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(54) **RESISTANCE HEATED COWL TRAY AND HVAC INTAKE**

(75) Inventor: **Lenora G. Hazen**, Fort Wayne, IN (US)

Correspondence Address:
INTERNATIONAL TRUCK INTELLECTUAL PROPERTY COMPANY,
4201 WINFIELD ROAD, P.O. BOX 1488
WARRENVILLE, IL 60555

(73) Assignee: **International Truck Intellectual Property Company, LLC**, Warrenville, IL (US)

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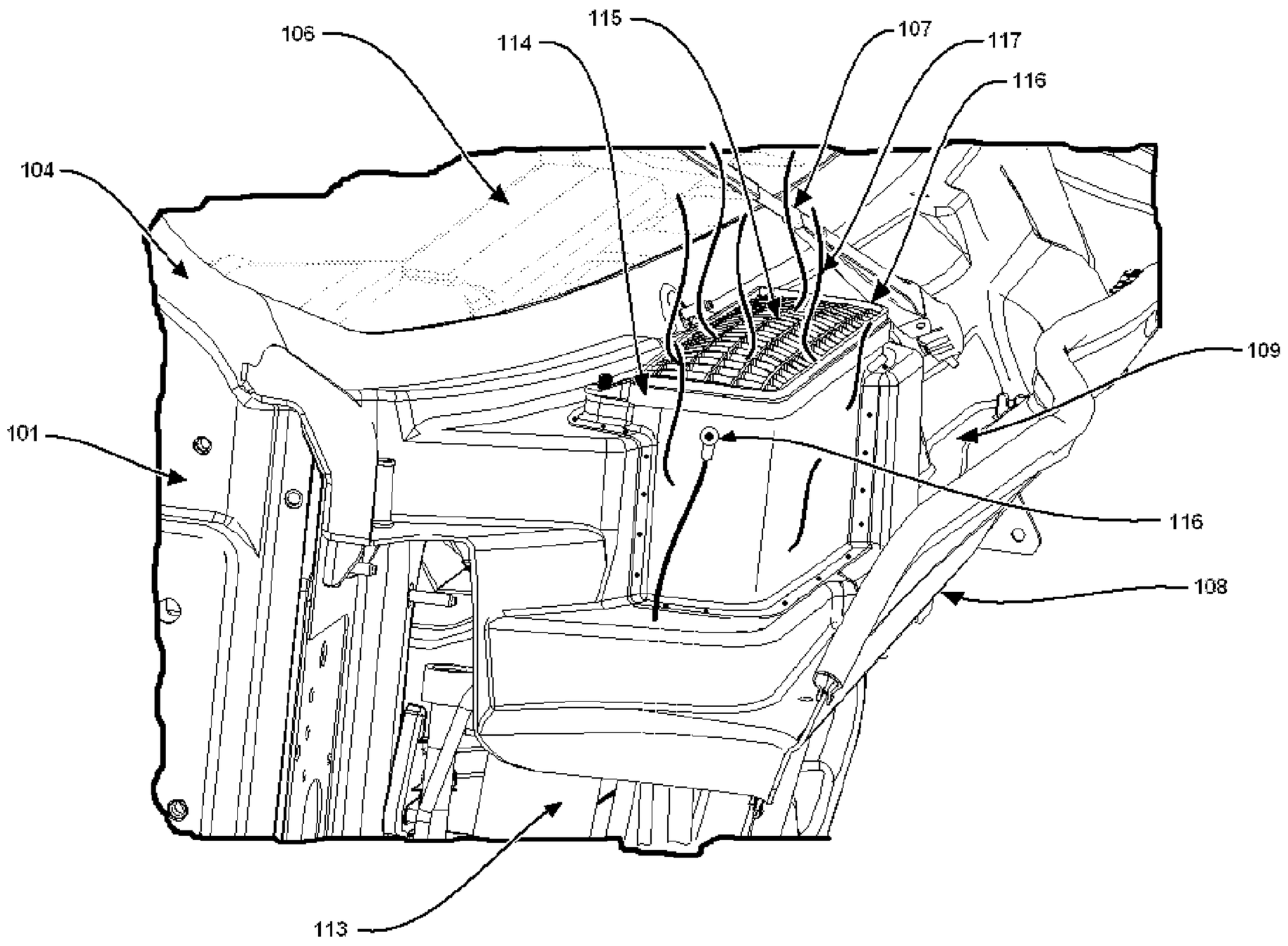
(52) **U.S. Cl.** **219/202**

(57) **ABSTRACT**

A vehicle having an occupant cabin, a cowl, and a Heating, Ventilation, and Air Conditioning (HVAC) system is provided with a cowl tray and adjoining HVAC intake. The cowl tray, HVAC intake, or both are constructed from a resistively conductive polymeric material, a polymeric material having embedded resistively conductive fibers, or a polymeric material having embedded resistively conductive wires, and are capable of generating heat upon the application of an electric current. Alternately, inserts constructed of such materials are attached to the cowl tray, HVAC intake, or both. The ability of the cowl tray and HVAC intake to generate heat is useful in preventing the accumulation of snow and ice.



