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(72) Inventeurs/Inventors:
HITCHCOCK, CORY MICHAEL, US;
BROCKETT, ADAM JOSEPH, US;
DAVIS, KENNETH GEORGE, US

(73) Propriétaire/Owner:
THE BOEING COMPANY, US

(74) Agent: SMART & BIGGAR LP

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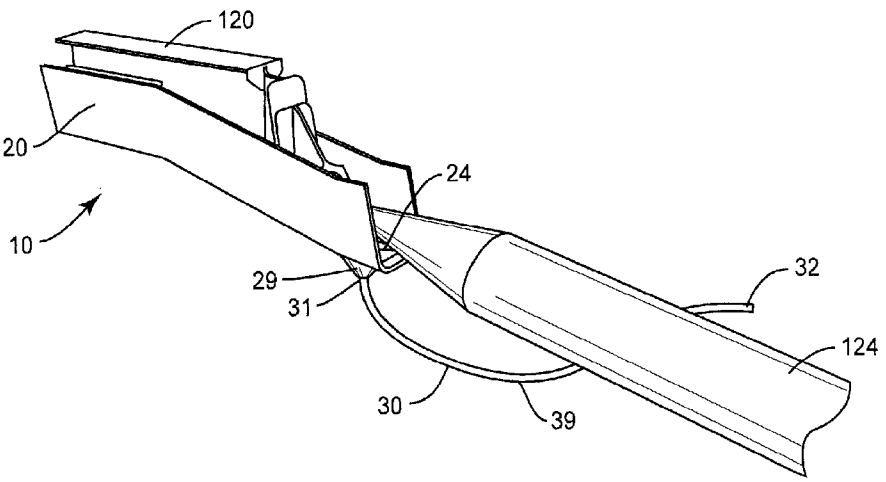

(57) Abrégé/Abstract:
Devices and methods to capture moisture at a structural member in a vehicle. The devices include a flexible tray that can snap-fit onto an exterior of the structural member. Once attached, the flexible tray can collect moisture from the structural member. A diverter is coupled to the flexible tray. The diverter diverts the collected moisture away from the structural member.

ABSTRACT

Devices and methods to capture moisture at a structural member in a vehicle. The devices include a flexible tray that can snap-fit onto an exterior of the structural member. Once attached, the flexible tray can collect moisture from the structural member. A diverter is coupled to the flexible tray. The diverter diverts the collected moisture away from the structural member.

DEVICES AND METHODS TO CAPTURE MOISTURE FROM A STRUCTURAL MEMBER

TECHNOLOGICAL FIELD

The present disclosure generally relates to moisture control. More particularly, the present disclosure relates to devices and methods for capturing moisture from a structural member in a vehicle.

BACKGROUND

In an aircraft, the outer skin is spaced from the walls and ceiling of a passenger cabin (or other compartment), and the gap is at least partially filled with an insulation layer. The insulation layer is typically formed from a waterproof material. During a flight, moisture from moist air can condense against the skin and freeze during cruise. During decent, this frozen moisture can thaw and drip back down towards the cabin. Because the insulation layer is waterproof, the moisture can flow along the insulation layer and drain into the bilge. However, at some locations, structures and/or supports can protrude through the insulation layer. For example, structural members that hold monuments and bins to the crown extend from the structure at the skin, through the insulation layer, and towards the cabin. The insulation layers come with predefined holes for the structural members to extend through the insulation layer. The holes are lined, and there can be a gap defined between the inner surface of the hole and the structural member. When the moisture thaws, it can drip down through the hole and into the cabin.

One current practice is to manually wrap the structural member with a material so the material absorbs the moisture and allows the moisture to evaporate back into the air. However, the moisture can be more than the material can absorb.

SUMMARY

The present application includes devices and methods to capture moisture from a structural member. The devices include a flexible tray that is attached to the structural member and collects the moisture. A diverter attached to the flexible tray diverts the moisture away from the structural member.

One aspect is directed to a device to capture moisture from a structural member. The device a flexible tray that snap-fits onto an exterior of the structural member and collects the moisture from the structural member. A diverter is coupled to the flexible tray and diverts the moisture collected by the flexible tray away from the structural member.

Another aspect is directed to a method of capturing moisture from a structural member. The method includes expanding a flexible tray by moving apart opposing lateral sides of the flexible tray. While the flexible tray is expanded, the method includes positioning the flexible tray over the structural member with the lateral sides of the flexible tray on opposing sides of the structural member and a bottom of the flexible tray along the bottom of the structural member. The method includes releasing the lateral sides and applying a compressive force through the lateral sides to the structural member to secure the flexible tray onto the structural member.

Another aspect is directed to a vehicle with a structural member that includes opposing lateral sides and a bottom that extends between the sides. A moisture capture device captures moisture from a structural member. The moisture capture device includes a flexible tray configured to snap-fit onto the structural member and to collect the moisture from the structural member, and a diverter coupled to the flexible tray and configured to divert the moisture collected by the flexible tray away from the structural member.

In one embodiment, there is provided a device to capture moisture from a structural member supporting components in an aircraft. The device comprises a flexible tray configured to snap-fit onto an exterior of the structural member and to collect the moisture from the structural member. The flexible tray comprises: opposing lateral sides configured to extend along opposing sides of the structural member, a bottom that extends between the lateral sides and forms a capture area underneath the structural member when the flexible tray is snap-fit onto the exterior of the structural member, and an outlet in the bottom of the flexible tray. The flexible tray is flexible for the lateral sides to be spread-apart by an outside force and for the flexible tray to rebound back towards an unflexed orientation with the lateral sides being angled inward to generate a compressive force to snap-fit onto the exterior of the structural member. The device further comprises a diverter coupled to the flexible tray at the outlet and configured to divert the moisture collected by the flexible tray away from the structural member.

In another embodiment, there is provided a method of capturing moisture from a structural member supporting components in an aircraft. The method comprises:

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expanding a flexible tray by moving apart opposing lateral sides of the flexible tray; while the flexible tray is expanded, positioning the flexible tray over an exterior of the structural member with the lateral sides of the flexible tray on opposing sides of the structural member and a bottom of the flexible tray along a bottom of the structural member, wherein the bottom of the flexible tray comprises an outlet; releasing the lateral sides of the flexible tray to apply a compressive force through the lateral sides to the structural member to secure the flexible tray onto the exterior of the structural member, wherein the bottom of the flexible tray forms a capture area underneath the structural member when the flexible tray is secured onto the exterior of the structural member; and diverting moisture collected by the flexible tray away from the structural member via a diverter coupled to the flexible tray at the outlet.

In another embodiment, there is provided an aircraft comprising: a structural member supporting components in the aircraft, the structural member including opposing sides and a bottom that extends between the opposing sides; and a moisture capture device to capture moisture from the structural member. The moisture capture device comprises a flexible tray configured to snap-fit onto the structural member and to collect the moisture from the structural member. The flexible tray comprises: opposing lateral sides configured to extend along the opposing sides of the structural member, a bottom that extends between the lateral sides of the flexible tray and forms a capture area underneath the bottom of the structural member when the flexible tray is snap-fit onto the structural member, and an outlet in the bottom of the flexible tray. The flexible tray is flexible for the lateral sides to be spread-apart by an outside force and to rebound back towards an

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unflexed orientation with the lateral sides being angled inward to generate a compressive force to snap-fit onto the structural member. The moisture capture device further comprises a diverter coupled to the flexible tray at the outlet and configured to divert the moisture collected by the flexible tray away from the structural member.

In another embodiment, there is provided a device to capture moisture from a structural member in an aircraft. The device comprises: an insulation layer positioned over the structural member in the aircraft, the insulation layer comprising an opening; and a flexible tray configured to snap-fit onto the insulation layer that is positioned over the structural member, the flexible tray positioned vertically below the opening in the insulation layer to collect the moisture from the structural member that moves through the opening in the insulation layer and the flexible tray configured to form a capture area underneath the insulation layer and the structural member. The flexible tray comprises: an elongated shape with a first end and a second end, lateral sides configured to extend along opposing sides of the structural member, a bottom that extends between the lateral sides of the flexible tray, and an outlet that extends through the bottom of the flexible tray between the first and second ends. The flexible tray comprises an unflexed orientation with the lateral sides of the flexible tray being angled inward with a width of an opening of the flexible tray being less than a width of the bottom of the flexible tray, and wherein the flexible tray is flexible for the lateral sides to be spread-apart by an outside force and to rebound back towards the unflexed orientation to generate a compressive force to snap-fit onto the structural member. The device further comprises a diverter coupled to the flexible tray at the

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outlet and configured to divert the moisture collected by the flexible tray away from the structural member and towards a separate section of the aircraft, wherein the flexible tray and the diverter comprise an integrally formed unitary construction.

In another embodiment, there is provided an aircraft comprising: an outer wall; a structural member that extends from the outer wall and that includes opposing sides and a bottom that extends between the opposing sides; an insulation layer positioned over the structural member, the insulation layer further comprising an opening; and a moisture capture device positioned on an inboard side of the insulation layer and extending around the insulation layer and the structural member to capture moisture from the structural member that accumulates at the insulation layer and that moves through the opening in the insulation layer. The moisture capture device comprises a flexible tray comprising a channel formed between opposing lateral sides and a bottom extending between the lateral sides of the flexible tray, the channel being wider at a lower section than at a top. The flexible tray is configured to generate a compressive force when the lateral sides of the flexible tray are spread apart to snap-fit onto the insulation layer and the structural member and to collect the moisture from the structural member that moves through the opening in the insulation layer. The moisture capture device further comprises a diverter coupled to the flexible tray and configured to divert the moisture collected by the flexible tray away from the structural member, wherein the flexible tray and the diverter comprise an integrally formed unitary construction.

