engages said housing in a guided slot, said slot having three detents corresponding to said unlocked, first lock and second lock positions of said slider.

7. The assembly as set forth in claim 6 wherein said locking mechanism has a biased plunger slidingly engaging said locking mechanism, said plunger biased for engagement with said detents.

8. The assembly as set forth in claim 7 wherein said actuator has a rotatable cam movable between an unlocked condition, a first locked condition and a second locked condition, said cam operatively engaging said locking mechanism for transferring said rotation of said cam thereto.

9. The assembly as set forth in claims 1, 3 or 7, wherein said inside lock lever has a swing arm pivotally mounted thereon, said swing arm movable between a coupling position and an uncoupling position, when said swing arm is in said coupling position, said swing arm extends into a path of rotation of the inside release lever enabling movement of said inside lock lever from the first lock position to the unlocked position, and when said swing arm is in said uncoupling position, said swing arm is rotated out of the path of rotation of said inside release, said uncoupling position corresponding to said second lock position.

10. The assembly as set forth in claim 9, wherein said housing has an abutment and said swing arm engages said abutment when said inside lock lever is rotated to the first lock position.

11. The assembly as set forth in claim 10, wherein a spring extends from said swing arm to said inside lock lever to bias the swing arm to the coupling position.

12. The assembly as set forth in claim 11, wherein said housing has a guide slot for guiding rotation of said swing arm, said guide slot being configured to enable rotation of the swing arm only when said inside lock lever is in said second lock position.

13. The assembly as set forth in any preceding claims 1 to 12, wherein said actuator includes:

a cover having at least one projecting abutment;

a cam rotatably mounted to said cover and including a camming surface defining at least one stop for selective engagement with said abutment;

a rocker movably mounted to said cover for selectively engaging said camming surface of said cam;

a first motor for rotating said cam between a first position wherein said stop engages said abutment and said rocker engages said camming surface corresponding to the unlatched condition of the door lock; a second position wherein said rocker engages said stop to prevent further rotation of said cam corresponding to the first locked condition; and a third position wherein said stop engages said abutment and said rocker is released from said camming surface corresponding to the second locked condition; and

a second motor for rotating said rocker to release said rocker from said camming surface.

14. The assembly as set forth in claim 13 wherein said camming surface includes at least two stops formed on opposing ends of said camming surface.

15. The assembly as set forth in claim 14 wherein said projecting abutment comprises a single projecting block having two opposing abutting surfaces.

16. The assembly as set forth in claim 15 further including a rocker return spring mounted to said rocker for continuously biasing said rocker to engage said camming surface.

17. The assembly as set forth in claim 16 further including a sector gear mounted to said cam, said sector gear in driving engagement with said first motor.

18. The assembly as set forth in claim 17 further including a cam return spring biasing said cam to said unlocked position.

19. The assembly as set forth in claim 18 wherein said cam and said sector gear have a lost motion connection therebetween.

20. The assembly as set forth in claim 19 wherein further including a cam control switch and said cam includes a plurality of undulations disposed about an outer surface thereof engaging said cam control switch such that said rotational movement of said cam may be monitored by movement of said cam control switch.

21. The assembly as set forth in claim 20 further including a central lock switch mounted and engaging said slider such that said movement of said slider may be monitored by movement of said lock mechanism switch.

22. The assembly as set forth in claim 21 further including a latch control switch and engaging said ratchet such that said movement of said ratchet may be monitored by movement of said latch control switch.

