US 20250282325A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0282325 A1**

MEDINA et al. (43) **Pub. Date: Sep. 11, 2025**

(54) **REAR WINDOW WIPER RECEPTACLE AND DRIVE SYSTEM**

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(21) Appl. No.: **19/072,346**

(22) Filed: **Mar. 6, 2025**

Related U.S. Application Data

(60) Provisional application No. 63/563,267, filed on Mar. 8, 2024.

Publication Classification

(51) **Int. Cl.**

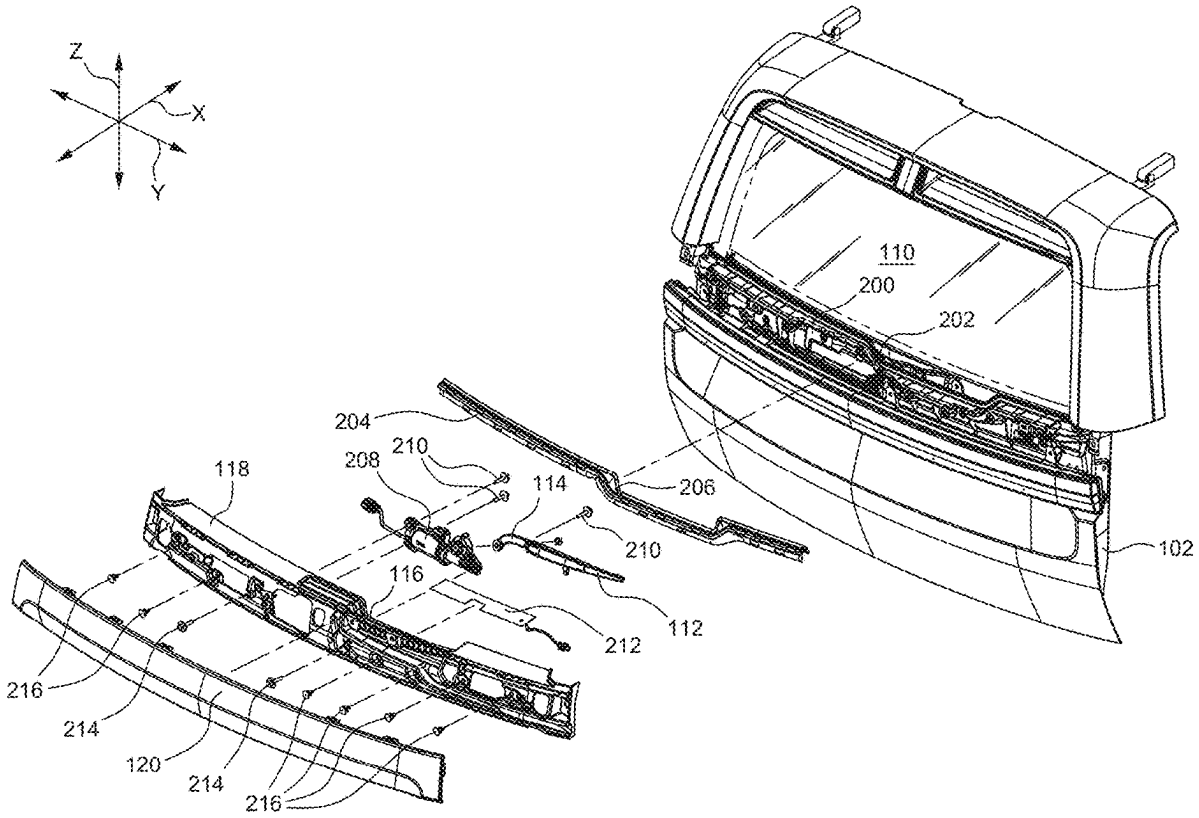
B60S 1/04	(2006.01)
B60S 1/08	(2006.01)
B60S 1/58	(2006.01)

(52) **U.S. Cl.**

CPC ***B60S 1/0402*** (2013.01); ***B60S 1/0447*** (2013.01); ***B60S 1/08*** (2013.01); ***B60S 1/583*** (2013.01)

(57) **ABSTRACT**

A vehicle door defines a window opening and include a structure having a surface defining a portion of a lower edge of the window opening and a recess extending downwardly from the surface. A window extends across the window opening. A window wiper is mounted to the structure and has a parked position in which the window wiper is positioned in the recess. The structure may be an applique and the recess may include a perforated wall permitting drainage into a channel defined by the applique. A drive unit for driving the window wiper may be mounted to a structural portion of the applique with non-structural portions extending to either side. A heating element may be mounted to the recess to facilitate melting of snow and ice. The drive unit may include a motor with an axis of rotation perpendicular to an axis of rotation of the window wiper.