In another embodiment, there is provided a method of capturing moisture from a structural member in an aircraft. The method comprises: expanding a flexible tray

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by moving apart opposing lateral sides of the flexible tray and expanding an opening of the flexible tray formed between top edges of the lateral sides of the flexible tray; while the flexible tray is expanded, positioning the flexible tray over the structural member with the lateral sides of the flexible tray on opposing sides of the structural member and a bottom of the flexible tray along a bottom of the structural member, wherein the structural member is attached to an outer wall of the aircraft; releasing the lateral sides of the flexible tray and generating a compressive force through the lateral sides of the flexible tray on the structural member to secure the flexible tray onto the structural member; positioning an end of a diverter away from the flexible tray and vertically below the bottom of the flexible tray, the diverter being attached to the flexible tray and the flexible tray and the diverter comprising an integrally formed unitary construction; collecting moisture that runs off the structural member and off the outer wall of the aircraft in the bottom of the flexible tray; and directing the moisture along the bottom of the flexible tray and into the diverter and away from the structural member towards an interior of the aircraft.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure **1** is a schematic diagram of a device attached to a structural member.

Figure **2** is a perspective view of a vehicle.

Figure **3** is a schematic section view of the vehicle of Figure **2** cut along the line III-III.

Figure **4** is a perspective view of a device attached to a structural member.

Figure **5** is a perspective view of a tray.

Figure **6** is an exploded perspective view of a device that includes a tray and a diverter.

Figure **7** is a perspective view of a diverter.

Figure **8**A is an end view of a tray that is flexed outward away from a central plane.

Figure **8**B is an end view of the tray of Figure **8**A that has returned towards an initial position.

Figure **9**A is an end view of a tray of a device in an unflexed orientation.

Figure **9**B is an end view of the tray of Figure **9**A that is flexed outward and extending around a structural member.

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Figure **9**C is an end view of the tray of Figure **9**B that is attached to the structural member.

Figure **10** is a side view of a device attached to a structural member and positioned outboard of an insulation layer.

Figure **11** is a side view of a device attached to a structural member and positioned over an insulation layer and positioned inboard of the insulation layer.

Figure **12** is a flowchart diagram of a method of attaching a device to a structural member to capture moisture.

DETAILED DESCRIPTION

The present application is directed to devices and methods to capture moisture from a structural member in a vehicle. The devices include a flexible tray that can snap-fit onto an exterior of the structural member. Once attached, the flexible tray can collect moisture that runs off from the structural member. The device also includes a diverter that is coupled to the flexible tray. The diverter diverts the collected moisture away from the structural member.

Figure **1** schematically illustrates a device **10** connected to a structural member **120**. The device **10** includes a flexible tray **20** that is connected to the structural member **120**. The tray **20** is shaped and sized to collect moisture from the structural member **120**. A diverter **30** is coupled to the flexible tray **20** and moves the collected moisture away from the tray **20** and the structural member **120**.

The device **10** can be used with a variety of different vehicles **100**. One type of vehicle **100** is an aircraft **100** as illustrated in Figure **2**. The aircraft **100** includes a

nose **101**, wings **102**, a fuselage **103**, and a tail **104**. Figure **2** also illustrates a downward arrow **105** indicating the expected direction in which the force of gravity will pull objects, such as liquid moisture, onboard the aircraft **100** in a nominal operational profile.

Figure **3** is a cross-sectional, schematic view of the aircraft **100** indicated by view arrows III-III in Figure **2**. Figure **3** illustrates a simplified version of a portion of the fuselage **103** that includes an outer wall **110**, a floor **111**, ceiling **112**, insulation layer **113**, and aesthetic fascia walls **114**. For purposes of explanation, the ceiling **112** and/or aesthetic fascia walls **114** represent an "inner wall" of the aircraft. A cabin **115** is formed within the inner wall and includes seats **116**, aisles, and various other components for the passengers. Structural members **120** support the different components in the aircraft **100**. One type of structural member **120** includes support beams **120** that extend from the outer wall **110**. Support members **124** are attached to the structural members **120** to support various components which can include luggage compartments **117**, the ceiling **112**, ducting, equipment, and racks.

Respiration and other sources of water cause moisture **130** to enter or form in the air in the cabin **115**. For example, warm exhaled air includes moisture **130** that rises upward through the luggage compartments **117**. Some of this warm and moist air rises through the ceiling **112**. Furthermore, some warm air continues to rise upward through the insulation layer **113** into a space **118** between the outer wall **110** and the insulation layer **113**.

As the outer wall **110** is cooled by the outside air at high altitude during flight, the temperature of the outer wall **110** eventually decreases to a temperature below

the freezing temperature of water. This cooling causes the moisture **130** (e.g., water) to condense out of the air in the space **118** and freeze onto the inner surface of the outer wall **110** as ice. As the temperature increases when the aircraft **100** changes to a lower altitude and/or commences descent for landing, the ice **130** begins to melt causing water droplets **130** to form that travel through the space **118** towards a bottom **119** of the fuselage **103**. Some moisture **130** enters gaps in the insulation layer **113**, particularly where the support members **124** extend through the insulation layer **113**.

The devices **10** are attached to the structural members **120** to capture the moisture **130** from the structural members **120**. Some aspects include capturing about twenty to one hundred millimeters of melted frost during each flight. The captured moisture **130** can be diverted down and outboard between the insulation layer **113** and the outer wall **110**. The collected moisture **130** is diverted into insulation cap strips and eventually into a bilge and overboard. The devices **10** can be positioned on the inboard side of the insulation layer **113** and/or positioned on the outboard side of the insulation layer **113**.

Figure **4** illustrates a device **10** attached to a structural member **120**. Specifically, Figure **4** includes the device **10** connected where the structural member **120** attaches to a support member **124**. The device **10** includes a tray **20** that is flexible to snap-fit onto the structural support **120**. The snap-fit is caused by the flexibility of the lateral sides **21** that can be forced apart and then rebound back towards their original shape to attach to the structural member **120**. The diverter

30 is coupled to the tray **20** and diverts the captured moisture away from the tray **20** and structural member **120**.

Figure **5** illustrates a tray **20** that includes a pair of opposing lateral sides **21** that are connected together by a bottom **22**. The lateral sides **21** can extend the entire length of the tray **20** from a first end **25** to a second end **26**, or may extend a lesser distance as illustrated in Figure **5**. The sides **21** extend upward from the bottom **22** an amount to capture the moisture **130** and to snap-fit onto the structural member **120**. The opposing sides **21** can have the same shape and/or size, or can have different shapes and/or sizes. The sides **21** can be substantially parallel to each other when no external forces are applied to the tray **20**. The sides **21** can extend an equal distance from the bottom **22**. The sides **21** can also extend different distances from the bottom **22**. The sides **21** and the bottom **22** define a substantially C-shaped channel **41**having an opening **59** opposite from the bottom **22**. During installation, the device **10** is positioned such that a portion of the structural member **120** passes through the opening **59** and is disposed within the channel **41**. The tray **20** is then coupled to the structural member **120** via connectors **28** as described in more detail below.

The tray **20** includes an elongated shape that extends between the first and second ends **25**, **26**. The elongated shape allows the tray **20** to extend along a length of the structural member **120** and capture the moisture. The tray **20** includes a longitudinal axis **50** that extends between the ends **25**, **26**.

The bottom **22** extends between and is connected to each of the lateral sides **21**. The bottom **22** includes a capture area **23**. When the device **10** is

attached to a structural member **120**, the capture area **23** is vertically lower than a remainder of the tray **20** such that the captured moisture collects in this capture area **23**. Figure **5** includes the bottom **22** with a continuous vertical drop from a first end **25** to a second end **26** with the capture area **23** being positioned at the second end **26**. Other aspects can include the capture area **23** positioned at different locations along the bottom **22**. Another embodiment includes the capture area **23** positioned at a central area with each of the ends **25**, **26** being vertically higher.

An outlet **24** is positioned at the capture area **23** for the moisture **130** to exit from the tray **20** and enter into the diverter **30**. The outlet **24** can include a single aperture, or can include multiple apertures. The one or more apertures can extend through the bottom **22**, one or both lateral sides **21**, or a combination of the bottom **22** and one or both of the lateral sides **21**. Figure **5** includes the outlet **24** being a single aperture that extends through the bottom **22**.

The lateral sides **21** include one or more connectors **28** to secure the tray **20** to the structural member **120**. The connectors **28** can include hook-and-loop fasteners that engage together or that engages the insulation layer **113**. The connectors **28** can also include a strap that is attached to one of the lateral sides **21** and with a length to extend over the structural member **120** and attach to the opposing lateral side **21**.

Walls **27** can be positioned at one or both ends **25**, **26** to prevent escape of the captured moisture. The walls **27** extend upward from the bottom **22** and between the lateral sides **21**.