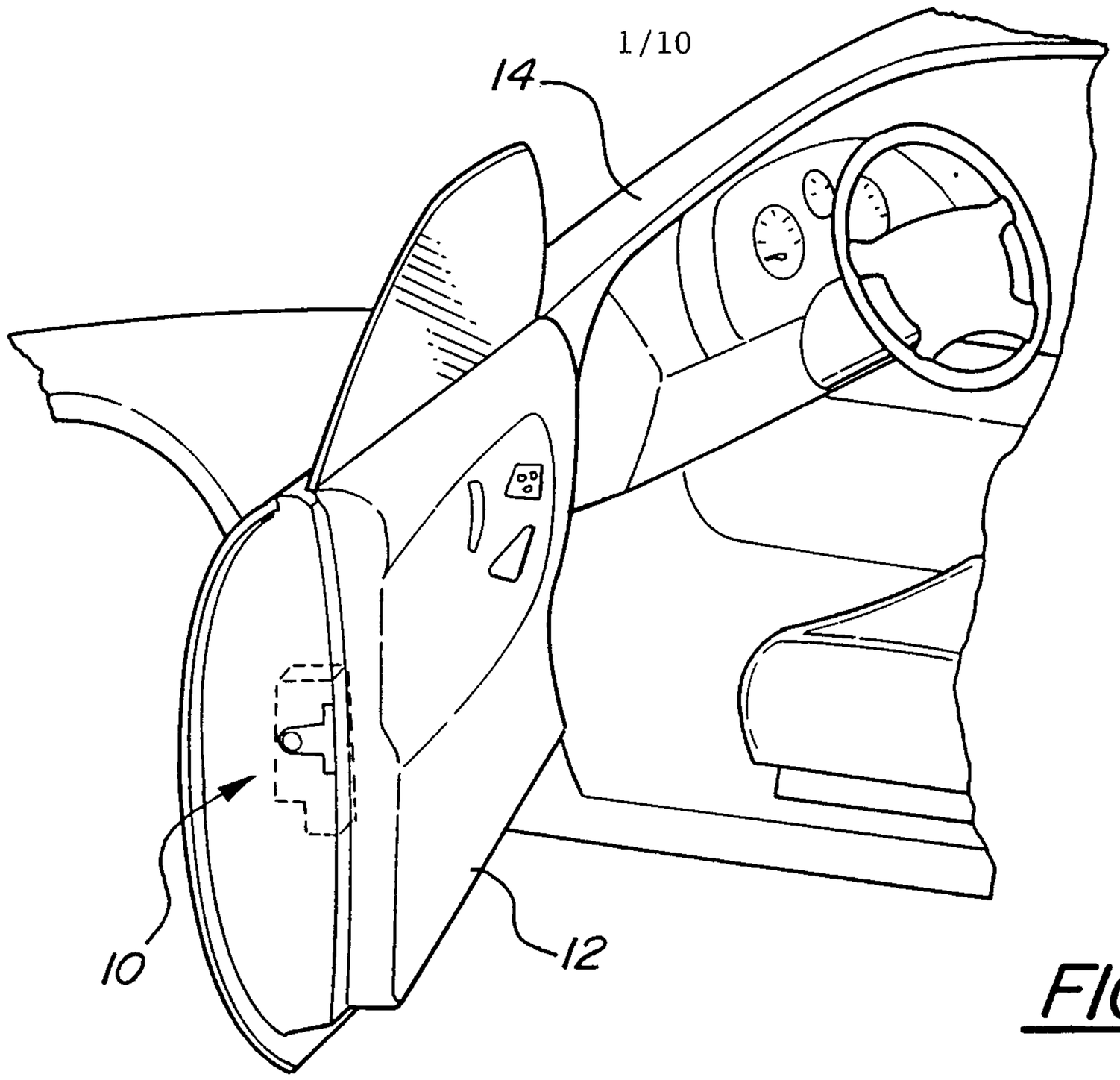


FIG - 1

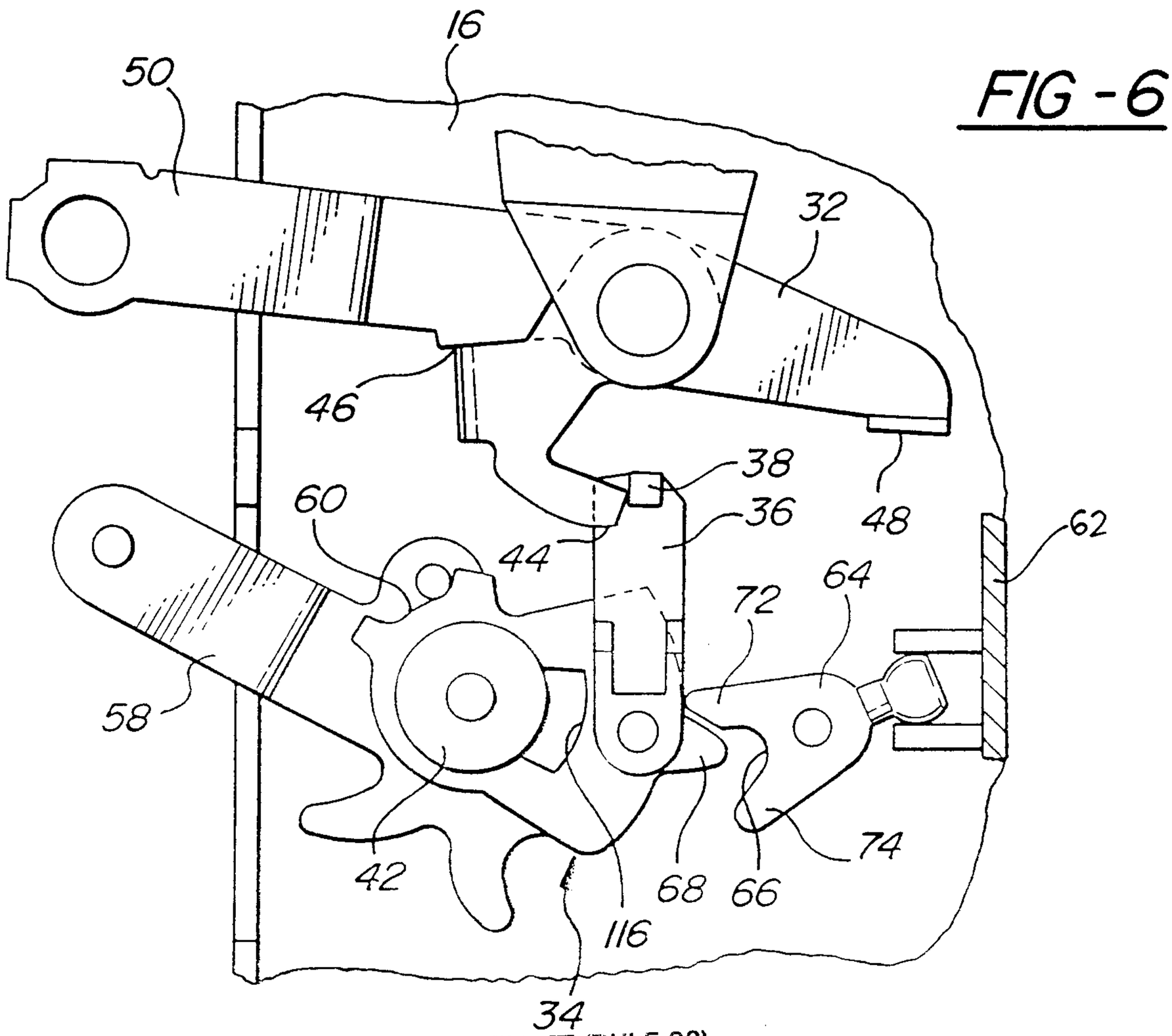