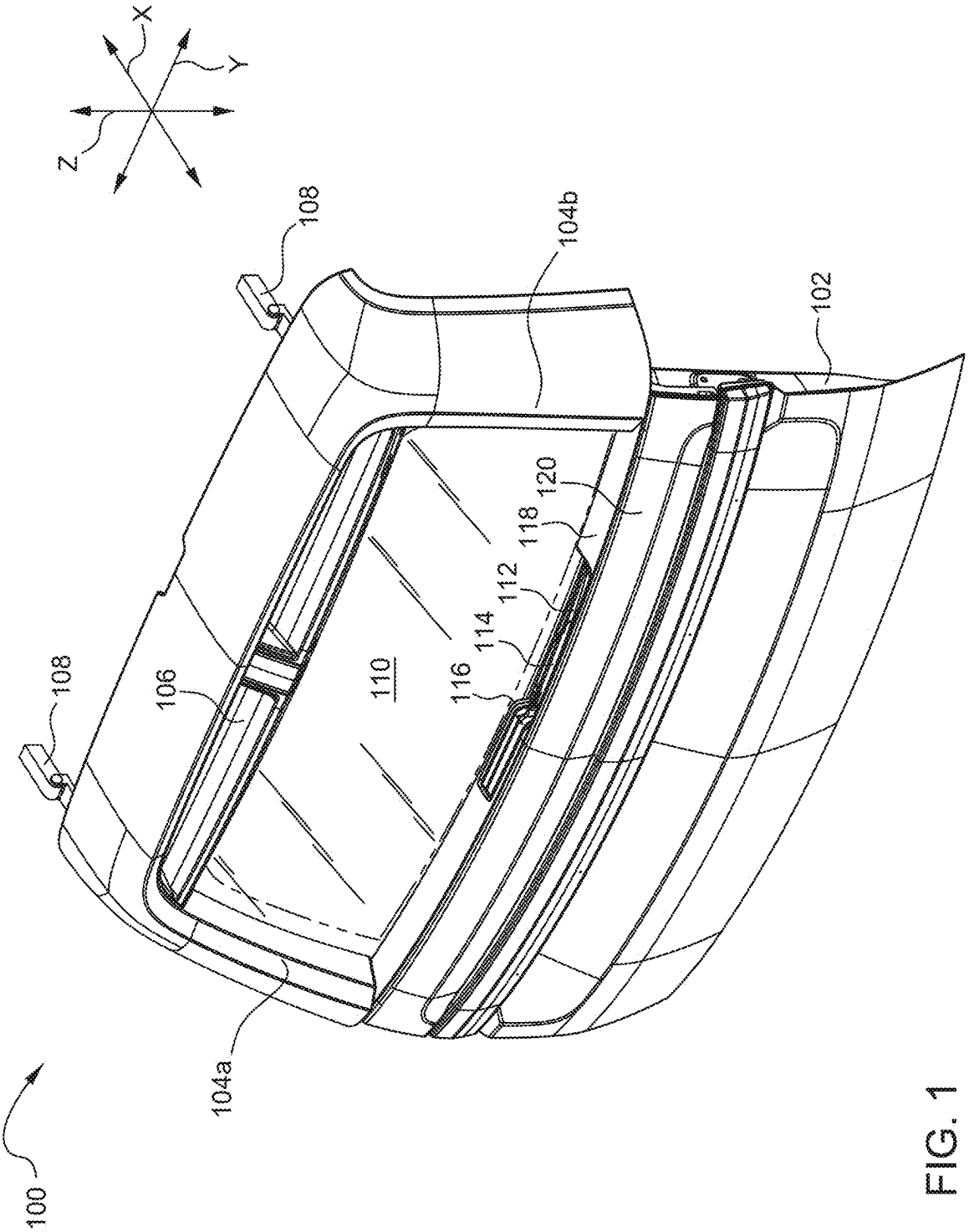


FIG. 1

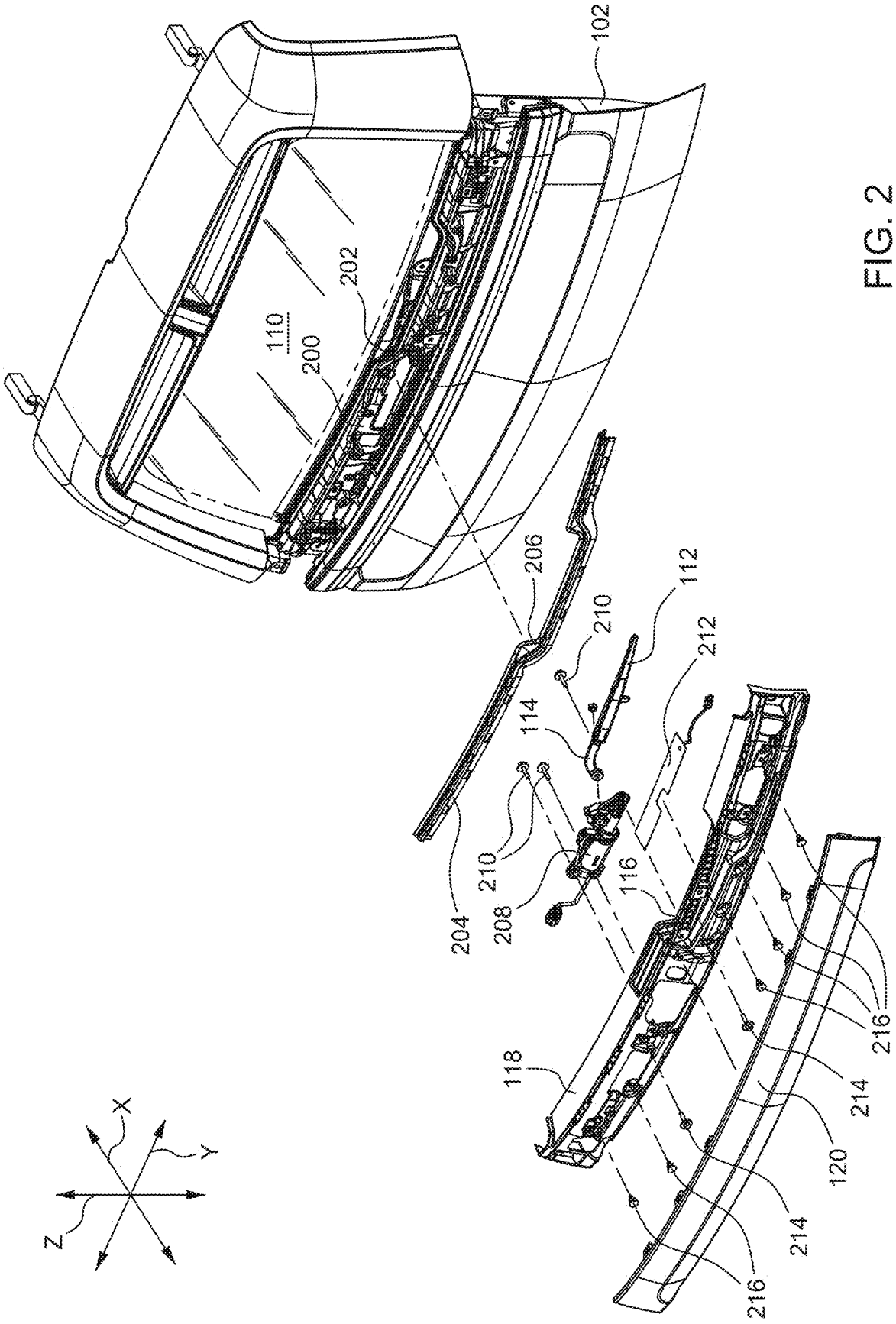
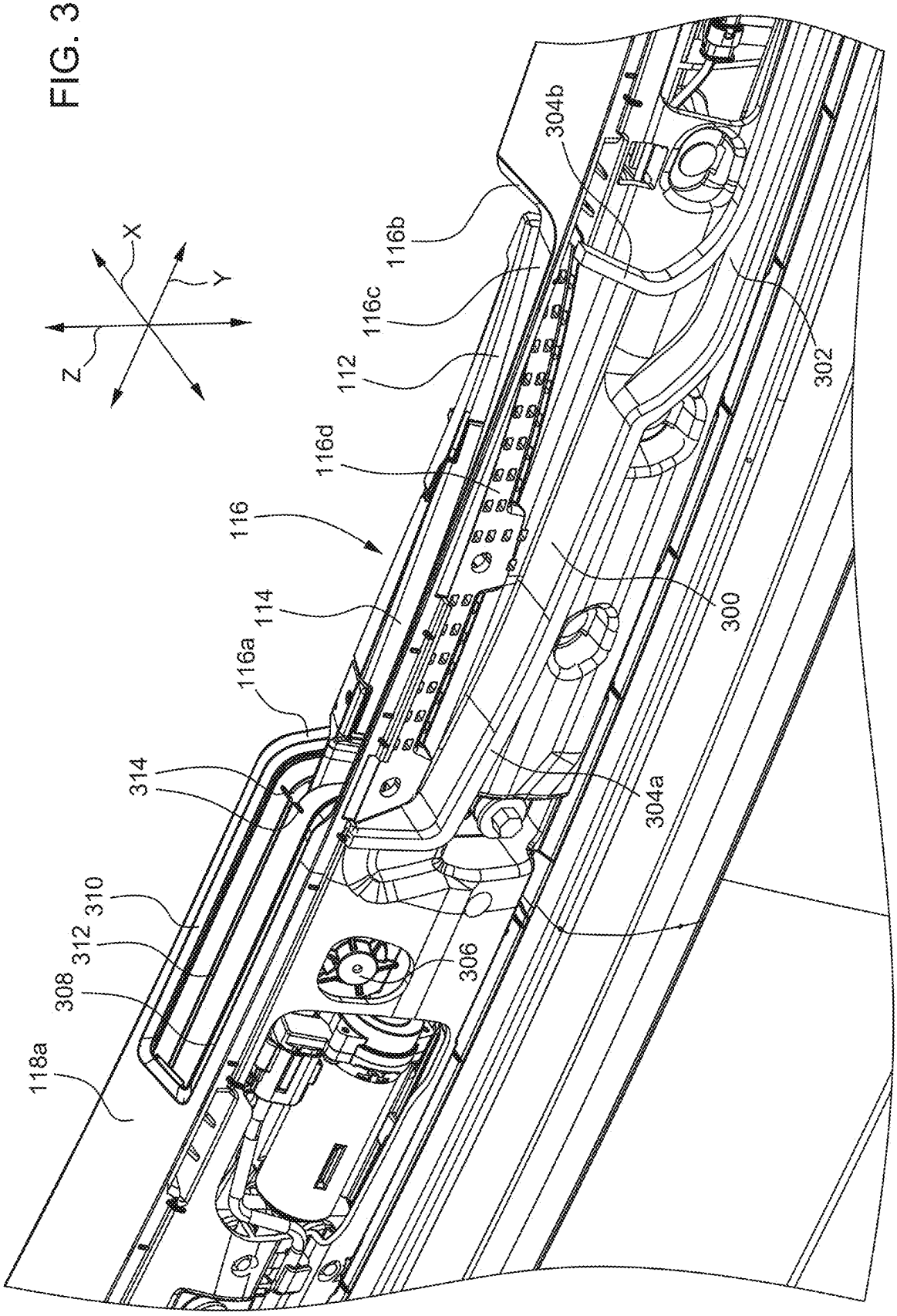

102
202
110
200
206
112
210
212
114
210
204
208
116
118
216
214
120
214
216
X
Y
Z

FIG. 2

FIG. 3


X
Y
Z
304b
116b
116c
112
116d
116
114
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314
310
312
308
118a
306
304a
300
302