As illustrated in Figure **4**, the diverter **30** is coupled to the tray **20** at the outlet **24**. Moisture collected by the tray **20** is moved through the outlet **24** and into the diverter **30**. The diverter **30** includes a first end **31** at the outlet **24** and a second end **32**. The length of the diverter **30** measured between the ends **31**, **32** can vary depending upon the context of use. Figure **4** includes the diverter **30** being a tube **39** with an enclosed interior sized to contain the moisture **130** and transfer the moisture **130** to a remote location away from the structural member **120**. Figure **6** illustrate another device **10** with the diverter **30** being a trough **38** that contains the moisture. Figure **7** includes a diverter **30** with an open top side **33**. The diverters **30** can be flexible to be positioned as needed through the interior of the vehicle **100**. Alternatively, the diverters **30** can include a rigid fixed shape.

The diverter **30** can be coupled to the tray **20** in a variety of different manners. The diverters **30** and tray **20** can have an integrally formed unitary construction and be a single, unitary piece, such as with a single molded piece. The coupling may also include mechanical engagement. Referring again to Figure **4**, the tray **20** also includes a protrusion **29** that extends outward from the bottom **22** at the outlet **24**. The tube **39** is sized to fit over or within the protrusion **29** to couple the diverter **30** to the tray **20**. Adhesive and/or mechanism fasteners can also be used to further couple the diverter **30** and tray **20**.

Figure **6** includes the tray **20** with the outlet **24** at the intersection of the bottom **22** and lateral side **21**. The first end **31** of the diverter **30** is shaped and sized to conform to the exterior of the tray **20** at the outlet **24**. The diverter **30**

includes a longitudinal axis **51**. In one aspect as illustrated in Figure **6**, the longitudinal axis **51** of the diverter **30** is substantially perpendicular to the longitudinal axis **50** of the tray **20**.

The tray **20** is flexible to snap-fit onto the structural member **120**. The diverter **30** can also be flexible, or can be rigid. The tray **20** and diverter **30** can be fabricated from the same or different materials and using the same or different techniques. Examples include but are not limited to fiberglass hand lay-up, vacuum-formed polycarbonate (or other plastic(s)), blow molded, injection molded, and 3D printed. One aspect includes the flexible tray **20** and the diverter **30** each being fabricated from a non-absorbent material. The material can include but is not limited to a close-cell foam and plastic.

The flexibility of the tray **20** is illustrated in Figures **8**A and **8**B. As illustrated in Figure **8**A, the tray **20** is flexible such that the lateral sides **21** can be forced outward away from a plane P that extends through a middle of the tray **20**. This increases the width **52** of the opening **59** of the tray **20**. A force F applied to the lateral sides **21** flexes the sides **21** outward away from the plane P. When the force F is removed as illustrated in Figure **8**B, the lateral sides **21** rebound inward towards the plane P resulting in a smaller width **52** of the opening **59** measured between the sides **21**. The rebound force applied by the sides **21** attaches the tray **20** to the structural member **120**. The rebound force applied by the sides **21** to the structural member **120** alone may be adequate to maintain the attachment, or one or more connectors **28** can also be used for the attachment. The lateral sides **21** can be substantially parallel when no forces are acting on the tray **20**. The lateral

sides **21** can also be angled outward or angled inward when no forces are acting on the tray **20**.

Figure **9**A illustrates a tray **20** in an unflexed orientation. The lateral sides **21** angle inward such that the width **52** of the open end **59** is smaller than a width **53** at the bottom **22**. Figure **9**B illustrates the lateral sides **21** of the tray **20** flexed outward by a force F to extend around the structural member **120**. In this flexed orientation, the width **52** of the opening **59** is larger than a width **123** of the structural member **120**. This provides for placing the tray **20** around the structural member **120**. As illustrated in Figure **9**C, when the force F is removed from the tray **20**, the lateral sides **21** return inward. Because the width **52** of the opening **59** in the unflexed orientation is smaller than the width **123** of the structural member **120**, the lateral sides **21** contact against the lateral sides **121** of the structural member **120**. This sizing difference prevents the device **10** from falling off the structural member **120**. Figure **9**C includes a tray **20** sized with the lateral sides **21** of the tray **20** contacting against the lateral sides **121** of the structural member **120**. The tray **20** can include other sizing, such as Figure **10** with the tray **20** secured to the structural member **120** with the lateral sides **21** spaced away from the lateral sides **121** of the structural member **120**. The tray **20** can be attached with the bottom **22** being spaced away from the structural member **120** while the lateral sides **21** are applying a compressive force to the structural member **120**.

The device **10** can be positioned at various locations on the vehicle **100**. Figure **10** includes the device **10** positioned at an outboard side of the insulation layer **113** (i.e., between the insulation layer **113** and the outer wall **110** of the

vehicle **100**). The device **10** is attached with the lateral sides **21** on opposing sides of the structural member **120**. This may include the lateral sides **21** of the tray **20** contacting against the lateral sides **121** of the structural member **120**, or the lateral sides **21** of the tray **20** spaced away from the lateral sides **121** of the structural member **120**. The bottom **22** that extends between the lateral sides **21** is positioned underneath the structural member **120**. The lateral sides **21** apply an inward compressive force to the structural member **120** to attach the device **10**. Moisture **130** from the structural member **120** is captured by the device **10**. Other moisture **130** in the area, such as moisture on the surface of the insulation layer **113**, moisture on the outer wall **110**, and other components, can also be captured in the tray **20**. The diverter **30** is attached at the outlet **24** of the tray **20** to receive the moisture **130**. The moisture **130** moves through the diverter **30** to a remote location away from the structural member **120**.

Figure **11** illustrates the device **10** positioned on an inboard side of the insulation layer **113**. The device **10** is sized to extend around the structural member **120** and the insulation layer **113**. The lateral sides **21** are on opposing sides of the structural member **120** and the insulation layer **113**. The lateral sides **21** apply an inward compressive force to maintain the attachment to the insulation layer **113** and the structural member **120**. The moisture **130** from the structural member **120** and the insulation layer **113** collects and moves through the insulation layer **113** to the tray **20**. The moisture **130** can move into the tray **20** through overlaps and seams in the insulation layer **113**, or the insulation layer **113** can include one or more openings **133** to allow for the moisture **130** to move into

the tray **20**. The diverter **30** receives the moisture **130** from the tray **20** and directs the moisture **130** to a remote location.

Figure **12** includes a method of capturing moisture **130** from a structural member **120** using a device **10**. This includes expanding the tray **20** by moving apart the opposing lateral sides **21** (block **90**). The required separation of the lateral sides **21** depends upon the size of the structural member **120** and can also depend upon the size of the insulation layer **113**. While expanded, the tray **20** is positioning over the structural member **120** with the lateral sides **21** positioned on opposing sides and the bottom **22** positioned along the bottom of the structural member **120** (block **91**). This can also include the lateral sides and bottom positioned over the insulation layer **113** as illustrated in Figure **11**. Once positioned, the lateral sides **21** are released thus applying a compressive force through the lateral sides **21** to the structural member **120** to secure the tray **20** onto the structural member **120** (block **92**). Once in position, the tray **20** captures the moisture **130** that from the structural member **120**. This moisture **130** moves to the outlet **24** in the tray **20** and into the diverter **30** where is it directed away from the structural member **120**.

The device **10** can be used on a variety of vehicles **100**. Vehicles **100** include but are not limited to manned aircraft, unmanned aircraft, manned spacecraft, unmanned spacecraft, manned rotorcraft, unmanned rotorcraft, satellites, rockets, missiles, manned terrestrial vehicles, unmanned terrestrial vehicles, manned surface water borne vehicles,, unmanned surface water borne

vehicles, manned sub-surface water borne vehicles, unmanned sub-surface water borne vehicles, and combinations thereof.

The present disclosure can be carried out in other ways than those specifically set forth herein without departing from essential characteristics of the disclosure. The present aspects are to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

EMBODIMENTS IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device to capture moisture from a structural member supporting components in an aircraft, the device comprising:

a flexible tray configured to snap-fit onto an exterior of the structural member and to collect the moisture from the structural member,

wherein the flexible tray comprises:

opposing lateral sides configured to extend along opposing sides of the structural member,

a bottom that extends between the lateral sides and forms a capture area underneath the structural member when the flexible tray is snap-fit onto the exterior of the structural member, and

an outlet in the bottom of the flexible tray,

wherein the flexible tray is flexible for the lateral sides to be spread-apart by an outside force and to rebound back towards an unflexed orientation with the lateral sides being angled inward to generate a compressive force to snap-fit onto the exterior of the structural member; and

a diverter coupled to the flexible tray at the outlet and configured to divert the moisture collected by the flexible tray away from the structural member.

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2. The device of claim **1**, wherein the flexible tray and the diverter include an integrally formed unitary construction.

3. The device of claim **1** or **2**, wherein each of the flexible tray and the diverter include a longitudinal axis, with the longitudinal axis of the flexible tray being substantially perpendicular to the longitudinal axis of the diverter.

4. The device of any one of claims **1** to **3**, wherein the flexible tray and the diverter are each fabricated from a non-absorbent material.

5. The device of any one of claims **1** to **4**, wherein the lateral sides of the flexible tray are angled inward such that a width of an opening of the flexible tray is less than a width of the bottom of the flexible tray.

6. The device of any one of claims **1** to **5**, wherein the diverter is a tube with a first end attached to the outlet and a second end that is spaced away from and vertically below the flexible tray.

