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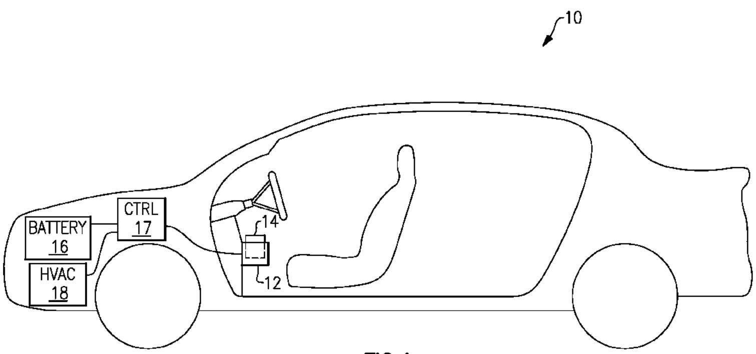

FIG.1

(57) **Abstract**: According to one aspect of the present disclosure, a beverage holder is disclosed that includes a longitudinal wall (21) and a side wall (24) that provide a beverage cavity (20) that is in fluid communication with an outlet. A first thermal device is proximate to the side wall and is configured to provide a conductive heat transfer with respect to the side wall. A second thermal device is in fluid communication with the outlet (31) and is configured to provide a convective heat transfer with respect to the beverage cavity (20) via an airflow that enters the beverage cavity (20) through the outlet (31).

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BEVERAGE HOLDER WITH CONVECTIVE AND CONDUCTIVE HEAT TRANSFER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Application No. 62/272,925, filed 12/30/2015, which is incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to beverage holders, and more particularly to a beverage holder that provides a conductive and a convective heat transfer with respect to a beverage cavity.

BACKGROUND

[0003] Beverage holders are a standard feature on most automobiles. A typical beverage holder is sized to partially receive a container (e.g., a can or bottle) that contains a beverage, such that a first portion of the container is enclosed within the beverage holder, and a second portion of the container extends outside of the beverage holder and is not enclosed. Although some beverage holders are known that provide heating or cooling, they suffer from poor performance and uneven temperate distributions in their beverages.

SUMMARY

[0004] One example embodiment of a beverage holder includes a longitudinal wall and a side wall providing a beverage cavity that is in fluid communication with an outlet. A first thermal device is proximate to the side wall and is configured to provide a conductive heat transfer with respect to the side wall. A second thermal device is in fluid communication with the outlet and is configured to provide a convective heat transfer with respect to the beverage cavity via an airflow that enters the beverage cavity through the outlet.

[0005] In another example embodiment of the above described beverage holder, the second thermal device comprises a plurality of fins that at least partially circumferentially extend along the side wall outside of the beverage cavity.

[0006] In another example embodiment of any of the above described beverage holders, the first thermal device comprises a thermoelectric device that is in a heat exchange relationship with the plurality of fins.

[0007] In another example embodiment of any of the above described beverage holders, the thermoelectric device and the plurality of fins are both secured to a thermally conductive plate

[0008] In another example embodiment of any of the above described beverage holders, the plurality of fins form a recess that receives a portion of the longitudinal wall and the side wall.

[0009] In another example embodiment of any of the above described beverage holders, the beverage holder includes a thermal transfer structure that is secured to the thermoelectric device, and an air manifold operative to divert some of the airflow to pass over the thermal transfer structure and then away from the beverage cavity.

[0010] In another example embodiment of any of the above described beverage holders, the beverage holder includes a first conduit situated within the first thermal device and in fluid communication with a heated or cooled fluid to effect the conductive heat transfer, and a second conduit that is in fluid communication with the first conduit. The plurality of fins at least partially surround the second conduit, enabling the heated or cooled fluid to heat or cool the fins as part of the convective heat transfer.

[0011] In another example embodiment of any of the above described beverage holders, the longitudinal wall comprises a longitudinal inner wall, and a longitudinal outer wall that is spaced apart from the inner wall and that, along with the inner wall, provides one or more air passages that circumferentially surround the beverage cavity. The airflow passes through the one or more air passages on its way from the second thermal device to the outlet.

[0012] In another example embodiment of any of the above described beverage holders, the inner and outer walls are generally cylindrical.

[0013] In another example embodiment of any of the above described beverage holders, the beverage holder includes a lip that extends from the outer wall, over the inner wall, and into the beverage cavity to provide the outlet from the one or more air passages into the beverage cavity.

[0014] In another example embodiment of any of the above described beverage holders, an inner diameter of the lip is less than an inner diameter of the beverage cavity.

[0015] In another example embodiment of any of the above described beverage holders, the side wall comprises a first material that is thermally conductive (e.g., metal), and the longitudinal wall comprises a second material that is different from the first material (e.g., plastic).

[0016] In another example embodiment of any of the above described beverage holders, the side wall is a bottom wall.

[0017] In another example embodiment of any of the above described beverage holders, the bottom wall is situated at a first end of the beverage cavity, and the outlet is situated proximate to an opposite second end of the beverage cavity.

[0018] In another example embodiment of any of the above described beverage holders, the second end of the beverage cavity is open.

[0019] In another example embodiment of any of the above described beverage holders, the airflow is directed into the beverage cavity from the outlet in a direction away from the second end.

[0020] An example method is disclosed of controlling a temperature of a beverage situated in a beverage cavity provided by a longitudinal wall and a side wall. The method includes conductively transferring heat with respect to the bottom wall of the beverage cavity. The method also includes convectively transferring heat with respect to the beverage cavity via airflow into the beverage cavity by directing an airflow across a plurality of fins that at least partially circumferentially extend along the side wall outside of the beverage cavity.

[0021] In another example embodiment of the above described method, the conductively transferring heat step includes powering a thermoelectric device that is proximate to the side wall, and the convectively transferring heat step includes transferring heat between the thermoelectric device and the plurality of fins.

[0022] In another example embodiment of any of the above described methods, the conductively transferring heat step includes diverting some of the airflow to pass over a thermal transfer structure and then away from the beverage cavity, and the thermal transfer structure is secured to the thermoelectric device.

[0023] In another example embodiment of any of the above described methods, the plurality of fins form a recess that receives a portion of the longitudinal wall and the side wall.

[0024] In another example embodiment of any of the above described methods, the side wall is a bottom wall.

[0025] In another example embodiment of any of the above described methods, the bottom wall is situated at a first end of the beverage cavity, and the method includes providing the airflow into the beverage cavity via an outlet proximate to an opposite second end of the beverage cavity.

[0026] In another example embodiment of any of the above described methods, conductively transferring heat includes pumping a heated or cooled fluid through a first conduit in a thermal device proximate to the bottom wall, and convectively transferring heat includes pumping the heated or cooled fluid through a second conduit that is in fluid communication with the first conduit, with the plurality of fins at least partially surrounding the second conduit.

[0027] In another example embodiment of any of the above described methods, the method includes channeling the heated or cooled fluid from a vehicle heating, ventilating, and air conditioning (HVAC) system.

[0028] The features described above, and other features, may be best understood from the following drawings and specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The present disclosure can be further understood by reference to the following detailed description when considered in connection with these accompanying drawings.

