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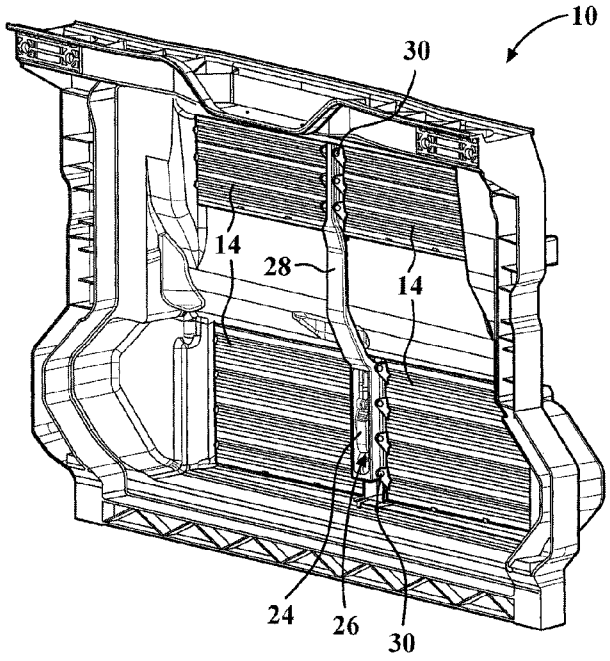

FIG. 4

(57) Abstract: The present invention is directed to a carrier for an automobile with integrated active ducting. The carrier includes at least one aperture, and at least one louver rotatably mounted in the aperture. Also attached to the carrier is an actuator, and the actuator is connected to the louver. The actuator is operable for moving the louver between an open position and a closed position such that when the louver is in the open position, air flow passes through the aperture.

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CARRIER WITH INTEGRATED DUCTING

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/271,413, filed July 21, 2009.

FIELD OF THE INVENTION

The present invention relates to a carrier for an automobile which has active ducting integrated with the carrier to provide greater control over the cooling of an automobile.

BACKGROUND OF THE INVENTION

Various attempts have been made to optimize the cooling of various automobile parts. Some of the various devices developed have been designed to control the air flow throughout the engine compartment of the automobile such that the desired amount of heat is transferred away from the engine, transmission, and other components which generate heat in order to maintain an optimal operating temperature.

However, it is also desirable to bring the engine up to the normal operating temperature as soon as possible after engine start-up. When the engine is substantially the same temperature as the surrounding environment and is turned on, the engine is the least fuel efficient (especially during start-up and the temperature of the surrounding environment is cold). The reduced fuel efficiency is why it is considered desirable to bring the engine up to the optimal operating temperature very quickly. Under these conditions, it is not desirable to remove heat away from the engine and the various components surrounding the engine, and therefore devices designed to control air flow around the engine are more beneficially used if they do not remove heat away from the engine at start-up.

Furthermore, components designed to provide optimal cooling when the vehicle is new may operate differently after the vehicle has accumulated significant mileage. This may occur due to various weather conditions, changes in the way the vehicle is operated in response to different drivers, or wear and tear on the vehicle components and other components. All of these factors may affect or change the operation of the components over time as the vehicle accumulates mileage. Also, with many current cooling systems, the airflow generated from the forward motion of a vehicle is not efficiently used to cool the various components of the vehicle. Rather, many of the components of a vehicle cause poor airflow which leads to aerodynamic inefficiencies.

Many of the components designed to control the air flow around an engine for controlling the operating temperature are manufactured as separate components and assembled to the vehicle during the manufacturing process. This increases the number of parts used to assemble the vehicle, complexity of manufacturing, and manufacturing costs.

Accordingly, there exists a need for a cooling system which is operable to have greater control over the airflow around an engine which is adaptable to be suited for use with many different vehicles, and is able to be integrated into one or more pre-existing vehicle components to reduce the number of overall parts used in manufacturing the vehicle.

SUMMARY OF THE INVENTION

The present invention is directed to an integrated active ducting for an automobile. The active ducting includes at least one aperture formed as part of a vehicle component, such as a carrier, and at least one louver rotatably mounted in the aperture. Also attached to the carrier is an actuator, and the actuator is connected to the louver. The actuator is operable for moving the louver between an open position and a closed position such that when the louver is in the open position, air flow passes through the aperture.

The carrier and ducting are integrated together as a single unit and are therefore assembled to the vehicle as a single unit during manufacturing. In an alternate embodiment, the ducting is integrated to a fan shroud, radiator housing, or the like.

More particularly, each louver has a pair of seals, with one seal from one louver contacting a corresponding seal of a corresponding louver for preventing airflow through the aperture of the carrier. Each seal includes a slip coat for reducing the friction between the seals, as well as limiting binding between the louvers from ice formation on the surface of the seals, and improving wear resistance to dirt and debris during cycling.

In another aspect of the present invention, a process for manufacture of a louver used in a louver system is provided. According to this process, as an extended length of a louver is extruded, the louver is extruded into pre-determined shaped cross-sections with dual durometer co-extrusion slip coats and also strengthening cores or wires. This provides a cost effective louver blank that can be cut to any desired length as required for particular applications.

The louver blank is then cut to length using the construction of the present invention. Connection features are formed on the ends which are adapted for connecting to a link mechanism. In a preferred embodiment, the connection features are die cut while cutting the louvers, or after the louvers are cut to a final length.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

Figure 1 is a first front perspective view of a carrier having integrated active ducting, according to the present invention;

Figure 2 is a first rear perspective view of a carrier having integrated active ducting, according to the present invention;

Figure 3 a second front perspective view of a carrier having integrated active ducting, according to the present invention;

Figure 4 a second rear perspective view of a carrier having integrated active ducting, according to the present invention;

Figure 5 is perspective view of a louver used as part of active integrated ducting, according to the present invention;

Figure 6 is an enlarged perspective view of an end of a louver used as part of active integrated ducting, according to the present invention;

Figure 7A is a side view of an end of a louver used as part of active integrated ducting, according to the present invention;

Figure 7B is a side view of another end of a louver used as part of active integrated ducting, according to the present invention;

Figure 7C is a perspective view of the end of the louver shown in Figure 7B, according to the present invention;

Figure 8A is a perspective view of several louvers used as part of active integrated ducting in a closed position, according to the present invention;

Figure 8B is an enlarged perspective view of the louvers used as part of active integrated ducting in a closed position shown in Figure 8A, according to the present invention;

Figure 8C is an enlarged perspective view of connecting portions attached to a set of louvers used as part of active integrated ducting in a closed position, according to the present invention;

Figure 9 is a perspective view of a connecting portion attached to a louver used as part of active integrated ducting, according to the present invention;

Figure 10 a second perspective view of a connecting portion attached to a louver used as part of active integrated ducting, according to the present invention;

Figure 11 is a first perspective view of a connecting portion operable for attachment to a louver used as part of active integrated ducting, according to the present invention;

Figure 12 is a second perspective view of a connecting portion operable for attachment to a louver used as part of active integrated ducting, according to the present invention;

Figure 13 is a third perspective view of a connecting portion operable for attachment to a louver used as part of active integrated ducting, according to the present invention;

Figure 14A is a sectional side view taken along lines 14A-14A of Figure 5;

Figure 14B is an enlarged view of the circled portion shown in Figure 14A;

Figure 15A is a sectional side view of an alternate embodiment of louvers used as part of active integrated ducting, according to the present invention;

Figure 15B is an enlarged view of the circled portion of Figure 15A;

Figure 16A is an enlarged view of another alternate embodiment of a louver used as part of active integrated ducting, according to the present invention;

Figure 16B is a sectional side view of the alternate embodiment of the louvers shown in Figure 16A used as part of active integrated ducting, according to the present invention;

Figure 17 is a sectional side view of yet another alternate embodiment of a louver used as part of active integrated ducting, according to the present invention;

Figure 18 is an exploded view of a fascia having active integrated ducting, with the fascia operable for connection with a vehicle support structure, according to the present invention; and

Figure 19 is an exploded view of a carrier having active integrated ducting, with the carrier operable for connection with a vehicle support structure, according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

An embodiment of a carrier having integrated active ducting is shown in the Figures generally at 10. The carrier 10 is a single molded component, and includes various ports, flanges, support members, and the like operable for connection with the various components located inside an engine compartment, such as a radiator, fan shroud, washer fluid container, the vehicle chassis, body-in-white (BIW), and other similar components. While the carrier 10 is molded as shown, it is within the scope of the invention that the carrier 10 is operable to be molded having other shapes such that the carrier 10 of the present invention is able to be used with different types of vehicles.

The carrier 10 includes several apertures 12 which function as ducting and are operable for allowing air flow therethrough. The ducting also includes a set of louvers 14 mounted within each of the apertures 12. The louvers 14

are operable to be in a first or open position to allow airflow through the apertures 12, or in a second or closed position to prevent airflow through the apertures 12, or any position therebetween.

The apertures 12 are broken up into two groups, upper apertures, generally shown at 16, and lower apertures, generally shown at 18. Dividing the upper apertures 16 is a mounting portion in the form of an upper vertical mount 20, and dividing the lower apertures 18 is another mounting portion in the form of a lower vertical mount 22. Connected to the lower vertical mount 22 is an actuator 24; there is also a linkage system, generally shown at 26, which is connected to both vertical mounts 20,22. The linkage system 26 includes a link mechanism 28 operable for movement controlled by the actuator 24. The link mechanism 28 is pivotally connected to a connection surface on at least one end of the louvers 14. In this embodiment, the connection surface is a first end 32 of the louver 14. A group of connecting portions 30 is connected to the louvers 14 on the first end 32. The connecting portions 30 and louvers 14 mounted in the lower apertures 18 are substantially the same as the connecting portions 30 and louvers 14 mounted in the upper apertures 16. The connecting portions 30 are each rotatably connected to the mounts 20,22 as shown in Figures 3 and 4. The louvers 14 are also rotatably connected to the apertures 12 on a second end 34.

In one embodiment, shown in Figures 5-7A and 8A-8B, the second end 34 of each of the louvers 14 includes a pin 36 which extends into a recess 38 formed as part of an outer wall 40 of the upper apertures 16 and a recess 42 formed as part of an outer wall 44 of the lower apertures 18. Referring again to the Figures generally, the upper vertical mount 20 also includes a set of upper mounting apertures 46 used for receiving a pin 48 formed as part of each of the connecting portions 30. Each of the connecting portions 30 also includes a flange or body portion 50 having a drive pin 52 which is pivotally connected to the link mechanism 28. The lower vertical mount 22 includes a

set of lower mounting apertures 54, which are also operable for receiving a respective pin 48 formed as part of each of the connecting portions 30.

Referring now to Figures 7B-7C, 8C, and 9-13, each of the connecting portions 30 has a first connecting plate 56 which is substantially parallel to a second connecting plate 58. The first connecting plate 56 has a first rounded portion 60, as well as a first square-shaped aperture 62 and a first locking apparatus 64. The second connecting plate 58 has a second rounded portion 66, a second square-shaped aperture 68, and a second locking apparatus 70. Each of the connecting plates 56,58 is connected to the body portion 50 such that a part of the body portion 50 forms a rear wall 72 adjacent each of the connecting plates 56,58.

Each locking apparatus 64,70 includes a contact surface 74 and a retention surface 76, and each locking apparatus 64,70 is operable for being selectively disposed in a corresponding square-shaped aperture 78 formed as part of the first end 32 of each of the louvers 14 when a connecting portion 30 is connected to the first end 32 of a louver 14. In this embodiment, there are two square-shaped apertures 78 formed as part of each louver 14, but it is within the scope of the invention that more or less apertures 78 may be used with more or less locking apparatuses 64,70.

The first end 32 of each louver 14 has a notch, generally shown at 80, with the notch 80 having a first depth 82, a second depth 83, and a desired height 84. Each notch 80 also includes a support surface 86 and side surfaces 88. To attach the connecting portion 30 to the first end 32 of a louver 14, each connecting portion 30 is positioned such that the louver 14 is disposed between the connecting plates 56,58 and a corner 90 of the support surface 86 contacts the contact surface 74 of a respective locking apparatus 64,70. A force is then applied to the connecting portion 30 to force the rear wall 72 toward the support surface 86. This in turn causes the contact surfaces 74 to move along the respective corners 90, and the connecting plates 56,58 to deflect, allowing the contact surfaces 74 to then move along

the outer surface of the louver 14 until each locking apparatus 64,70 is in alignment with a respective aperture 78. At which point each locking apparatus 64,70 then moves into one of the apertures 78, the connecting plates 56,58 are no longer deflected, and return to their original positions. Once a locking apparatus 64,70 is located in an aperture 78, the retention surface 76 is then in contact with an inner surface 92 of an aperture 78, preventing the connecting portion 30 from becoming detached from the louver 14.