7. A method of capturing moisture from a structural member supporting components in an aircraft, the method comprising:

expanding a flexible tray by moving apart opposing lateral sides of the flexible tray;

while the flexible tray is expanded, positioning the flexible tray over an exterior of the structural member with the lateral sides of the flexible tray on opposing sides of the structural member and a bottom of the flexible tray along a bottom of the structural member, wherein the bottom of the flexible tray comprises an outlet;

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releasing the lateral sides of the flexible tray to apply a compressive force through the lateral sides to the structural member to secure the flexible tray onto the exterior of the structural member, wherein the bottom of the flexible tray forms a capture area underneath the structural member when the flexible tray is secured onto the exterior of the structural member; and

diverting moisture collected by the flexible tray away from the structural member via a diverter coupled to the flexible tray at the outlet.

8. The method of claim **7**, further comprising:

coupling a first end of the diverter to the outlet; and

positioning a second end of the diverter away from the flexible tray and vertically below the bottom of the flexible tray.

9. The method of claim **7** or **8**, further comprising, after securing the flexible tray to the exterior of the structural member, positioning the outlet in the bottom of the flexible tray vertically below a remainder of the bottom of the flexible tray.

10. The method of any one of claims **7** to **9**, wherein expanding the flexible tray comprises applying an outward force to the lateral sides of the flexible tray and increasing a width of an opening of the flexible tray.

11. The method of any one of claims **7** to **10**, further comprising directly contacting the lateral sides of the flexible tray against the structural member.

12. The method of any one of claims **7** to **10**, further comprising contacting the lateral sides of the flexible tray against an insulation layer at the structural member and spacing the lateral sides of the flexible tray away from the structural member.

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13. The method of any one of claims **7** to **12**, further comprising spacing the bottom of the flexible tray away from the bottom of the structural member while the lateral sides of the flexible tray are applying the compressive force to the structural member.

14. The method of any one of claims **7** to **13**, further comprising:

collecting the moisture in the bottom of the flexible tray from the structural member.

15. The method of claim **14**, wherein diverting the moisture collected by the flexible tray away from the structural member comprises:

transferring the moisture from the bottom of the flexible tray to the diverter; and

moving the moisture along the diverter and away from the flexible tray.

16. The method of any one of claims **7** to **15**, further comprising:

expanding the flexible tray by moving apart the lateral sides of the flexible tray; and

unsecuring the flexible tray from the exterior of the structural member.

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17. An aircraft comprising:

a structural member supporting components in the aircraft, the structural member including opposing sides and a bottom that extends between the opposing sides; and

a moisture capture device to capture moisture from the structural member, the moisture capture device comprising:

a flexible tray configured to snap-fit onto the structural member and to collect the moisture from the structural member, wherein the flexible tray comprises:

opposing lateral sides configured to extend along the opposing sides of the structural member,

a bottom that extends between the lateral sides of the flexible tray and forms a capture area underneath the bottom of the structural member when the flexible tray is snap-fit onto the structural member, and

an outlet in the bottom of the flexible tray,

wherein the flexible tray is flexible for the lateral sides to be spread-apart by an outside force and to rebound back towards an unflexed orientation with the lateral sides being angled inward to generate a compressive force to snap-fit onto the structural member; and

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a diverter coupled to the flexible tray at the outlet and configured to divert the moisture collected by the flexible tray away from the structural member.

18. The aircraft of claim **17**, further comprising an insulation layer that extends around the structural member, the insulation layer positioned between the structural member and the moisture capture device.

19. A device to capture moisture from a structural member in an aircraft, the device comprising:

an insulation layer positioned over the structural member in the aircraft, the insulation layer comprising an opening; and

a flexible tray configured to snap-fit onto the insulation layer that is positioned over the structural member, the flexible tray positioned vertically below the opening in the insulation layer to collect the moisture from the structural member that moves through the opening in the insulation layer and the flexible tray configured to form a capture area underneath the insulation layer and the structural member, the flexible tray comprising:

an elongated shape with a first end and a second end,

lateral sides configured to extend along opposing sides of the structural member,

a bottom that extends between the lateral sides of the flexible tray, and

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an outlet that extends through the bottom of the flexible tray between the first and second ends,

wherein the flexible tray comprises an unflexed orientation with the lateral sides of the flexible tray being angled inward with a width of an opening of the flexible tray being less than a width of the bottom of the flexible tray, and wherein the flexible tray is flexible for the lateral sides to be spread-apart by an outside force and to rebound back towards the unflexed orientation to generate a compressive force to snap-fit onto the structural member; and

a diverter coupled to the flexible tray at the outlet and configured to divert the moisture collected by the flexible tray away from the structural member and towards a separate section of the aircraft, wherein the flexible tray and the diverter comprise an integrally formed unitary construction.

20. The device of claim **19**, wherein each of the flexible tray and the diverter include a longitudinal axis, with the longitudinal axis of the flexible tray being substantially perpendicular to the longitudinal axis of the diverter.

21. The device of claim **19** or **20**, wherein the flexible tray and the diverter are each fabricated from a non-absorbent material.

22. The device of any one of claims **19** to **21**, wherein the outlet is positioned at an intersection of the bottom and one of the lateral sides of the flexible tray.

23. The device of any one of claims **19** to **22**, wherein the diverter is a tube with a first end attached to the outlet and a second end that is spaced away from and vertically below the flexible tray.

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24. The device of any one of claims **19** to **23**, wherein the flexible tray further comprises end walls positioned at the first and second ends of the flexible tray, the end walls extend upward from the bottom of the flexible tray and between the lateral sides of the flexible tray.

25. An aircraft comprising:

an outer wall;

a structural member that extends from the outer wall and that includes opposing sides and a bottom that extends between the opposing sides;

an insulation layer positioned over the structural member, the insulation layer further comprising an opening; and

a moisture capture device positioned on an inboard side of the insulation layer and extending around the insulation layer and the structural member to capture moisture from the structural member that accumulates at the insulation layer and that moves through the opening in the insulation layer, the moisture capture device comprising:

a flexible tray comprising a channel formed between opposing lateral sides and a bottom extending between the lateral sides of the flexible tray, the channel being wider at a lower section than at a top, the flexible tray configured to generate a compressive force when the lateral sides of the flexible tray are spread apart to snap-fit onto the insulation layer and the structural member and to collect the moisture from the structural member that moves through the opening in the insulation layer; and

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a diverter coupled to the flexible tray and configured to divert the moisture collected by the flexible tray away from the structural member, wherein the flexible tray and the diverter comprise an integrally formed unitary construction.

26. The aircraft of claim **25**, further comprising an outlet that extends through the bottom of the flexible tray between a first end and a second end of the flexible tray, with the diverter coupled to the flexible tray at the outlet.

27. The aircraft of claim **25**, wherein the flexible tray further comprises end walls positioned at ends of the flexible tray, the end walls extend upward from the bottom of the flexible tray and between the lateral sides of the flexible tray.

28. The aircraft of any one of claims **25** to **27**, wherein each of the flexible tray and the diverter comprise a longitudinal axis, with the longitudinal axis of the flexible tray being substantially perpendicular to the longitudinal axis of the diverter.

29. The aircraft of claim **25**, wherein the diverter comprises a tube with a first end attached to an outlet of the flexible tray and a second end that is spaced away from and vertically below the flexible tray.

30. A method of capturing moisture from a structural member in an aircraft, the method comprising:

expanding a flexible tray by moving apart opposing lateral sides of the flexible tray and expanding an opening of the flexible tray formed between top edges of the lateral sides of the flexible tray;

while the flexible tray is expanded, positioning the flexible tray over the structural member with the lateral sides of the flexible tray on opposing sides of the structural member and a bottom of the flexible tray along a

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bottom of the structural member, wherein the structural member is attached to an outer wall of the aircraft;

releasing the lateral sides of the flexible tray and generating a compressive force through the lateral sides of the flexible tray on the structural member to secure the flexible tray onto the structural member;

positioning an end of a diverter away from the flexible tray and vertically below the bottom of the flexible tray, the diverter being attached to the flexible tray, the flexible tray and the diverter comprising an integrally formed unitary construction;

collecting moisture that runs off the structural member and off the outer wall of the aircraft in the bottom of the flexible tray; and

directing the moisture along the bottom of the flexible tray and into the diverter and away from the structural member towards an interior of the aircraft.

31. The method of claim **30**, further comprising securing the flexible tray to the structural member through just the compressive force applied through the lateral sides of the flexible tray.

32. The method of claim **30** or **31**, wherein expanding the flexible tray comprises applying an outward force to the lateral sides of the flexible tray and increasing a width of the opening of the flexible tray.

33. The method of any one of claims **30** to **32**, further comprising directly contacting the lateral sides of the flexible tray against the structural member.

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34. The method of any one of claims **30** to **32**, wherein positioning the flexible tray over the structural member comprises:

contacting the lateral sides of the flexible tray against an insulation layer positioned over the structural member; and

positioning the flexible tray vertically below an opening in the insulation layer.

35. The method of claim **34**, wherein collecting the moisture that runs off the structural member and the outer wall in the bottom of the flexible tray comprises capturing moisture that runs off the structural member and the outer wall and that moves through the opening in the insulation layer in the bottom of the flexible tray.

36. The method of any one of claims **30** to **35**, further comprising spacing the bottom of the flexible tray away from the bottom of the structural member while the lateral sides of the flexible tray are applying the compressive force on the structural member.

37. The method of any one of claims **30** to **36**, wherein directing the moisture along the bottom of the flexible tray and into the diverter further comprises:

transferring the moisture from the bottom of the flexible tray to the diverter that is attached to the flexible tray; and

moving the moisture along the diverter and away from the flexible tray.