Electrically Heated HVAC Intake

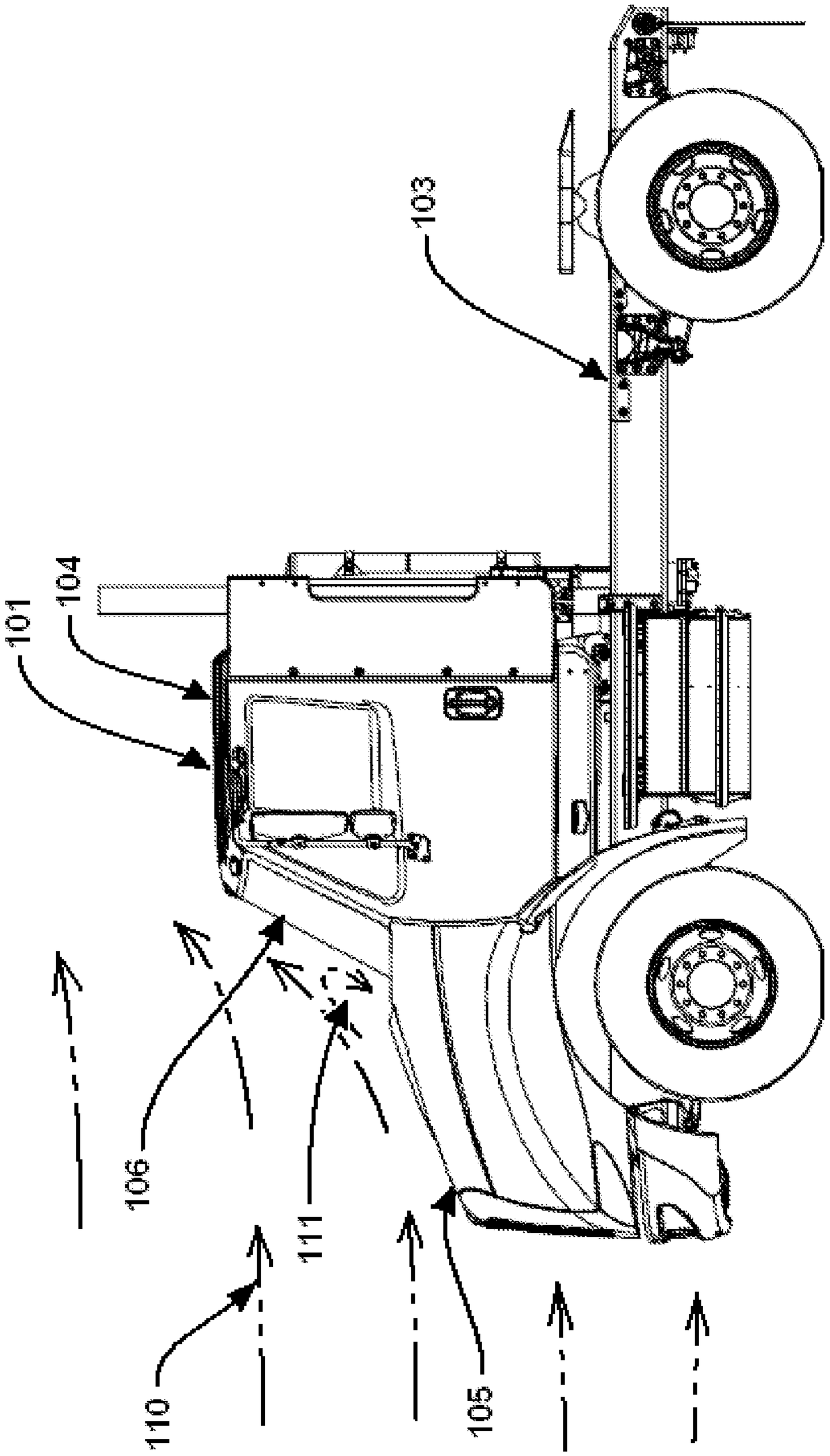


Figure 1
Vehicle Having Region of Recirculation
Near Base of Windshield

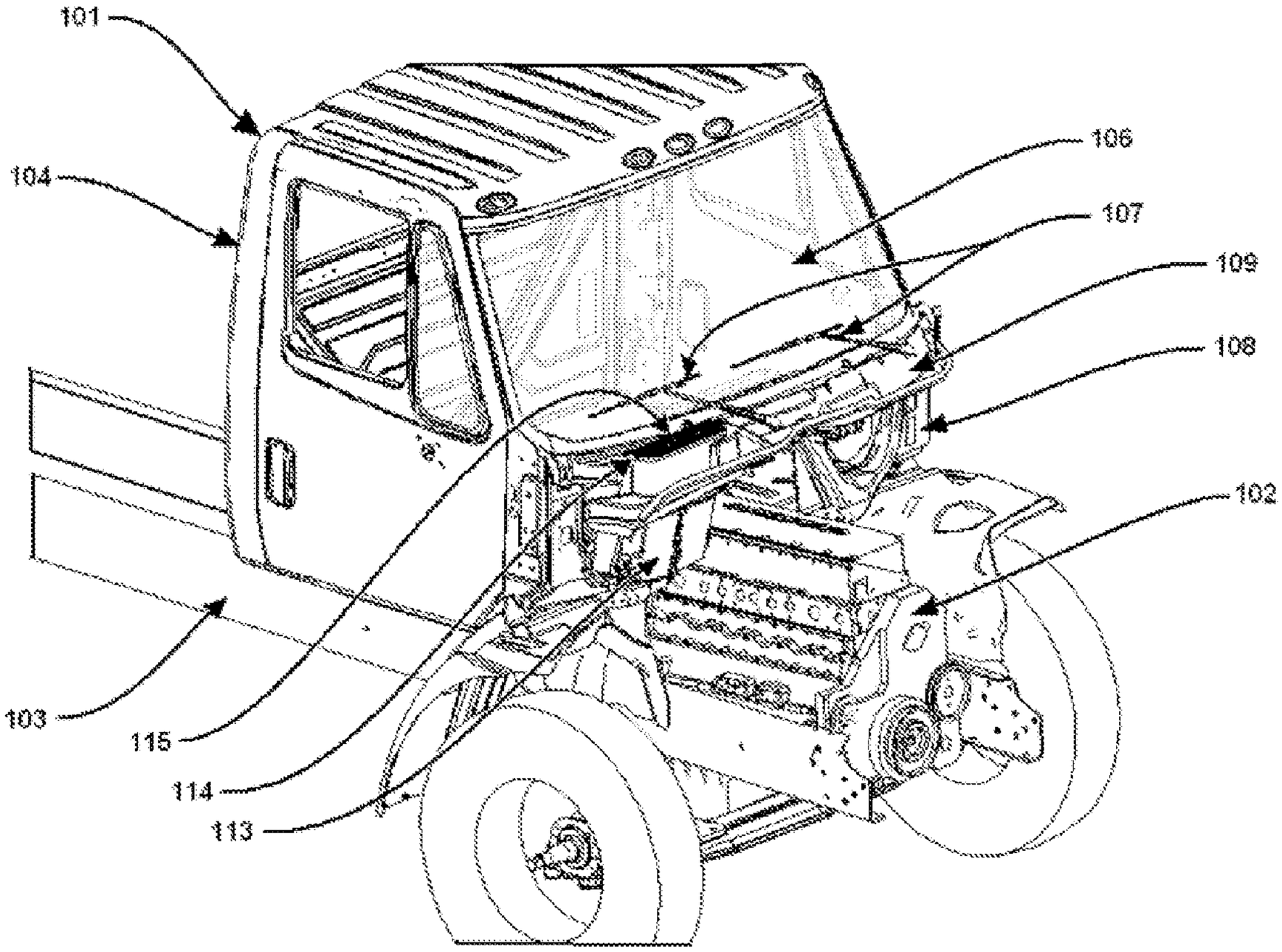


Figure 2
Partial View of Vehicle Having Cowl Tray with HVAC Intake

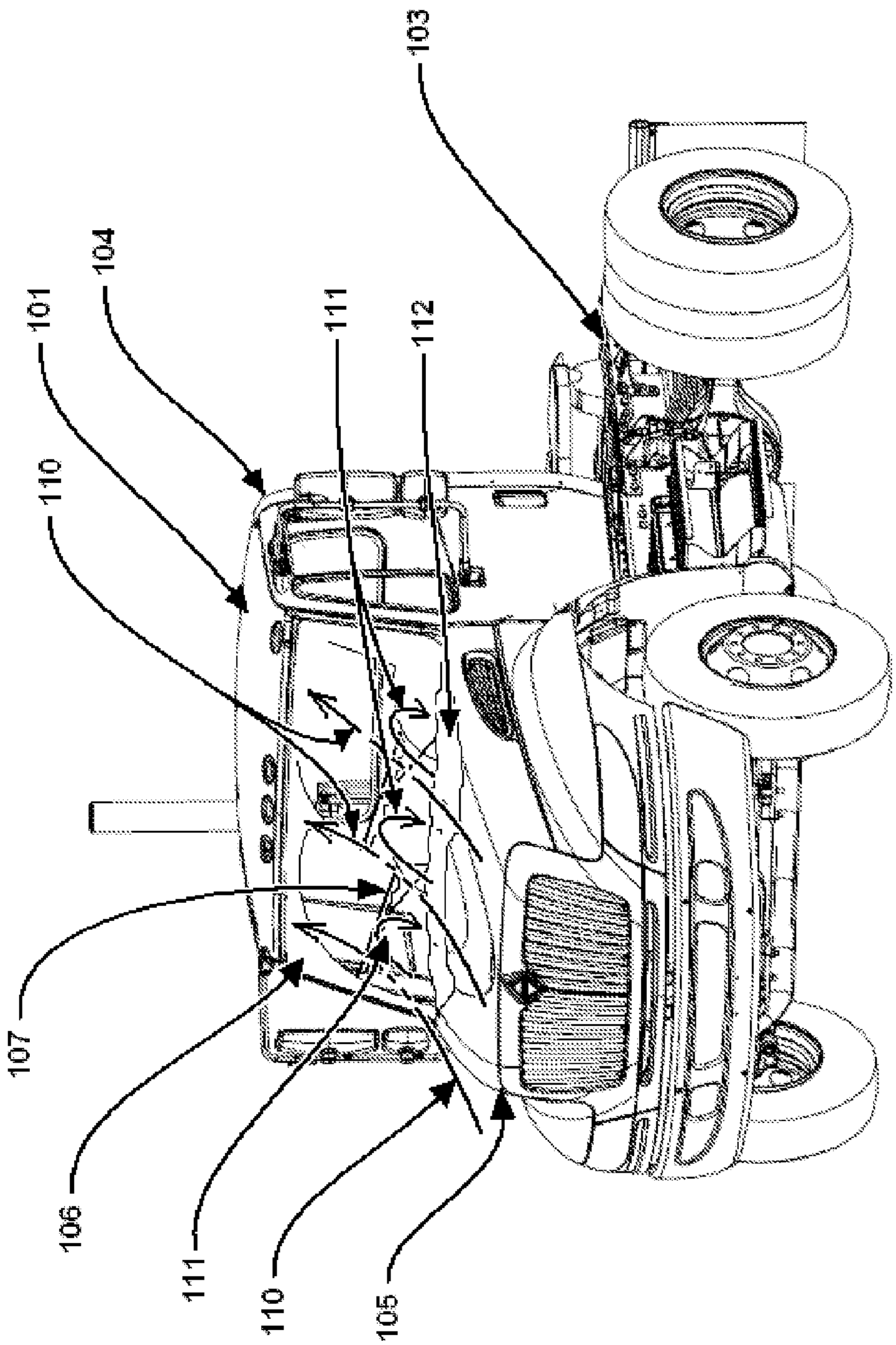


Figure 3
Vehicle with Snow and Ice Accumulation at Base of Windshield Due to Turbulent Precipitation