When it is desired to detach the connecting portion 30 from the louver 14, an object (such as a screwdriver, for example) is inserted through the first square-shaped aperture 62, the corresponding square-shaped aperture 78 formed as part of the louver 14 in alignment with the first square-shaped aperture 62, and pressed against the contact surface 74 of the second locking apparatus 70 to cause the second connecting plate 58 to deflect. Additionally, an object is also inserted through the second square-shaped aperture 68, through a corresponding square-shaped aperture 78 formed as part of the louver 14 in alignment with the second square-shaped aperture 68, and pressed against the contact surface 74 of the first locking apparatus 64, thereby causing the first connecting plate 56 to deflect. Once each of the connecting plates 56,58 deflects sufficiently, the locking apparatuses 64,70 are removed from the apertures 78, and the connecting portion 30 is able to be pulled away from the louver 14.

When the connecting portion 30 is connected to a louver 14, there is a rounded portion 94 formed as part of the louver 14 which is received into a first semi-circular recess 96 formed as part of the first rounded portion 60 and a second semi-circular recess 98 formed as part of the second rounded portion 66. This in combination with the connecting plates 56,58 ensures that the connecting portion 30 and louver 14 rotate together when connected to one another.

Each louver 14 has a first lip 100 and a second lip 102; the first lip 100 is connected to and used for supporting a first flap 104, and the second lip 102 is used for supporting a second flap 106. The flaps 104,106 are used for providing control of the airflow through the apertures 12. When the louvers 14 are in the closed position, the second flap 106 of one louver 14 is in contact with a first flap 104 of an adjacent louver 14, best seen in Figures 8A-8C.

Referring again to Figures 5-8C and 14A-14B, extending through each louver 14 is a pair of wires 108 which function to control the coefficient of linear thermal expansion (CLTE) of the louvers 14. Each wire 108 has an outer surface with a defined texture to provide a more secure connection between the wires 108 and the louver 14. The textured surface may be a ribbed, knurled, ridged, or any other type of surface suitable for providing a proper "grip" between the wires 108 and louvers 14 as they are coextruded.

The actuator 24 is operable to control the movement of the connecting portions 30 through the use of the link mechanism 28 being connected to each drive pin 52. The actuator 24 is operable to be actuated mechanically, hydraulically, electrically, through vacuum actuation, lost motion actuation, or by any other suitable method. The actuator 24 is controlled to move the connecting portions 30, which rotate the louvers 14 such that the louvers 14 are opened to a desired position. The louvers 14 are operable to be positioned between the fully open position to maximize the amount of airflow through the apertures 12, or to the fully closed position as shown in Figures 3 and 4, substantially reducing or eliminating air flow around the radiator, engine, and other components under the hood of a vehicle.

The actuator 24 is also operable to move the louvers 14 to positions between the fully open and fully closed positions as may be desired or selected, or required for optimum temperature control. The link mechanism 28, the connecting portions 30, and the louvers 14 are all connected such that they move substantially in unison. When looking at Figures 3 and 4, the louvers 14 are in the closed position. When the actuator 24 is actuated, the

link mechanism 28 is moved upwardly, causing the drive pin 52 of each connecting portion 30 to rotate relative to the link mechanism 28, and each of the pins 48 disposed in the upper mounting apertures 46 and the lower mounting apertures 54 rotate as well. Similarly, each of the pins 36 located in the recesses 38,42 of the respective outer walls 40,44 rotate as well. Because the link mechanism 28 is a solid member, this in turn rotates all of the louvers 14 substantially in unison.

As the vehicle travels, and the louvers 14 are in at least a partially open position, air flow passes through the apertures 12 and removes heat from the various components located behind the carrier 10. In one particular embodiment, a radiator is disposed behind the carrier 10 such that when the louvers 14 are opened, air flow transfers heat away from the radiator, and the coolant flowing through the radiator is reduced in temperature.

If it is desired to reduce or substantially eliminate air flow around the various components of the engine (for the purpose of bringing the engine up to the desired temperature after a cold start), the actuator 24 is actuated to move the louvers 14 to the closed position, which then prevents air flow through the apertures 12.

In one embodiment, the louvers 14 shown in Figures 3-14B are formed using a coextrusion process. The louvers 14 are made of a type of thermoplastic material such as, but not limited to, polypropylene (PP). The wires 108 are made of a metal (such as aluminum or steel), and the flaps 104,106 are made of a Thermoplastic Vulcanizates (TPV), but it is within the scope of the invention that other types of Thermoplastic Elastomers (TPE) may be used. The louvers 14 may optionally include a slip coat 109 (shown in Figures 5-7B, 8A-8B, and 9-10). The slip coat 109 reduces the friction between the flaps 104,106, limits binding between the louvers 14 from ice formation on the surface of the flaps 104,106, and improves wear resistance to dirt and debris during cycling.

The louvers 14, wires 108, flaps 104,106, and slip coat 109 are coextruded together, and each louver 14 is then cut to the desired length to fit the carrier 10 shown in Figures 1-4. However, it is within the scope of the invention that the louvers 14 may be cut to any desired length to fit any carrier, or to fit into any size aperture different from the apertures 12. It is also within the scope of the invention that the louvers 14 may be used in other various locations which are part of a vehicle.

Part of the present invention includes the process for creating the louvers 14. One step in the process involves extruding a louver blank used to form the louvers 14, and another step in the process involves forming the ends 32,34 of the louvers 14. In one embodiment, the louver blank used to form the louvers 14 is extruded using a dual durometer. As the louvers 14 are extruded into a louver blank and cut, in one embodiment a stamping process may be used to form each end 32,34 of each louver 14 and cut the louvers 14 to the desired length simultaneously. This provides the advantage over cutting the louvers 14 to the desired length, and then stamping the ends 32,34 as a separate operation.

The notch 80 and the apertures 78 are formed in the first end 32 as the louver 14 is cut to the desired length, and the pin 36 is formed in the second end 34 as the louver 14 is cut to the desired length. Cutting the louver blank and stamping the ends 32,34 simultaneously reduces the steps in the manufacturing process, and also allows for greater flexibility in the applications in which the louvers 14 are used since they may be cut to any desired length. In an alternative embodiment, as the second end 34 is formed on one louver 14, the first end 32 may be formed on the subsequent louver 14 by using a single stamping die.

Additionally, because the louvers 14 are coextruded, the wires 108, flaps 104,106, and the slip coat 109 are formed as part of the louver 14 during the extrusion process, which eliminates the step of forming the flaps 104,106 and slip coat 109 as separate components and attaching the flaps 104,106

and slip coat 109 during separate manufacturing processes. Another advantage of coextruding the louvers 14 is that the louvers 14, wires 108, flaps 104,106, and slip coat 109 are all cut to the same length simultaneously, which eliminates attempting to cut the louver 14, flaps 104,106, and the slip coat 109 to the same length and then assemble them together (which would require a tolerance to account for the louver 14, flaps 104,106, and slip coat 126 not being cut to exactly the same length).

Shown in Figures 15A and 15B is another embodiment of louvers, shown generally at 110, which are operable with the carrier 10 to function as an integrated ducting system according to the present invention. The louvers 110 in this embodiment have a body portion 112 which is made of PP, but it is within the scope of the invention that other types of thermoplastics may be used. The body portion 112 includes a pair of hollow sections 114 and a central hollow section 116 to reduce the overall amount of material used. One of the hollow sections 114 is part of a first lip 118, and another of the hollow sections 114 is part of a second lip 120. Connected to the first lip 118 is a first or spring seal 122, and connected to the second lip 120 is a second or reaction seal 124. Each of the seals 122,124 are made of a TPV material in a similar manner as compared to the previous embodiment.

As with the previous embodiment, each of the seals 122,124 has a slip coat 126 which reduces the friction between the seals 122,124, limits binding between the louvers 110 from ice formation on the surface of the seals 122,124, and improves wear resistance to dirt and debris during cycling.

Also similar to the previous embodiment, there is a pair of wires 128 which function to control the coefficient of linear thermal expansion (CLTE) of the louvers 110. Each wire 128 also has an outer surface with a defined texture to provide a more secure connection between the wires 128 and the louver 110 similar to the previous embodiment.

The body portion 112 of each louver 110 is coextruded with the seals 122,124, the slip coat 126, and the wires 128. This allows all the components

to be cut to any desired length, and may be used with the carrier 10, or integrated with other automotive parts to provide desired cooling. The ends of the louvers 110 shown in Figures 15A and 15B may be shaped similar to the ends 32,34 of the louvers 14 of the previous embodiment, and be connected to connecting portions 30 for allowing the louvers 110 to pivot relative to the carrier 10 substantially in unison.

In can be seen in Figures 15A and 15B that the seals 122,124 are not identical. The first seal 122 includes a recessed portion 130 which surrounds the end of the first lip 118 and also has a flexible portion 132. The slip coat 126 on the first seal 122 extends onto the flexible portion 132, and selectively contacts the slip coat 126 coextruded to the second seal 124. Essentially, the slip coat 126 coextruded to the second seal 124 functions at least in part as a contact surface or reaction surface to the flexible portion 132. The second seal 124 also has a recessed portion 134 which is connected to the end of the second lip 120; the recessed portion 134 is formed with an elongated portion 136, and the slip coat 126 coextruded with the second seal 124 covers the recessed portion 134 and the elongated portion 136.

As the actuator 24 operates to move the link mechanism 28, thereby rotating the louvers 110 substantially in unison, the slip coat 126 of both the first seal 122 and the second seal 124 contact each other when the louvers 110 are in the closed position. More specifically, the flexible portion 132 flexes and is positioned as shown in Figure 15B when the louvers 110 are in the closed position and the first seal 122 is in contact with the second seal 124. The flexible portion 132 is shown in phantom depicts the position of the flexible portion 132 when the first seal 122 is not in contact with the second seal 124. The slip coat 126 along the elongated portion 136 of the second seal 124 contacts the slip coat 126 along the flexible portion 132 of the first seal 122 when the louvers 110 are in the closed position.

Referring now to Figures 16A and 16B, louvers according to another embodiment of the preset invention are shown generally at 138. Similar to the

previous embodiment, the louvers 138 each have a body portion 140 made of a thermoplastic material, such as PP. However, this embodiment also includes a support member or support spine 142 for providing increased strength. The support spine 142 is made of metal, such as but not limited to steel or aluminum, and in addition to providing strength, the support spine 142 also functions to control the CLTE of the louvers 138 (essentially performing the same function as the wires 108,128 of the previous embodiments).

The louvers 138 of this embodiment also have a first seal 144 and a second seal 146. The seals 144,146 are bulb-style seals, and are made of a TPV material, and each have a slip coat 148 for reducing friction and limiting binding between the louvers 138 when ice forms on the louvers 138, also improving the resistance to wear and debris during cycling.

The first seal 144 includes a first rounded segment 150, a first flat segment 152, a second rounded segment 154, and a second flat segment 156. The second flat segment 156 functions as a contact surface for a first rounded segment 158 of the second seal 146 mounted on an adjacent louver 138. The second seal 146 also includes a first flat segment 160, a second rounded segment 162, and a second flat segment 164. The various segments 150,152,154,156 of the first seal 144 and the various segments 158,160,162,164 of the second seal 146 are flexible, and deflect when the louvers 138 are in the closed position, and the first rounded segment 158 of the second seal 146 is pressed against the second flat segment 156 of the first seal 144. Each of the seals 144,146 include open sections 166 which help to reduce the amount of material used to produce the seals 144,146 and also increase the flexibility of the seals 144,146.

The louvers 138 of this embodiment are also suitable for mounting in the apertures 12, and may be cut to have ends similar to the first end 32 and second end 34 of the louvers 14 of the first embodiment. The louvers 138 of this embodiment may be cut to any length to be suited for use with any size aperture or location on a vehicle. Furthermore, because the body portion 140,

the support spine 142, the seals 144,146, and the slip coat 148 are all coextruded together, the construction of the louvers 138 is simplified and more efficient.

Another embodiment of a louver for use with the carrier 10 to create integrated active ducting is shown in Figure 17 generally at 168. The louver 168 of this embodiment also has a body portion 170 and a support spine 172. The body portion 170 and support spine 172 function in a similar manner to the previous embodiments, and are made of substantially the same materials, but the are shaped differently. The louvers 168 of this embodiment also include seals, but the seals of this embodiment are whisker-style seals. There is a first whisker-style seal 174 and a second whisker-style seal 176. Each of the seals 174,176 includes an arcuate portion 178 which is bonded to the body portion 170, and a flexible portion 180 integrally formed with the arcuate portion 178. There is a slip coat 182 connected to each of the flexible portions 180 of the seals 174,176 which functions in a similar manner to the slip coats 126,148 described in the previous embodiments to reduce friction between the louvers 168, limit the effect of ice formation on the surfaces of the seals 174,176, as well as improve wear resistance to dirt and debris.

When the louvers 168 of this embodiment are in operation, each louver 168 is rotated between an open position and a closed position. When in the closed position, the flexible portions 180 of the respective seals 174,176 contact one another and deflect to prevent air flow between the louvers 168. As with the previously described embodiments, the body portion 170, support spine 172, seals 174,176, and slip coat 182 are all coextruded simultaneously to reduce manufacturing time, and increase efficiency.