FIG - 6

FIG-2

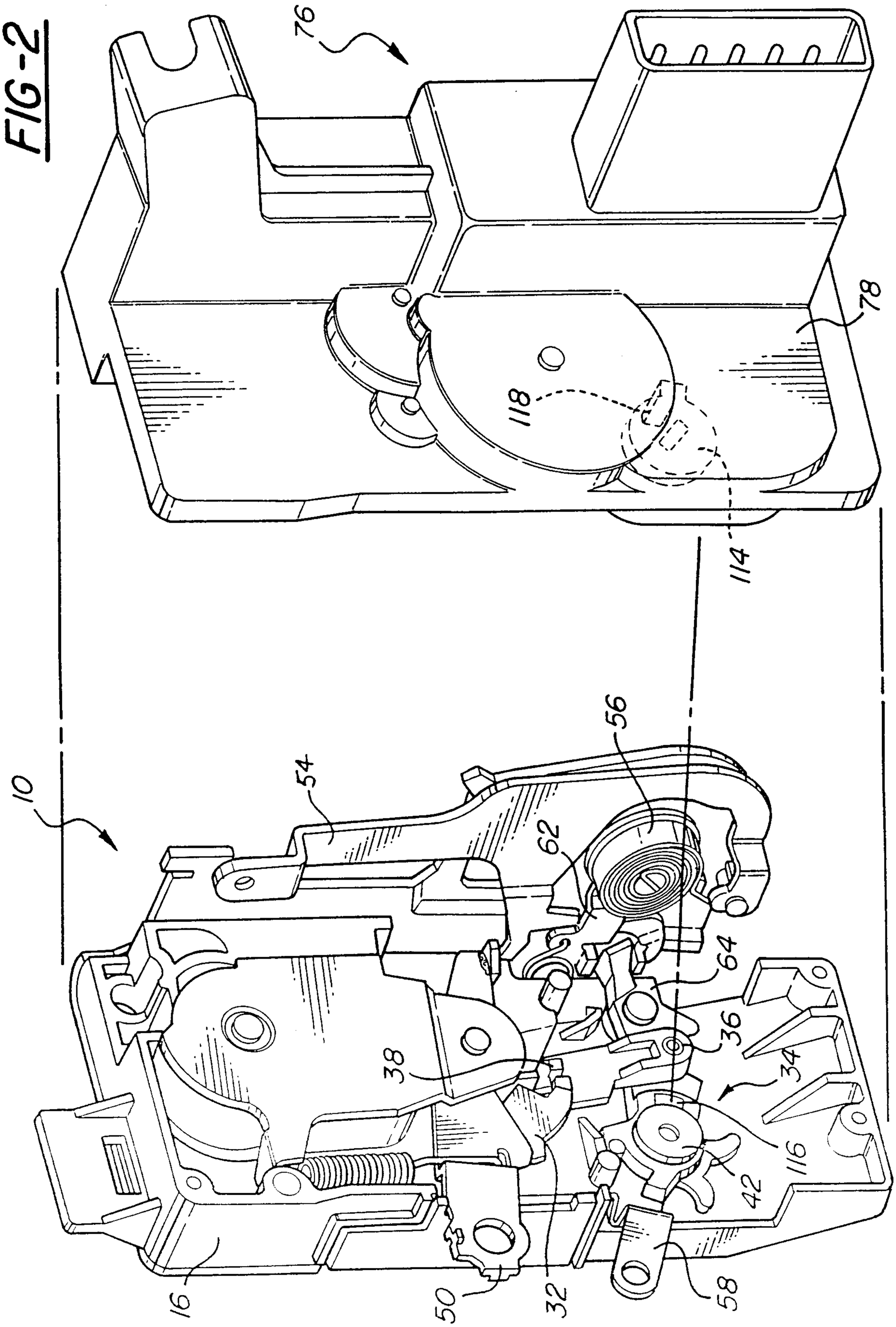
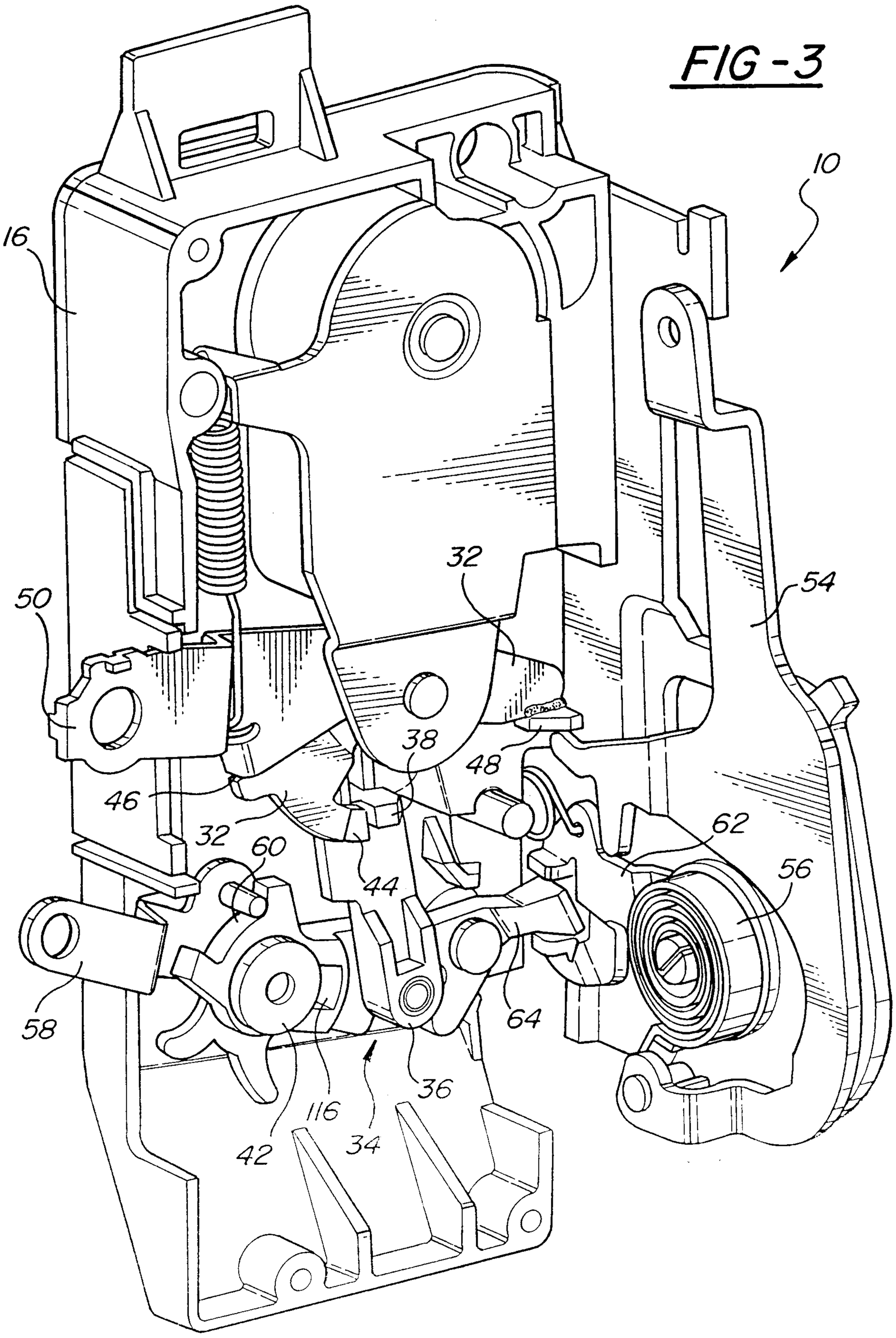