[0030] Fig. 1 schematically illustrates an example vehicle that includes a beverage holder.

[0031] Fig. 2 schematically illustrates an example beverage holder configured to provide both convective and conductive heat transfer.

[0032] Fig. 3 schematically illustrates a cutaway view of the beverage holder of Fig. 2.

[0033] Figs. 4-6 schematically illustrate a plurality of dividers that separate inner and outer walls of the beverage holder of Fig. 2.

[0034] Figs. 7-10 schematically illustrate an example embodiment in which the beverage holder of Fig. 2 includes a thermoelectric device.

[0035] Figs. 11-15 schematically illustrate an embodiment in which the beverage holder of Fig. 2 includes a conduit for receiving a heated or cooled fluid for the conductive heat transfer.

[0036] Fig. 16 schematically illustrates an example HVAC system of the vehicle of Fig. 1.

[0037] Figs. 17-18 schematically illustrate another example embodiment.

[0038] Figs. 19-21 schematically illustrate another example embodiment.

[0039] Fig. 22 is a flowchart of a method for controlling a temperature of a beverage situated in a beverage holder.

[0040] Fig. 23 schematically illustrates a dual beverage holder embodiment.

[0041] The embodiments described herein may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

DETAILED DESCRIPTION

[0042] According to one aspect of the present disclosure, a beverage holder is disclosed that includes a longitudinal wall and a side wall (e.g., a bottom wall) that provide a beverage cavity that is in fluid communication with an outlet. A first thermal device is proximate to the side wall and is configured to provide a conductive heat transfer with respect to the side wall. A second thermal device is in fluid communication with the outlet and is configured to provide a convective heat transfer with respect to the beverage cavity via an airflow that enters the beverage cavity through the outlet. In one or more embodiments, the first thermal device is situated at a first end of the beverage cavity, and the outlet is situated proximate an opposite second end of the beverage cavity. In one or more embodiments, the airflow is directed into the beverage cavity in a direction away from the second end.

[0043] Fig. 1 schematically illustrates an example vehicle 10 that includes a beverage holder 12, into which a beverage container 14 is inserted. The beverage holder 12 is operative to cool and/or heat the beverage container 14 using both convective and conductive heat transfer. The beverage holder 12 is operatively connected to a vehicle battery 16. In some embodiments, the beverage holder also utilizes a vehicle heating, ventilating, and air conditioning (HVAC) system 18. A control circuit 17 is configured to control the convective and conductive heat transfer features of the beverage holder 12 using the battery 16, and in some embodiments also using the HVAC system 18. The control circuit 17 may be operative to control the convective and/or conductive heat transfer based on a user interface presented to a driver and/or passenger, such as a knob, dial, switch, graphical user interface (GUI), or the like (not shown).

[0044] The beverage container 14 may be a cup or bottle, for example. As used herein, a “beverage” could include a liquid drink such as water, juice, tea, coffee, soda, or the like, or could include another liquid food such as a soup or some other blended or pureed food item.

[0045] Fig. 2 schematically illustrates an example beverage holder 12 configured to provide both convective and conductive heat transfer for a beverage in beverage container 14. A beverage cavity 20 is provided by a longitudinal wall 21 and a bottom wall 24 that is situated at a first end 26 of the beverage cavity 20. The beverage cavity 20 is in fluid communication with an outlet 31 (e.g., a vent). A second end 28 of the beverage holder 12, that is opposite the first end 26, is open for receiving a beverage container 14 (see Fig. 1). The beverage container may be received into the beverage cavity 20 along a central longitudinal axis L, for example. The longitudinal wall 21 includes a longitudinal inner wall 22 and a longitudinal outer wall 32. The bottom wall 24 may be composed of a first material that is thermally conductive (e.g., a metal, such as aluminum), while the inner wall 22 may be composed of a second material (e.g., plastic) that is different from the first material. Use of plastic, for example, can minimize parasitic heating/cooling of the inner wall 22 of the beverage holder 12.

[0046] The beverage holder 12 is operative to provide a conductive heat transfer with respect to the first end 26 of the beverage cavity 20, and convective heat transfer with respect to the second end 28 of the beverage cavity 20. A first thermal device 30 that is proximate to, and in contact with, the bottom wall 24 is configured to provide a conductive heat transfer with respect to the bottom wall 24. A second thermal device (e.g., comprising fins 36) is in fluid communication with the outlet 31 and is configured to provide a convective heat transfer with respect to the beverage cavity 20 via an airflow that enters the beverage cavity 20 through the outlet 31. In the example of Fig. 2, the airflow is directed into the beverage cavity 20 in a direction away from the second end 28 through the outlet 31. The airflow is shown in Fig. 2 by the arrows that are not associated with reference numerals. In one or more embodiments, the first thermal device 30 is spaced apart from the bottom wall 24, such that radiant heat exchange is used to transfer heat between the thermal device 30 and the bottom wall 24.

[0047] The longitudinal wall 21 includes a longitudinal inner wall 22 and a longitudinal outer wall 32 that is spaced apart from the longitudinal inner wall 22. In the example of Figs. 2-7, the walls 22, 32 are generally cylindrical about the central longitudinal axis L. The longitudinal wall 21 provides one or more air passages 34 that circumferentially surround the beverage cavity 20 and extend between the inner and outer walls 22, 32 (see Figs. 4-6). The airflow passes through the one or more air passages 34 on its way from the second thermal device to the outlet 31. Although only a single outlet 31 has been discussed so far, it is understood that multiple outlets could be included.

[0048] A plurality of thermally conductive fins 36 are either secured to or in fluid communication with the first thermal device 30. The airflow passes through the fins 36 before entering the beverage cavity 20. The fins 36 are situated outside of the beverage cavity 20, and in the example of Fig. 2 at least partially circumferentially extend along the first end 26 of the beverage cavity 20. In some examples (e.g., those of Figs. 11-15), the fins 36 may reside at least partially within the one or more air passages 34 and/or may at least partially wrap around the beverage cavity 20.

[0049] An air movement device 38 (e.g., a fan or blower) is operative to provide the airflow. In the example of Fig. 2, the first thermal device 30 is situated between the air movement device 38 and the bottom wall 24.

[0050] In the example of Fig. 2, the outlet 31 comprises a lip 40 that at least partially circumferentially extends around the second end 28 of the beverage cavity 20. The lip 40 extends from the outer wall 32, over the inner wall 22, and into the beverage cavity 20 to provide the outlet 31 from the one or more air passages 34 into the beverage cavity 20. In the example of Fig. 2, an inner diameter D1 of the lip 40 is less than an inner diameter D2 of the beverage cavity 20. Of course, it is understood that smaller outlets could be used (e.g., ones which only extends around a portion of the second end 28 of the beverage cavity 20.

[0051] Fig. 3 schematically illustrates a cutaway view of the beverage holder 12 of Fig. 2. Although not shown in Fig. 3, it is understood that the fins 36 could extend circumferentially around the bottom wall 24 (e.g., as shown in Figs. 11-12) alternatively or in addition to extending along the bottom wall 24.