38. The method of any one of claims **30** to **37**, further comprising:

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expanding the flexible tray by moving apart the lateral sides of the flexible tray; and

unsecuring the flexible tray from the structural member.

39. The method of any one of claims **30** to **38**, wherein the flexible tray further comprises end walls at ends of the flexible tray, the end walls configured to prevent escape of the moisture from the flexible tray.

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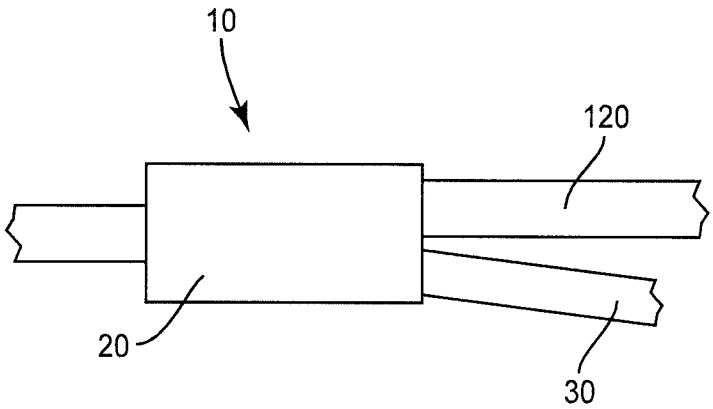

FIG. 1

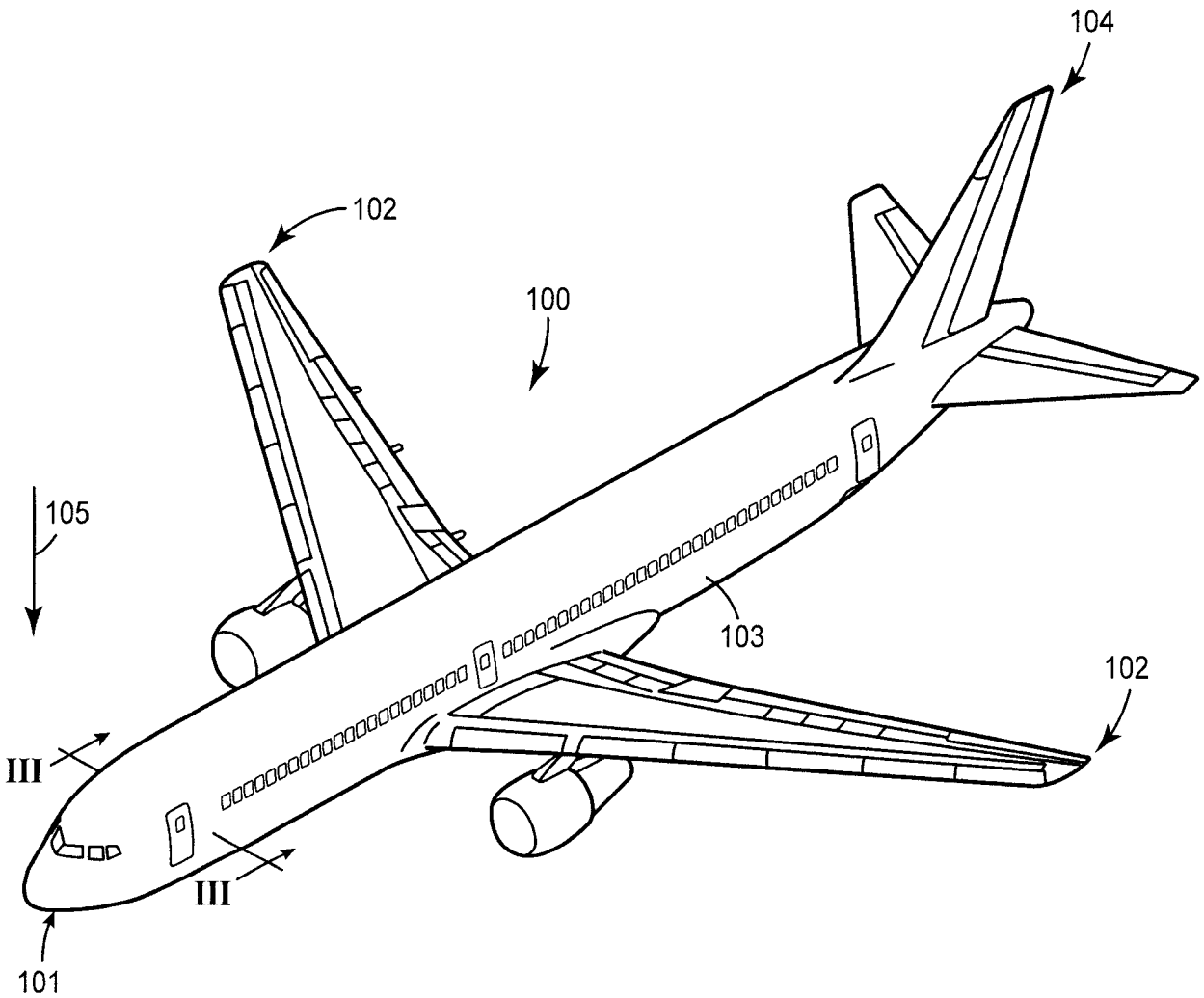

FIG. 2

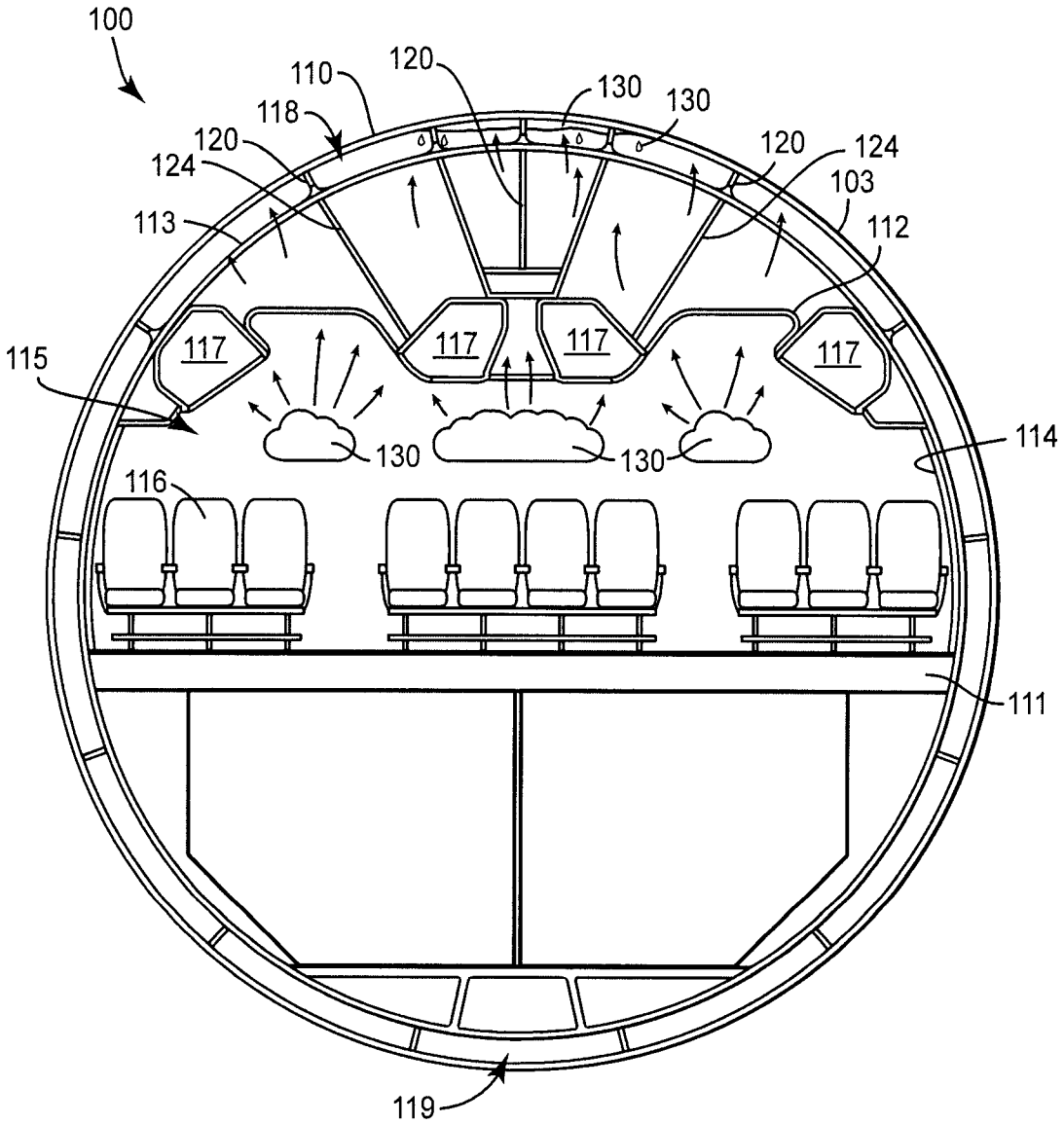
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FIG. 3