It should be appreciated that all of the embodiments of the present invention provide the advantages of increased efficiency during manufacturing because of the use of coextrusion, and that the louvers 14,110,138,168 may be cut to any length to suit any size aperture for any vehicle. While the louvers 14,110,138,168 have been described for use with the carrier 10, the

louvers 14,110,138,168 may be used with other vehicle components as well. An example of this is shown in Figure 18, where the louvers 14 of the first embodiment have been incorporated for use with a fascia 184. The fascia 184 is connected to a vehicle support structure, such as a body-in-white (BIW) component or chassis. Referring to Figure 19, the carrier 10 is shown as being connectable to the BIW structure 186. However, it is within the scope of the invention that any of the louvers 14,110,138,168 may be connected to any structure as may be necessary so as to control air flow around various vehicle components, such as components in the engine compartment of a vehicle, and therefore control cooling. The louvers 14,110,138,168 may be incorporated into components such as, but not limited to, fenders, the hood, fascia, bumpers, ground effects, and the like.

The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A component for a vehicle having integrated active ducting, comprising:

at least one aperture;

at least one louver rotatably mounted in said at least one aperture; and

an actuator connected to said at least one louver, operable for moving said at least one louver between an open position and a closed position such that when said at least one louver is in said open position, air flow passes through said at least one aperture, and when said at least one louver is in said closed position, air flow is substantially prevented from moving through said at least one aperture.

2. The component for a vehicle having integrated active ducting of claim 1, further comprising:

a link mechanism, said at least one louver pivotally connected to said link mechanism; and

an actuator connected to said link mechanism operable for moving said link mechanism such that said link mechanism repositions said at least one louver.

3. The component for a vehicle having integrated active ducting of claim 1, further comprising at least one connecting portion operable for rotatably connecting a first end of said at least one louver to said component.

4. The component for a vehicle having integrated active ducting of claim 3, said at least one connecting portion further comprising:

a body portion;

a pin formed as part of said body portion, said pin operable for extending into at least one mounting aperture formed as part of a mounting portion of said at least one aperture;

a drive pin, said link mechanism pivotally connected to said body portion by said drive pin;

at least one connecting plate formed as part of said body portion; and

at least one locking apparatus formed as part of said first connecting plate operable for providing a connection between said at least one connecting plate and at least one louver such that as said link mechanism is moved by said actuator, said link mechanism applies a force to said drive pin, causing said body portion, said at least one connecting plate, and at least one louver to pivot.

5. The component for a vehicle having integrated active ducting of claim 6, said at least one louver further comprising:

at least one square-shaped aperture located in proximity to said at first end, said at least one square-shaped aperture operable for receiving a portion of said at least one locking apparatus, connecting said at least one connecting portion to said first end of said at least one louver;

a notch formed on said first end in proximity to said at least one square-shaped aperture, said at least one connecting portion disposed in said notch when said at least one connecting portion is connected to said first end of said at least one louver; and

a pin formed on a second end of said at least one louver operable for being received into a recess formed in an outer wall of said at least one aperture such that said at least one louver is rotatably mounted in said at least one aperture.

6. The component for a vehicle having integrated active ducting of claim 5, said at least one aperture further comprising a plurality of upper apertures and a plurality of lower apertures.

7. The component for a vehicle having integrated active ducting of claim 6, said mounting portion further comprising an upper vertical mount formed as part of said component and dividing at least two of said plurality of upper apertures.

8. The component for a vehicle having integrated active ducting of claim 7, said mounting portion further comprising a lower vertical mount formed as part of said component and dividing at least two of said plurality of lower apertures.

9. The component for a vehicle having integrated active ducting of claim 1, said at least one louver further comprising:

a body portion;

a first seal connected to said body portion; and

a second seal connected to said body portion, said first seal and said second seal operable for providing a sealing function when said at least one louver is in said closed position.

10. The component for a vehicle having integrated active ducting of claim 9, said at least one louver further comprising a slip coat, a portion of said slip coat connected to said first seal, and a portion of said slip coat connected to said second seal, operable for reducing friction between objects that come in contact with either of said first seal or said second seal.

11. The component for a vehicle having integrated active ducting of claim 10, said at least one louver further comprising:

a first lip formed as part of said body portion, said first seal connected to said first lip; and

a second lip formed as part of said body portion, said second seal connected to said second lip.

12. The component for a vehicle having integrated active ducting of claim 11, said first seal further comprising a first flap and said second seal further comprising a second flap, said first flap and said second flap operable for providing a sealing function when said at least one louver is in said closed position, a portion of said slip coat connected to said first flap, and a portion of said slip coat connected to said second flap.

13. The component for a vehicle having integrated active ducting of claim 11, said at least one louver further comprising:

at least two hollow sections formed as part of said body portion;

a central hollow section formed as part of said body portion in between said at least two hollow sections;

said first seal further comprising a spring seal connected to said body portion in proximity to one of said at least two hollow sections; and

said second seal further comprising a reaction seal connected to said body portion in proximity to one of said at least two hollow sections.

14. The component for a vehicle having integrated active ducting of claim 11, further comprising:

said at least one louver further comprising a plurality of louvers operable for being rotatably mounted in said at least one aperture;

said spring seal further comprising a plurality of spring seals, each of said plurality of louvers having one of said plurality of spring seals;

said reaction seal further comprising a plurality of reaction seals, each of said plurality of louvers having one of said plurality of reaction seals;

each of said plurality of spring seals further comprising a recessed portion, said first lip of one of said plurality of louvers disposed in said recessed portion of one of said plurality of spring seals;

each of said plurality of reaction seals further comprising a recessed portion, said second lip of one of said plurality of louvers disposed in said recessed portion of one of said plurality of reaction seals;

each of said plurality of spring seals further comprising a flexible portion, a portion of said slip coat connected to said flexible portion; and

each of said plurality of reaction seals further comprising an elongated portion, a portion of said slip coat connected to said flexible portion;

wherein said flexible portion of one of said plurality of louvers is operable for selectively contacting said elongated portion of another of said plurality of louvers when said plurality of louvers are moved to said closed position.

15. The component for a vehicle having integrated active ducting of claim 9, said at least one louver further comprising a support spine integrally formed with said body portion, said support spine operable for increasing the rigidity of said body portion.

16. The component for a vehicle having integrated active ducting of claim 15, said at least one louver further comprising:

said first seal further comprising a first bulb-style seal connected to said body portion; and

said second seal further comprising a second bulb-style seal connected to said body portion, said first bulb-style seal and said second bulb-style seal operable for providing a sealing function when said at least one louver is in said closed position.

17. The component for a vehicle having integrated active ducting of claim 16, further comprising:

said at least one louver further comprising a plurality of louvers operable for being rotatably mounted in said at least one aperture;

said first bulb-style seal further comprising a plurality of first bulb-style seals, each of said plurality of louvers having one of said plurality of first bulb-style seals; and

said second bulb-style seal further comprising a plurality of second bulb-style seals, each of said plurality of louvers having one of said plurality of second bulb-style seals;

wherein one of said plurality of first bulb-style seals of one of said plurality of louvers is operable for selectively contacting one of said plurality of second bulb-style seals of another of said plurality of louvers when said plurality of louvers are moved to said closed position.

18. The component for a vehicle having integrated active ducting of claim 15, said at least one louver further comprising:

said first seal further comprising a first whisker-style seal connected to said body portion; and

said second seal further comprising a second whisker-style seal connected to said body portion, said first whisker-style seal and said second whisker-style seal operable for providing a sealing function when said at least one louver is in said closed position.

19. The component for a vehicle having integrated active ducting of claim 18, further comprising:

said at least one louver further comprising a plurality of louvers operable for being rotatably mounted in said at least one aperture;

said first whisker-style seal further comprising a plurality of first whisker-style seals, each of said plurality of louvers having one of said plurality of first whisker-style seals; and

said second whisker-style seal further comprising a plurality of second whisker-style seals, each of said plurality of louvers having one of said plurality of second whisker-style seals;

wherein one of said plurality of first whisker-style seals of one of said plurality of louvers is operable for selectively contacting one of said plurality of second whisker-style seals of another of said plurality of louvers when said plurality of louvers are moved to said closed position.

20. The component for a vehicle having integrated active ducting of claim 1, further comprising at least one wire extending through said louver operable for controlling the coefficient of linear thermal expansion of said at least one louver.

21. The component for a vehicle having integrated active ducting of claim 20, said at least one wire having an outer surface with a defined texture operable for securing the connection between each of said plurality of wires and said plurality of louvers.

22. The component for a vehicle having integrated active ducting of claim 21, said defined texture of said at least one wire being one selected from the group consisting of a ribbed surface, a knurled surface, and a ridged surface.

23. The component for a vehicle having integrated active ducting of claim 1, further comprising of claim 1, wherein said component is one selected from the group consisting of a carrier, a fan shroud, radiator housing, washer fluid container, and the like.

24. The component for a vehicle having integrated active ducting of claim 1, said component operable for connection with a vehicle support structure.

25. The component for a vehicle having integrated active ducting of claim 24, said vehicle support structure further comprising one selected from the group consisting of a body-in-white and a chassis.

26. A carrier having integrated ducting, comprising:

a plurality of upper apertures formed as part of said carrier;

a plurality of lower apertures formed as part of said carrier;

a plurality of louvers, a portion of said plurality of louvers mounted in each of said plurality of upper apertures, and a portion of said plurality of louvers mounted in each of said plurality of lower apertures, said plurality of louvers operable for movement between an open position and a closed position;

a plurality of wires, two of said plurality of wires extending through each of said plurality of louvers, said plurality of wires operable for controlling the coefficient of linear thermal expansion of each of said plurality of louvers, each of said plurality of wires having outer surface with a defined texture operable for securing the connection between each of said plurality of wires and said plurality of louvers;

an upper vertical mount dividing said plurality of upper apertures;

a lower vertical mount dividing said plurality of lower apertures;

a plurality of connecting portions, one of said plurality of connecting portions operable for connection with a first end of one of said plurality of louvers, one or more of said plurality of connecting portions operable for connection with said upper vertical mount, and one or more of said plurality of connecting portions operable for connection with said lower vertical mount;

a link mechanism connected to each of said plurality of louvers;

an actuator connected to said link mechanism operable for moving said link mechanism such that said plurality of louvers are moved between said open position and said closed position; and

a slip coat connected to each of said plurality of louvers, said slip coat operable for reducing friction between one of said plurality of louvers and another of said plurality of louvers, preventing binding between each of said plurality of louvers.

27. The carrier having integrated ducting of claim 26, each of said plurality of connecting portions further comprising:

a body portion;

a pin formed as part of said body portion, operable for extending into one of a plurality of upper mounting apertures formed as part of said upper vertical mount for connection with said upper vertical mount, or for extending into one of a plurality of lower mounting apertures formed as part of said lower vertical mount for connection with said lower vertical mount;

a drive pin, said link mechanism pivotally connected to said body portion by said drive pin;

a first connecting plate formed as part of said body portion;

a first locking apparatus formed as part of said first connecting plate operable for providing a connection between said first connecting plate and one of said plurality of louvers;

a second connecting plate formed as part of said body portion; and

a second locking apparatus formed as part of said second connecting plate, operable for providing a connection between said second connecting plate and one of said plurality of louvers such that as said link mechanism is moved by said actuator, said link mechanism applies a force to said drive pin, causing said body portion, said first connecting plate, said second connecting plate, and at least one of said plurality of louvers to pivot.

28. The carrier having integrated ducting of claim 27, each of said plurality of louvers further comprising:

a plurality of square-shaped apertures formed in proximity to said first end, one of said plurality of square-shaped apertures operable for receiving said first locking apparatus formed as part of said first connecting plate and another of said plurality of square-shaped apertures operable for receiving said second locking apparatus formed as part of said second connecting plate to connect one of said plurality of connecting portions to said first end of one of said plurality of louvers;

a notch formed on said first end in proximity to said plurality of square-shaped apertures, said notch having a first side surface of a first depth and a second side surface of a second depth, one of said plurality of connecting portions disposed between said first side surface and said second side surface when said one of said plurality of connecting portions is connected to one of said plurality of louvers;

a support surface formed as part of said notch adjacent said first side surface and said second side surface, said support surface being in contact with said body portion of one of said plurality of connecting portions when one of said plurality of connecting portions is connected to said first end of one of said plurality of louvers; and

a pin formed on a second end of each of said plurality of louvers, said pin operable for rotatable connection in one of said plurality of upper apertures or one of said plurality of lower apertures.

29. The carrier having integrated ducting of claim 26, each of said plurality of louvers further comprising:

a first lip;

a second lip formed on an opposite side of each of said plurality of louvers in relation to said first lip;

a first flap connected to said first lip; and

a second flap connected to said second lip, said second flap of one of said plurality of louvers selectively in contact with said first flap of another of said plurality of louvers when said plurality of louvers are in a closed position;

wherein said slip coat is disposed on said first flap and said second flap, said slip coat operable for reducing friction between said first flap of one of said plurality of louvers and said second flap of another of said plurality of louvers as said plurality of louvers are changed between said open position and said closed position.