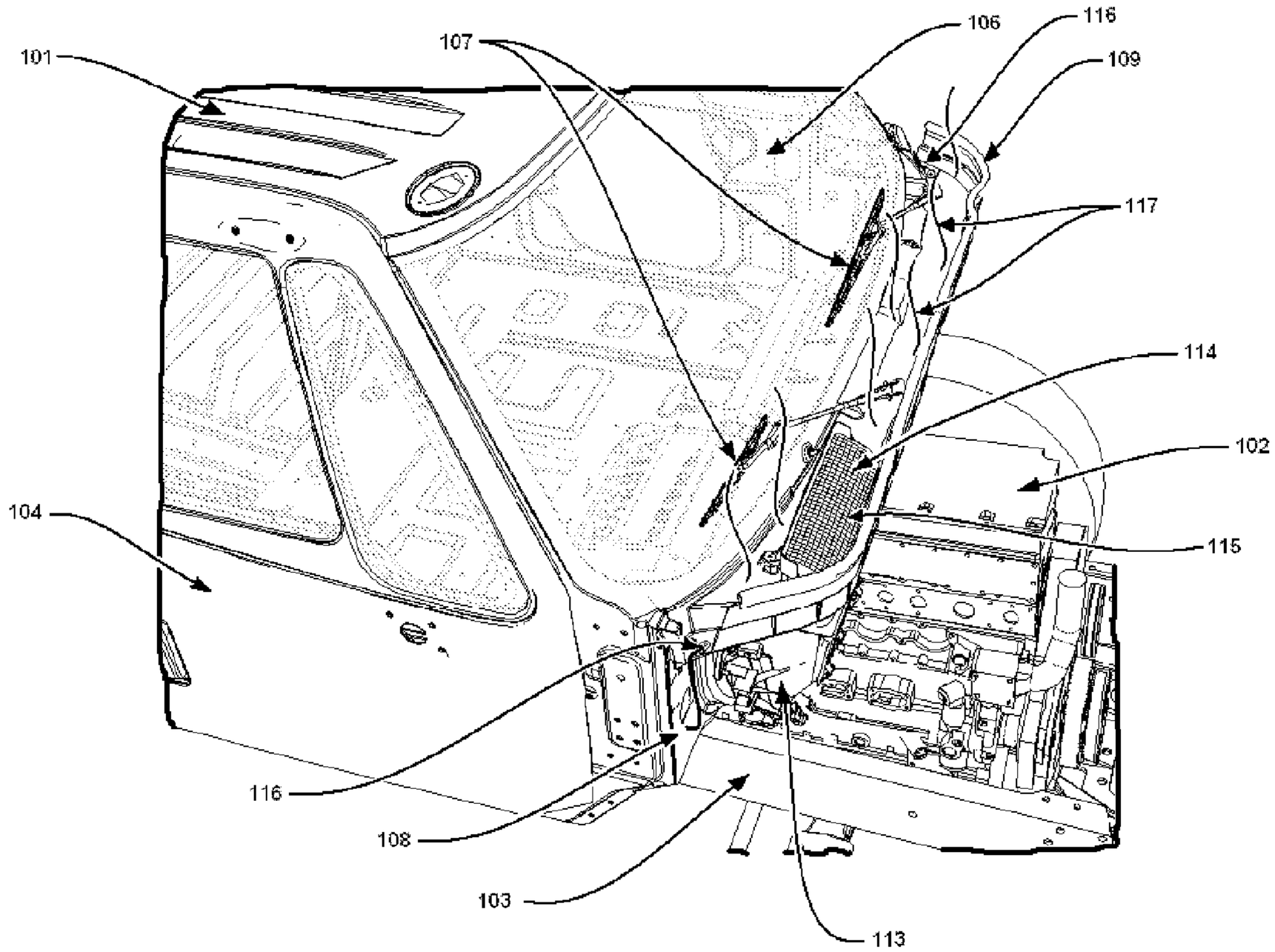


Figure 4
Electrically Heated Cowl Tray

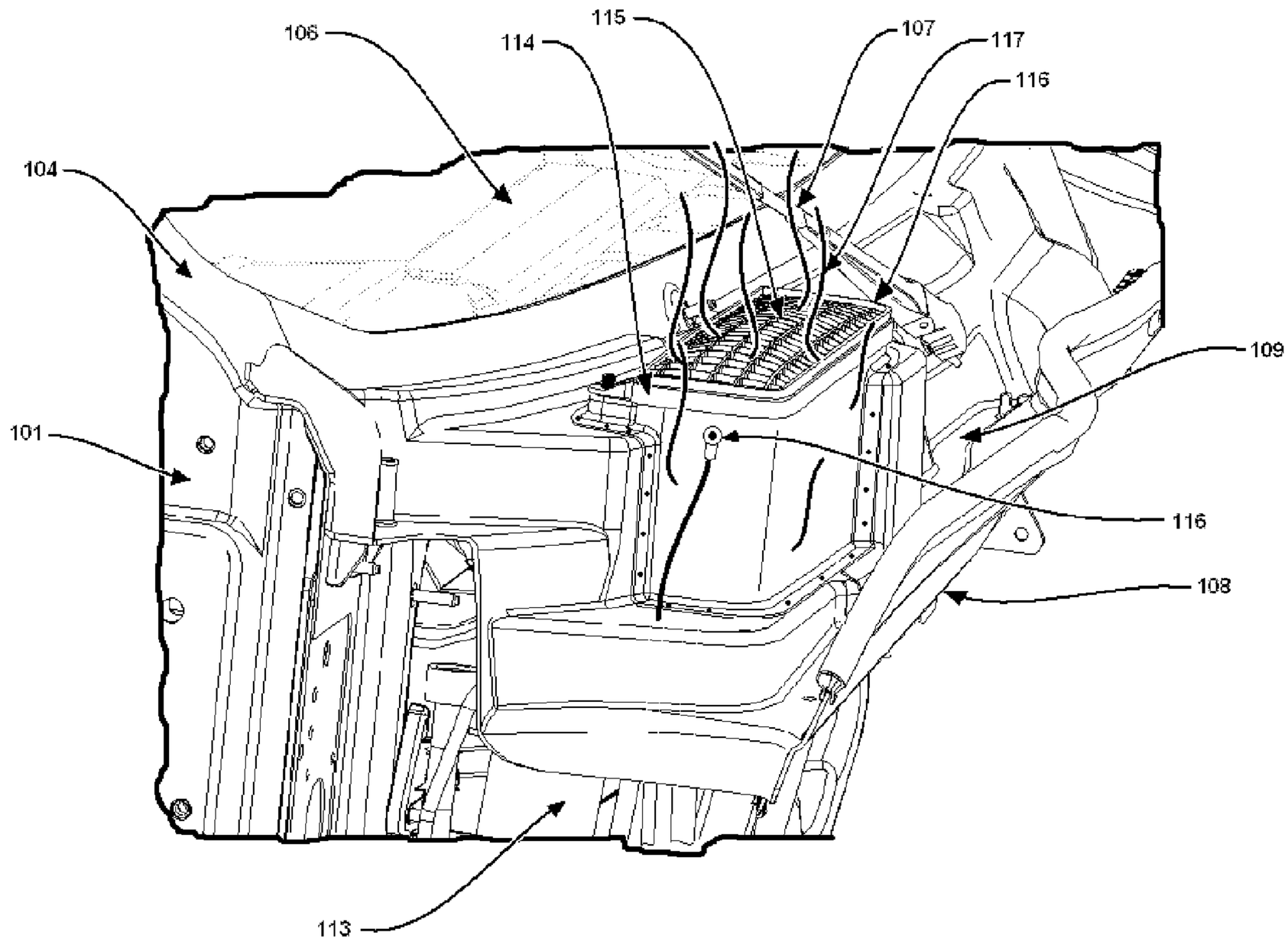


Figure 5
Electrically Heated HVAC Intake

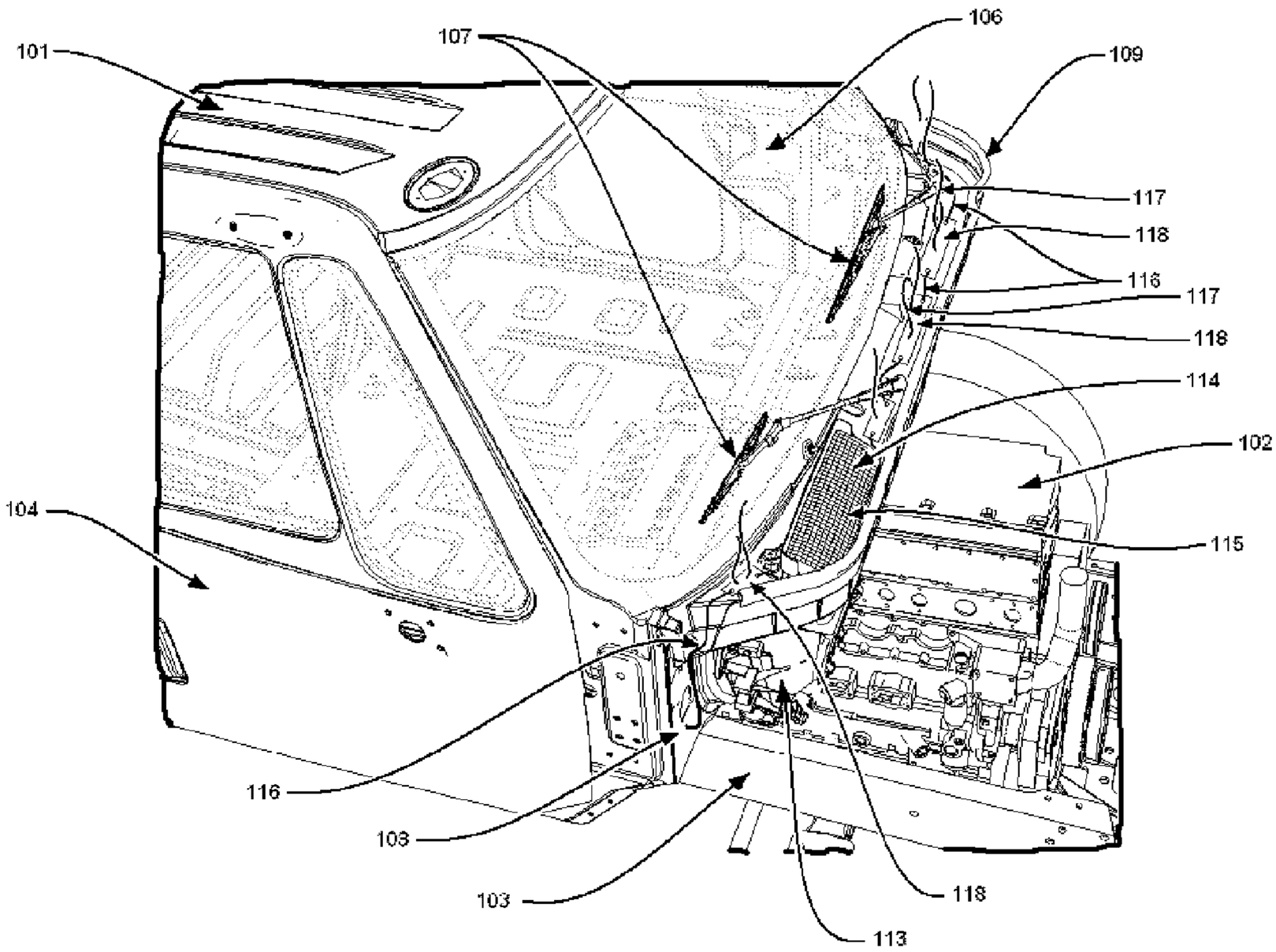