[0052] Figs. 4-6 schematically illustrate a plurality of dividers 42 that separate the inner wall 22 and outer wall 32 of Fig. 2. In particular, the dividers 42 extend radially outward from the inner wall 22 to the outer wall 32 to form a plurality of air passages 34. Figs. 5-6 illustrate the inner wall 22 and dividers 42 without the outer wall 32. As shown in Figs. 5-6, the dividers 42 may also wrap around the bottom wall 24, and extend away from the bottom wall 24, such that each divider 42 is L-shaped. Although Fig. 4 illustrates seventeen dividers, and Fig. 6 illustrates eleven dividers, it is understood that these are only examples and that other quantities of dividers 42 and air passages 34 could be used.

[0053] Figs. 7-10 schematically illustrate an embodiment in which the first thermal device 30 of Fig. 2 is a thermoelectric device (TED) 30'. As an example, the TED 30' may be a Peltier device having opposing first and second faces, and being configured, when a voltage is applied to the Peltier device, to provide heating to the first face and to provide cooling to the second face. The TED 30' may be powered from the vehicle battery 16, for example.

[0054] As shown in Fig. 7, the beverage holder 12 also includes a thermal transfer structure 44 (e.g., a heatsink) that is thermally coupled to the TED 30', such that the TED 30' is situated between the thermal transfer structure 44 and the bottom wall 24. The thermal transfer structure 44 in Fig. 7 includes a plurality of pins 46 that extend away from the beverage cavity 20 in a direction parallel to the longitudinal axis L.

[0055] The beverage holder in Fig. 7 also includes an air manifold 48 operative to divert some of the main airflow described in Fig. 2 to pass over the thermal transfer structure 44 and then away from the beverage cavity 20. This diverted portion of the main airflow will be referred to as the "diverted airflow." Various views of this the air manifold 48 and the diverted airflow are shown in Figs. 8-9 (where the arrows not associated with a reference numeral show the diverted airflow).

[0056] The air manifold 48 includes an outer cylindrical wall 50 and an inner cylindrical wall 52. Prior to diversion, the airflow is directed within the outer cylindrical wall 50.

The air which passes between the cylindrical walls 50, 52 and enters one of a plurality of air inlets 54 is the non-diverted, main airflow. The inlets 54 direct the main airflow to pass through the fins 36, and then to pass between the longitudinal walls 22, 32 in the air passage(s) 34 and ultimately into the beverage cavity 20 at outlet(s) 31. The airflow which passes within an inner cylinder defined by inner cylindrical wall 52 is the diverted airflow that passes through the pins 46, and then through one of a plurality of channels 56 away from the beverage cavity 20.

[0057] Fig. 10 illustrates an example of the thermal transfer structure 44 which includes the pins 46 extending away from the TED 30', and which also includes fins 36 that extend away from a thermally conductive plate 58 that may be fastened and/or adhered to the bottom wall 24. Each of the TED 30' and the fins 36 are secured to the plate 58, which is operable to transfer heat between the TED 30' and the fins 36. The plate 58 may be at least partially composed of copper or aluminum, for example. The plate 58 may be mounted to the bottom wall 24, or may be a part of the bottom wall 24, for example. As shown in Fig. 10, the TED 30' is situated radially inwards from the plurality of fins 36.

[0058] Figs. 11-15 schematically illustrate an embodiment in which first thermal device 30'' includes a first conduit 60 that is situated within the thermal device 30'' and is in fluid communication with a heated or cooled fluid to effect the conductive heat transfer (see Fig. 13). A second conduit 62 is in fluid communication with the first conduit 60. The plurality of thermally conductive fins 36 at least partially surround (and may also extend radially away from) the second conduit 62, enabling the heated or cooled fluid to heat or cool the fins 36 as part of the convective heat transfer. As shown in Fig. 11, the plurality of fins 36 may form a recess 67 that receives a portion of the longitudinal wall 21 and the bottom wall 24. In the embodiment of Figs. 11-15, the fins 36 wind around at least a portion of the beverage cavity 20. The first conduit 60 connects to an inlet 64 and an outlet 66. The second conduit 62 connects to its own outlet 68, as well as the outlet of 66 of the first conduit 60. Although an example of a direction of flow for the heated or cooled fluid is shown in Figs. 11-12, it is understood that this is only an example, and that an opposite flow direction could be used.

[0059] The inlet 64 and outlet 66 connect to the thermal device 30'' via respective connectors 70, 72. In one example, the connectors 70, 72 mount to first thermal device 30'' via respective threaded connections. Fig. 14 illustrates an example of a bottom of the beverage holder

12 of Fig. 11 with the air movement device 38 removed, and Fig. 15 illustrates an example of the bottom of the beverage holder 12 of Fig. 11 with the air movement device 38 installed in the form of a fan. The first thermal device 30'' in these embodiments may be shaped as a circular disc, for example.

[0060] As discussed above, a heated or cooled fluid passes through the conduits 60, 62. The fluid may be channeled from HVAC system 18, for example. An example of such an HVAC system 18 is schematically shown in Fig. 16. The main components of the HVAC system 18 are a compressor 74, an expansion valve 76, an evaporator 78, and a condenser 80. Refrigerant circulates within conduit 82 (which may be a closed loop) between the evaporator 78 and condenser 80 sides. Each of the evaporator 78 and condenser 80 act as heat exchanger.

[0061] The evaporator 78 receives lower temperature, lower pressure refrigerant from the expansion valve 76 and causes the refrigerant to boil, which absorbs heat from ambient air and causes a cooling effect. The compressor 74 compresses the gaseous refrigerant to a high temperature, and causes the refrigerant to condense to a liquid, which provides a heating effect. The conduit 82 may be formed into respective coils 84, 86 in the evaporator 78 and condenser 80 to maximize the heat exchange, and respective fans 88, 90 may be used to pass air over the coils 84, 86 to increase an amount of heat exchange that is achieved. In one or more embodiments, the fluid that is passed through the conduits 60, 62 may be from the evaporator side 78 (if cooling is desired) or the condenser side 80 (if heating is desired). In some embodiments, the air movement device 38 includes one of the fans 88, 90.

[0062] Figs. 17-18 schematically illustrate another example embodiment that utilizes a different configuration for the second conduit 62 and fins 36. In this embodiment, the fins 36 are spaced further away from the first thermal device 30, and the air movement device 38 is a blower. Fig. 18 illustrates the beverage holder 12 of Fig. 17 from a different cross-sectional vantage point. In this embodiment the inlet 64 and outlet 66 mount to the thermal device 30'' in a direction that is transverse to the longitudinal axis L. Here too, the fluid flow could be reversed if desired.