FIG-3



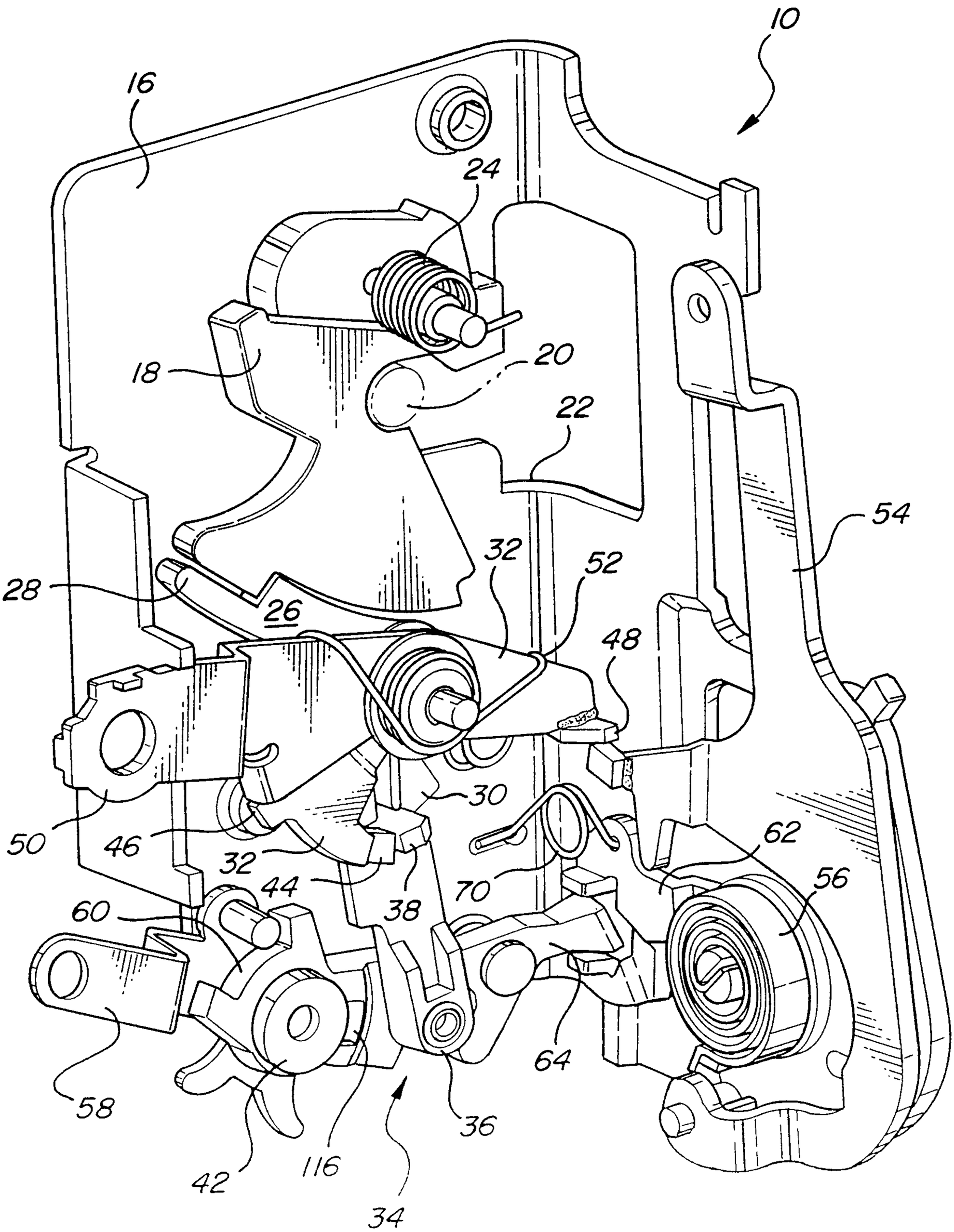

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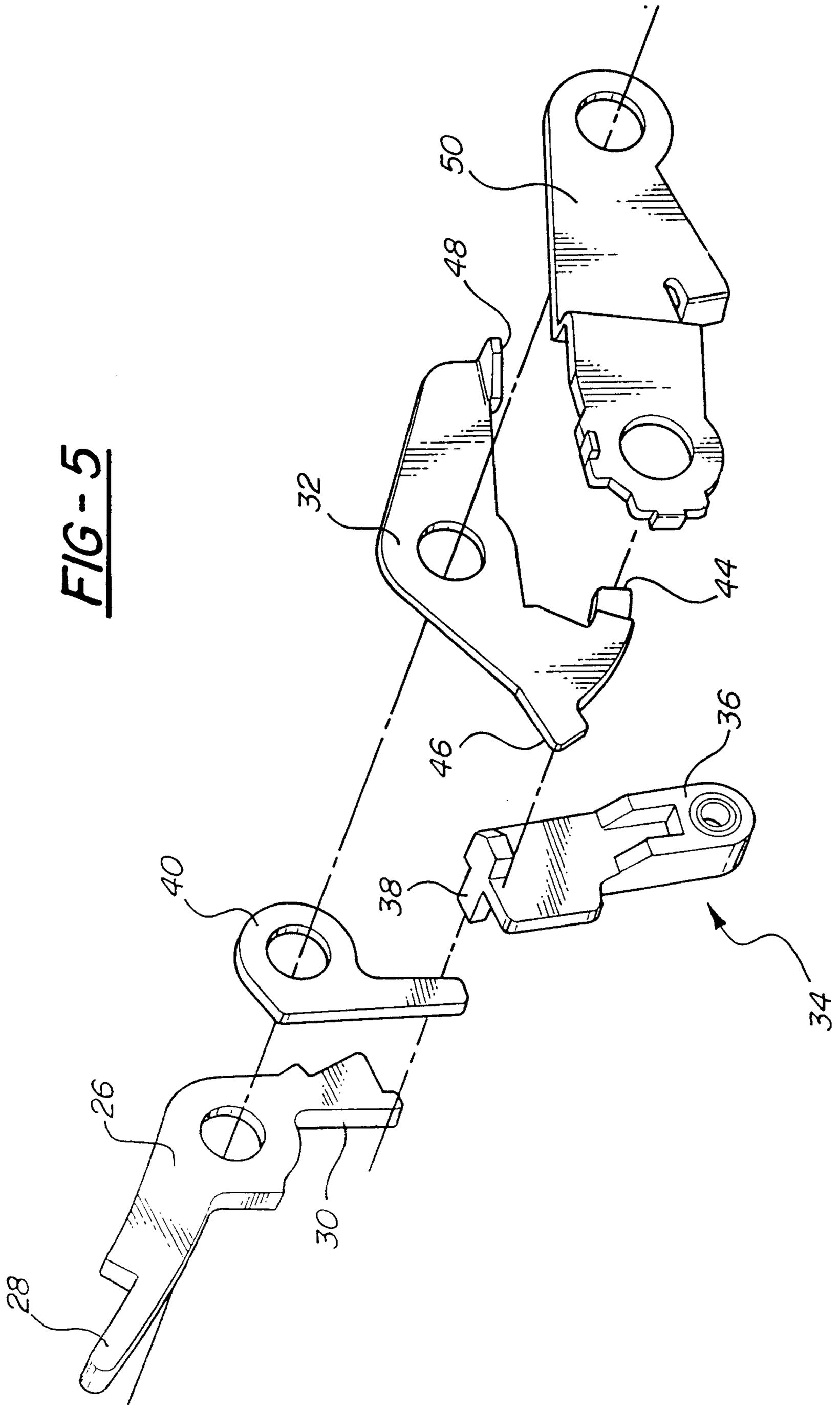
FIG-4