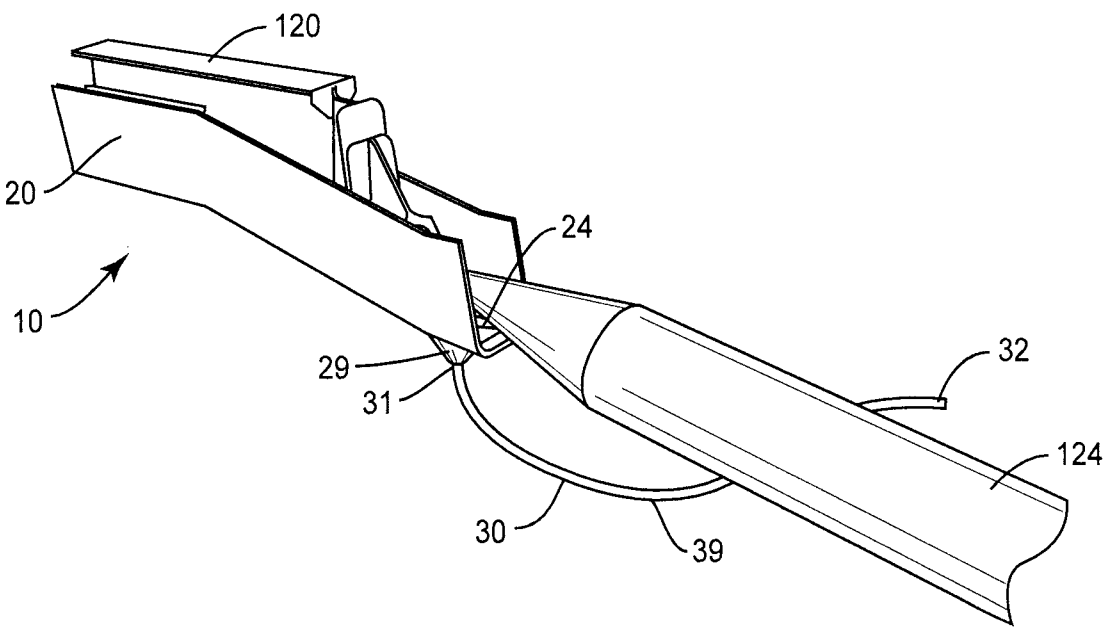


FIG. 4

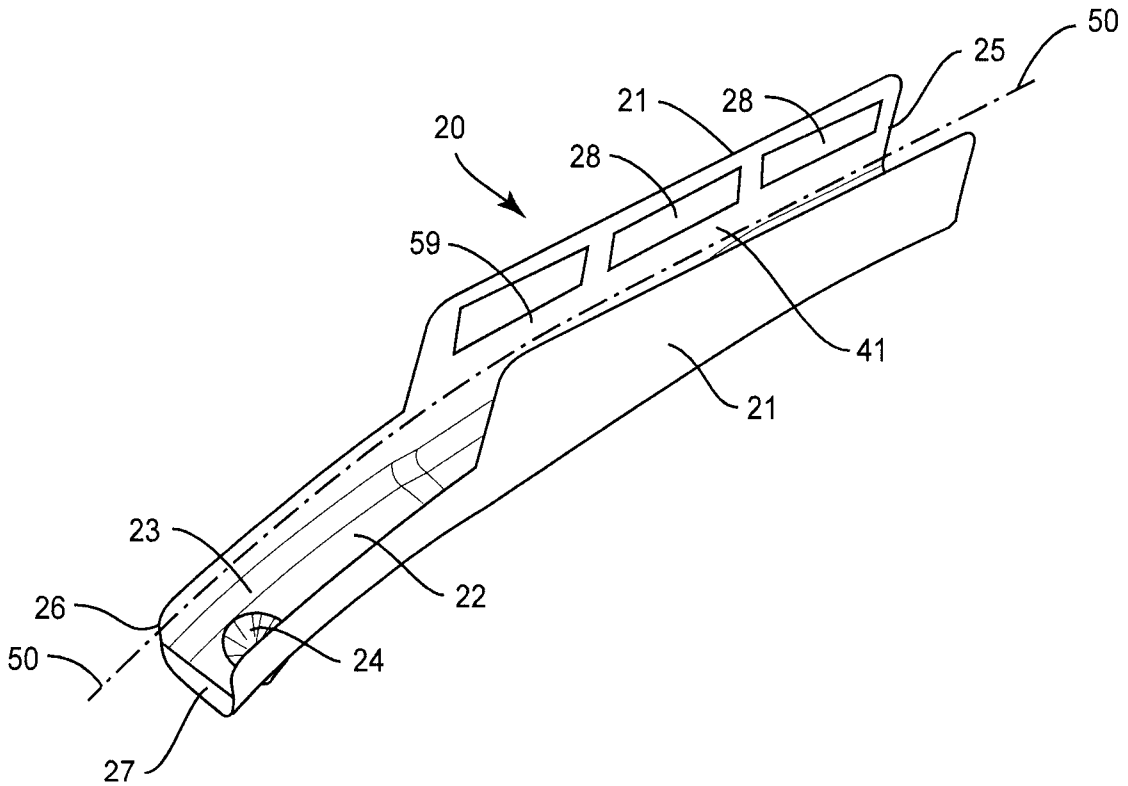


FIG. 5

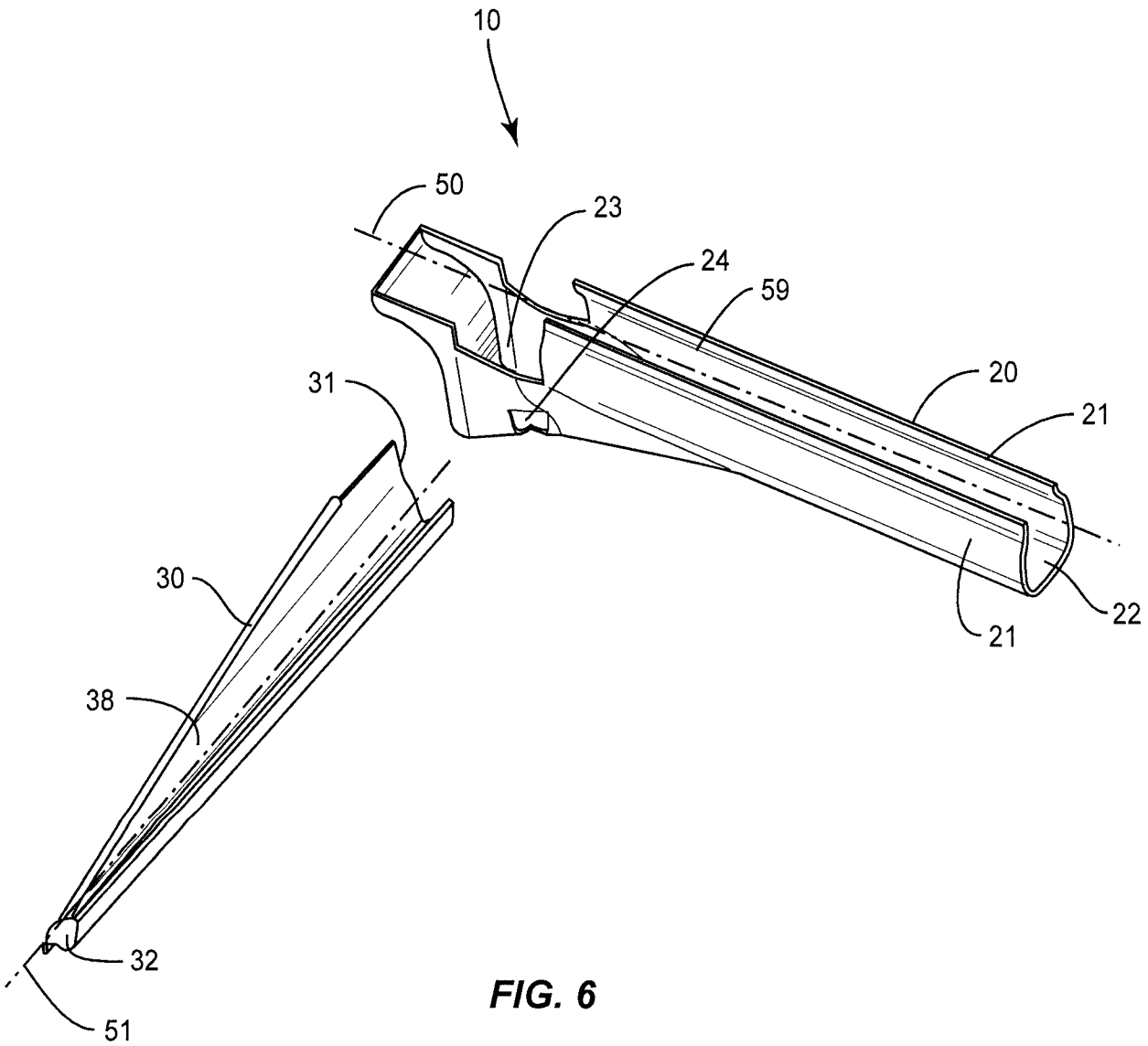


FIG. 6

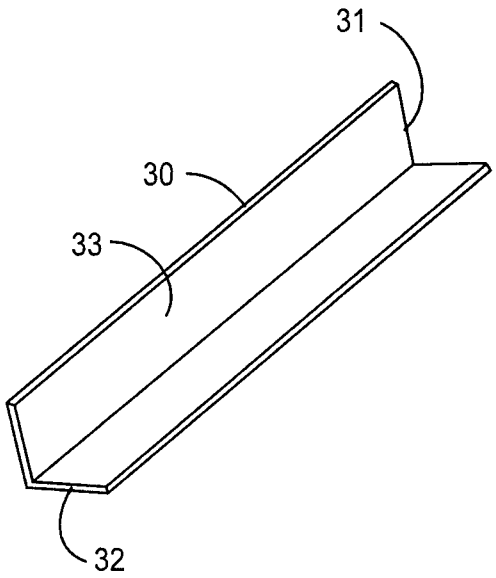


FIG. 7

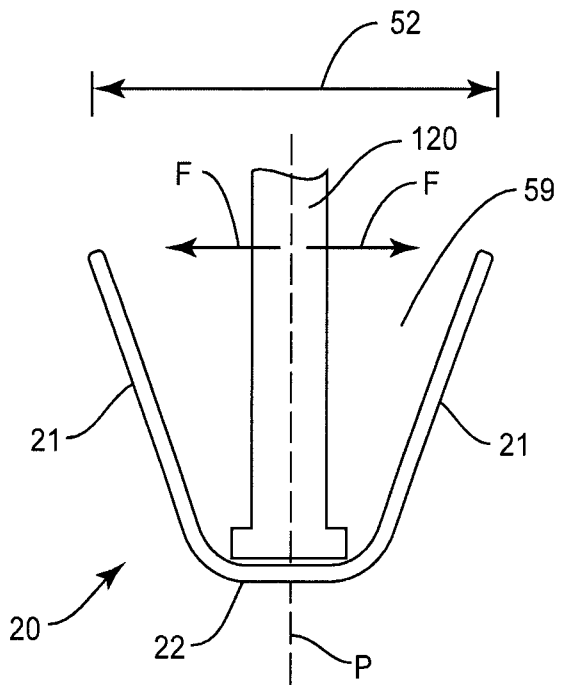


FIG. 8A

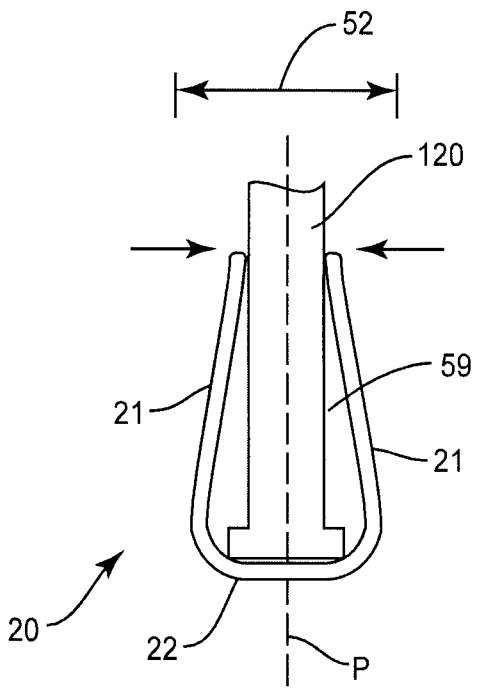


FIG. 8B

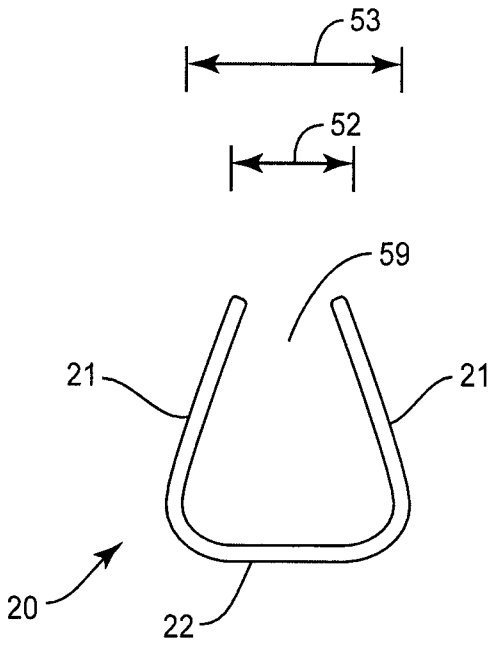