[0063] Figs. 19-21 schematically illustrate an example embodiment in which air is recirculated within the beverage cavity 20. In this embodiment, the airflow of the convective heat exchange enters the beverage cavity 20 in a similar fashion through outlet 31 (with the outlet 31 comprising a lip 40 that is squared instead of rounded), but does not come from beneath the beverage cavity 20. Instead, the airflow enters from the side of the beverage cavity through an inlet 110 which is connected to an intake 114 within the beverage cavity. The intake guides the airflow into a passage 112 that winds along an outside of the beverage cavity 20 until it reaches outlet 31. This permits air to be recirculated within the beverage cavity. A series of thermally conductive fins 116 reside within the passage 112, and are thermally coupled to a thermal element 118 that includes fluid ports 120A, 120B for circulating a fluid (e.g., a liquid) in a conduit 122 to heat or cool the fins 116. One of the fluid ports 120A, 120B serves as a fluid inlet, and the other of the fluid ports 120A, 120B serves as a fluid outlet. In one or more embodiments, the fluid that flows in the conduit is refrigerant from HVAC system 18. A direction of airflow in the passage 112 is shown by arrows that do not have reference numerals.

[0064] Fig. 22 is a flowchart of a method 200 for controlling a temperature of a beverage situated in a beverage cavity 20 of a beverage holder 12, wherein the beverage cavity 20 is provided by a longitudinal wall 21 and a bottom wall 24. The method 200 includes conductively transferring heat with respect to the bottom wall 24 of the beverage cavity 20 (block 202). The method 200 also includes convectively transferring heat with respect to the beverage cavity 20 via airflow into the beverage cavity 20 (block 204).

[0065] In one or more embodiments, the bottom wall 24 is situated at a first end 26 of the beverage cavity 20, and the method 200 includes providing the airflow into the beverage cavity 20 via an outlet 31 proximate to an opposite second end 28 of the beverage cavity 20.

[0066] In one or more embodiments, convectively transferring heat (block 204) includes passing the airflow across a plurality of fins 36 that are heated or cooled.

[0067] In one or more embodiments, conductively transferring heat (block 202) includes pumping a heated or cooled fluid through a first conduit 60 in first thermal device 30'' that is proximate to the bottom wall 24, and convectively transferring heat (block 204) includes pumping the heated or cooled fluid through a second conduit 62 that is in fluid communication with the first conduit 60, with the plurality of fins 36 at least partially surrounding the second conduit 62. The heated or cooled fluid (e.g., refrigerant) in some examples is channeled from vehicle HVAC system 18.

[0068] In one or more embodiments, conductively transferring heat (block 202) includes powering a thermoelectric device 30' proximate to the bottom wall 24 (e.g., via vehicle battery 16), and diverting some of the airflow to pass over a thermal transfer structure 44 and then away from the beverage cavity 20, wherein the thermal transfer structure 44 is secured to the thermoelectric device 30'. The thermal transfer structure 44 may include a heatsink, for example.

[0069] Fig. 23 schematically illustrates a dual beverage holder embodiment in which convective and conductive heat transfer is provided for multiple beverage holders 12A-B. Fig. 23 is simplified in that the thermally conductive fins 36 are not illustrated. However, this dual arrangement could be applied to any of the embodiments discussed above. In the embodiments using the heated or cooled fluid (Figs. 11-15), the fluid from beverage holder 12A may flow to beverage holder 12B before returning to the vehicle HVAC system 18. In other embodiments, each beverage holder 12A-B has its own inlet and outlet lines to permit independent temperate control of respective beverages in the beverage holders 12A-B. Of course, a dual beverage holder arrangement could also be utilized for any of the other embodiments that use thermoelectric devices (e.g., those of Figs. 7-10). Separate control circuits 17 may be utilized for each beverage holder 12A-B in some embodiments.

[0070] In the example of Fig. 23, multiple air movement devices 38A-B are included (one for each beverage holder 12A-B), but a single first thermal device 30 is shared by the beverage holders 12A-B. In other embodiments this may be reversed, such that a shared fan is used, but each beverage holder 12A-B has its own first thermal device 30. The arrows in Fig. 23 that are not associated with a reference numeral indicate an airflow direction.

[0071] Each of the embodiments discussed herein can be configured to effect a warming or cooling of a beverage residing in the beverage cavity 20. This change between warming and cooling can be achieved through reversing a polarity or orientation of a Peltier device such as TED 30', or changing a temperature of the fluid that passes through conduits 60, 62, for example. In one or more embodiments, the control circuit 17 is operative to control whether the beverage holder 12 heats or cools a beverage (e.g., by reversing a polarity of TED 30', or implementing a plumbing change/re-routing that causes the thermal element 118 to circulate a heated liquid instead of a cooled liquid or vice versa) In one or more embodiments, the control circuit 17 includes, or is in communication with, a sensor that is configured to measure a current temperature of either the thermal element 30, 118 or the bottom wall 24 of the beverage cavity 20. In one or more embodiments, a user interface of the control circuit 17 enables a user to enter a desired temperature as a setpoint, and the control circuit controls the thermal device 30 and/or 118 to achieve the desired temperature.

[0072] The embodiments discussed herein provide a number of improvements over the prior art by achieving a more even temperature distribution in beverages. In prior art cooled beverage holders, beverages such as plastic bottles that extend several inches outside of a beverage holder would be very unevenly cooled with a bottom end of the beverage being considerably cooler than an upper end of the beverage residing outside of the beverage holder. The combined conductive and convective heat exchange disclosed herein can achieve a more even temperature distribution.

[0073] Although example embodiments have been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of the claims. For that reason, the following claims should be studied to determine their true scope and content.

CLAIMS

What is claimed is:

1. A beverage holder comprising:

a longitudinal wall and a side wall providing a beverage cavity that is in fluid communication with an outlet;

a first thermal device proximate to the side wall and configured to provide a conductive heat transfer with respect to the side wall; and

a second thermal device in fluid communication with the outlet and configured to provide a convective heat transfer with respect to the beverage cavity via an airflow that enters the beverage cavity through the outlet.

2. The beverage holder of claim 1, wherein the second thermal device comprises a plurality of fins that at least partially circumferentially extend along the side wall outside of the beverage cavity.

3. The beverage holder of claim 1, wherein the first thermal device comprises a thermoelectric device that is in a heat exchange relationship with the plurality of fins.

4. The beverage holder of claim 3, wherein the thermoelectric device and the plurality of fins are both secured to a thermally conductive plate.

5. The beverage holder of claim 2, wherein the plurality of fins form a recess that receives a portion of the longitudinal wall and the side wall.

6. The beverage holder of claim 2, comprising:

a thermal transfer structure that is secured to the thermoelectric device; and

an air manifold operative to divert some of the airflow to pass over the thermal transfer structure and then away from the beverage cavity.

7. The beverage holder of claim 2, comprising:

a first conduit situated within the first thermal device and in fluid communication with a heated or cooled fluid to effect the conductive heat transfer; and

a second conduit that is in fluid communication with the first conduit, wherein plurality of fins at least partially surround the second conduit, enabling the heated or cooled fluid to heat or cool the fins as part of the convective heat transfer.

8. The beverage holder of claim 1, wherein the longitudinal wall comprises:

a longitudinal inner wall; and

a longitudinal outer wall that is spaced apart from the inner wall and that, along with the inner wall, provides one or more air passages that circumferentially surround the beverage cavity, wherein the airflow passes through the one or more air passages on its way from the second thermal device to the outlet.