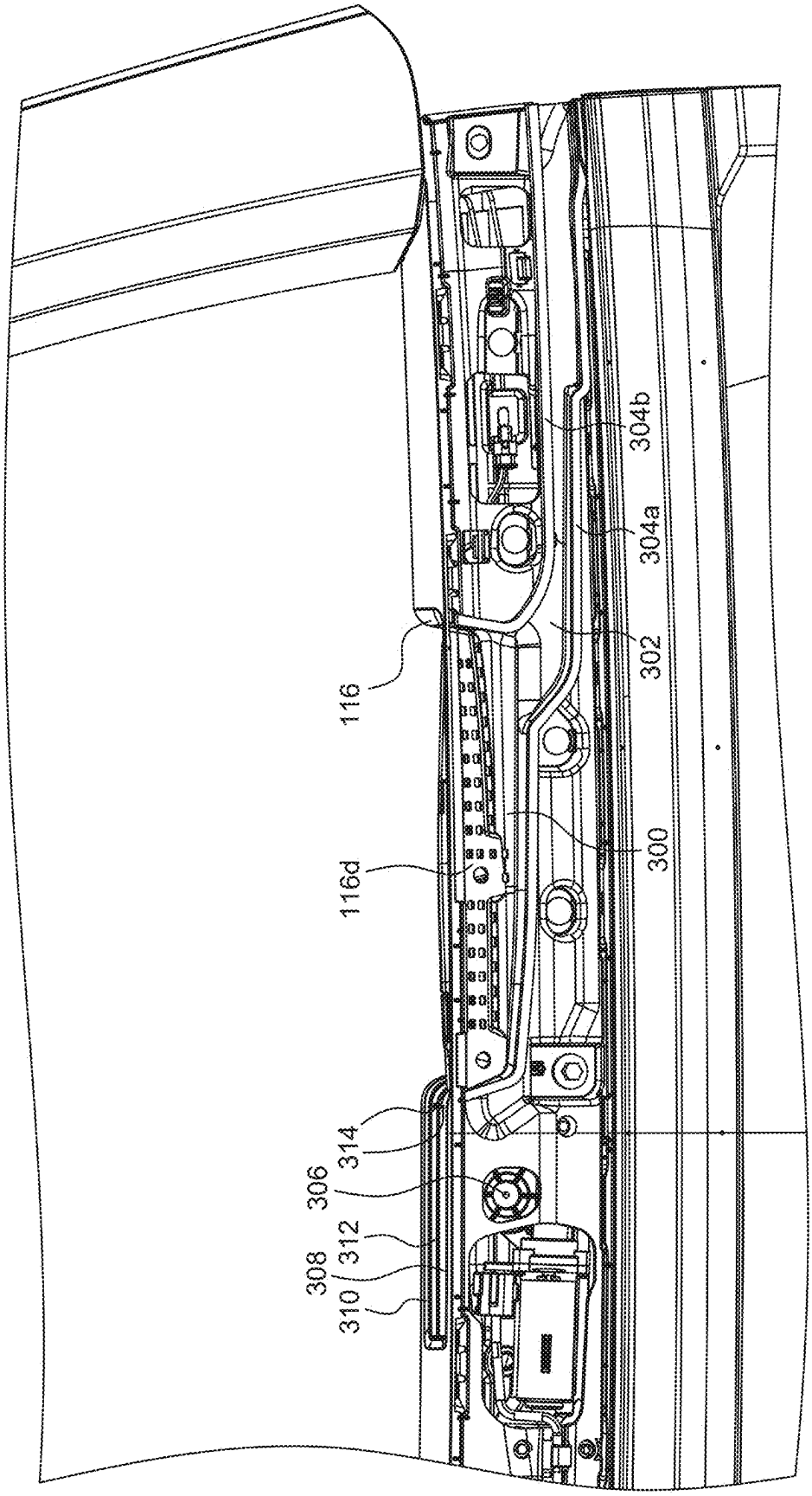
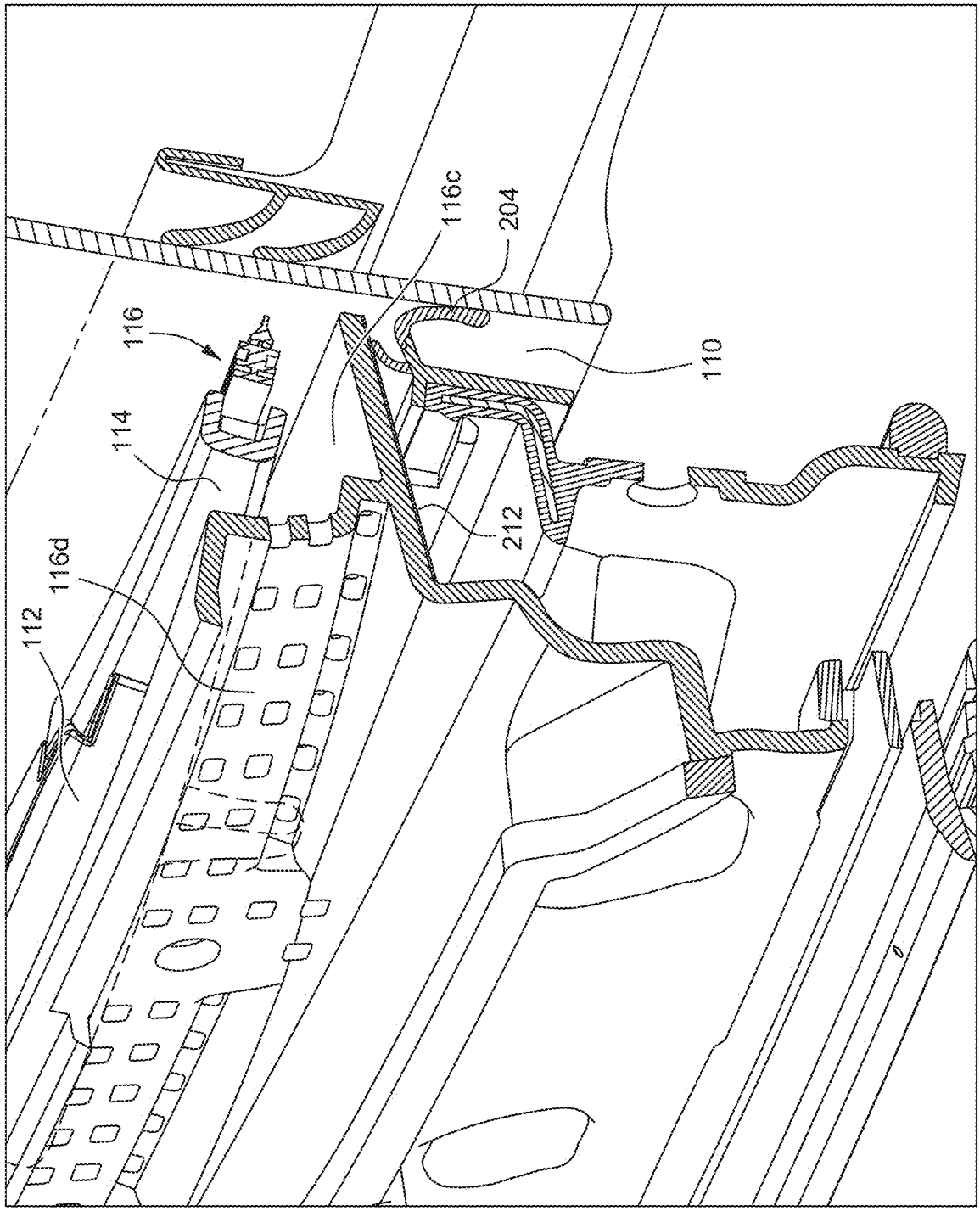