Figure 6
Cowl Tray with
Electrically Heated Inserts

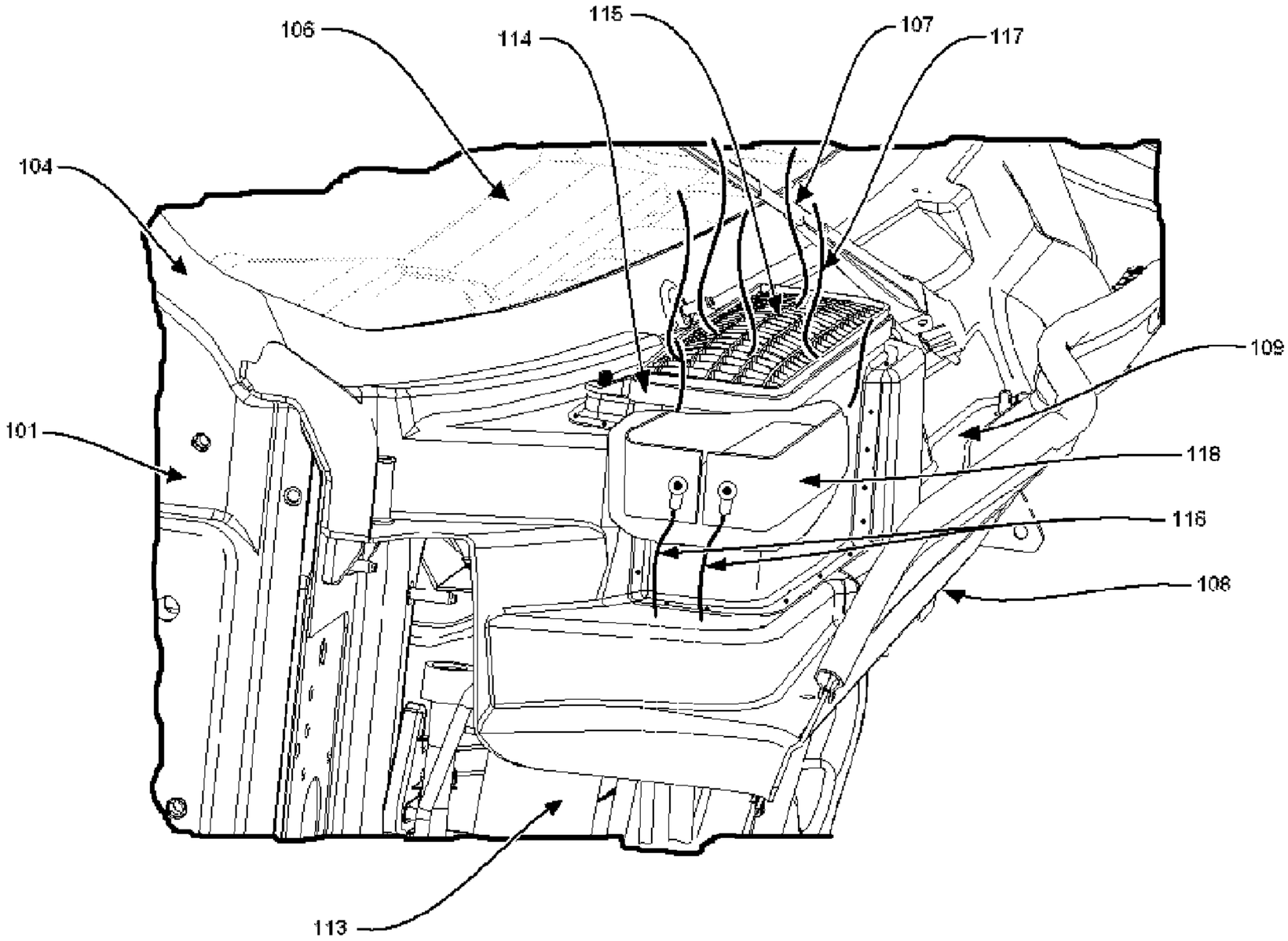


Figure 7
HVAC Intake with
Electrically Heated Insert

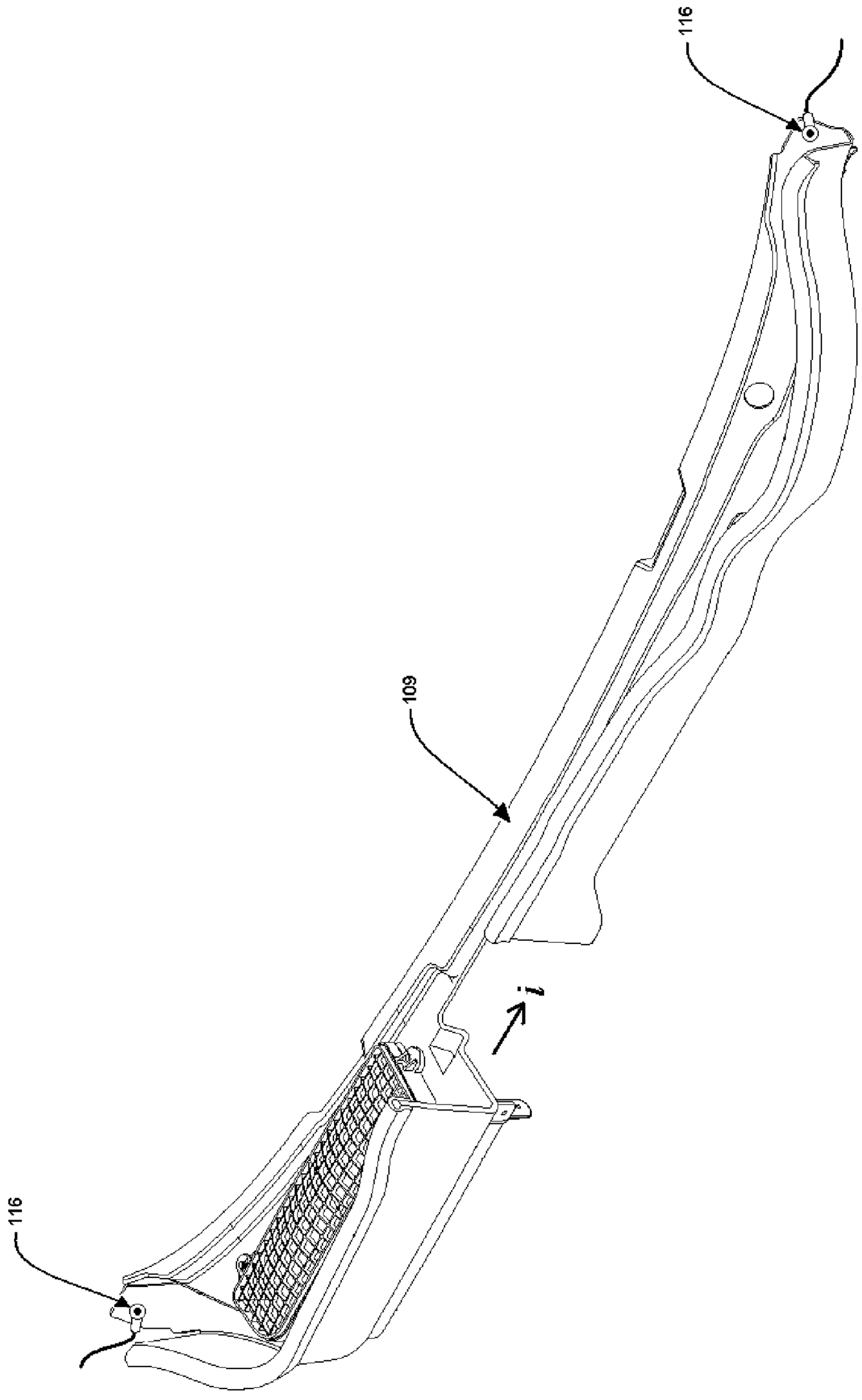


Figure 8