9. The beverage holder of claim 8, wherein the inner and outer walls are generally cylindrical.

10. The beverage holder of claim 9, comprising a lip that extends from the outer wall, over the inner wall, and into the beverage cavity to provide the outlet from the one or more air passages into the beverage cavity.

11. The beverage holder of claim 10, wherein an inner diameter of the lip is less than an inner diameter of the beverage cavity.

12. The beverage holder of claim 1, wherein the side wall comprises a first material that is thermally conductive, and the longitudinal wall comprises a second material that is different than the first material.

13. The beverage holder of claim 12, wherein the first material comprises metal, and the longitudinal wall comprises plastic.

14. The beverage holder of claim 1, wherein the side wall is a bottom wall.

15. The beverage holder of claim 14, wherein the bottom wall is situated at a first end of the beverage cavity, and the outlet is situated proximate to an opposite second end of the beverage cavity.

16. The beverage holder of claim 15, wherein the second end of the beverage cavity is open.

17. The beverage holder of claim 15, wherein the airflow is directed into the beverage cavity from the outlet in a direction away from the second end.

18. A method of controlling a temperature of a beverage situated in a beverage cavity provided by a longitudinal wall and a side wall, the method comprising:

conductively transferring heat with respect to the side wall of the beverage cavity; and

convectively transferring heat with respect to the beverage cavity via airflow into the beverage cavity by directing an airflow across a plurality of fins that at least partially circumferentially extend along the side wall outside of the beverage cavity.

19. The method of claim 17:

wherein the conductively transferring heat step comprises powering a thermoelectric device that is proximate to the side wall; and

wherein the convectively transferring heat step comprises transferring heat between the thermoelectric device and the plurality of fins.

20. The method of claim 19, wherein the conductively transferring heat step comprises:

diverting some of the airflow to pass over a thermal transfer structure and then away from the beverage cavity, wherein the thermal transfer structure is secured to the thermoelectric device.

21. The method of claim 18, wherein the plurality of fins form a recess that receives a portion of the longitudinal wall and the side wall.

22. The method of claim 18, wherein the side wall is a bottom wall.

23. The method of claim 22, wherein the bottom wall is situated at a first end of the beverage cavity, the method comprising:

providing the airflow into the beverage cavity via an outlet proximate to an opposite second end of the beverage cavity.

24. The method of claim 18:

wherein the conductively transferring heat step comprises pumping a heated or cooled fluid through a first conduit in a thermal device proximate to the bottom wall; and

wherein the convectively transferring heat step comprises pumping the heated or cooled fluid through a second conduit that is in fluid communication with the first conduit, the plurality of fins at least partially surrounding the second conduit.

25. The method of claim 24, comprising:

channeling the heated or cooled fluid from a vehicle heating, ventilating, and air conditioning (HVAC) system.