FIG - 5



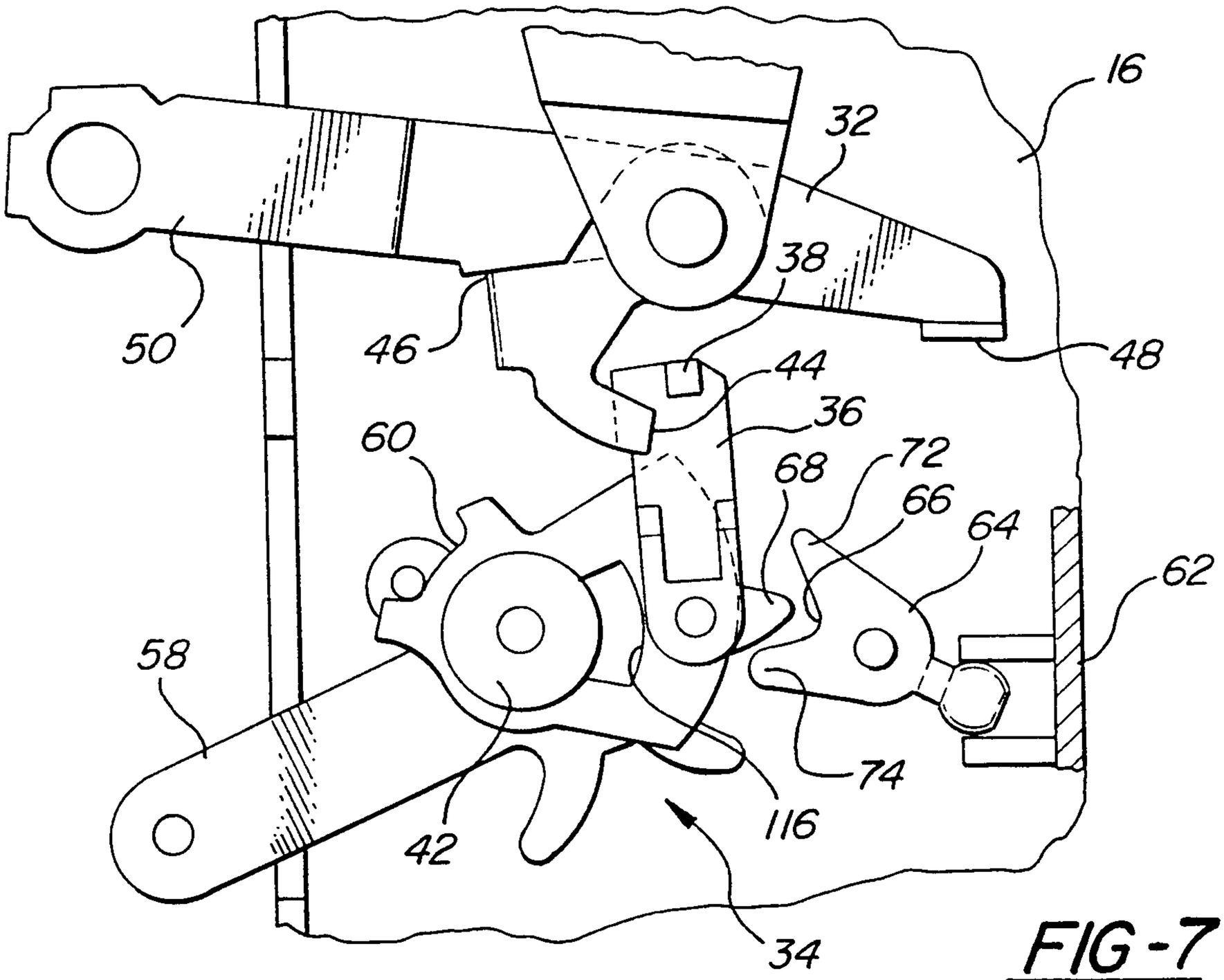

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FIG-7

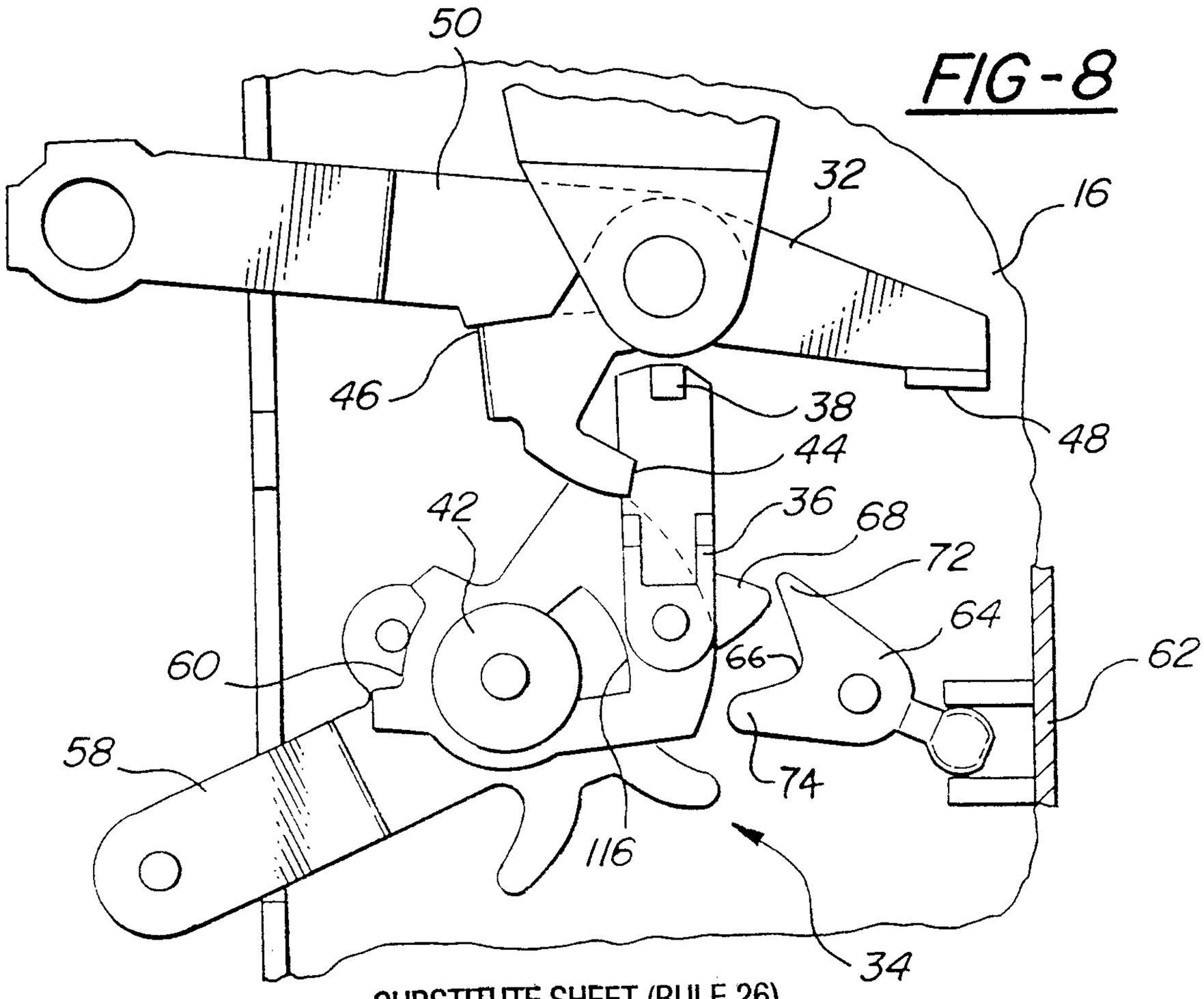