30. The carrier having integrated ducting of claim 26, each of said plurality of louvers further comprising:

a body portion;

at least two hollow sections formed as part of said body portion;

a central hollow section formed as part of said body portion between said at least two hollow sections;

a first lip formed as part of said body portion in proximity to one of said at least two hollow sections;

a spring seal connected to said first lip, said spring seal having a recessed portion and a flexible portion, said first lip operable for being received into said recessed portion of said spring seal;

a second lip formed as part of said body portion in proximity to one of said at least two hollow sections; and

a reaction seal connected to said second lip, said reaction seal having a recessed portion and an elongated portion, said second lip operable for being received into said recessed portion of said reaction seal;

wherein said flexible portion of one of said plurality of louvers is operable for selectively contacting said elongated portion of another of said plurality of louvers when said plurality of louvers are moved to said closed position.

31. The carrier having integrated ducting of claim 26, each of said plurality of louvers further comprising:

a body portion;

a support spine integrally formed with said body portion operable for providing additional rigidity to said body portion;

a first bulb-style seal connected to said body portion; and

a second bulb-style seal connected to said body portion, and said first bulb-style seal of one of said plurality of louvers is operable for selectively contacting said second bulb-style seal of another of said plurality of louvers when said plurality of louvers are moved to said closed position;

wherein said slip coat is connected to each of said first bulb-style seal and said second bulb-style seal for reducing friction between said first bulb-style seal of one of said plurality of louvers and said second bulb-style seal of another of said plurality of louvers when said plurality of louvers are moved to said closed position.

32. The carrier having integrated ducting of claim 26, each of said plurality of louvers further comprising:

a body portion;

a support spine integrally formed with said body portion operable for providing additional rigidity to said body portion;

a first whisker-style seal having an arcuate portion and a flexible portion, part of said body portion operable for being received into said arcuate portion of said first whisker-style seal; and

a second whisker-style seal having an arcuate portion and a flexible portion, part of said body portion operable for being received into said arcuate portion of said second whisker-style seal;

wherein said slip coat is disposed on said first whisker-style seal and said second whisker-style seal, said slip coat operable for reducing friction

between said first flexible portion of said first whisker-style seal of one of said plurality of louvers and said flexible portion of said second whisker-style seal of another of said plurality of louvers as said plurality of louvers are changed between said open position and said closed position.

33. The carrier having integrated ducting of claim 26, said carrier operable for connection with one selected from the group consisting of a body-in-white, a chassis, and a frame.

34. The carrier having integrated ducting of claim 26, said defined texture of said plurality of wires being one selected from the group consisting of a ribbed surface, a knurled surface, and a ridged surface.

35. A method for making a louver used for an integrated active ducting system, comprising the steps of:

providing a body portion;

providing first seal operable for being connected to said body portion;

providing a second seal operable for being connected to said body portion;

providing a slip coat, a portion of said slip coat connected to said first seal, and a portion of said slip coat connected to said second seal; and

coextruding said body portion, said first seal, said second seal, and said slip coat simultaneously such that said body portion, said first seal, said second seal, and said slip coat are connected together to form a single louver.

36. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of:

simultaneously forming a first end on said louver and cutting said body portion, said first seal, said second seal, and said slip coat; and

simultaneously forming a second end on said louver and cutting said body portion, said first seal, said second seal, and said slip coat such that as said first end and said second end are formed on said louver, said body portion, said first seat, said second seal, and said slip coat are cut to a desired length.

37. The method for making a louver used for an integrated active ducting system of claim 36, further comprising the steps of:

providing a plurality of louvers; and

simultaneously cutting said second end of one of said plurality of louvers and cutting said first end of another of said plurality of louvers as said plurality of louvers are cut to said desired length.

38. The method for making a louver used for an integrated active ducting system of claim 36, further comprising the steps of:

providing at least one square-shaped aperture formed as part of said first end of said louver;

providing a connecting portion operable for connection with said at least one square-shaped aperture;

providing a notch formed as part of said first end in proximity to said at least one square-shaped aperture;

connecting said at least one connecting portion to said first end such that said at least one connecting portion is disposed in said notch; and

providing a pin formed as part of said second end of said louver operable for being received into a recess formed in an outer wall of said at least one aperture such that said at least one louver is rotatably mounted in said at least one aperture.

39. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of reducing friction

between objects that come in contact with either of said first seal or said second seal with said slip coat.

40. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of

providing a first lip formed as part of said body portion, said first seal connected to said first lip; and

providing a second lip formed as part of said body portion, said second seal connected to said second lip.

41. The method for making a louver used for an integrated active ducting system of claim 40, further comprising the steps of:

providing said first seal further to be further comprised of a first flap;

providing said second seal further comprising a second flap;

connecting a portion of said slip coat to said first flap;

connecting a portion of said slip coat to said second flap; and

providing a sealing function with said first flap and said second flap when said at least one louver is in said closed position.

42. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of:

providing at least two hollow sections formed as part of said body portion;

providing a central hollow section formed as part of said body portion in between said at least two hollow sections;

providing said first seal to be further comprised of a spring seal connected to said body portion in proximity to one of said at least two hollow sections; and

providing said second seal to be further comprised of a reaction seal connected to said body portion in proximity to one of said at least two hollow sections.

43. The method for making a louver used for an integrated active ducting system of claim 42, further comprising the steps of:

providing a recessed portion formed as part of said spring seal;

disposing said first lip of one of said plurality of louvers in said recessed portion of said spring seal;

providing a recessed portion formed as part of said reaction seal;

disposing said second lip of one of said plurality of louvers in said recessed portion of said reaction seal;

providing a flexible portion formed as part of said spring seal;

extruding said spring seal such that a portion of said slip coat connected to said flexible portion; and

providing an elongated portion formed as part of said reaction seal; and

extruding said reaction seal such that a portion of said slip coat is connected to said reaction portion.

44. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of;

providing a support spine integrally formed with said body portion; and

increasing the rigidity of said body portion through the use of said support spine.

45. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of:

providing said first seal to be further comprised of a first bulb-style seal connected to said body portion;

providing said second seal to be further comprised of a second bulb-style seal connected to said body portion,

extruding said first bulb-style seal such that a portion of said slip coat connected to said first bulb-style seal; and

extruding said second bulb-style seal such that a portion of said slip coat is connected to said second bulb-style seal.

46. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of:

providing said first seal to be further comprised of a first whisker-style seal connected to said body portion;

providing said second seal to be further comprised of a second whisker-style seal connected to said body portion;

coextruding said first whisker-style seal such that a portion of said slip coat is connected to said first whisker-style seal; and

coextruding said second whisker-style seal such that a portion of said slip coat is connected to said second whisker-style seal.

47. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of:

providing at least one wire operable for extending through said body portion; and

coextruding said at least one wire with said body portion, said first seal, said second seal, and said slip coat.

48. The method for making a louver used for an integrated active ducting system of claim 47, further comprising the steps of:

extending said at least one wire through said louver; and

controlling the coefficient of linear thermal expansion of said at least one louver with said at least one wire.

49. The method for making a louver used for an integrated active ducting system of claim 48, further comprising the steps of providing a defined texture on an outer surface of said at least one wire operable for securing the connection between each of said plurality of wires and said plurality of louvers.

50. The method for making a louver used for an integrated active ducting system of claim 49, further comprising the steps of providing said defined texture of said at least one wire to be one selected from the group consisting of a ribbed surface, a knurled surface, and a ridged surface.

51. The method for making a louver used for an integrated active ducting system of claim 35, further comprising the steps of connecting said louver to one selected from the group consisting of a carrier, a fan shroud, radiator housing, washer fluid container, and the like.

52. A process for manufacture of a louver system including a link mechanism having attachment connections, comprising:

extruding an extended length of a louver blank;

cutting said louver blank into a plurality of pre-determined lengths for assembly into said louver system;

forming a connection surface on at least one end portion of said predetermined lengths of said louver blank; and

assembling said predetermined lengths of said louver blank to said link mechanism using said connection surface.

53. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, wherein said louver blank is coextruded using dual durometers.

54. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, said louver blank further comprising a body portion, wherein said body portion is coextruded over a core structure.

55. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 54, wherein said core structure further comprises a support spine.

56. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 54, wherein said core structure further comprises at least one wire.

57. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, wherein a slip coat is formed on said louver blank.

58. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 57, further comprising at least one seal coextruded onto said louver blank, a portion of said slip coat coextruded onto said at least one seal.

59. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 58, said at least one seal being one selected from the group consisting of a flap, a spring seal, a bulb-style seal, and a whisker-style seal.

60. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, wherein said connection surface is die cut during cutting of said louver blank.

61. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, said connection surface further comprising a first end formed during the cutting of said louver blank.

62. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 61, further comprising:

a notch formed as part of said first end during the cutting of said louver blank;

at least one square-shaped aperture formed as part of said first end during the cutting of said louver blank, said at least one square-shaped aperture located in proximity to said notch; and

a connecting portion operable for connection with said notch and said at least one square-shaped aperture, said connecting portion operable for being pivotally connected to said link mechanism.

63. The process for manufacture of a louver system including a linkage mechanism having attachment connections of claim 52, further comprising a pin formed on a second end of said louver blank operable for allowing said louver blank to be rotated by said link mechanism.

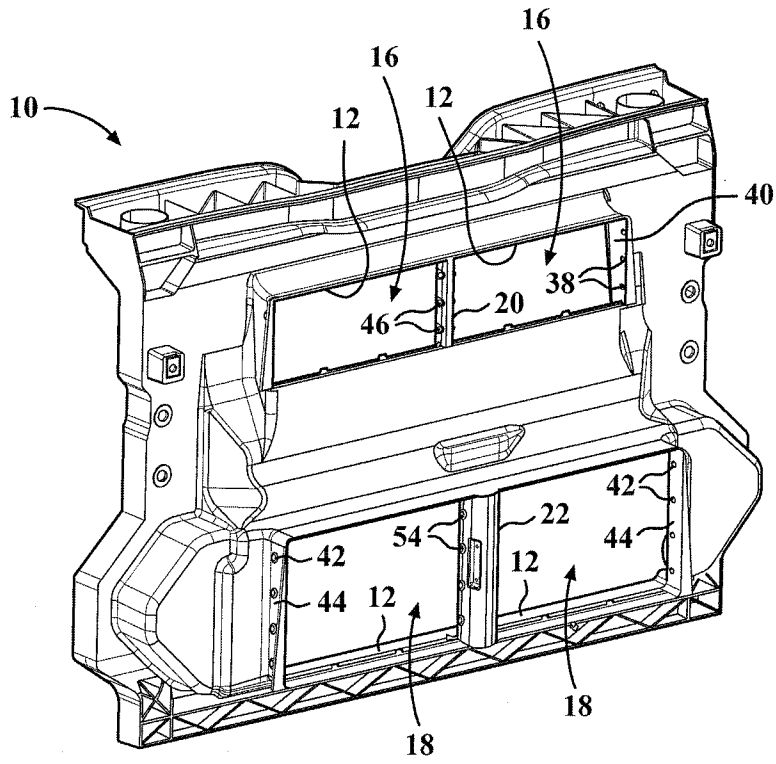
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FIG. 1

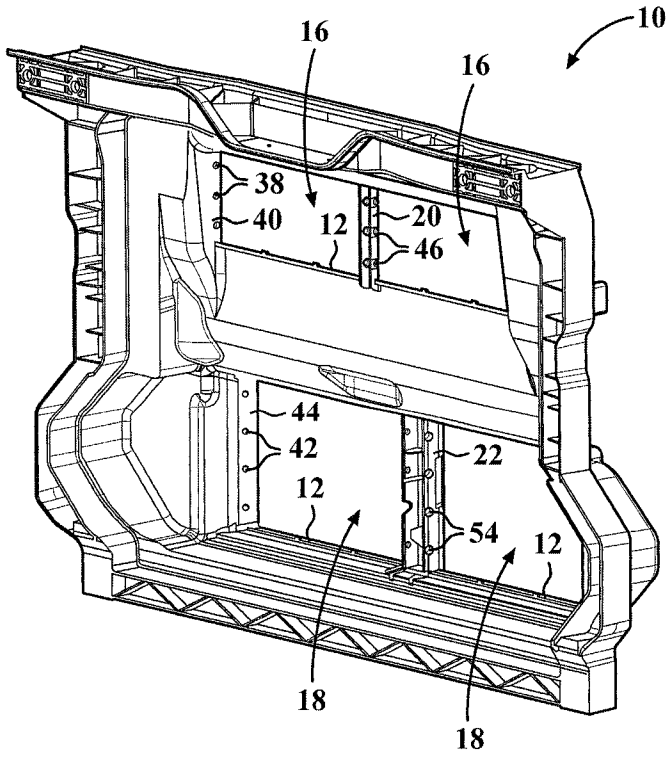
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FIG. 2