FIG. 4

FIG. 5



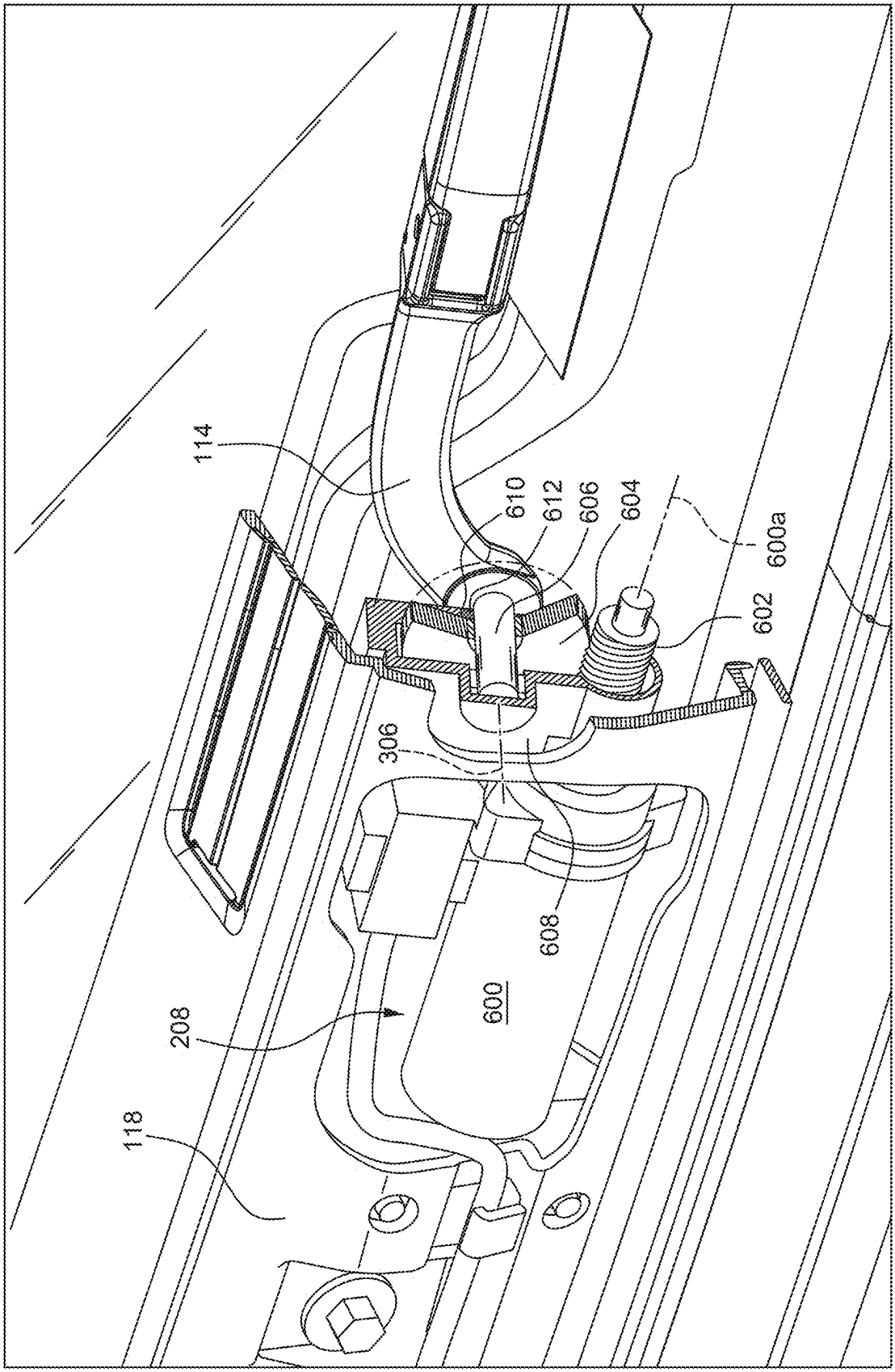


FIG. 6

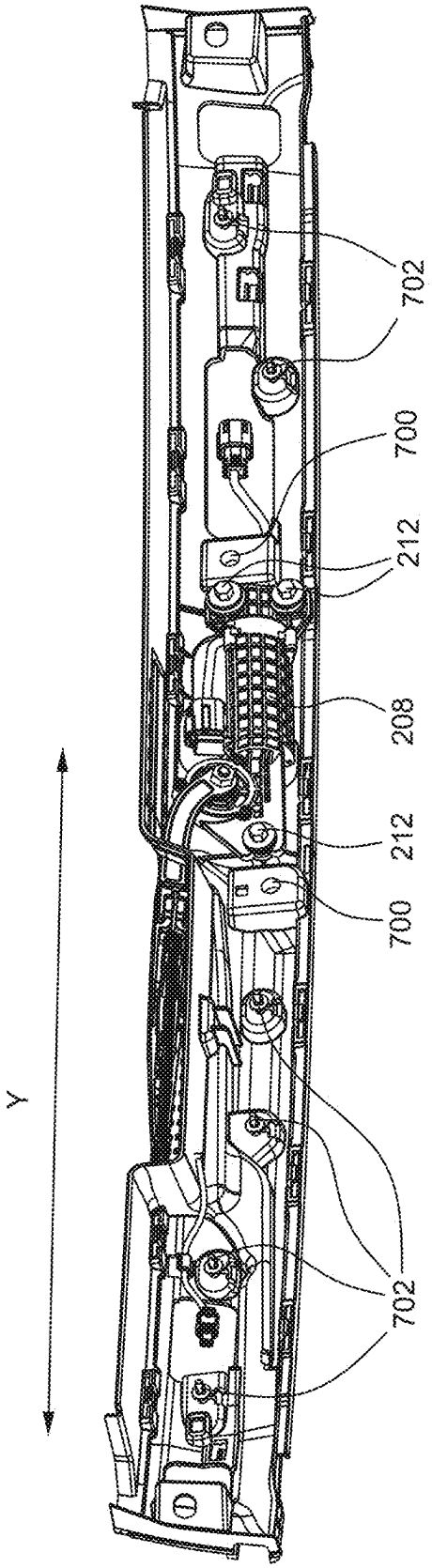


FIG. 7

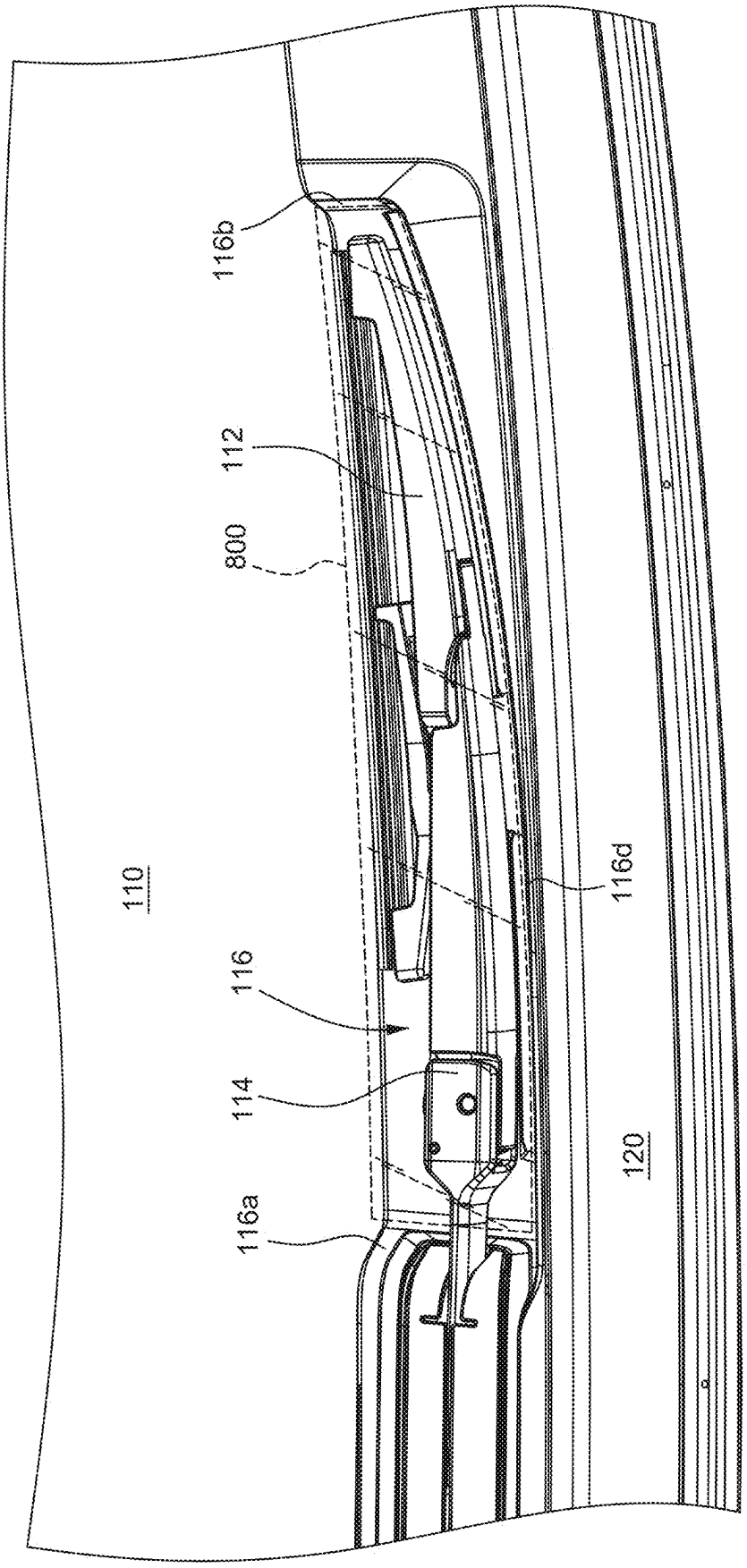


FIG. 8

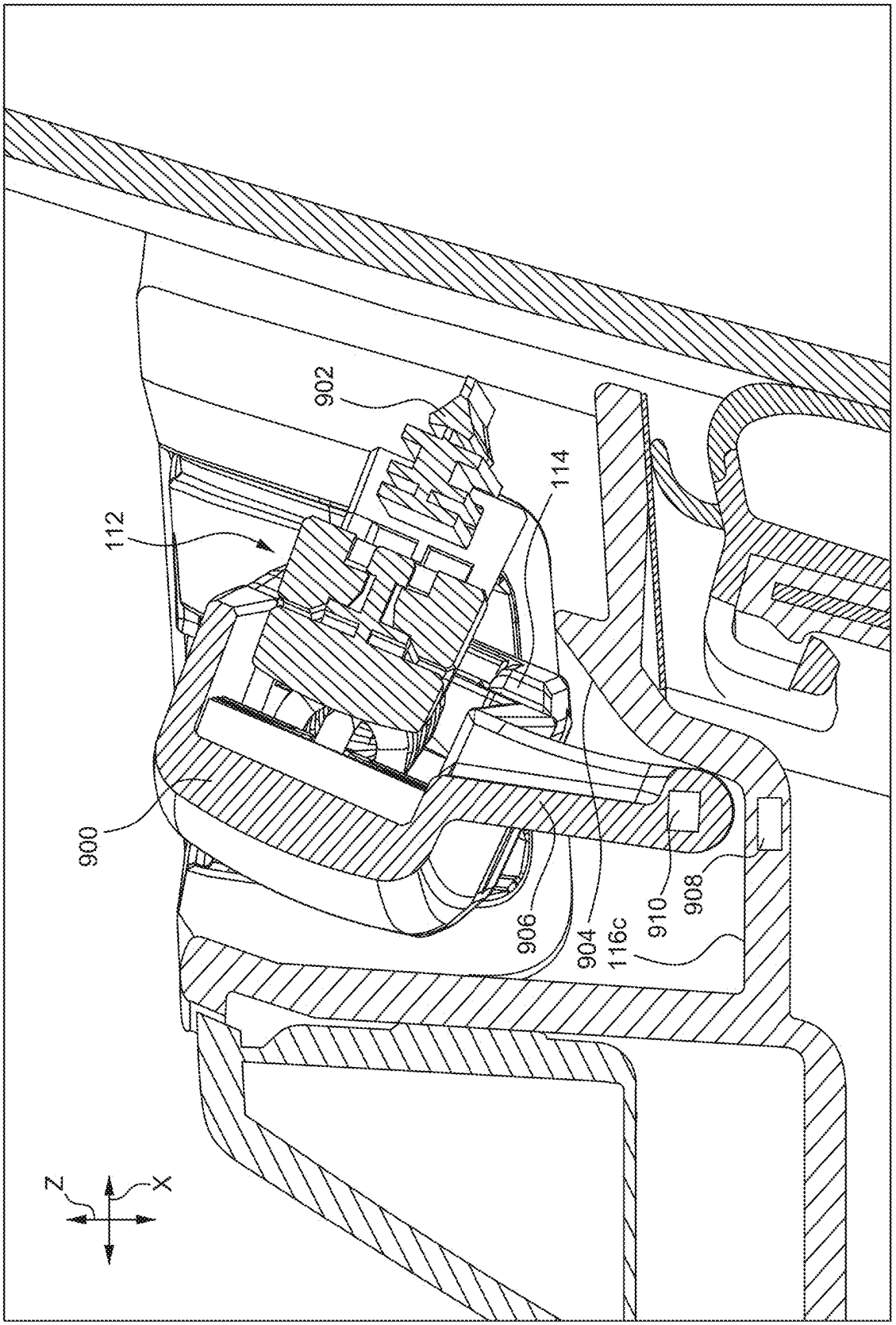


FIG. 9

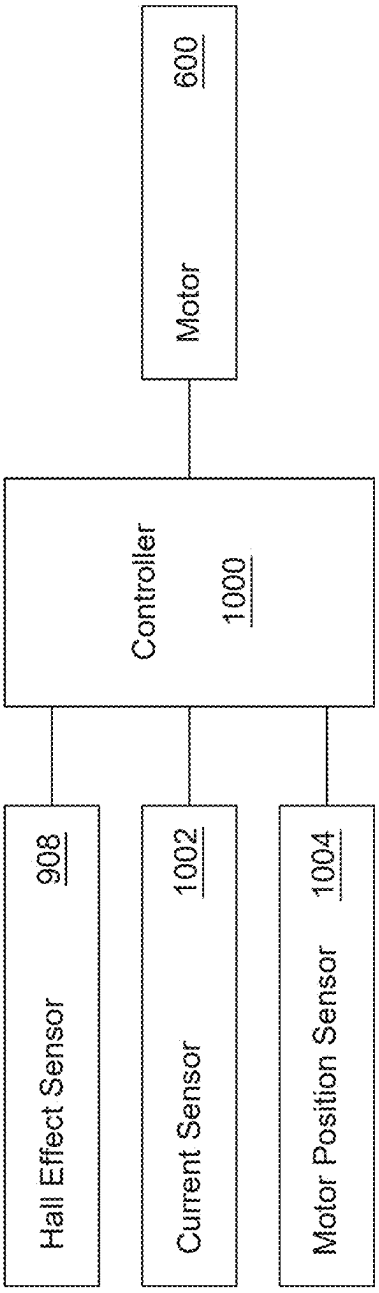

Motor
600
Controller
1000
Hall Effect Sensor
908
Current Sensor
1002
Motor Position Sensor
1004

FIG. 10

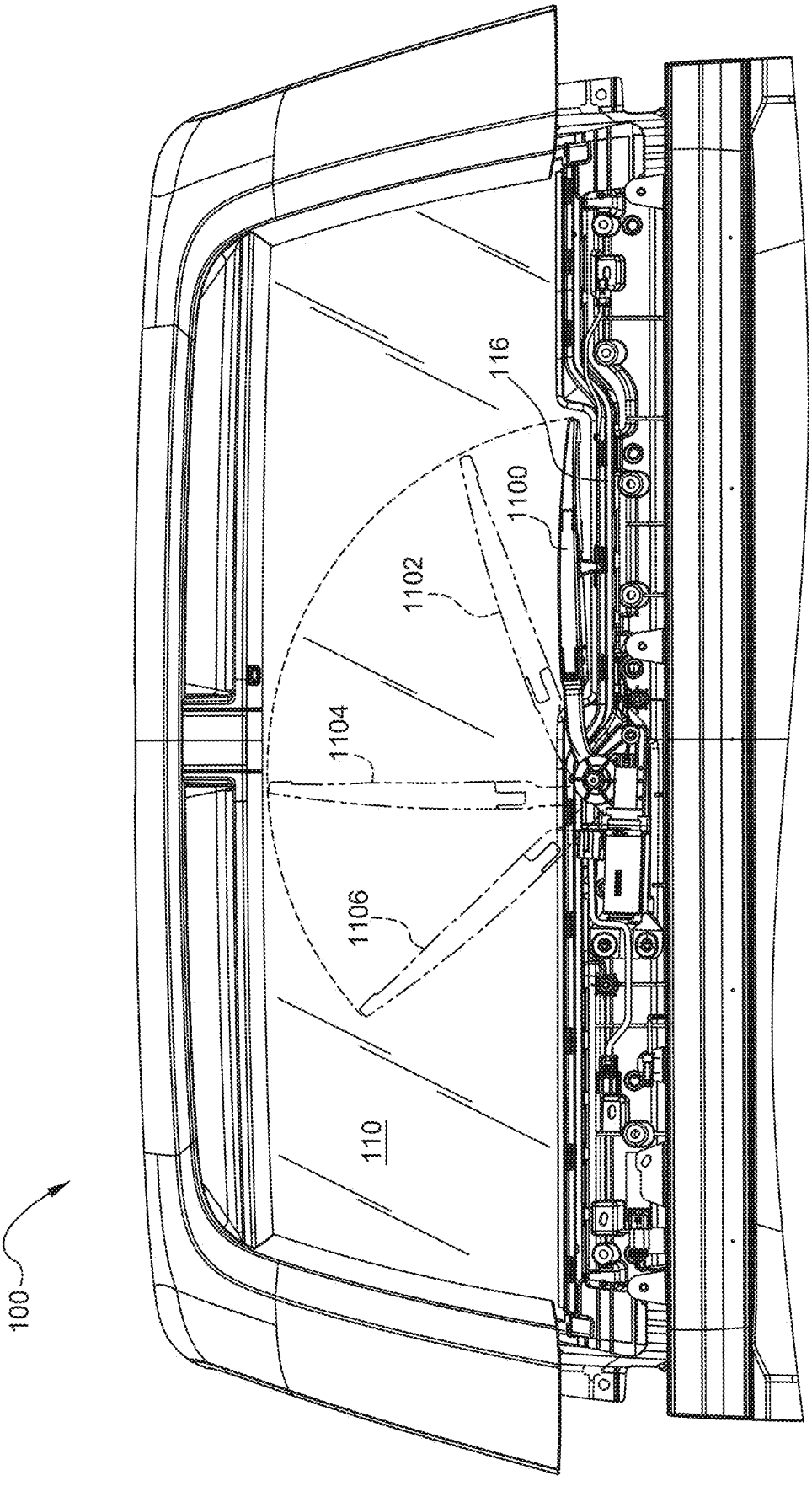


FIG. 11

REAR WINDOW WIPER RECEPTACLE AND DRIVE SYSTEM

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Application Ser. No. 63/563,267 filed Mar. 8, 2024, and entitled HIDDEN REAR WIPER DESIGN, which is hereby incorporated herein by reference in its entirety.

INTRODUCTION

[0002] The present disclosure relates to receptacle for a rear wiper and a drive system for driving the rear wiper.

SUMMARY

[0003] The present disclosure describes an approach for implementing a window wiper on a door of a vehicle. In one aspect, a vehicle door defines a window opening, the vehicle door including a structure having a surface defining a portion of a lower edge of the window opening and a recess extending downwardly from the surface. A window extends across the window opening. A window wiper is mounted to the structure and has a parked position in which the window wiper is positioned in the recess.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. **1** illustrates a rear liftgate of a vehicle with a rear window wiper and a corresponding receptacle in accordance with certain embodiments.

[0005] FIG. **2** is an exploded view of the rear liftgate of the vehicle in accordance with certain embodiments.

[0006] FIG. **3** illustrates a receptacle for a rear window wiper in accordance with certain embodiments.

[0007] FIG. **4** illustrates a drainage channel for the receptacle in accordance with certain embodiments.

[0008] FIG. **5** is a cross-sectional view illustrating placement of a heating pad and seals relative to the receptacle in accordance with certain embodiments.

[0009] FIG. **6** illustrates a drive motor and drive gears for a rear wiper in accordance with certain embodiments.

[0010] FIG. **7** illustrates the mounting of the drive motor and drive gears to an applique in accordance with certain embodiments.