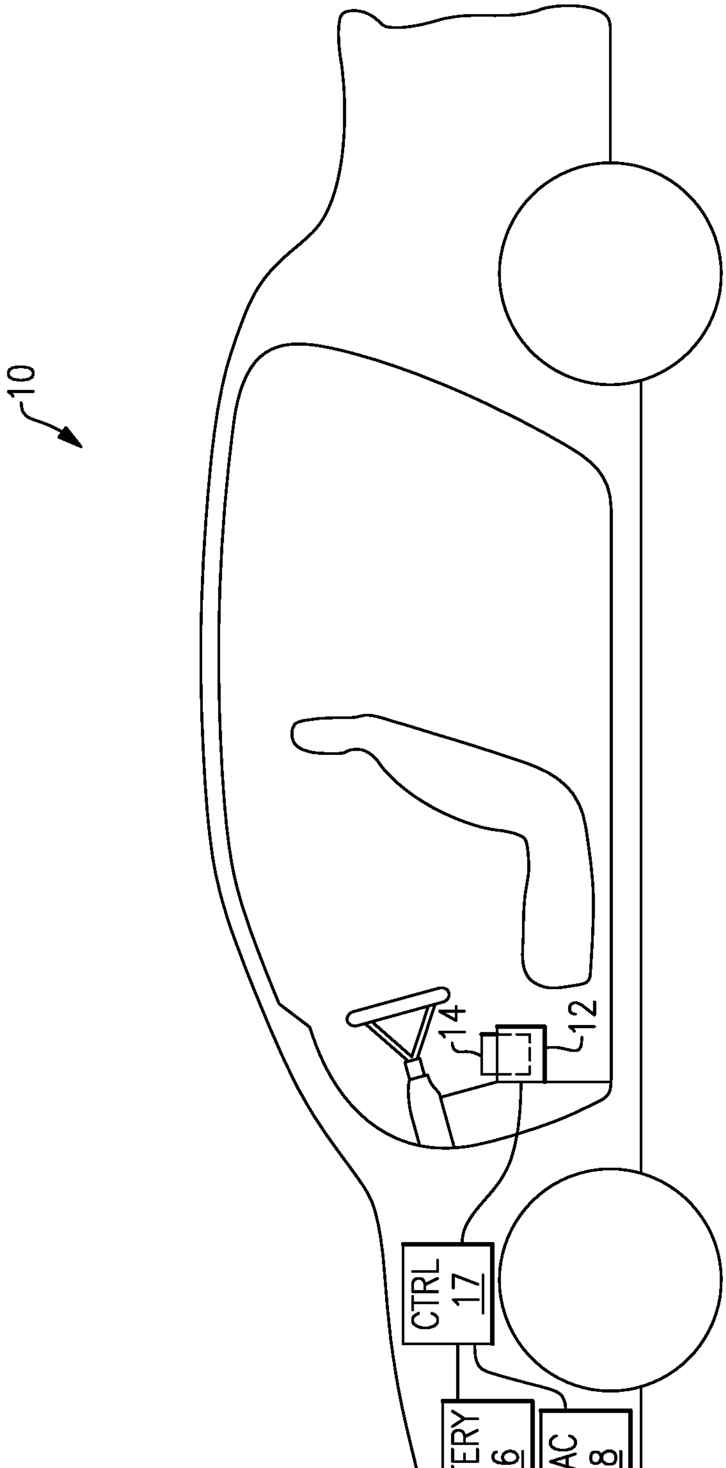

FIG.1

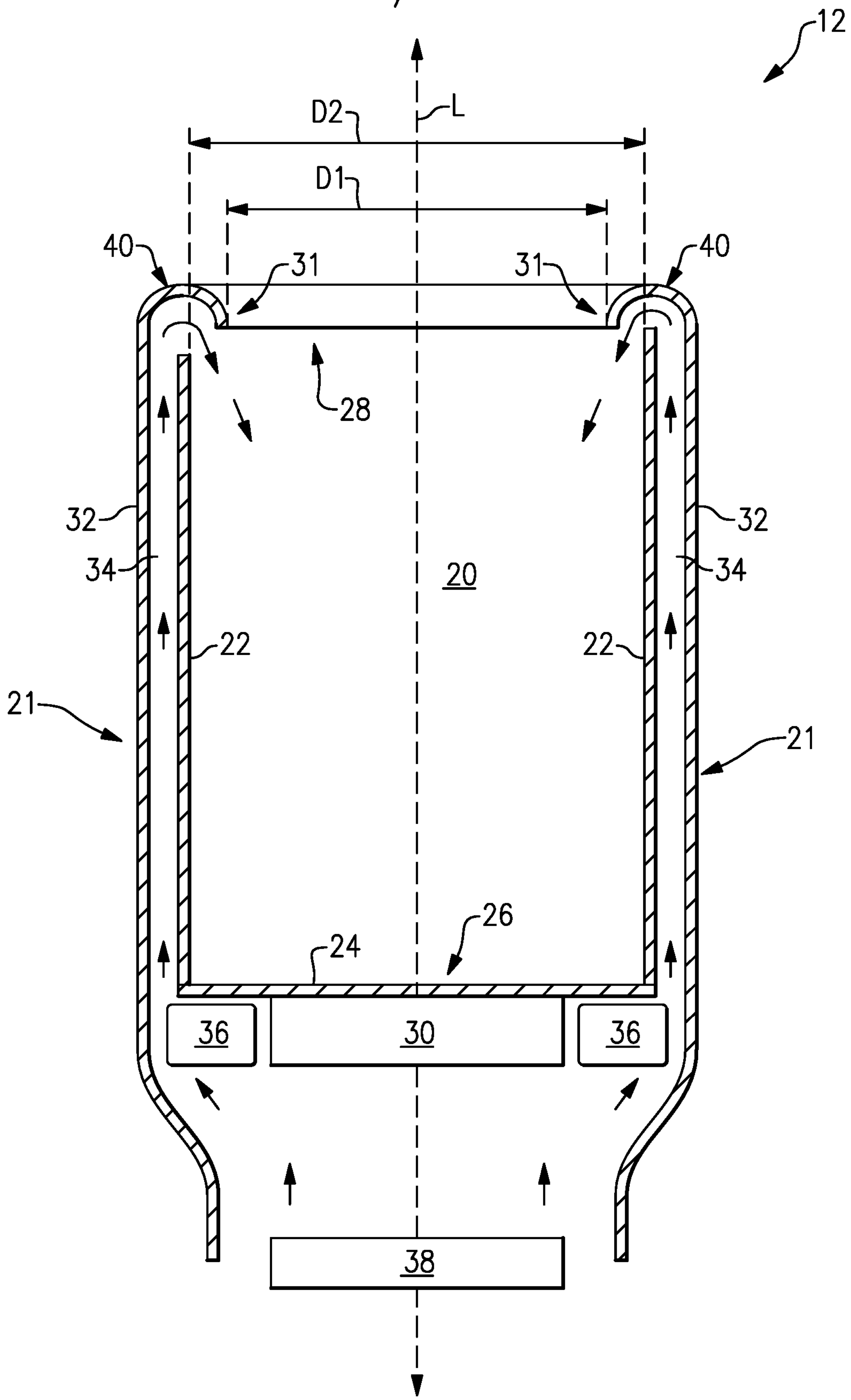

FIG.2

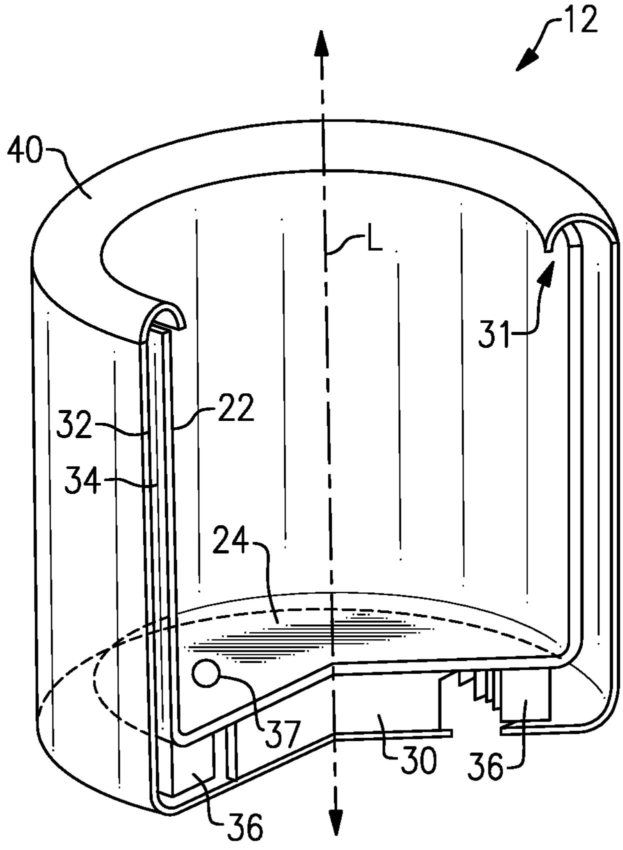

FIG.3

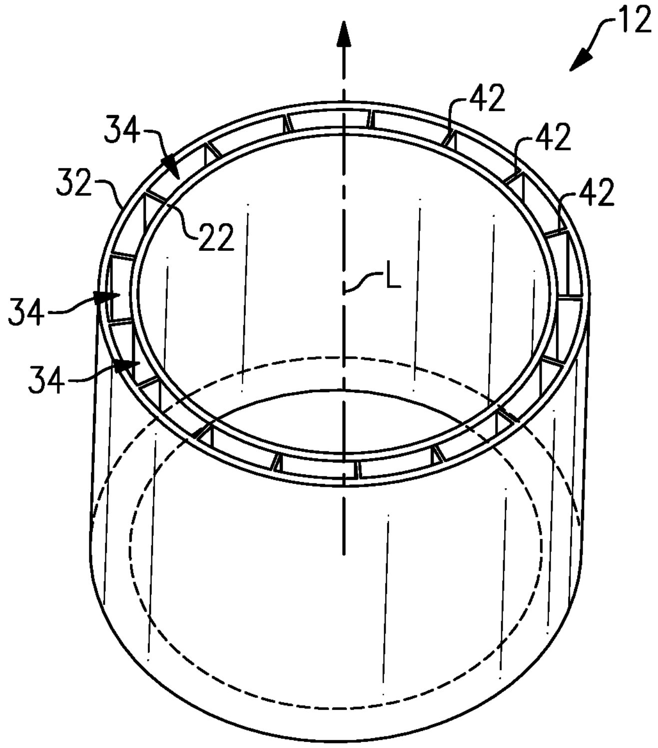

FIG.4

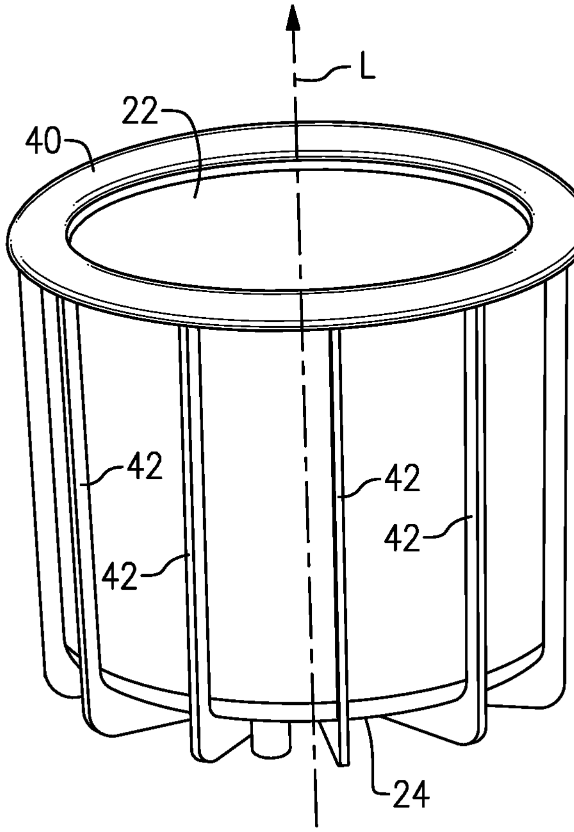