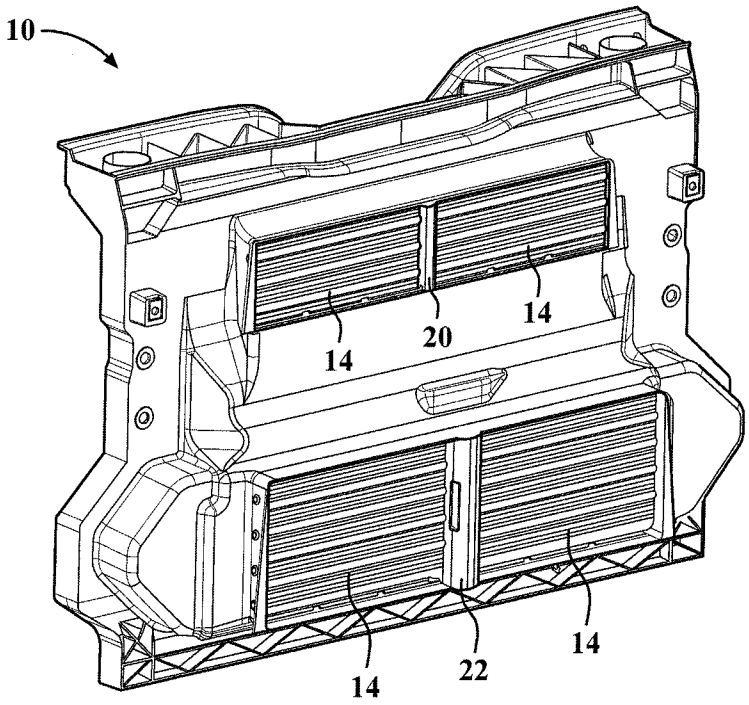


FIG. 3

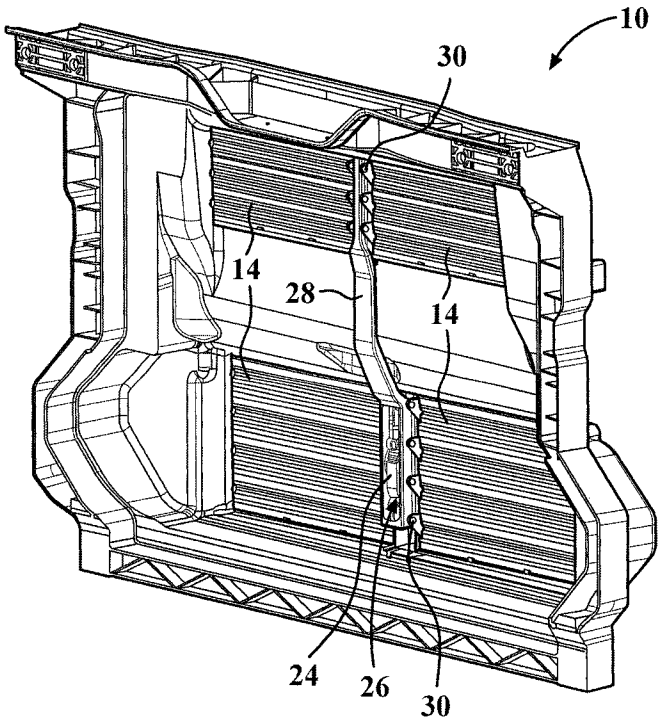
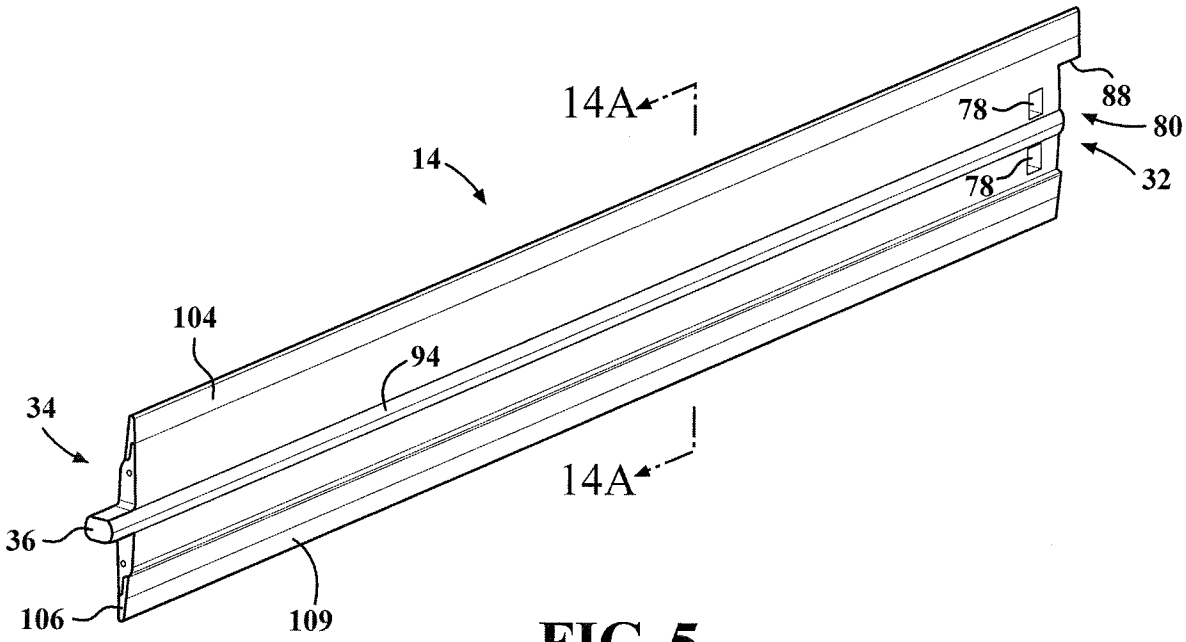


FIG. 4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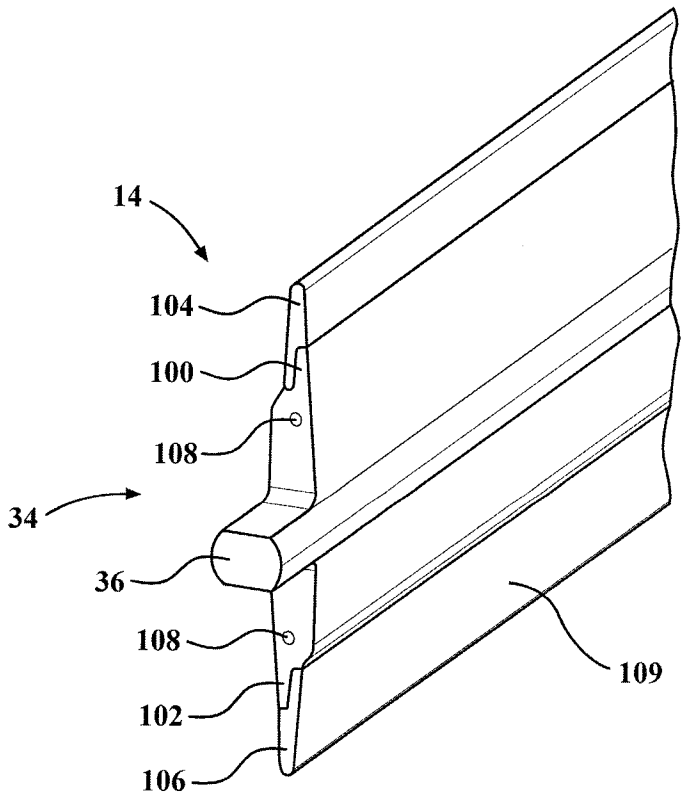
109

FIG. 5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34
36
108
102
106
109

FIG. 6

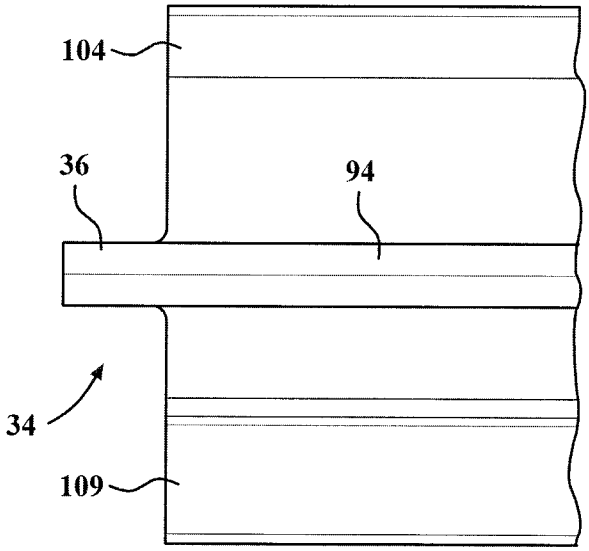


FIG. 7A

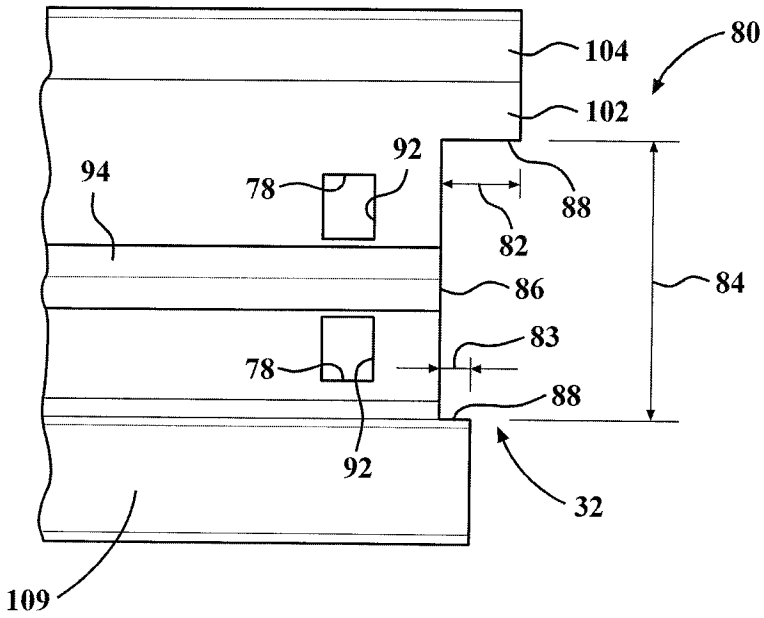


FIG. 7B

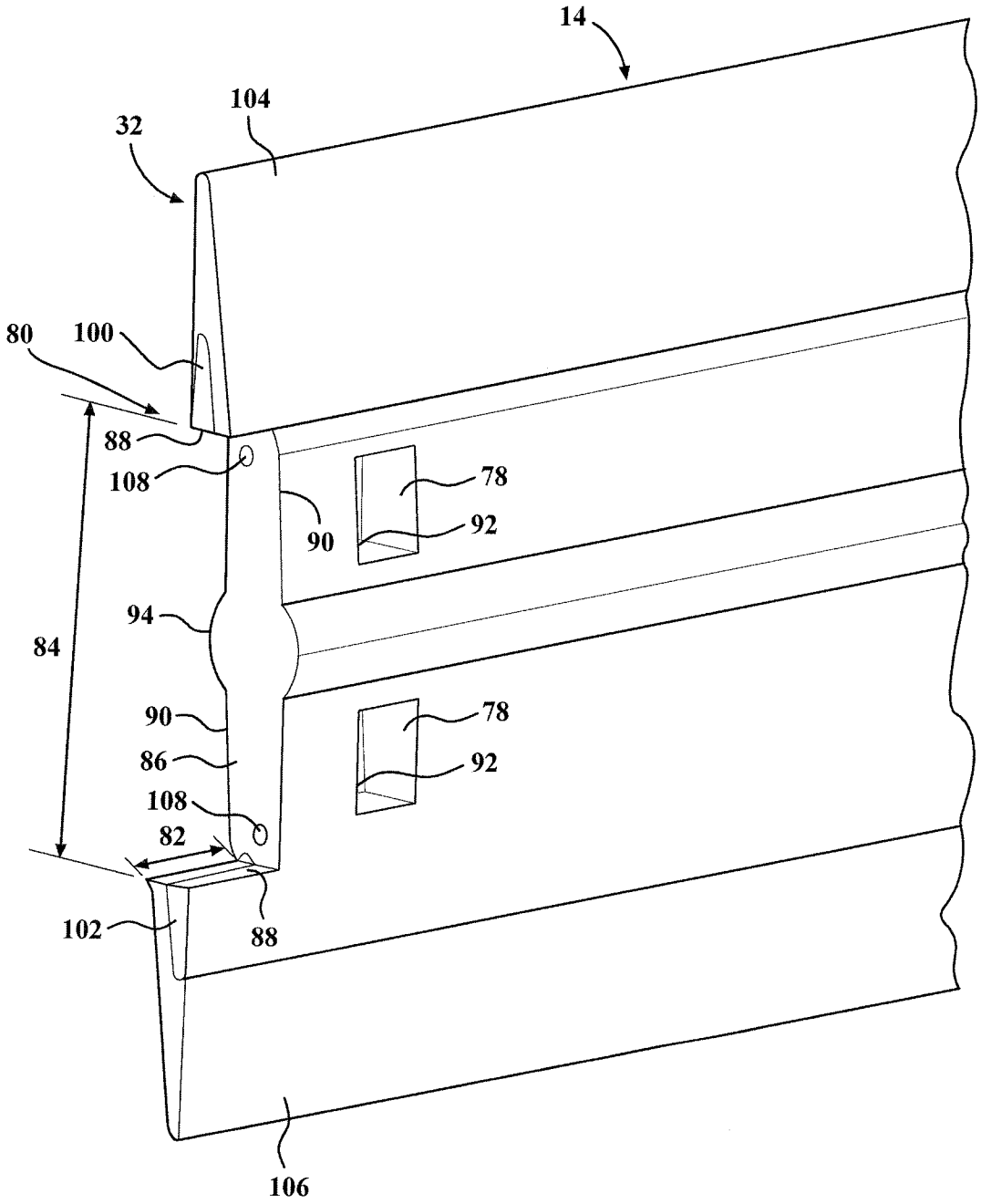
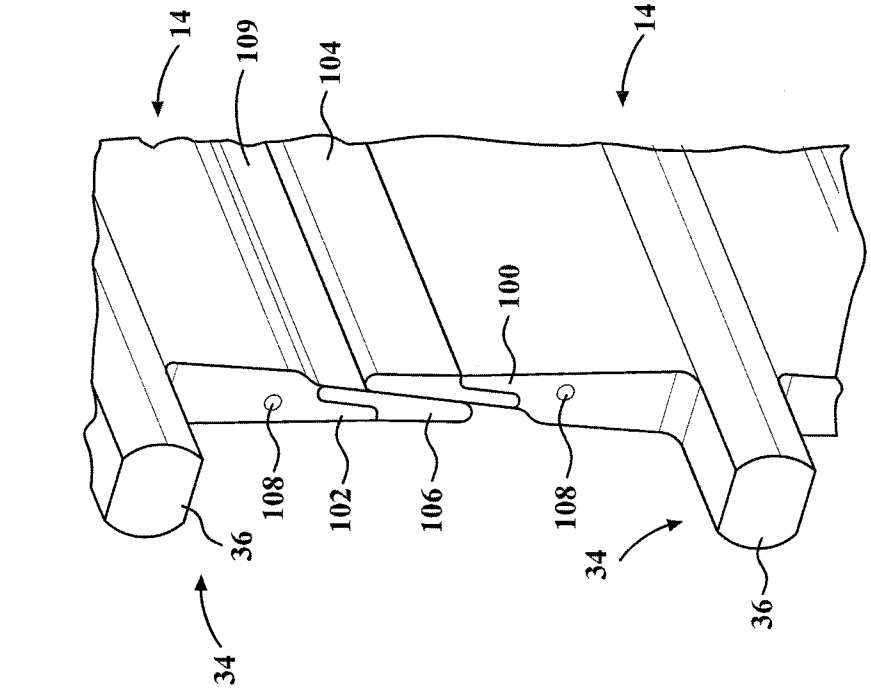