Cowl Tray Constructed of Resistively Conductive Polymeric Material

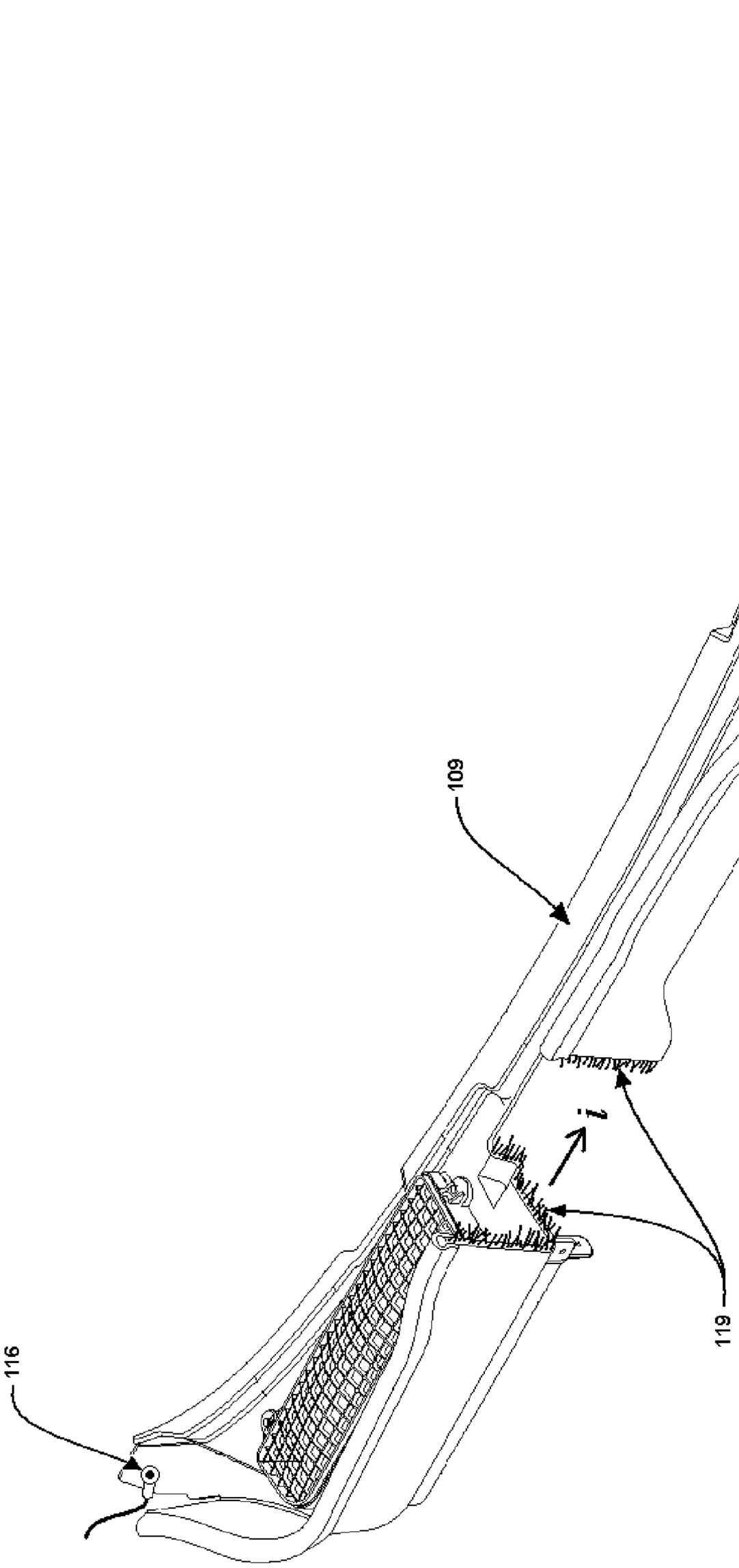


Figure 9
Cowl Tray Constructed of Polymeric Material having Resistively Conductive Fibers