[0011] FIG. **8** illustrates a cover for the receptacle in accordance with certain embodiments.

[0012] FIG. **9** illustrates placement of a ramp and a Hall effect sensor relative to the receptacle in accordance with certain embodiments.

[0013] FIG. **10** is a schematic block diagram of components for controlling a rear wiper in accordance with certain embodiments.

[0014] FIG. **11** illustrates various positions of the rear wiper in accordance with certain embodiments.

DETAILED DESCRIPTION

[0015] The aesthetics of a vehicle are very important to buyers. However, successfully achieving a desired look for a vehicle often requires various technical solutions. This disclosure describes an approach for stowing a window wiper when not in use. A structure, such as an applique, is secured to a vehicle door (e.g., a rear liftgate) along the lower edge of window and defines a recess into which the window wiper inserts when parked. The applique defines a perforated wall and a channel below the perforated wall to conduct fluid to an edge of the vehicle door. A drive unit is mounted to the applique and includes a motor with an axis of rotation perpendicular to the axis of rotation of the arm. The applique defines a slot with a seal mounted within the slot. An arm mounting the window wiper to the drive unit moves within a slit defined by the seal. The applique may include a structural portion to which the drive unit is mounted, and which is secured to the vehicle door. Remaining portions of the applique may be non-structural and secured using non-structural fasteners, such as snap fasteners. The applique may be an inner applique that is covered by an outer applique.

[0016] Referring to FIG. **1**, a rear liftgate **100** for a vehicle, such as a sport utility vehicle (SUV), hatchback, station wagon, or other type of vehicle, may include a lower panel **102**, pillars **104***a*, **104***b* connected to the lower panel **102** and extending upwardly from the lower panel **102**, and a top frame member **106** that connects to both of the pillars **104***a*, **104***b* and is offset above the lower panel **102**. The lower panel **102**, pillars **104***a*, **104***b*, and top frame member **106** are structurally secured to one another to form an integral member. The lower panel **102**, pillars **104***a*, **104***b*, and top frame member **106** together define a window opening covered by a window **110**. The rear liftgate **100** covers a rear opening defined by the vehicle and may be rotated about hinges **108** mounting the rear liftgate **100** to a roof of a vehicle. The window **110** may be openable and may retract within the lower panel **102**. The mechanism used to retract the window **110** may be implemented according to any approach known in the art for implementing openable vehicle windows.

[0017] Although a rear liftgate **100** is described herein with hinges **108** at the top, any other type of vehicle door may benefit from the embodiments disclosed herein, such as a rear door with side-mounted hinges **108** or a tailgate with bottom-mounted hinges **108**. Likewise, the approach described herein may be used with respect to a fixed window that is mounted in a portion of a vehicle that is not some type of vehicle door, e.g., a fixed windshield or rear window.

[0018] The approach described herein may be understood with respect to an X and Y direction that are perpendicular to one another. The X direction may be defined as parallel to a direction of travel of the vehicle when steered wheels are oriented straight. The Y direction may be defined as perpendicular to the X direction and the X and Y direction may be perpendicular to the direction of gravity when the vehicle is on a level surface. As used herein the Z direction is perpendicular to the X and Y directions. The axis of rotation of the hinges **108** may be substantially (e.g., within 1 degree of) parallel to the Y direction.

[0019] Rain, snow, or other obscurants may be at least partially cleared from the window **110** by a rear wiper **112** mounted to a rear wiper arm **114**. Aesthetics of the vehicle may be enhanced by providing a receptacle **116** in which the rear wiper **112** and rear wiper arm **114** seat when not in use.

[0020] The receptacle **116** may be defined by an inner applique **118** secured to the lower panel **102** and over a portion of the window **110**. An outer applique **120** may secure to the inner applique **118** to cover components mounted to the inner applique **118** as discussed below and for aesthetics.

[0021] Referring to FIG. **2**, the lower panel **102** may define, or have secured thereto, a glass carrier **200** config-

ured to support and retain a lower edge of the window **110**. The glass carrier **200** may be a structural member mounted integrally to the lower panel **102** or formed monolithically with the lower panel **102**. The glass carrier **200** may define a recess **202** that is aligned with the receptacle **116** when assembled such that the glass of the window **110** extends across the recess **202** in the Y direction and downwardly in the Z direction below portions of the glass carrier **200** that extend in the Y direction on either side of the recess **202**.

[0022] A seal **204** may extend along a lower edge of the window **110** and be positioned between the glass carrier **200** and the inner applique **118** when assembled. The seal **204** may follow the contours of the glass carrier **200** and therefore define a corresponding recess **206** that extends downwardly in the Z direction along, or under in the Z direction, the recess **202** and recess **116** when assembled. The seal **204** may hinder fluid flow between the glass carrier **200** and the inner applique **118**.

[0023] A drive unit **208** may mount directly to the inner applique **118** using fasteners **210** that engage the inner applique **118** and the drive unit **208**. The fasteners **210** may be structural fasteners, such as steel bolts. The wiper arm **114** mounts to an output of the drive unit **208**. The drive unit **208** may be positioned between the inner applique **118** and the glass carrier **200**, or another portion of the lower panel **102**, when assembled.

[0024] A heating element **212** may be mounted to the inner applique **118**, e.g., to a portion of the inner applique **118** defining the receptacle **116** in order to melt snow and ice that may collect in the receptacle **116**. In addition, a resistive heater incorporated into the window **110** may extend over portions of the window **110** that extend into the recess **202** to further facilitate melting of snow and ice.

[0025] Snap fasteners **216** or other non-structural fasteners may be used to secure the outer applique **120** to the inner applique **118**, such as after the inner applique **118** is secured to the glass carrier **200**. For example, snap fasteners **216** may be secured to the inner applique **118** and portions thereof may protrude outwardly to engage the outer applique **120** and secure the outer applique **120** to the inner applique **118**.

[0026] FIG. **3** provides a more detailed view of the recess **116**, the recess **116** may include sidewalls **116***a*, **116***b* that extend downwardly from an upper surface **118***a* of the inner applique **118** along the Z direction and are offset from one another along the Z direction. A bottom wall **116***c* of the recess **116** may extend between the sidewalls **116***a*, **116***b* in the Y direction, the bottom wall **116***c* being offset from the upper surface **118***a* along the Z direction. The depth of the bottom wall **116***c* relative to the upper surface **118***a* along the Z direction may be some multiple of the height of the wiper **112** and wiper arm **114**, such as 1.1, 1.2, 1.5, or 2 times the maximum height of the wiper **112** and wiper arm **114** assembly above the bottom wall **116***c* in the Z direction when parked in the receptacle **116**. A forward wall of the receptacle **116** extending between the side walls **116***a*, **116***b* and along the bottom wall **116***c* may be formed by the window **110** or part of the inner applique **118**. The bottom wall **116***c* may be sloped, e.g., sloping downwardly in the Z direction with distance from the window **110** along the X direction. A rearward wall **116***d* of the receptacle **116** may extend between the sidewalls **116***a*, **116***b* and along the bottom wall **116***c* having the bottom wall **116***c* positioned between the window **110** and the rear wall **116***d*. The rear wall **116***d* may be perforated to allow fluid to drain from the receptacle **116**. The rearward wall **116***d* may be angled, e.g., sloped rearwardly in the X direction with distance from the bottom wall **116***c* along the Z direction. An upper edge of the rearward wall may be flush with a rearward edge of the upper surface **118***a*. The perforations in the rearward wall **116***d* may be sized to resist clogging while also preventing larger particles from passing therethrough. For example, the perforations each have an area of between 0.25 and 2 square centimeters or between 0.5 and 1.5 square centimeters. There may be any number of perforations, such as from 20 to 50 perforations. The rearward mall **116***d* may also be formed of a metal mesh or screen.

[0027] Referring to FIG. **4**, while still referring to FIG. **3**, beneath the rearward wall, the inner applique **118** may define a collection surface **300**. As noted above, the rearward wall **116***d* may be sloped outwardly in the X direction. The collection surface **300** may extend under the rearward wall **116***d* in the X direction and along the rearward wall **116***d* in the Y direction. The collection surface **300** may catch fluid draining through the perforations in the rearward wall **116***d*. A channel **302** may extend downwardly along the Z direction from the collection surface **300** and outwardly to an edge of the inner applique **118**. The collection surface **300** itself may be sloped downwardly to an inlet of the channel **302** to facilitate drainage. Seals **304***a*, **304***b* may mount to the inner applique **118** and be captured between the inner applique **118** and the outer applique **120**. The seal **304***a* may extend around one side (e.g., the left side) of the rearward wall **116**, the collection surface **300**, and a lower side of the channel **302**. The seal **304***b* may extend around the opposite side of the rearward wall **116** (e.g., the right side), and the upper side of the channel **302**. The seals **304***a*, **304***b*, collection surface **300**, and channel **302** may therefore provide a sealed channel from the rearward wall **116** to one side of the inner applique **118**. Water exiting the side of the inner applique **118** may drain along a side of the lower panel **102** and then fall from the vehicle.