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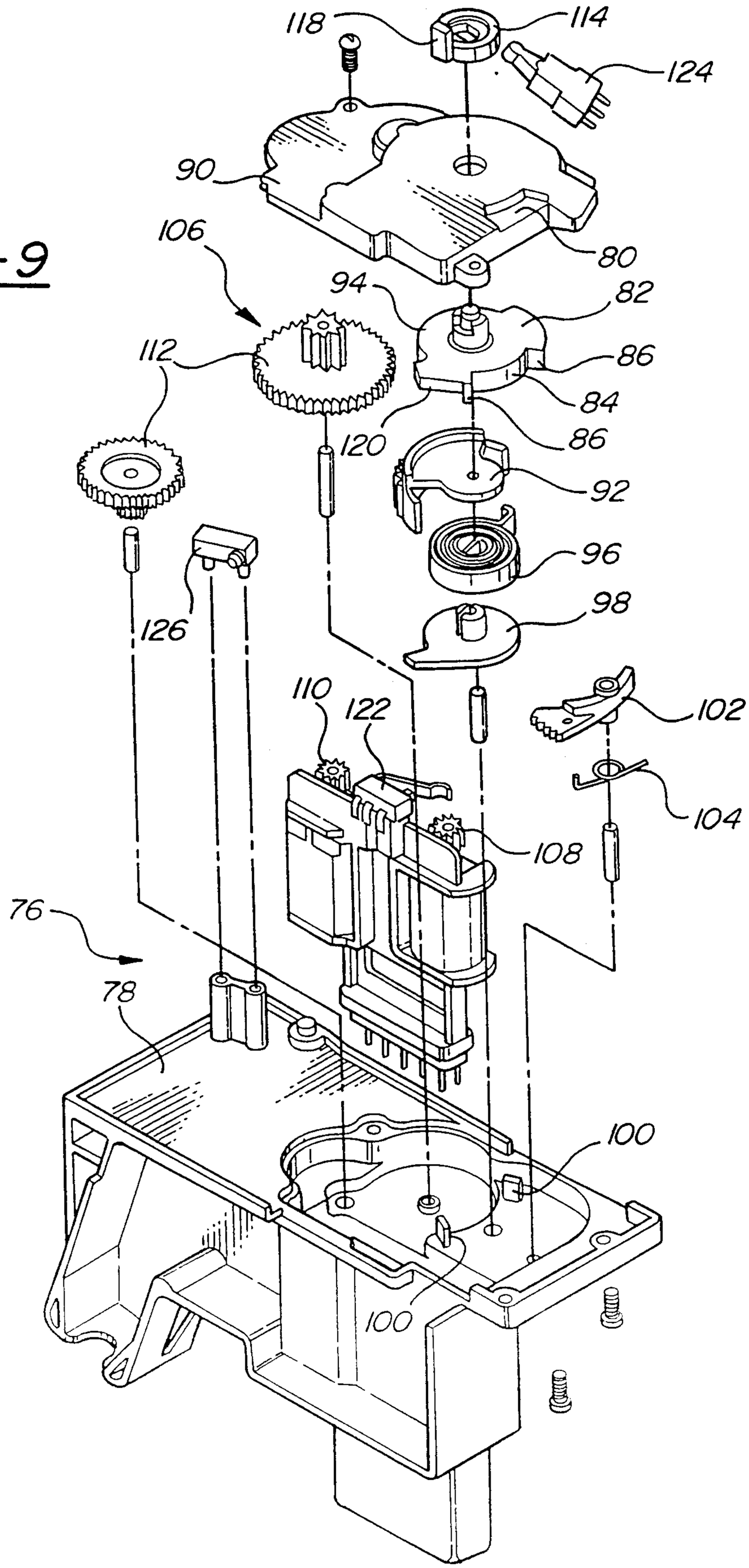
FIG-8

FIG-9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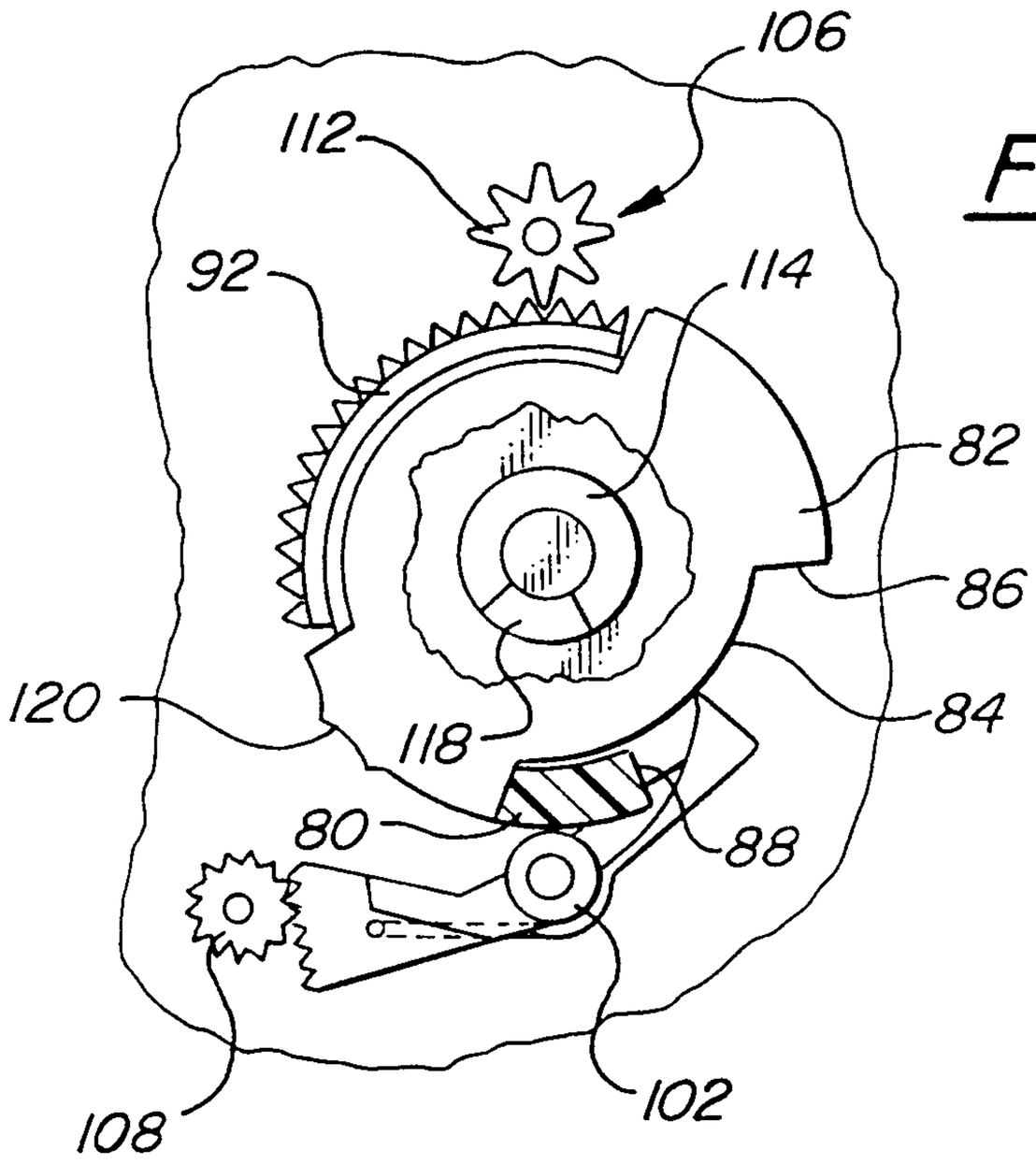