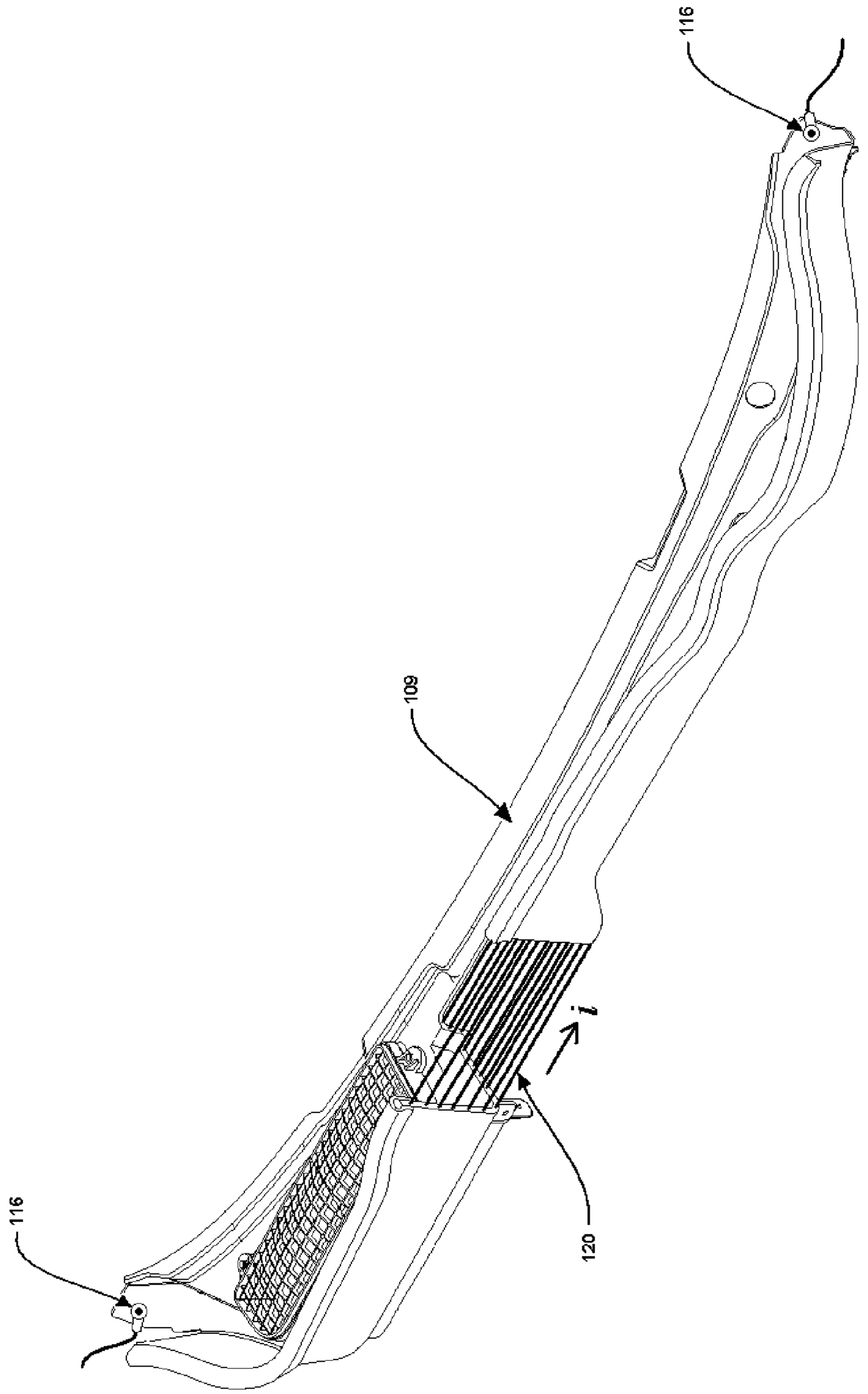


Figure 10
Cowl Tray Constructed of a Polymeric Material having Embedded Resistively Conductive Wires

RESISTANCE HEATED COWL TRAY AND HVAC INTAKE

CLAIM OF PRIORITY

[0001] This application is a continuation-in-part application of and claims the priority benefit of the filing date of Non-Provisional application Ser. No. 11/428,666 filed Jul. 5, 2006, on behalf of the same inventor as the present application and assigned to the assignee hereof.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to the use of an electrical resistance heated molded or formed polymeric material in the construction of a cowl tray and a Heating, Ventilation, and Air Conditioning (HVAC) intake. The polymeric material itself may be capable of generating heat by means of electrical resistance, or it may be imbued with resistively conductive fibers or overmolded resistance wires. The cowl tray or HVAC intake constructed of an electrical resistance heated molded or formed polymeric material is used to prevent accumulation of snow and ice, both within the HVAC intake, and upon the cowl tray beneath the vehicle windshield wipers. The HVAC intake may be integrated directly into the cowl tray, which cowl tray and intake may be located at the base of the vehicle windshield in a location prone to snow and ice accumulation, due to the action of the vehicle windshield wipers, and due to turbulent precipitation.

[0004] 2. Description of the Related Art

[0005] Ground traveling vehicles having an occupant cabin are almost universally equipped with some form of Heating, Ventilation, and Air Conditioning (HVAC) system. This system functions to draw air from outside the occupant cabin, heat or cool it to a comfortable temperature, and introduce it into the occupant cabin. The air intake for the HVAC system may be placed at any of a number of locations external to the cabin. However, there are several advantages to locating the intake at the base of the vehicle windshield.

[0006] As a ground traveling vehicle moves, it displaces air. Relative to the frame of reference of the moving vehicle, the air flows past the vehicle. This airflow is laminar in some locations, turbulent in others, and at various angles oblique to the direction of travel depending on the geometry of the vehicle body, resulting in regions of high and low pressure. One location that exhibits consistently high pressure is at the base of the windshield, where the moving air must make a transition from the angle of the hood to the angle of windshield. This area is characterized by a region of turbulent recirculation, and somewhat elevated static pressure. For this reason, the HVAC air intake is often there located. In the same way, vehicle manufacturers have in the past located the vehicle engine air intake in the same area. Often, this was referred to as cowl induction.

[0007] An advantage to locating the HVAC air intake in a region of elevated static pressure is the fact that so doing provides greater airflow through the HVAC system and into the cabin. Even when the HVAC blower is not operating, a system having its air intake so located provides positive pressure within the vehicle cabin, thereby minimizing draft incursions and water seepage through and around the various seals and seams that are characteristic of a vehicle occupant cabin. Locating the HVAC air intake at the base of the windshield has other advantages as well. The airflow at this point is well up and away from the level at which vehicle exhaust is commonly discharged. The intake may be discreetly hidden from view by the vehicle hood. Additionally, the base of the windshield is proximate to the HVAC air distribution plenum, eliminating the need for lengthy ductwork.

[0008] There is, however, a disadvantage to having the HVAC air intake located at the base of the vehicle windshield. When moving air enters a region of turbulent recirculation, it tends to precipitate anything held in suspension. In order to deal with this effect, U.S. Pat. No. 6,868,928 teaches the use of a cowl tray, which catches and drains away moisture, although in the case of the invention taught in U.S. Pat. No. 6,868,928, the region of elevated static pressure is being utilized in an engine cowl induction system. Although the cowl tray taught in U.S. Pat. No. 6,868,928 deals well with liquid water precipitate, snow and ice accumulation at the base of the vehicle windshield continues to be a problem. The snow and ice often packs the cowl tray full, so that the windshield wipers cannot freely complete their range of motion. Snow and ice also tends to enter the HVAC intake, restricting airflow.

[0009] The situation of snow and ice entering the HVAC air intake is exacerbated by the fact that the opening of the HVAC air intake is relatively large and oriented vertically, in order to facilitate ease of routing and maximize airflow. Usually, some sort of intake screen is provided, in order to prevent leaves and other large debris from entering the HVAC system. This screen tends to be the point at which snow and ice accumulates. Further, the windshield wipers tend to push at least some snow into the area of recirculation and even directly into the HVAC air intake itself. Under certain conditions, sufficient snow and ice may accumulate to completely block the intake, reducing the amount of airflow available for heating and defrosting the vehicle windows.