FIG.5

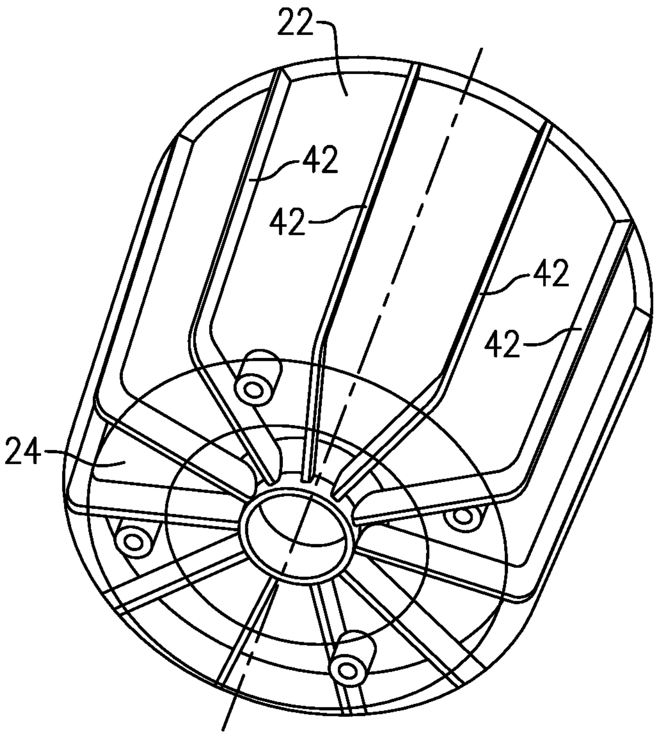

FIG.6

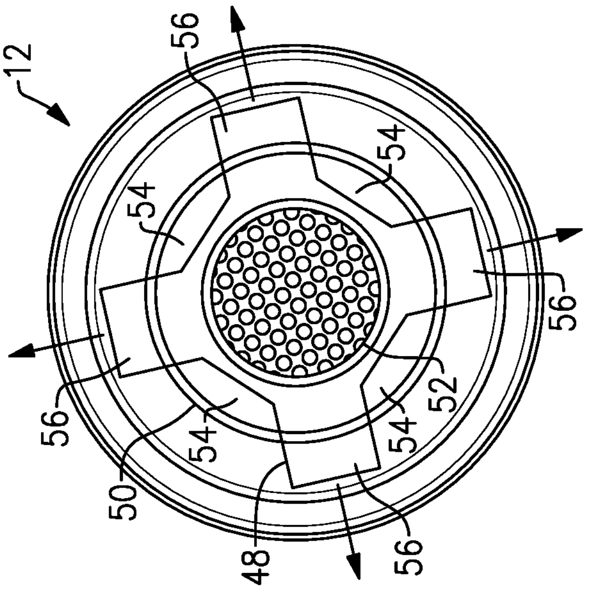

FIG.8

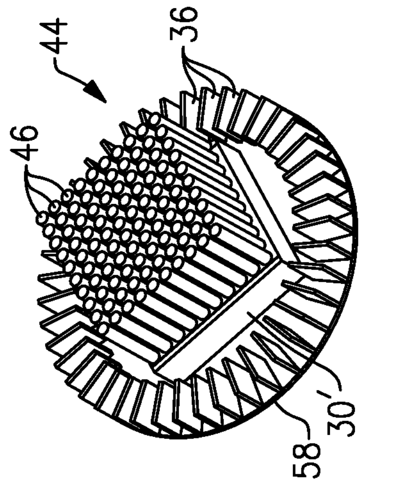

FIG.10

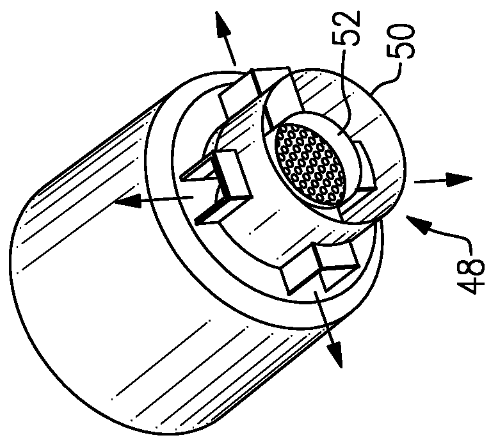

FIG.9