FIG. 9A

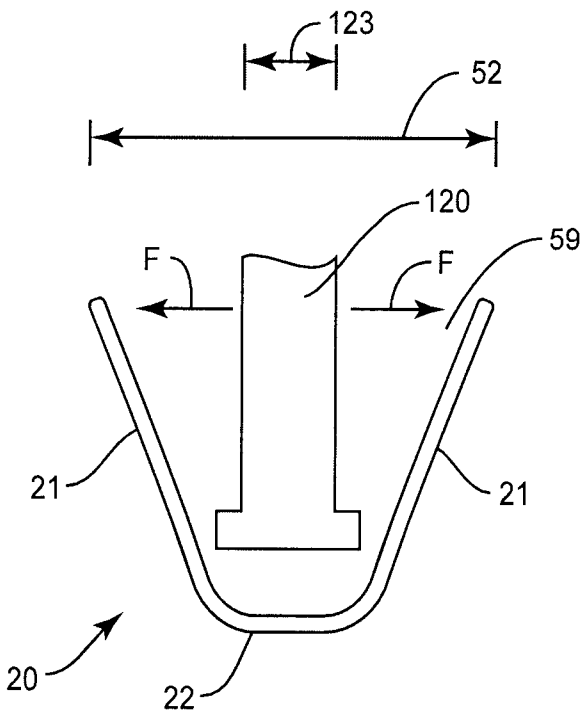


FIG. 9B

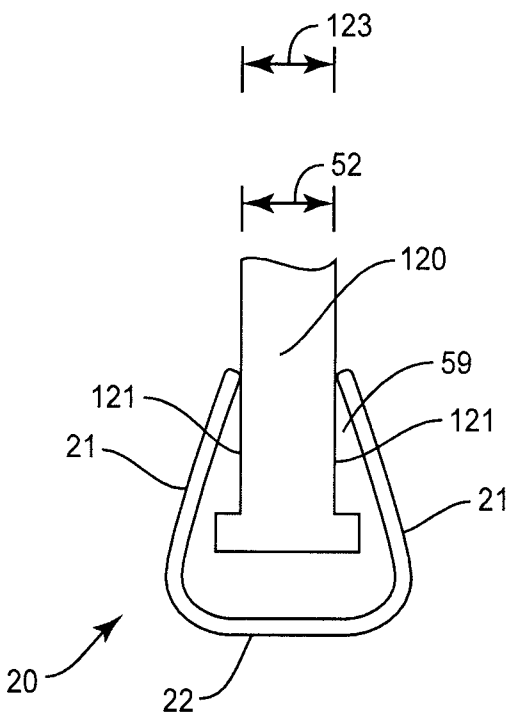


FIG. 9C

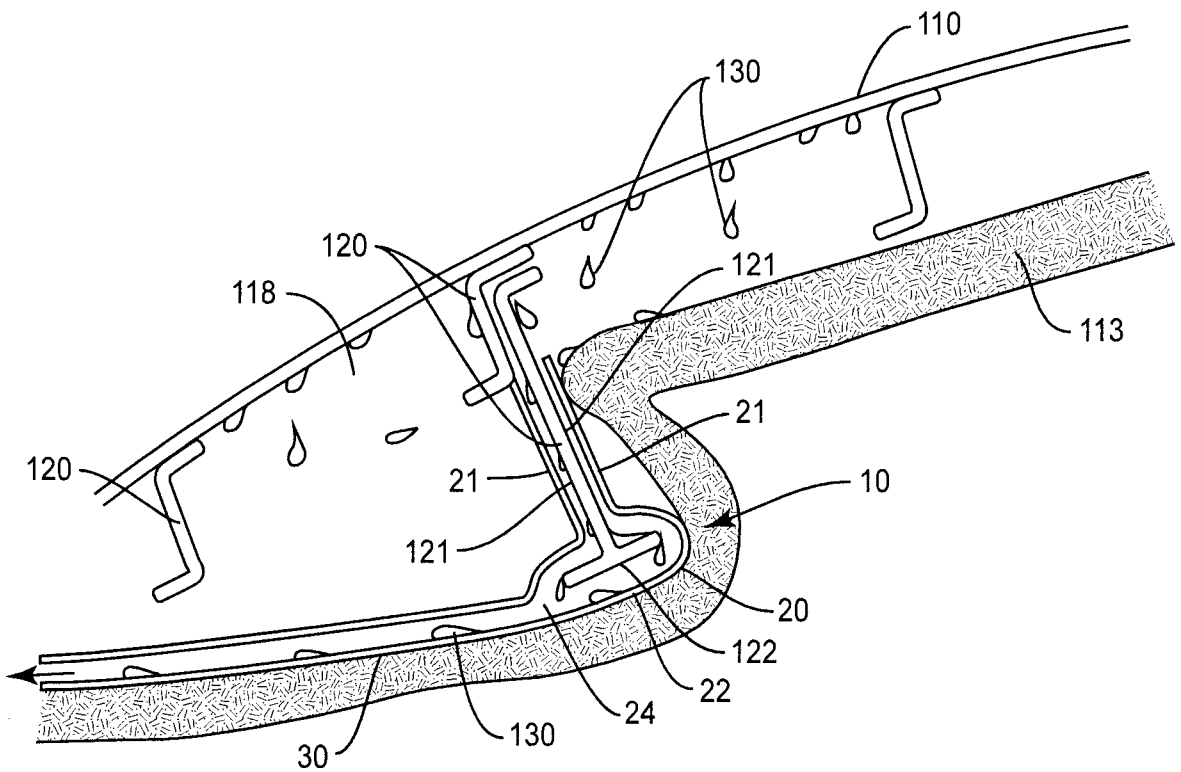


FIG. 10

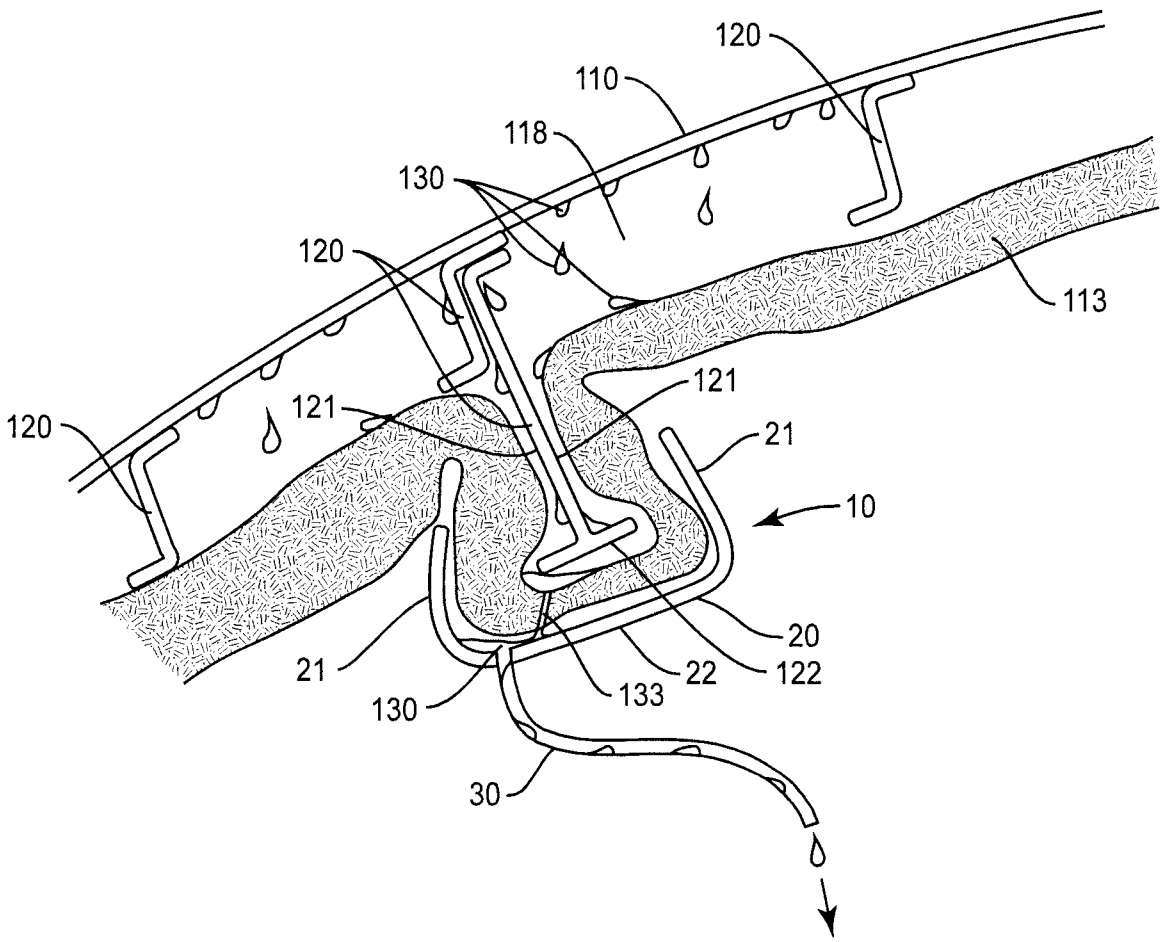
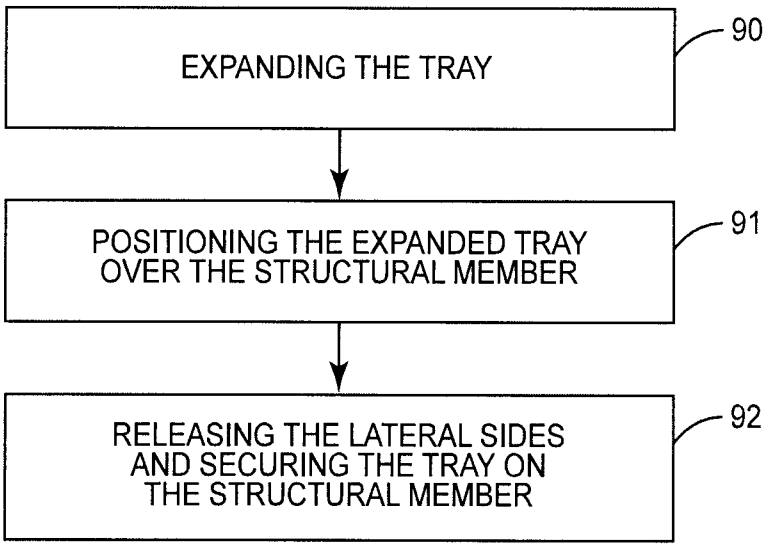


FIG. 11


EXPANDING THE TRAY
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POSITIONING