[0028] Continuing with reference to both FIGS. **3** and **4**, an axis of rotation **306** of the wiper arm **114** may be positioned below the upper surface **118***a* of the inner applique **118**. Accordingly, the wiper arm **114** may be required to translate relative to the upper surface **118***a*. A slot **308** may be defined in the upper surface **118***a* and the sidewall **116***a* to permit movement of the wiper arm **114**. In some embodiments, to reduce entry of water and other contaminants into the slot **308**, a seal **310** may be mounted within the slot **308**. The seal **310** may be made of a flexible material, such as a material having a Shore A hardness of from 30 to 50. The seal **310** may define a slit **312** aligned with the movement of the wiper arm **114**, e.g., perpendicular to the axis of rotation **306**. Prior to insertion of the wiper arm **114**, the slit **312** may be narrower than the thickness of the portion of the wiper arm **114** positioned in the slit **312** during movement as measured perpendicular to the slit **312**. The slit **312** will therefore be locally deformed and widened as the wiper arm **114** moves therethrough. The seal **310** will therefore reduce the area available for contaminants to enter the slot **308**.

[0029] As best seen in FIG. **3**, the seal **310** may be bent to conform to the transition from the upper surface **118***a* to the sidewall **116***a*. For example, the seal **310** may be include portions that are oriented substantially (e.g., within 10 degrees of) perpendicular to one another with a curved transition between these portions. The longevity of the seal **310** may be enhanced by placing a second slit **314** perpen-

dicular to the slit **312** and extending on either side of the slit **312**. The second slit **314** may be placed in the curved transition between the portions of the seal **310** that are substantially perpendicular to one another, e.g., at a position along a transition between the upper surface **118***a* and the sidewall **116***a*. The second slit **314** may permit free deflection of the seal **310** by the wiper arm **114** and avoid creasing or puckering of the seal **310** that might otherwise result from deflection by the wiper arm **114**.

[0030] Referring to FIG. **5**, the heating element **212** may be mounted to the inner applique **118** on a lower surface of the bottom wall **116***c*. The heating element **212** may cover at least 50, 70, 80, or 90 percent of the area of a substantially planar portion of the bottom wall **116***c*, e.g., a planar portion of the bottom wall **116***c* between the perforated rear wall **116***d* and the window **110** and between the sidewalls **116***a*, **116***b*. As used herein, substantially planar may be understood as having a radius of curvature of greater than 1 meter.

[0031] FIG. **5** further illustrates the relationship of the seal **204** to the receptacle **116**. The seal **204**, e.g., the recess **206** defined by the seal **204**, may be positioned below the bottom wall **116***c*. Accordingly, the window **110** may likewise extend below the bottom wall **116***c* and engage the seal **204**.

[0032] Referring to FIG. **6**, the drive unit **208** may include an electric motor **600** having an axis of rotation **600***a* that is substantially (e.g., within 0.5 degrees) perpendicular to the axis of rotation **306** of the wiper arm **114**. The axis of rotation **600***a* may therefore be positioned substantially (e.g., within 5 degrees of) tangent to the curvature of the portion of the outer applique **120** (see FIG. **1**) extending over the drive unit **208**. As shown in FIG. **6**, the motor **600** may be elongated along the axis of rotation **600***a* such that the illustrated orientation of the motor **600** results in less protrusion of the motor **600** normal to the outer applique **120** and therefore enables a more compact design.

[0033] A worm gear **602** is coupled to the output shaft of the motor **600** and drives a gear **604** couple to an output shaft **606** defining the axis of rotation **306**. The output shaft **606** is connected to the wiper arm **114**. The worm gear **602** and gear **604** may be positioned within a housing **608** that is either mounted to the motor **600** or contains the motor **600**. The housing **608** may define an opening **610** through which the output shaft **606** extends. A bearing **612** may be positioned in the opening **610** and extend around the output shaft **606** to facilitate rotation of the output shaft **606** relative to the housing **608**. The bearing **612** may include seals and be suitable for outdoor use, e.g., tolerant to exposure to moisture and other contaminants, in order to withstand small amounts of moisture or other contaminants that may be pass through the slits **312**, **314** in the seal **310**.

[0034] Referring to FIG. **7**, as noted above, the drive unit **208** may mount to the inner applique **118** using fasteners **210**. Fasteners **214** (see FIG. **2**) may then extend through openings **700** positioned adjacent (e.g., within 4, 8, or 12 centimeters from the fasteners **210**) and fasten the inner applique **118** to the glass carrier **200** or directly to the lower panel **102**.

[0035] Other than the portion of the inner applique **118** between the openings **700**, and a region around the openings **700**, e.g., within a radius of 2, 4, or 6 centimeters from centers of the openings **700**, referred to herein a "the structural portion,", the inner applique **118** is not a structural member. Accordingly, portions of the inner applique **118** extending outwardly in the Y direction from the structural portion ("the non-structural portions") may be thinner, include fewer stiffening structures, and/or include large openings. The extent of the non-structural portions on either side of the structural portion may be at least 1, 1.5, or 2 times the extent of the structural portion in the Y direction. The non-structural portions of the inner applique **118** may be mounted using non-structural fasteners suitable for decorative structures, such as the illustrated snap fasteners **702** distributed across the non-structural portion. The snap fasteners **702** may engage corresponding openings in the glass carrier **202** or lower panel **102** to secure the non-structural portions of the inner applique to the glass carrier **202** or lower panel **102**.

[0036] Referring to FIG. **8**, in some embodiments, entry of water, snow, and other contaminants into the receptacle **116** while the wiper **112** is parked may be further reduced by mounting a cover **800** to the wiper **112** and/or wiper arm **116**. The cover **800** may cover substantially all, e.g., 70, 80, 90, or 95 percent, of an area extending between the window **110** and the rearward wall **116***d* and between the sidewalls **116***a*, **116***b*. Stated differently, when the wiper **112** is parked, a gap of no more than 10, 5, 2, or 1 millimeter may be present between the cover **800** and surrounding structures (the window **110**, the rearward wall **116***d*, and the sidewalls **116***a*, **116***b*). The cover **800** may be made of a rigid material (e.g., Shore A hardness greater than 60) or a flexible material (Shore A less than 60). In other embodiments, the cover **800** may be mounted to the inner applique **118** and may deflect to allow the wiper **112** and wiper arm **114** to enter the receptacle **116** and thereafter recoil to cover the receptacle **116**. For example, an edge of the cover **800** may be captured between the inner applique **118** and the outer applique **120** to mount the cover **800** over the applique. The cover **800** may be formed of two pieces mounted to the inner applique and defining a slot permitting the wiper **112** and wiper arm **114** to pass therethrough.

[0037] Referring to FIG. **9**, the wiper **112** may include a wiper blade mount **900** that is pivotally mounted to the wiper arm **114** according to any approach known in the art. A wiper blade **902** inserts within the wiper blade mount **900** according to any approach known in the art. In some embodiments, it may be desirable to maintain the wiper blade **902** out of contact with the window **110** when the wiper **112** is parked.

[0038] The wiper blade mount **900** may engage a ramp **904** formed in the receptacle **116**, such as formed on the inner applique **118** protruding upwardly from the bottom wall **116***c*. The ramp **904** may urge the wiper blade mount **900** away from the window **110** sufficiently that the wiper blade **902** does not contact the window **110**. For example, the ramp **904** may be sloped downwardly (sloping away from the upper surface of the inner applique **118***a* and toward the bottom wall **116***c*) with distance from the window **110** along the X direction. The ramp **904** may have a uniform slope or areas of different slope as shown in FIG. **9**. For example, a first region with a first slope closest to the window **110** and a second region with a second slope that is greater than the first slope, the first region being positioned between the second region and the window **110** along the X direction.

[0039] The wiper blade mount **900** may define a protrusion **906** configured to engage the ramp **904**. The protrusion **906** may rest on or be adjacent (e.g., within 5 millimeters) the bottom wall **116***c* when the wiper **112** is parked.

[0040] In some embodiments, it may be desirable to sense whether the wiper **112** has been successfully parked. In some embodiments, a Hall effect sensor **908** may be mounted in or on the receptacle **116***c*, such as in, on, or below the bottom wall **116***c*. A magnet may be mounted to the wiper **112**, such as in or on the protrusion **906** or elsewhere on the wiper **112**, or to the wiper arm **114**, such that that Hall effect sensor **908** will sense the magnetic field of the magnet **910** when the wiper **112** is parked.

[0041] The illustrated Hall effect sensor **908** is one example of a parking sensor that is capable of detecting that the wiper **112** is parked. Other types of sensors, such as a contact sensor (e.g., button) that senses contact with the wiper **112** may likewise be used,

[0042] Referring to FIG. **10**, a vehicle to which the rear liftgate **100** is mounted may include a controller **1000**, such as an electronic control unit (ECU) or other type of controller. The controller **1000** may receive the output of the Hall effect sensor **908**. The controller **1000** may further receive the output of a current sensor **1002** sensing the amount of current drawn by the motor **600**. In some embodiments, the motor **600** includes a motor position sensor **1004** such that the actual amount of rotation of the motor **600** is known. The controller **1000** may therefore receive the output of the motor position sensor **1004**. The controller **1000** may translate the output of the motor position sensor **1004** to an angular displacement of the wiper **112** and derive an estimated angular position of the wiper. The controller **1000** may use the illustrated inputs to control the motor **600** to achieve a desired position and speed of the wiper **112**.