FIG-10

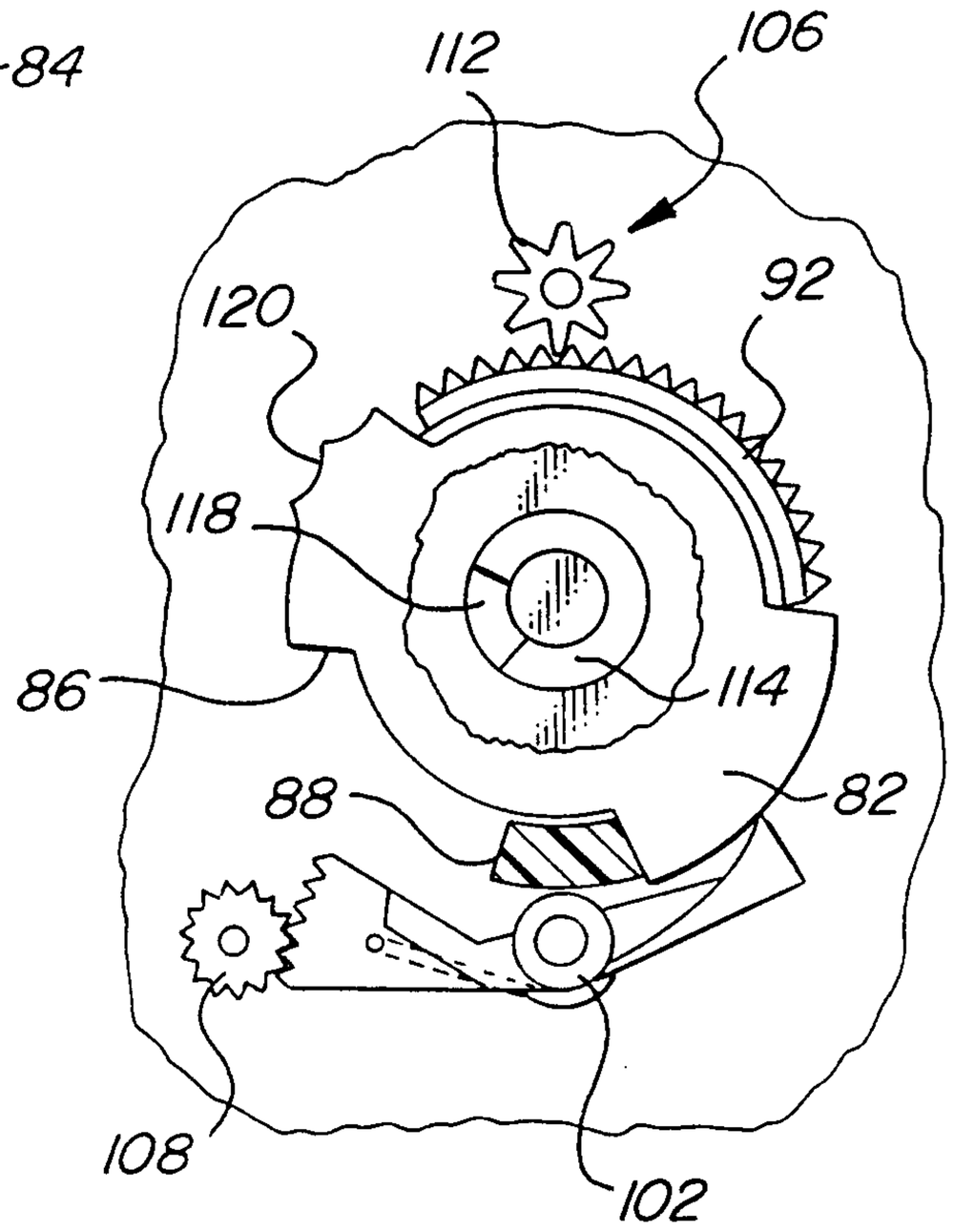

FIG-12

FIG-11

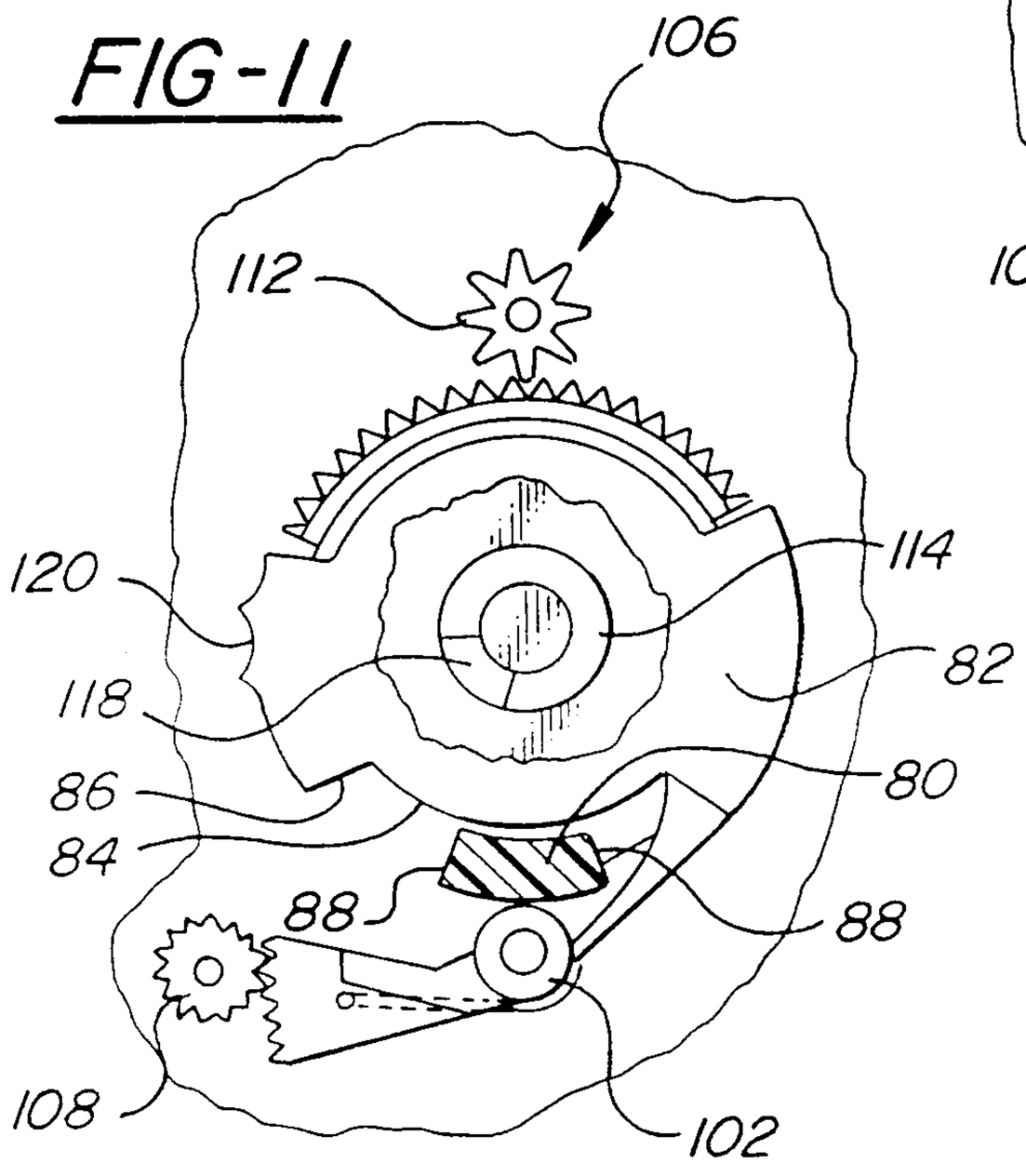

FIG - 13

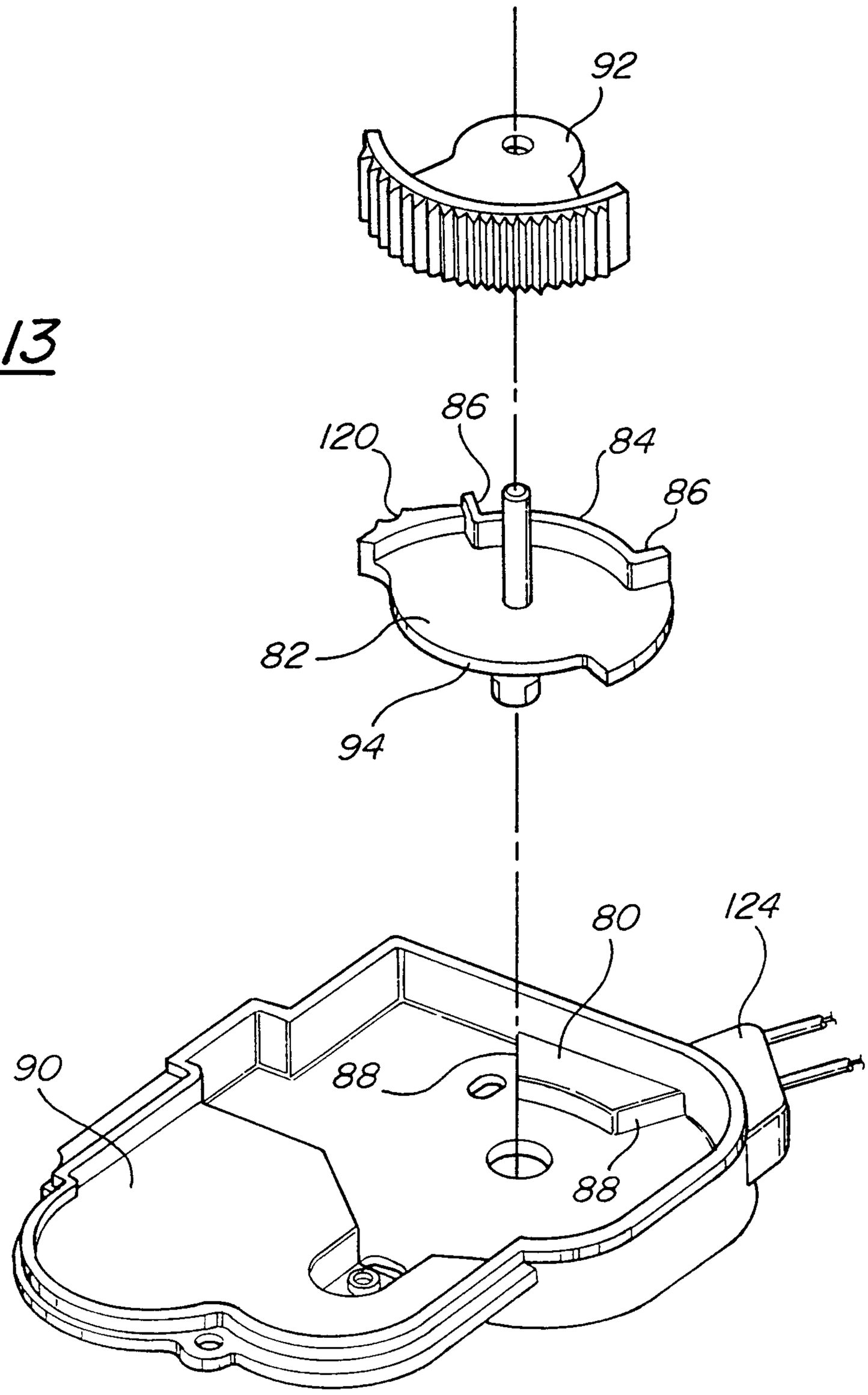

FIG-14

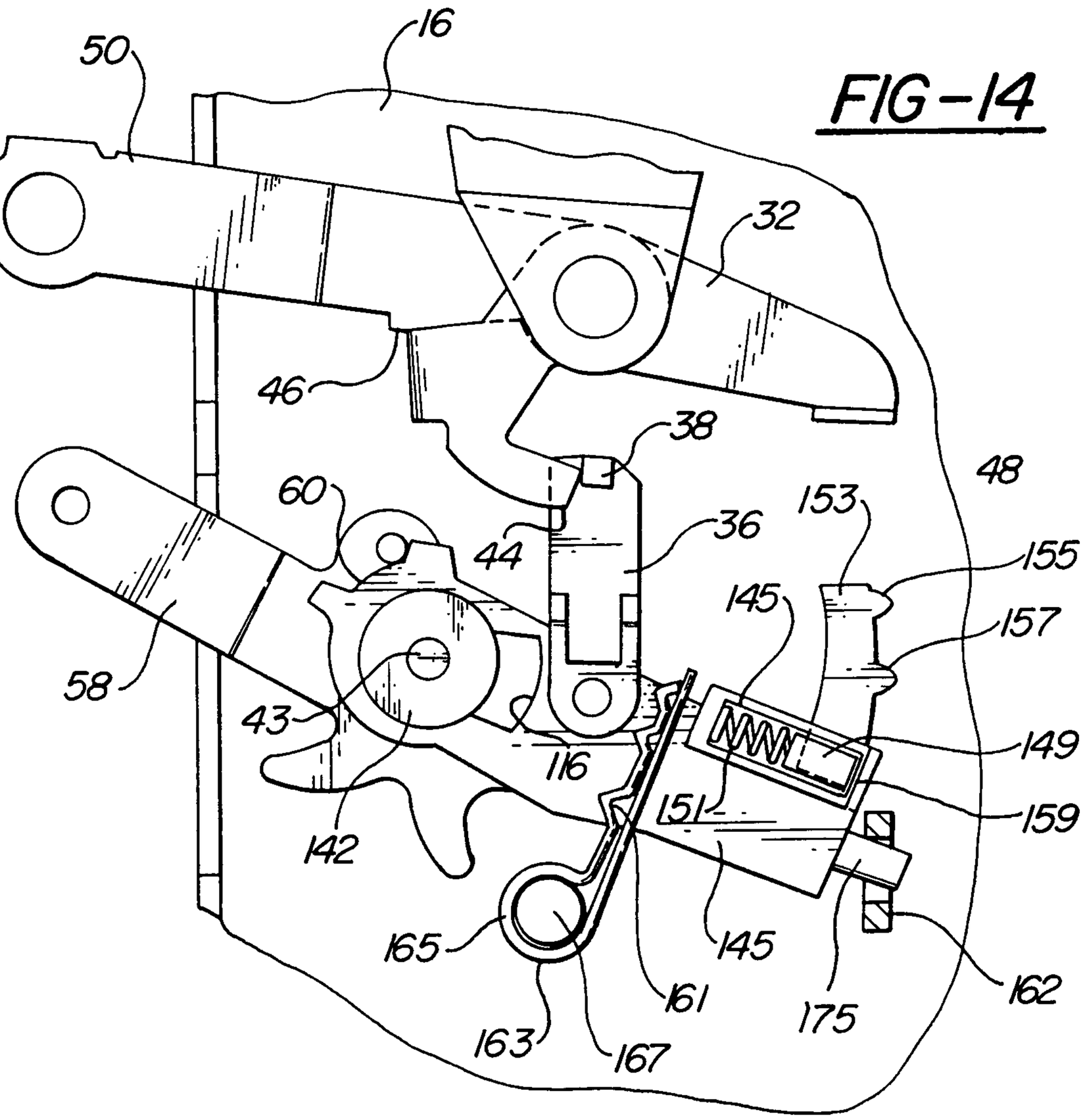