SUMMARY OF THE INVENTION

[0010] It is the object of the present invention to eliminate the problem of snow and ice accumulation upon the cowl tray and within the HVAC air intake by providing sufficient heat to melt the snow and ice as it is deposited. In order to accomplish this, either the HVAC air intake or the cowl tray, or both, are formed of a molded or formed polymeric material that is capable of generating heat when an electric current is applied. The polymeric material itself may be resistively conductive in order to generate heat, or it may be imbued with resistively conductive fibers, or provided with overmolded resistance wires. Alternately, inserts made of such material or having such overmolded resistance wires may be provided within the HVAC air intake, proximate to the opening in the cowl tray or equivalent structure, or upon the surface of the cowl tray extending along its length beneath the base of the windshield and the windshield wipers. These inserts may be bonded or attached to the HVAC air intake or to the cowl tray.

[0011] Such resistively conductive polymeric materials are well known in the art. Examples include polyacetylene, polypyrolle, polyaniline, polythiophene, polyfluorene, polynaphthalene, poly(p-phenylene sulfide), poly(para-phenylene vinylene), and poly(3,4-ethylenedioxythiophene) (PEDT). Other polymeric materials may be made to be resistively conductive by the addition of graphite fiber or

other resistively conductive fiber fillers in lieu of the nylon or glass fibers which are commonly used as fiber matrix reinforcements. Common polymers such as polycarbonate or polypropylene may be so modified.

[0012] The resistively conductive polymeric material from which the HVAC air intake, cowl tray, or inserts are formed generate heat upon the application of an electrical current. This current is provided by the vehicle electrical system. The circuit providing this current may be provided with a manually operated switch, such that the vehicle operator determines the operation of the intake or cowl heater. Alternately, automatic operation of the circuit may be based on ambient conditions, such as temperature, moisture, or the direct presence of snow and ice upon the cowl tray or in the HVAC intake. In the case of such automatic operation, ambient condition or snow and ice sensors provide electrical signals to an automatic switch or control mechanism, which controls activation of the intake or cowl heater electrical circuit. Multiple or graduated current settings may be utilized.

[0013] As in the prior art, water control and drainage is provided within the HVAC air intake in the form of labyrinthine intake geometry, sharp transitions, weep holes, and duckbills. In this way, the present invention accommodates the runoff from the melting snow and ice.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1**—Vehicle having region of air recirculation and increased static pressure at base of windshield near cowl.

[0015] FIG. **2**—Partial view of vehicle having HVAC intake located near base of windshield and within cowl tray.

[0016] FIG. **3**—Vehicle experiencing snow accumulation at base of windshield due to turbulent precipitation.

[0017] FIG. **4**—A view of a first embodiment of the present invention.

[0018] FIG. **5**—A view of a second embodiment of the present invention.

[0019] FIG. **6**—A view of a third embodiment of the present invention.

[0020] FIG. **7**—A view of a fourth embodiment of the present invention.

[0021] FIG. **8**—A view of a fifth embodiment of the present invention.

[0022] FIG. **9**—A view of a sixth embodiment of the present invention.

[0023] FIG. **10**—A view of a seventh embodiment of the present invention.

DESCRIPTION OF THE INVENTION

[0024] FIG. **1** shows a vehicle **101** having a chassis **103**, a cab **104**, a windshield **106**, and a hood **105**. FIG. **1** further shows air flow **110** moving past the vehicle **101**. A region of recirculation **111**, exhibiting increased static pressure, exists near the base of the windshield **106**.

[0025] FIG. **2** shows a partial view of a vehicle **101** having an engine **102**, a chassis **103**, and a cab **104**. The hood **105** of vehicle **101** is not shown in FIG. **2**. The cab **104** of vehicle **101** has a windshield **106** and windshield wipers **107**. Below the windshield **106** and separating occupants of the cab **104** from the engine **102**, is a cowl **108**. A cowl tray **109** located upon the cowl **108** at the base of the windshield **106** provides drainage of moisture runoff from the windshield **106** and hood **105** (not shown). Connected to the cowl tray **109** is an HVAC system **113**, which provides heated or cooled air to the occupants of the cab **104**. An HVAC intake opening **114** is integrated into the cowl tray **109**, and is provided with an HVAC intake screen **115**.

[0026] FIG. **3** shows a vehicle **101** having a chassis **103**, a cab **104**, a hood **105**, and a windshield **106**. Air flow **110** relative to the vehicle **101** makes a transition from a direction approximately parallel to the hood **105** of the vehicle **101** to a direction approximately parallel to the windshield **106**. The change in direction of the air flow **110** results in a region of air recirculation **111**. This region of air recirculation **111** deposits snow and ice **112** near the base of the windshield **106**. The location of the snow and ice **112** deposit overlies the cowl tray **109** (not shown) and HVAC intake opening **114** (not shown) as they are shown in FIG. **2**. The windshield **106** shown in FIG. **3** is further provided with a set of windshield wipers **107**, which windshield wipers **107** tend to push additional snow and ice **112** towards the base of the windshield **106**.

[0027] FIG. **4** shows a partial view of a vehicle **101** having an engine **102**, a chassis **103**, and a cab **104**, similar to the vehicle **101** shown in FIG. **2**. The hood **105** of vehicle **101** is not shown in FIG. **4**. The cab **104** of the vehicle **101** shown in FIG. **4** is again provided with a windshield **106**, windshield wipers **107**, a cowl **108**, and a cowl tray **109**. An HVAC system **113** connects to the cowl tray **109**, passes through the cowl **108**, and into the interior of the cab **104**, in order to provide heated or cooled air to the occupants thereof. Air enters the HVAC system **113** at the HVAC intake opening **114**, which is integrated into the cowl tray **109**. The HVAC intake opening **114** is protected against the entry of large debris by means of the HVAC intake screen **115**. In the embodiment of the present invention shown in FIG. **4**, the cowl tray **109** is constructed of a resistively conductive polymeric material, or a polymeric material having resistively conductive fibers embedded within, or a polymeric material with overmolded resistively conductive wires. Electrical leads **116** are attached to the cowl tray **109** at opposite ends. An electric current, provided by the electrical leads **116**, causes the cowl tray **109** to generate heat, which is represented in FIG. **4** by wavy "heat lines" **117**. The generated heat prevents accumulation of snow and ice upon the cowl tray **109**.

[0028] FIG. **5** shows a partial view of a vehicle **101** having a cab **104**, a windshield **106**, windshield wipers **107**, a cowl **108**, and a cowl tray **109**, similar to the vehicle **101** shown in FIG. **4**. The hood **105** of vehicle **101** is not shown in FIG. **5**. An HVAC system **113** again connects to the cowl tray **109**, passes through the cowl **108**, and into the interior of the cab **104**, in order to provide heated or cooled air to the occupants thereof. Air enters the HVAC system **113** at the HVAC intake opening **114**, which HVAC intake opening **114** is provided with an HVAC intake screen **115**. In the embodiment of the present invention shown in FIG. **5**, the HVAC intake opening **114** and the HVAC intake screen **115** are constructed of a resistively conductive polymeric material, or a polymeric material having resistively conductive fibers embedded within, or a polymeric material with overmolded resistively conductive wires. Electrical leads **116** are attached to the HVAC intake opening at approximate opposite locations. Only one such electrical lead **116** is visible in FIG. **5**, although the approximate location of the other is indicated. An electric current, provided by the electrical leads **116**, causes the HVAC intake opening **114** and the HVAC intake

screen **115** to generate heat, which is represented in FIG. **5** by wavy "heat lines" **117**. The generated heat prevents accumulation of snow and ice upon the HVAC intake screen **115** or within the HVAC intake opening **114**.