FIG. 7C


14
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104
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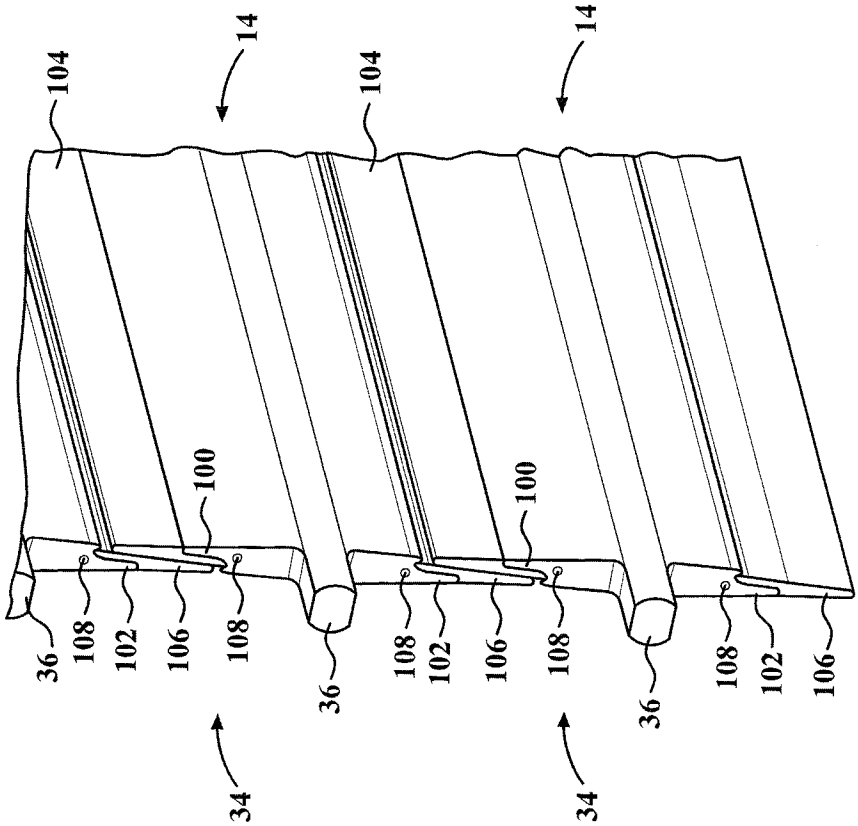
100
108
102
106
108
36
34
34
36

FIG. 8B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14
100
100
108
102
106
108
36
34
34
36