[0043] Referring to FIG. **11**, for example, the wiper **112** may be movable among various positions. In a parked position **1100**, the wiper **112** is positioned within the receptacle **116** and can be sensed using a parking sensor, e.g., the Hall effect sensor **908**. The wiper **112** and wiper arm **114** are positioned below the upper surface **118***a* of the inner applique **118** in the parked position as discussed above.

[0044] The wiper **112** may have a start position **1102** that is angularly offset from the parked position **1100**, a service position **1104**, and an end position **1106**. During normal operation, the controller **1000** may cause the motor **600** to oscillate the wiper **112** between the start and end positions **1102**, **1106**. When the wiper **112** is not in use, the controller **1000** may cause the motor **600** to drive the wiper **112** to the parked position **1100**. When in an intermittent mode of operation, the controller **1000** may pause movement of the wiper **112** between strokes at either the start position **1102** or the end position **1106** or alternate therebetween.

[0045] The controller **1000** may cause the motor **600** to move the wiper **112** to the service position **1104**, such as in response to an input received from a user, to facilitate servicing of the wiper **112**, such as replacement of the wiper blade **902**. In the illustrated embodiment, the service position **1104** is between the start and end positions **1102**, **1106**. This is particularly helpful since the wiper **112** is less accessible when in the recess **116**. The controller **1000** may cause the wiper **112** to remain in the service position for a fixed amount of time or until instructed to move the wiper **112** to the parked position **1100** by an input received from a user.

[0046] The controller **1000** may sense successful parking of the wiper **112** using various events. For example, as the wiper **112** approaches the parked position, the estimated angular position of the wiper **112** will indicate the angular position is at a point where the wiper **112** engages the ramp **904**. Likewise, the current sensor **1002** may produce an output indicating increased resistance from sliding the wiper **112** over the ramp and overcoming the resulting friction as well as any biasing force between the wiper **112** and wiper arm **114** that biases the wiper blade **902** into engagement with the window **110**. When in the parked position **1100**, the estimated angular position of the wiper will correspond to the parked position, the Hall effect sensor **908** may indicate proximity of the magnet **910**, and there may be a rise in the output of the current sensor **1002** as the interference between the wiper **112** and bottom wall **116***c* prevents further movement. The controller **1000** may detect all of these events and stop invoking rotation of the motor **600**.

[0047] Following being placed in the service position, the controller **1000** may perform a calibration step, e.g., to relate the output of the motor position sensor **1004** to the estimated angular position of the wiper **112**. For example, the output of the Hall effect sensor **908** and current sensor may be used to detect that the wiper **112** is in the parked position **1100** as described above. The estimated angular position of the wiper **112** as output from the motor position sensor **1004** (or obtained from data derived therefrom) may therefore be recorded by the controller **1000** as corresponding to the parked position **1100**. The calibration step may also be performed upon manufacture. For example, the arm **114** may be installed in any position and then the calibration step may be performed.

[0048] In some instances, there may be ice or snow crusted on the window **110** that resists movement of the wiper **112**. The controller **1000** may detect such obstructions based on an output of the current sensor **1002** indicating a current draw that is higher than an expected value for the current estimated angular position of the wiper **112** and/or based on the change in the estimated angular position being less than an expected value for the current estimated angular of the wiper **112** and/or indicating complete stoppage of the wiper **112**. In response, the controller **1000** may cause the motor **600** to reverse the direction of movement of the wiper **112** until the start or end position **1102**, **1106** is reached. The controller **1000** may then again reverse the direction of movement of the wiper **112** and attempt to perform a complete stroke of the region between the start and end positions **1102**, **1106**. If the wiper **112** is found to be obstructed at the same position (e.g., within 10 degrees of the same position) based on the current draw and or rate of change in angle of the wiper **112**, an obstruction may be verified and the controller **1000** may cause the wiper **112** to return to the parked position **1100** and generate an error message, such as output on an infotainment screen of the vehicle.

[0049] The descriptions of the various embodiments of the present disclosure have been presented for purposes of illustration. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

[0050] In the preceding, reference is made to embodiments presented in this disclosure. However, the scope of the present disclosure may exceed the specific described

embodiments. Instead, any combination of the features and elements, whether related to different embodiments, is contemplated to implement and practice contemplated embodiments. Furthermore, although embodiments disclosed herein may achieve advantages over other possible solutions or over the prior art, the embodiments may achieve some advantages or no particular advantage. Thus, the aspects, features, embodiments and advantages discussed herein are merely illustrative.

[0051] While the foregoing is directed to embodiments of the present disclosure, other and further embodiments may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

What is claimed is:

1. A vehicle assembly comprising:
- a vehicle door defining a window opening, the vehicle door including a structure having a surface defining a portion of a lower edge of the window opening and a recess extending downwardly from the surface;
- a window extending across the window opening; and
- a window wiper mounted to the structure and having a parked position in which the window wiper is positioned in the recess.

2. The vehicle assembly of claim **1**, wherein a perforated wall extends across the recess and permits fluid to drain from the recess.

3. The vehicle assembly of claim **2**, wherein the perforated wall extends across a first side of the recess and the window extends across a second side of the recess opposite the first side.

4. The vehicle assembly of claim **2**, wherein the structure defines a channel under the perforated wall and configured to conduct fluid away from the recess to a side of the vehicle door.

5. The vehicle assembly of claim **1**, wherein a drive unit is mounted to the structure, an arm being mounted to the drive unit and the window wiper being mounted to the arm, the structure defining a slot permitting movement of the arm within the slot, the slot extending across a portion of the surface and the recess.

6. The vehicle assembly of claim **5**, further comprising a seal positioned in the slot, the seal defining a first slit permitting movement of the arm within the first slit.

7. The vehicle assembly of claim **6**, wherein the seal further defines a second slit extending substantially perpendicular to the first slit and extending to either side of the first slit, the second slit being positioned at a curved transition between a first portion of the seal and a second portion of the seal that is angled relative to the first portion.

8. The vehicle assembly of claim **7**, wherein the second portion is substantially perpendicular to the first portion.

9. The vehicle assembly of claim **5**, wherein the drive unit includes a motor and a worm gear having a first axis of rotation, a drive gear engaging the worm gear and having a second axis of rotation that is perpendicular to the first axis of rotation, the arm being mounted to the drive gear.

10. The vehicle assembly of claim **5**, wherein the structure is an applique configured to secure to a lower panel of the vehicle door, the applique including:
- a structural portion, the drive unit being mounted to the structural portion and the structural portion being mounted to the lower panel of the vehicle door; and
- non-structural portions extending outwardly from the structural portion and being mounted to the lower panel of the vehicle door using non-structural fasteners.

11. The vehicle assembly of claim **10**, wherein the non-structural fasteners include snap fasteners.

12. The vehicle assembly of claim **10**, wherein:
- the applique is an inner applique;
- the vehicle assembly further comprising an outer applique secured to the inner applique;
- the inner applique includes a perforated wall extending across the recess and permitting fluid to drain from the recess;
- the inner applique includes a channel under the perforated wall and configured to conduct fluid away from the recess to a side of the vehicle door; and
- the vehicle assembly includes a seal positioned around the perforated wall and the channel, the seal being positioned between the inner applique and the outer applique.

13. The vehicle assembly of claim **1**, further comprising a cover secured to at least one of the window wiper and the structure and configured to substantially cover the recess.

14. The vehicle assembly of claim **1**, further comprising a heating element mounted to the structure and configured to melt ice within the recess.

15. The vehicle assembly of claim **14**, wherein the heating element is mounted below a bottom wall of the recess.

16. The vehicle assembly of claim **1**, further comprising a magnet mounted to the window wiper and a Hall effect sensor mounted to the structure and configured to sense the magnet when the window wiper is positioned within the recess.

17. The vehicle assembly of claim **1**, further comprising a ramp positioned in the recess and configured to urge the window wiper away from the window when the window wiper is positioned in the recess.

18. The vehicle assembly of claim **1**, wherein the vehicle door is a rear liftgate.

19. An apparatus comprising:
- a portion of a vehicle defining a window opening;
- a structure secured to the portion and having a surface defining a portion of a lower edge of the window opening and a recess extending downwardly from the surface;
- a window extending across the window opening; and
- a window wiper mounted to the structure and having a parked position in which the window wiper is positioned in the recess.

20. An apparatus comprising:
- a structure configured to secure along a lower edge of a window opening defined by a portion of a vehicle, the structure having a surface defining a portion of a lower edge of the window opening and a recess extending downwardly from the surface;
- a window wiper mounted to the structure and having a parked position in which the window wiper is positioned in the recess; and
- a drive unit mounted to the structure and coupled to the window wiper to actuate the window wiper.

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