THE EXPANDED TRAY OVER THE STRUCTURAL MEMBER
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RELEASING THE LATERAL SIDES AND SECURING THE TRAY ON THE STRUCTURAL MEMBER
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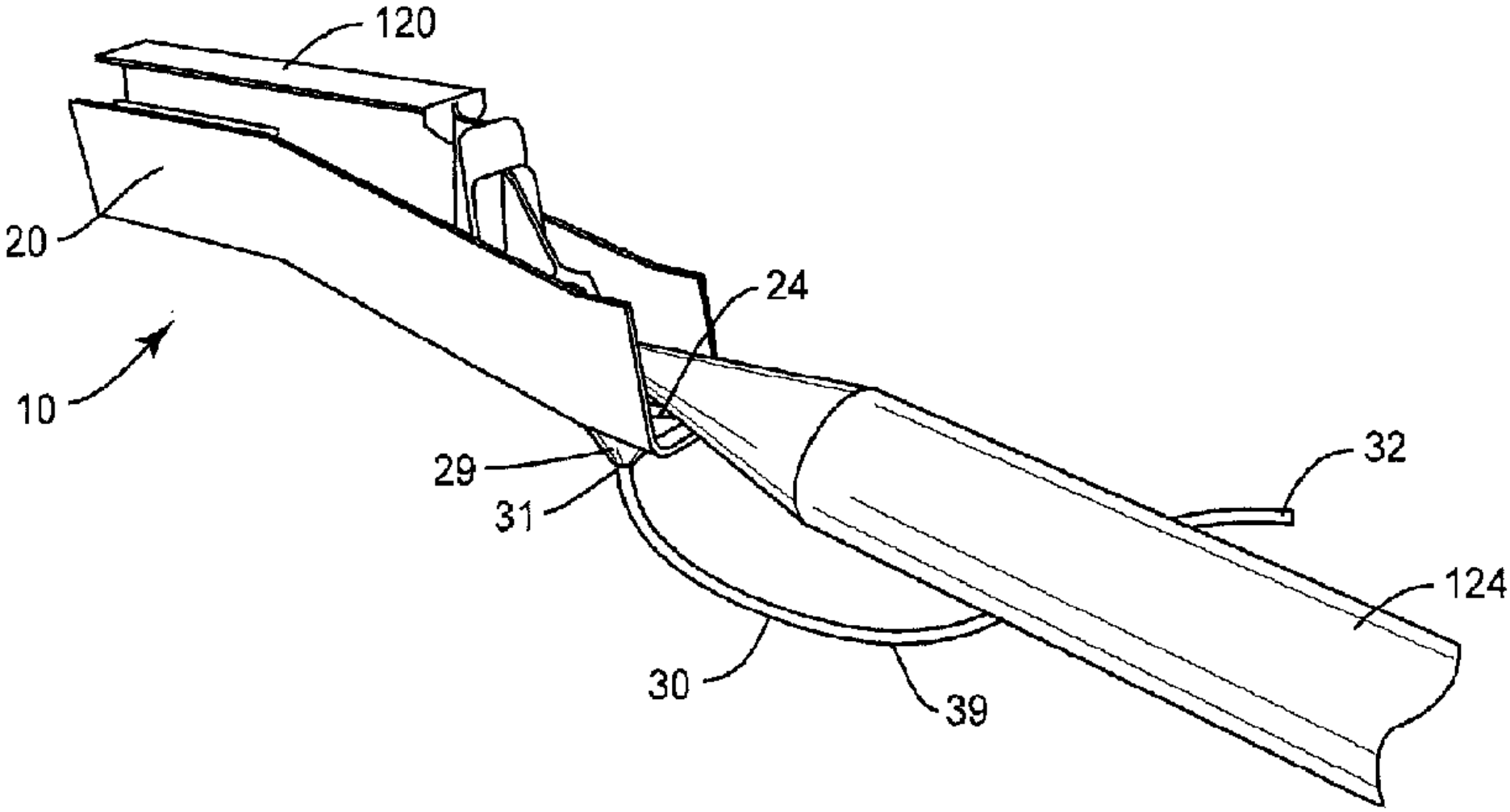
FIG. 12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