FIG. 8A

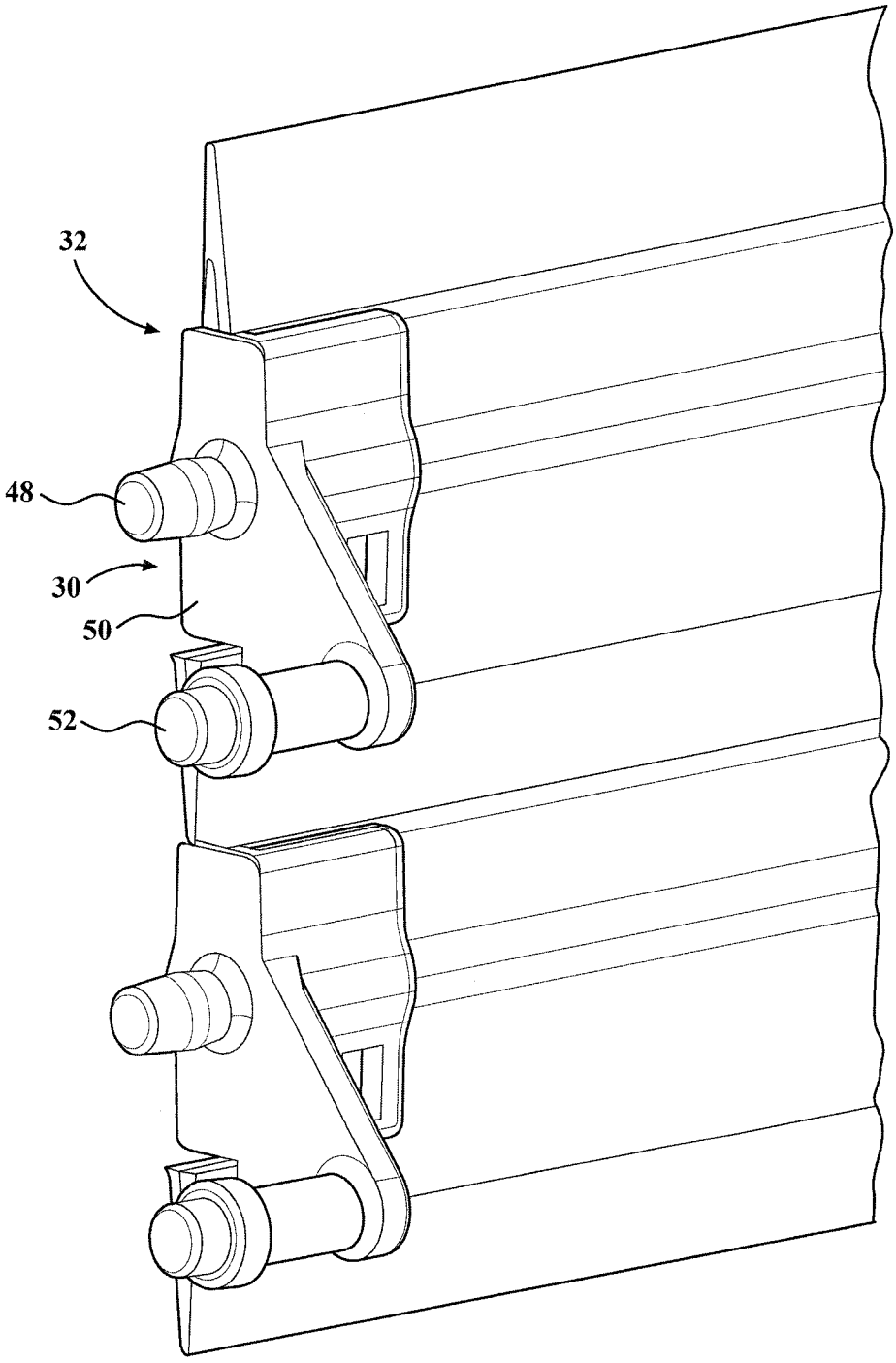

FIG. 8C

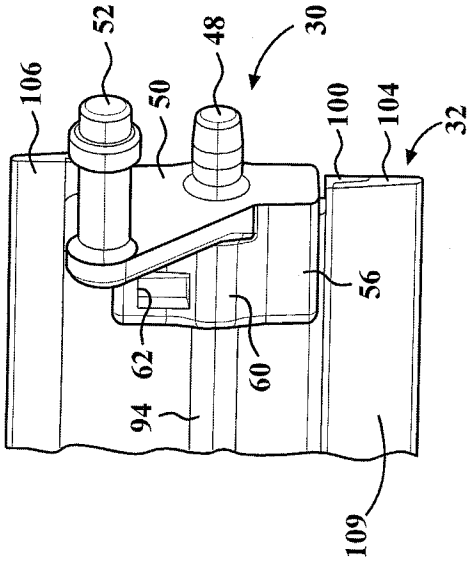

FIG. 10

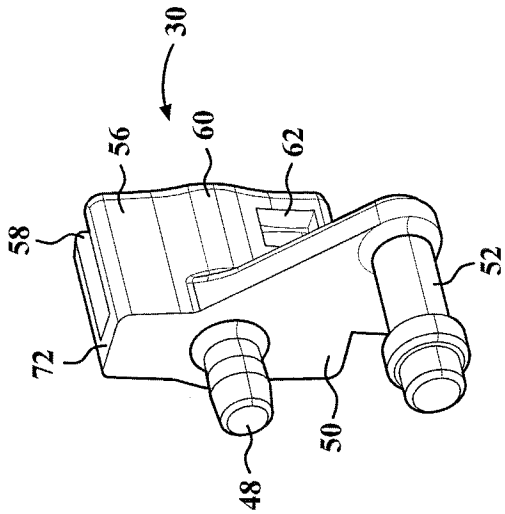

FIG. 12

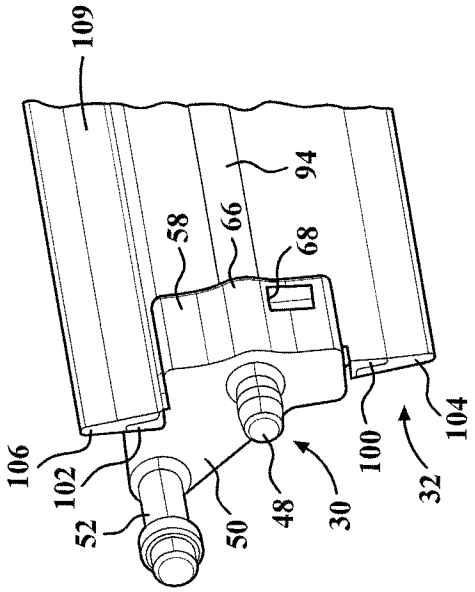

FIG. 9

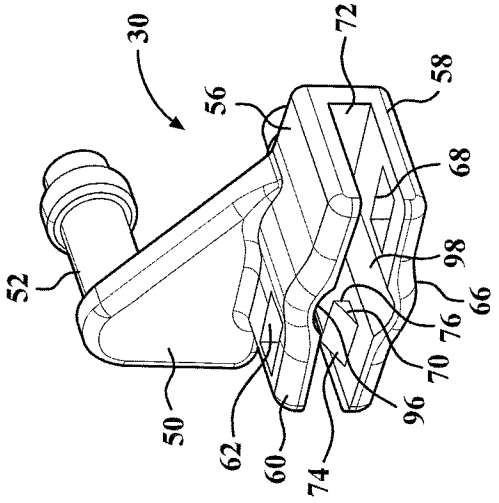

FIG. 11

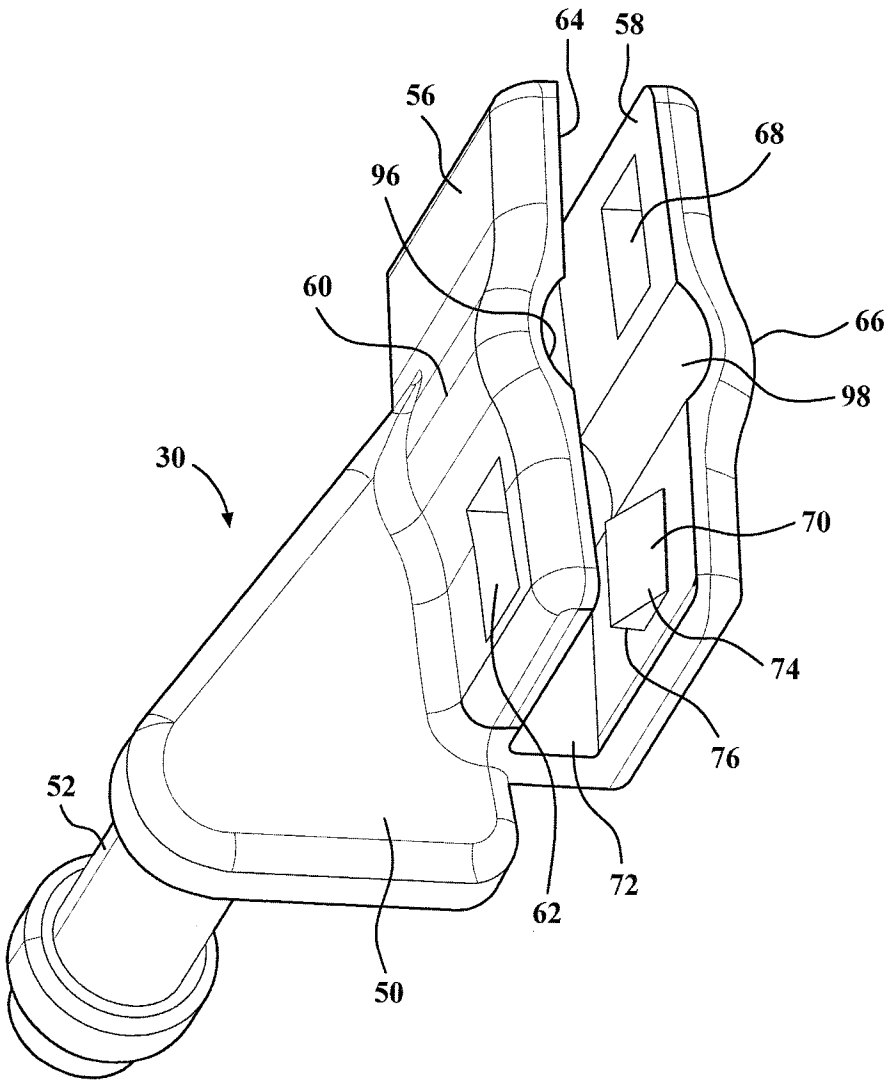

FIG. 13

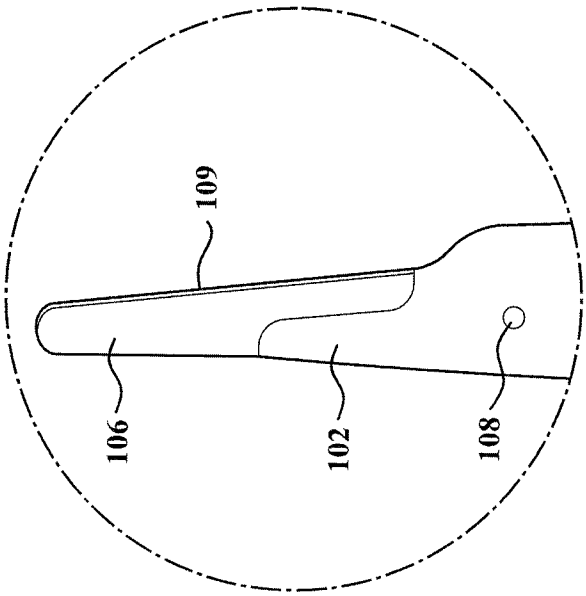

FIG. 14B

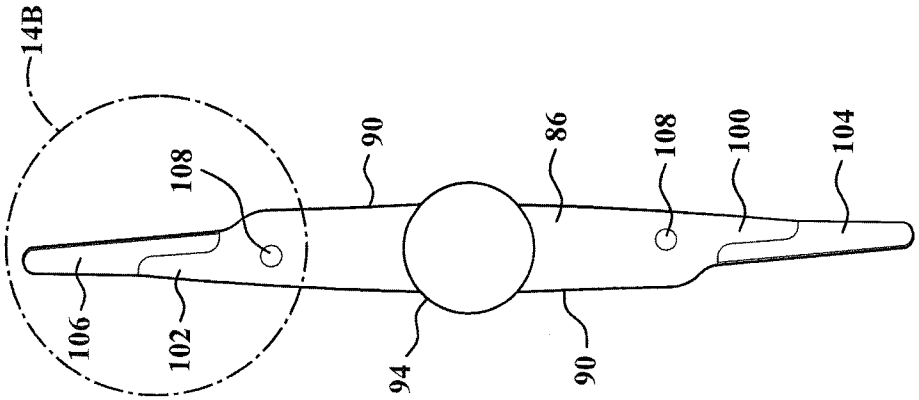

FIG. 14A

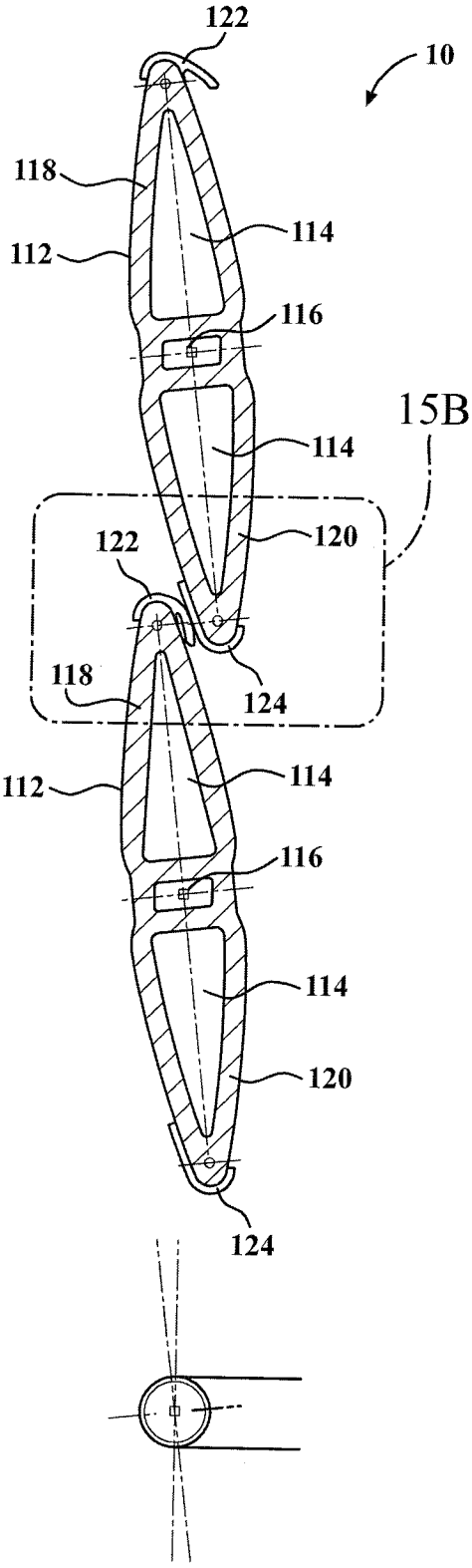

FIG. 15A

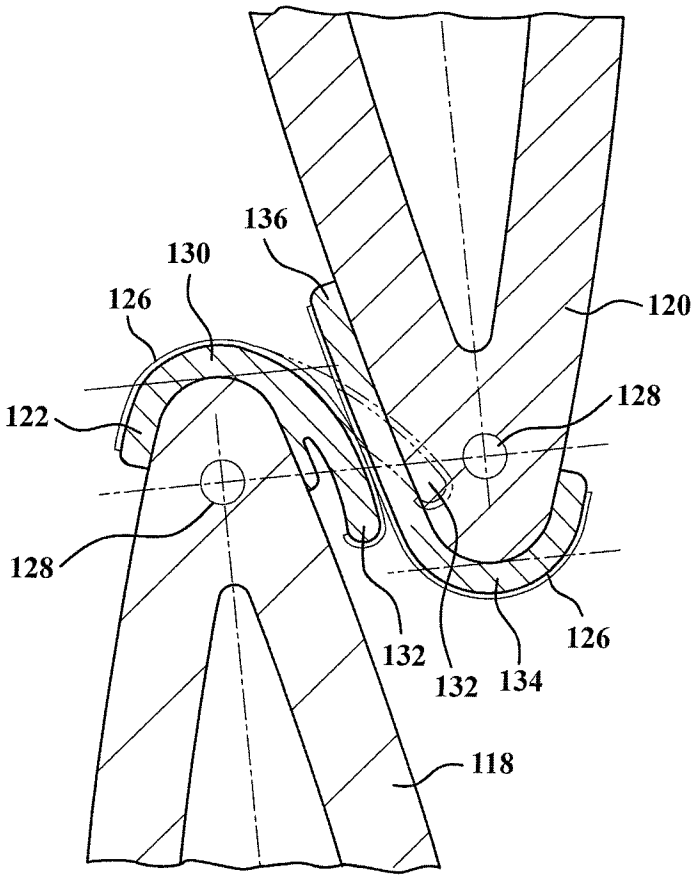

FIG. 15B

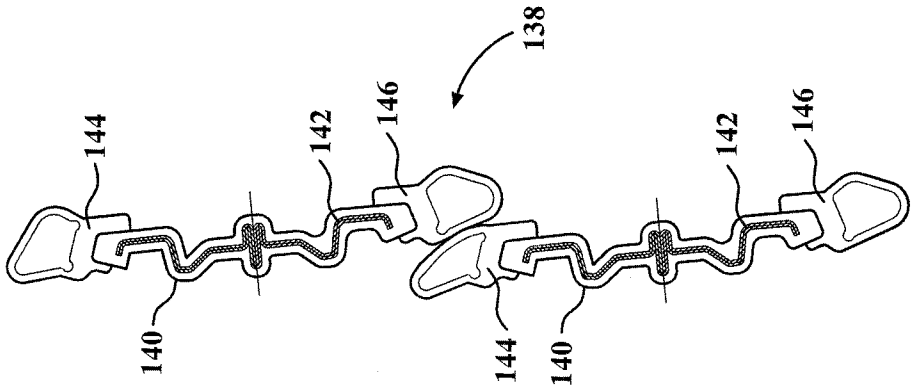

FIG. 16B

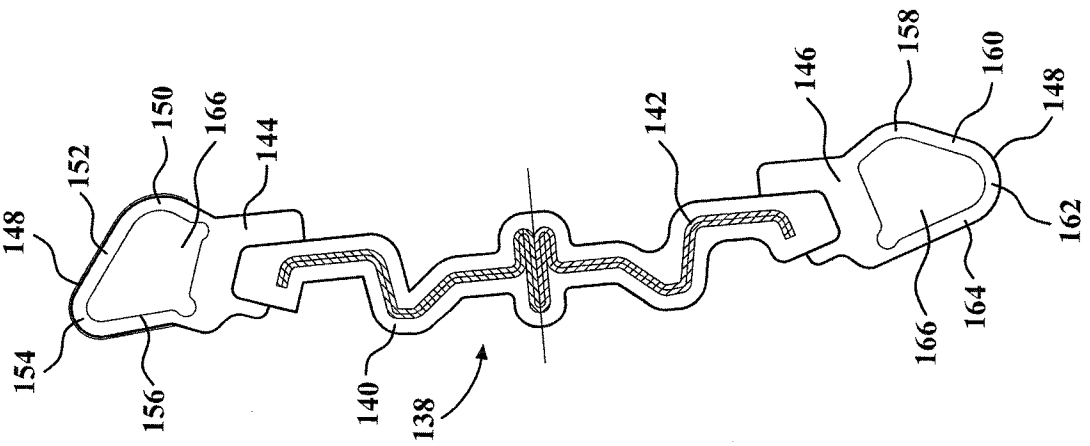

FIG. 16A

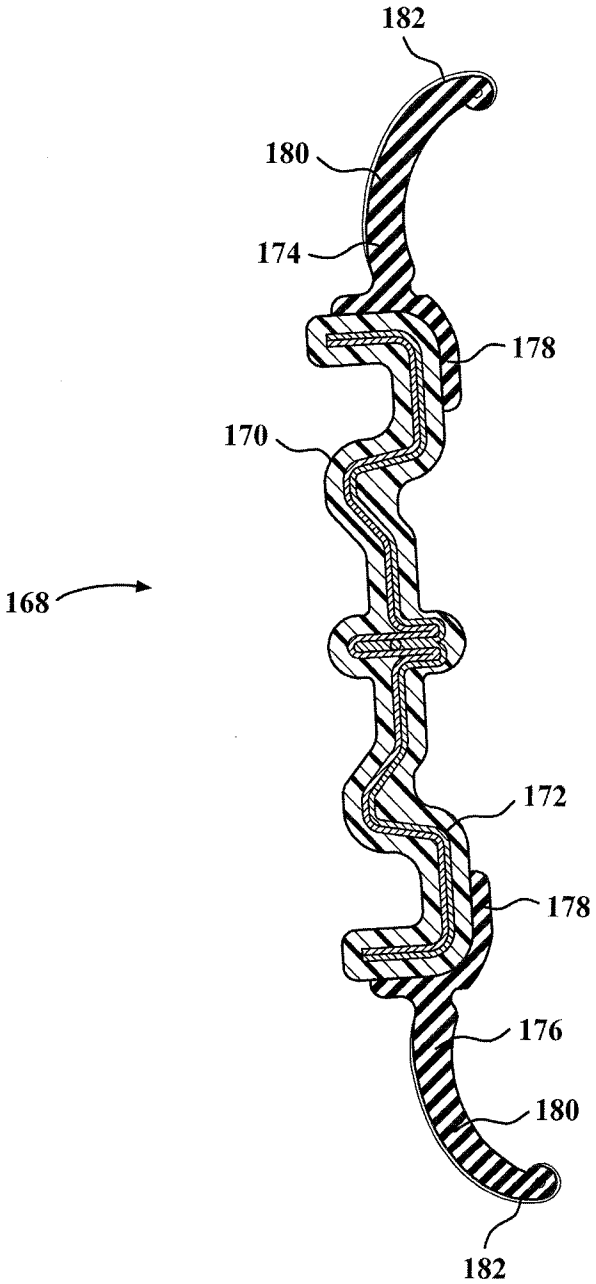

FIG. 17

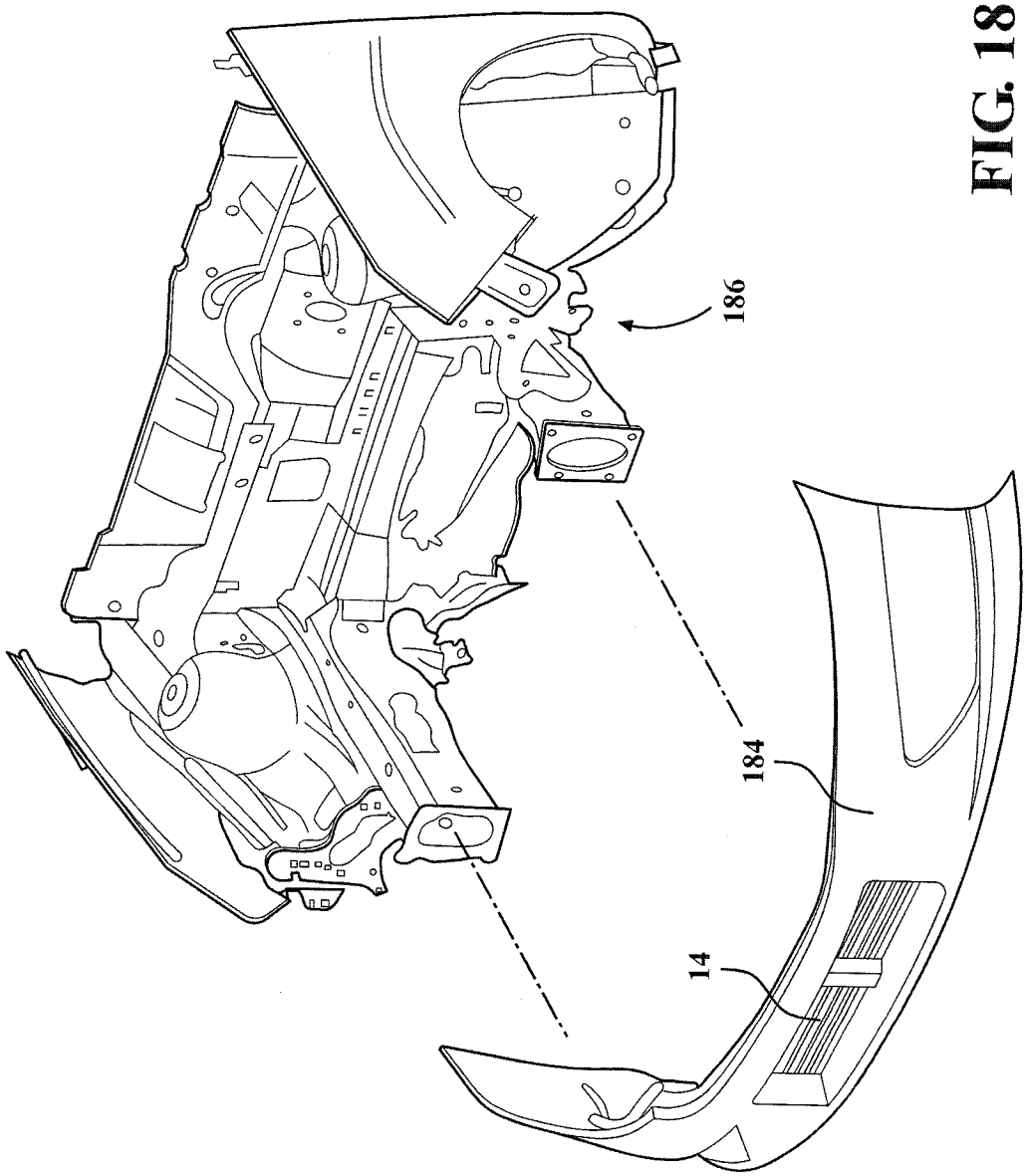

FIG. 18

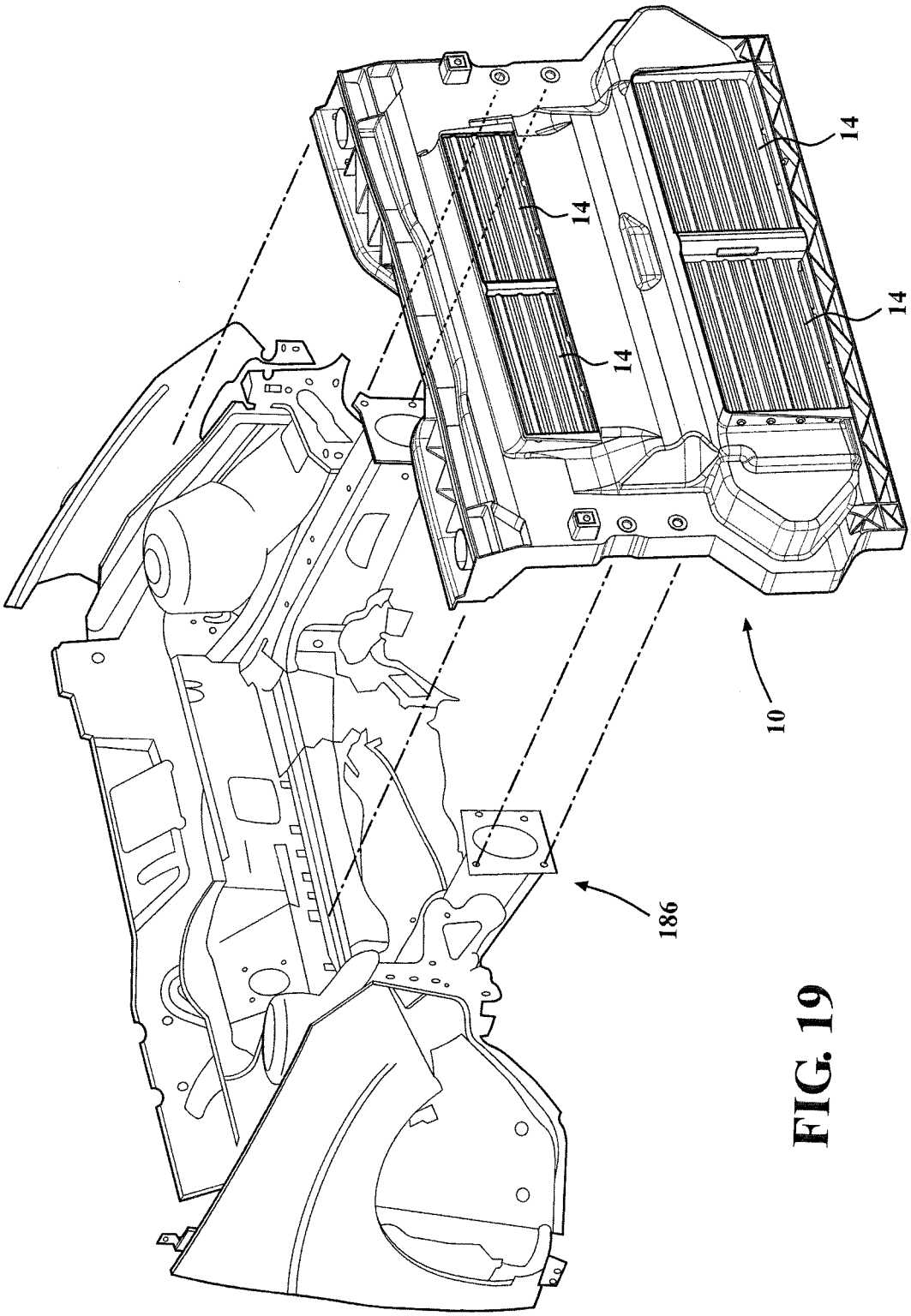

FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/001149

A. CLASSIFICATION OF SUBJECT MATTER

IPC: ***B60K 11/08*** (2006.01) , ***B60R 19/52*** (2006.01) , ***B62D 25/08*** (2006.01) , ***B62D 25/24*** (2006.01) , ***B62D 65/16*** (2006.01) , ***F24F 13/15*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: ***B60K 11/08*** , ***B60R 19/52*** , ***B62D 25/08*** , ***B62D 25/24*** , ***B62D 65/16*** , ***F24F 13/15***

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Epoque using Epodoc, Total Patent, Canadian Patents Database, using keywords: duct, louver, air vent, actuator, seal, slip coat, extrude, co extrude

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US7025159B2 (SMITH et al.) 11 April 2006 (11-04-2006) *Fig 5 and pages 3,4,5,6,7*	1,2,3,4, 9-25
X	US7111660B2 (HARTMANN) 26 September 2006 (26-09-2006) *Figures 1, 3 and pages 4-11*	52-63
A	US7290630B2 (MAEDA et al.) 06 November 2007 (06-11-2007) *whole document*	1,2,3,4,9-63
A	EP1114743B1 (OBARA) 28 February 2007 (28-02-2007) *whole document*	1,2,3,4,9-63
A	US4440212 (TANINO et al.) 03 April 1984 (03-04-1984) *whole document*	1,2,3,4,9-63

[ ] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 November 2010 (02-11-2010)	18 November 2010 (18-11-2010)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Arthur Gary Grant (819) 953-9698