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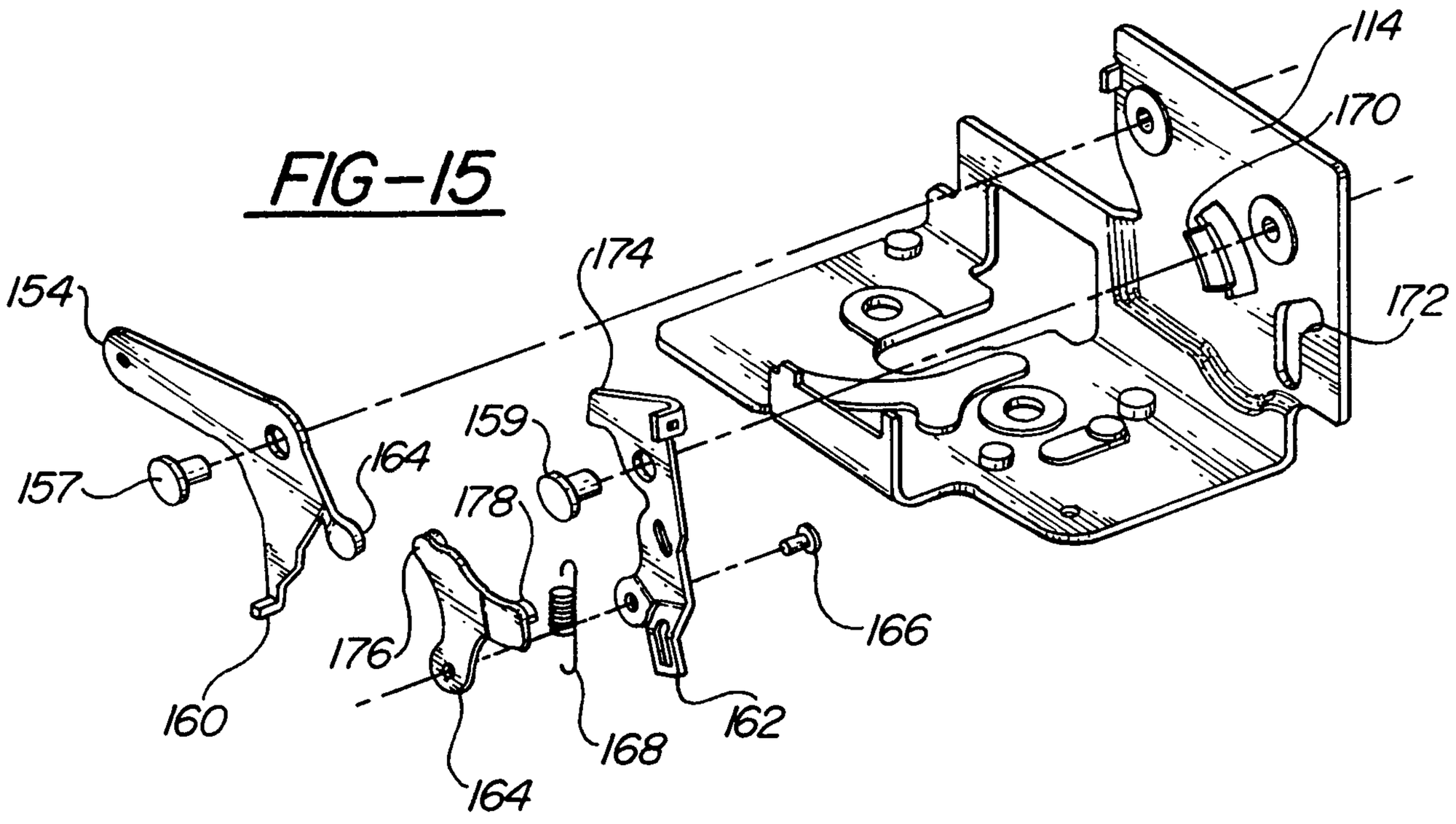
FIG-15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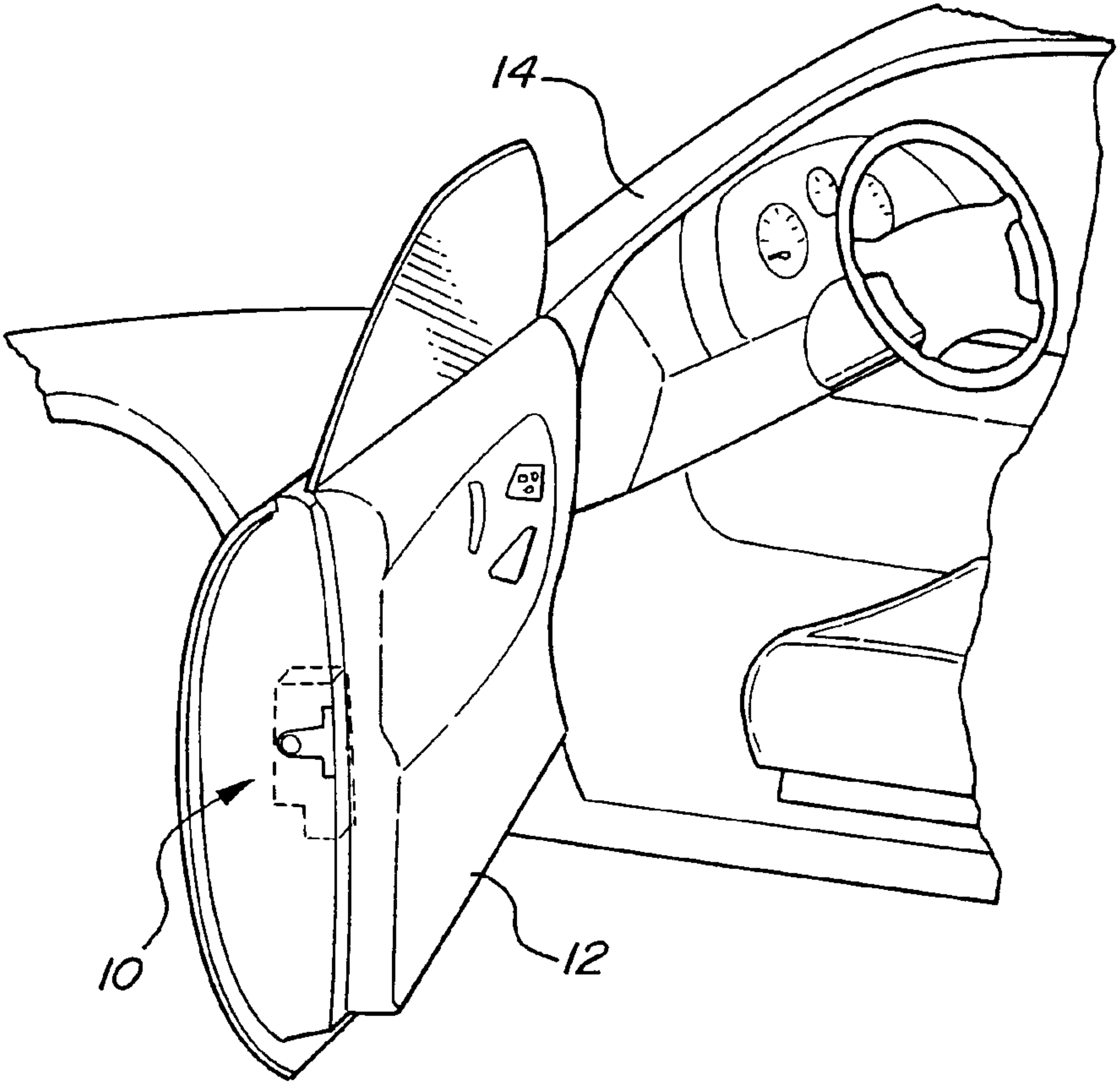
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