[0029] FIG. **6** shows a partial view of a vehicle **101** having an engine **102**, a chassis **103**, a cab **104**, a windshield **106**, windshield wipers **107**, a cowl **108**, and a cowl tray **109**, similar to the vehicles **101** shown in FIG. **4** and FIG. **5**. The hood **105** of vehicle **101** is not shown in FIG. **6**. An HVAC system **113** connected to the cowl **108** and the cowl tray **109** is again provided having an HVAC intake opening **114** and an HVAC intake screen **115**. A series of heated inserts **118** constructed of a resistively conductive polymeric material, or a polymeric material having resistively conductive fibers embedded within, or a polymeric material with overmolded resistively conductive wires, are attached to the cowl tray **109**. Electrical leads **116** connect one heated insert **118** to the next, and connect to the vehicle **101**, whereby an electric current is provided in order to cause the resistively conductive polymeric heated inserts **118** to generate heat. The heat generated is represented in FIG. **6** by wavy "heat lines" **117**. The generated heat prevents accumulation of snow and ice upon the cowl tray **109**.

[0030] FIG. **7** shows a partial view of a vehicle **101** having a cab **104**, a windshield **106**, windshield wipers **107**, a cowl **108**, and a cowl tray **109**, similar to the vehicles **101** shown in FIGS. **4-6**. The hood **105** of vehicle **101** is not shown in FIG. **7**. An HVAC system **113** again connects to the cowl tray **109**, passes through the cowl **108**, and into the interior of the cab **104**, in order to provide heated or cooled air to the occupants thereof. Air enters the HVAC system **113** at the HVAC intake opening **114**, which HVAC intake opening **114** is provided with an HVAC intake screen **115**. In the embodiment of the present invention shown in FIG. **7**, a heated insert **118** constructed of a resistively conductive polymeric material, or a polymeric material having resistively conductive fibers embedded within, or a polymeric material with overmolded resistively conductive wires, is attached within the HVAC intake opening **114**, which HVAC intake opening **114** is shown partially cut-away in order to better show the heated insert **118**. An electric current is provided by electrical leads **116**, causing the heated insert **118** to generate heat. The heat generated, represented by wavy "heat lines" **117**, warms the HVAC intake opening **114** and the HVAC intake screen **115**, and prevents accumulation of snow and ice thereupon.

[0031] FIG. **8** shows an embodiment of the present invention, a cowl tray **109** constructed of a resistively conductive polymeric material. Electrical current "i", provided by electrical leads **116**, flows through the resistively conductive polymeric material, causing the cowl tray **109** to generate heat. The cowl tray **109** is shown partially cut-away, in order to show a representation of the electric current flow therethrough.

[0032] FIG. **9** shows another embodiment of the present invention, a cowl tray **109** constructed of a polymeric material having resistively conductive fibers **119** encased therein. Electrical current "i", provided by electrical leads **116**, flows through the resistively conductive fibers **119**, causing the cowl tray **109** to generate heat. The cowl tray **109** is shown partially cut-away, in order to show the resistively conductive fibers **119**, as well as a representation of the electric current flow therethrough.

[0033] FIG. **10** shows another embodiment of the present invention, a cowl tray **109** constructed of a polymeric material having resistively conductive wires **120** embedded therein. Electrical current "i", provided by electrical leads **116**, flows through the resistively conductive wires **120**, causing the cowl tray **109** to generate heat. The cowl tray **109** is shown partially cut-away, in order to show the resistively conductive wires **120**, as well as a representation of the electric current flow therethrough.

[0034] Other permutations of the invention are possible without departing from the teachings disclosed herein, provided that the function of the invention is to use a vehicle cowl tray or HVAC intake formed of resistively conductive polymeric material, polymeric material containing resistively conductive fibers, or polymeric material having embedded resistively conductive wires, or inserts of such material located upon a cowl tray or HVAC intake, in order to prevent accumulation of snow and ice in and upon the cowl tray and HVAC intake. Other advantages to a vehicle equipped with a cowl tray or HVAC intake formed of resistively conductive polymeric material, polymeric material containing resistively conductive fibers, or polymeric material having embedded resistively conductive wires, or inserts of such material located upon a cowl tray or HVAC intake, may also be inherent in the invention, without having been described above.

We claim:

1. A vehicle for operation on the ground, said vehicle having an electrical system, said vehicle further having an occupant cabin, said occupant cabin being provided with a cowl and a windshield, said windshield having a base proximate to said cowl, comprising:

a cowl tray, said cowl tray being capable of generating heat in response to the application of an electric current thereto, said cowl tray being attached to said cowl proximate to said base of said windshield; and

at least one electrical lead connecting said cowl tray to said electrical system.

2. The vehicle for operation on the ground of claim **1**, wherein:

said cowl tray is constructed of a resistively conductive polymeric material.

3. The vehicle for operation on the ground of claim **1**, wherein:

said cowl tray is constructed of a polymeric material having embedded resistively conductive fibers.

4. The vehicle for operation on the ground of claim **1**, wherein:

said cowl tray is constructed of a polymeric material having embedded resistively conductive wires.

5. The vehicle for operation on the ground of claim **1**, wherein:

application of said electric current is controlled by at least one sensor.

6. A vehicle for operation on the ground, said vehicle having an electrical system, said vehicle further having an occupant cabin, said occupant cabin being provided with a cowl and a windshield, said windshield having a base proximate to said cowl, comprising:

a cowl tray, said cowl tray being attached to said cowl proximate to said base of said windshield;

at least one insert attached to said cowl tray, said at least one insert being capable of generating heat in response to the application of an electric current thereto; and

at least one electrical lead connecting said at least one insert to said electrical system.

7. The vehicle for operation on the ground of claim **6**, wherein:

said at least one insert is constructed of a resistively conductive polymeric material.

8. The vehicle for operation on the ground of claim **6**, wherein:

said at least one insert is constructed of a polymeric material having embedded resistively conductive fibers.

9. The vehicle for operation on the ground of claim **6** wherein:

said at least one insert is constructed of a polymeric material having embedded resistively conductive wires.

10. The vehicle for operation on the ground of claim **6**, wherein:

application of said electric current is controlled by at least one sensor.

11. A vehicle for operation on the ground, said vehicle having an electrical system, said vehicle further having an occupant cabin, said occupant cabin being provided with a cowl and a windshield, said windshield having a base proximate to said cowl, said occupant cabin being provided with a cowl tray attached to said cowl proximate to said base of said windshield, said occupant cabin being further provided with an HVAC system, comprising:

an air intake connected to said HVAC system, said air intake adjoining said cowl tray, said air intake being capable of generating heat in response to the application of an electric current thereto; and

at least one electrical lead connecting said air intake to said electrical system.

12. The vehicle for operation on the ground of claim **11**, wherein:

said air intake is further provided with an air intake screen, said air intake screen being capable of generating heat in response to the application of an electric current thereto.

13. The vehicle for operation on the ground of claim **11**, wherein:

said air intake is constructed of a resistively conductive polymeric material.

14. The vehicle for operation on the ground of claim **11**, wherein:

said air intake is constructed of a polymeric material having embedded resistively conductive fibers.

15. The vehicle for operation on the ground of claim **11**, wherein:

said air intake is constructed of a polymeric material having embedded resistively conductive wires.

16. The vehicle for operation on the ground of claim **11**, wherein:

application of said electric current is controlled by at least one sensor.

17. A vehicle for operation on the ground, said vehicle having an electrical system, said vehicle further having an occupant cabin, said occupant cabin being provided with a cowl and a windshield, said windshield having a base proximate to said cowl, said occupant cabin being provided with a cowl tray attached to said cowl proximate to said base of said windshield, said occupant cabin being further provided with an HVAC system, comprising:

an air intake connected to said HVAC system, said air intake adjoining said cowl tray;

at least one insert attached to said air intake, said at least one insert being capable of generating heat in response to the application of an electric current thereto; and

at least one electrical lead connecting said at least one insert to said electrical system.

18. The vehicle for operation on the ground of claim **17**, wherein:

said at least one insert is constructed of a resistively conductive polymeric material.

19. The vehicle for operation on the ground of claim **17**, wherein:

said at least one insert is constructed of a polymeric material having embedded resistively conductive fibers.

20. The vehicle for operation on the ground of claim **17**, wherein:

said at least one insert is constructed of a polymeric material having embedded resistively conductive wires.

21. The vehicle for operation on the ground of claim **17**, wherein:

application of said electric current is controlled by at least one sensor.

* * * * *