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/001149

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons :

1. [ ] Claim Nos. :
because they relate to subject matter not required to be searched by this Authority, namely :

2. [X] Claim Nos. : 5,6,7,8
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically :

Claim 5 depends from claim 6, and claim 6 depends from claim 5, thereby defining subject matter so unclear that no meaningful opinion can be formed. Claims 7 and 8 depend from claim 5, and thereby also define unclear subject matter.

3. [ ] Claim Nos. :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows :

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos. :

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos. :

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2010/001149

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US7025159B2	11 April 2006 (11-04-2006)	JP2005093434A	07 April 2005 (07-04-2005)
		US2005056472A1	17 March 2005 (17-03-2005)
		US2006116062A1	01 June 2006 (01-06-2006)
		US7607501B2	27 October 2009 (27-10-2009)
US7111660B2	26 September 2006 (26-09-2006)	CA2424156A1	21 July 2004 (21-07-2004)
		CA2454994A1	21 July 2004 (21-07-2004)
		US2004140676A1	22 July 2004 (22-07-2004)
		US7017954B2	28 March 2006 (28-03-2006)
		US2004140065A1	22 July 2004 (22-07-2004)
US7290630B2	06 November 2007 (06-11-2007)	DE102004035741A1	24 March 2005 (24-03-2005)
		JP2005053464A	03 March 2005 (03-03-2005)
		US2005023057A1	03 February 2005 (03-02-2005)
EP1114743A1	11 July 2001 (11-07-2001)	CN1318020A	17 October 2001 (17-10-2001)
		CN1174882C	10 November 2004 (10-11-2004)
		DE60033622D1	12 April 2007 (12-04-2007)
		DE60033622T2	23 August 2007 (23-08-2007)
		EP1114743A4	08 December 2004 (08-12-2004)
		EP1114743B1	28 February 2007 (28-02-2007)
		JP2001030754A	06 February 2001 (06-02-2001)
		US6808224B1	26 October 2004 (26-10-2004)
		US2004251712A1	16 December 2004 (16-12-2004)
		US7105125B2	12 September 2006 (12-09-2006)
		WO0105611A1	25 January 2001 (25-01-2001)
US4440212A	03 April 1984 (03-04-1984)	JP57018516A	30 January 1982 (30-01-1982)