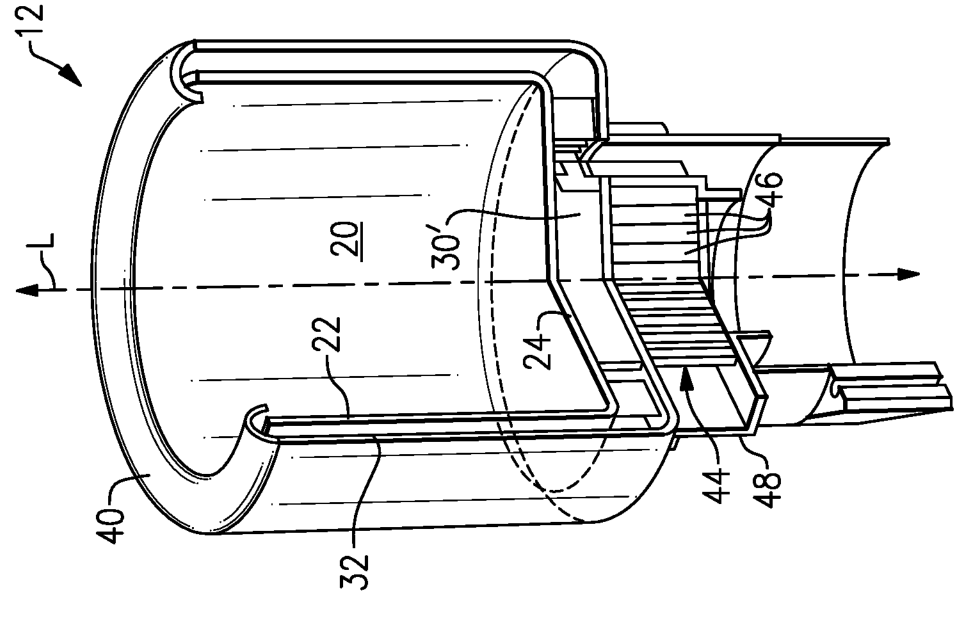

FIG.7

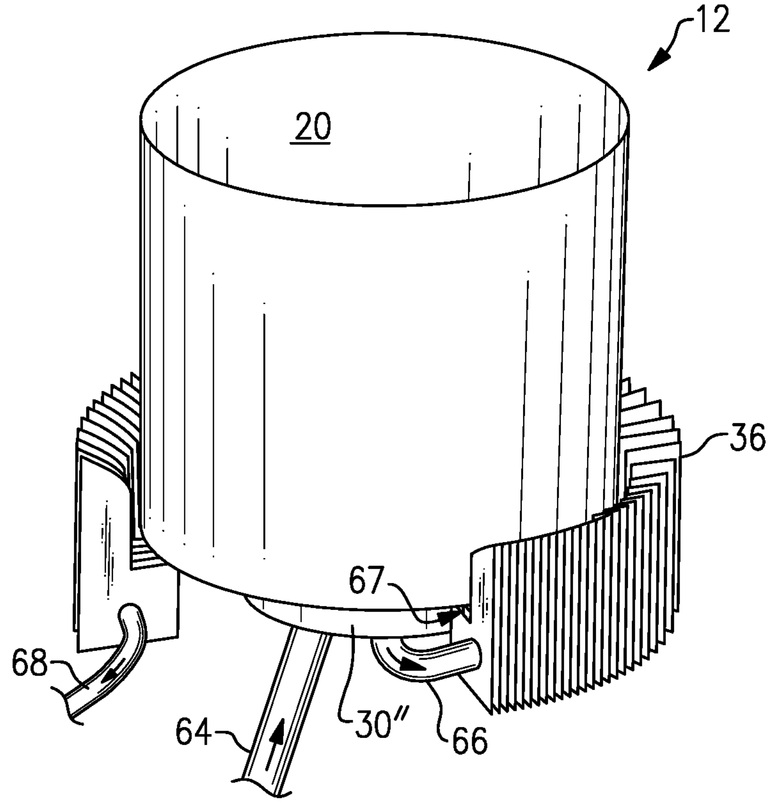

FIG.11

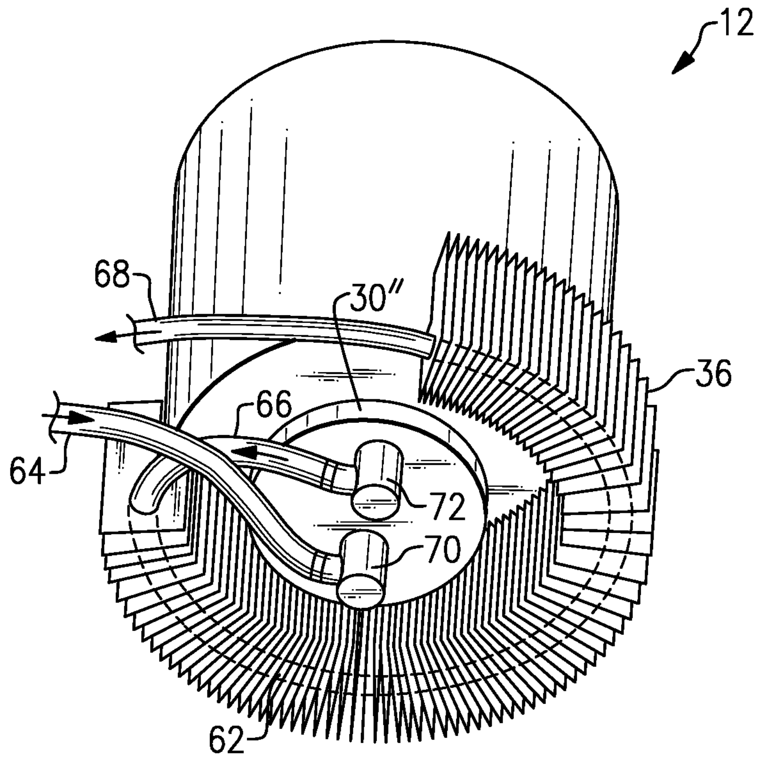

FIG.12

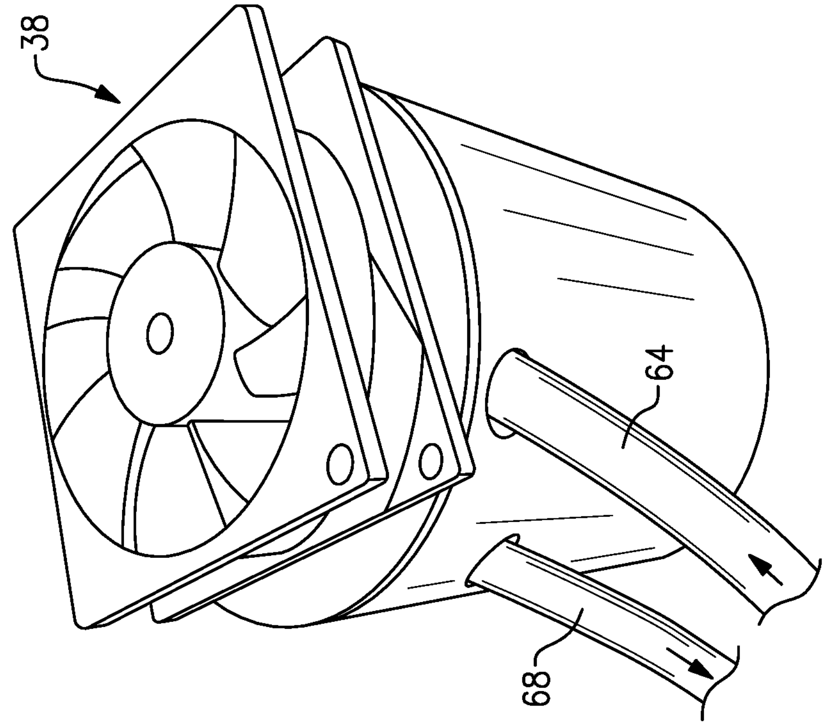

FIG.15

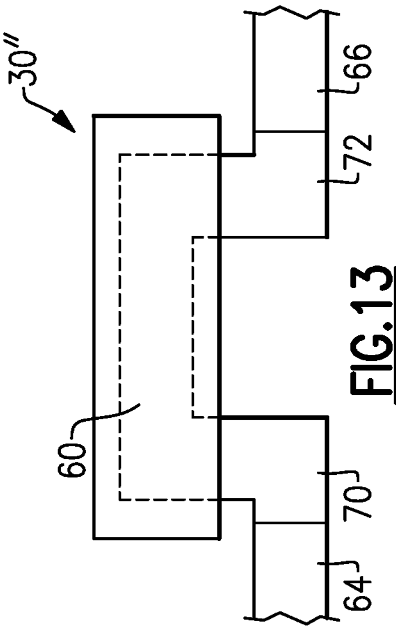

FIG.13

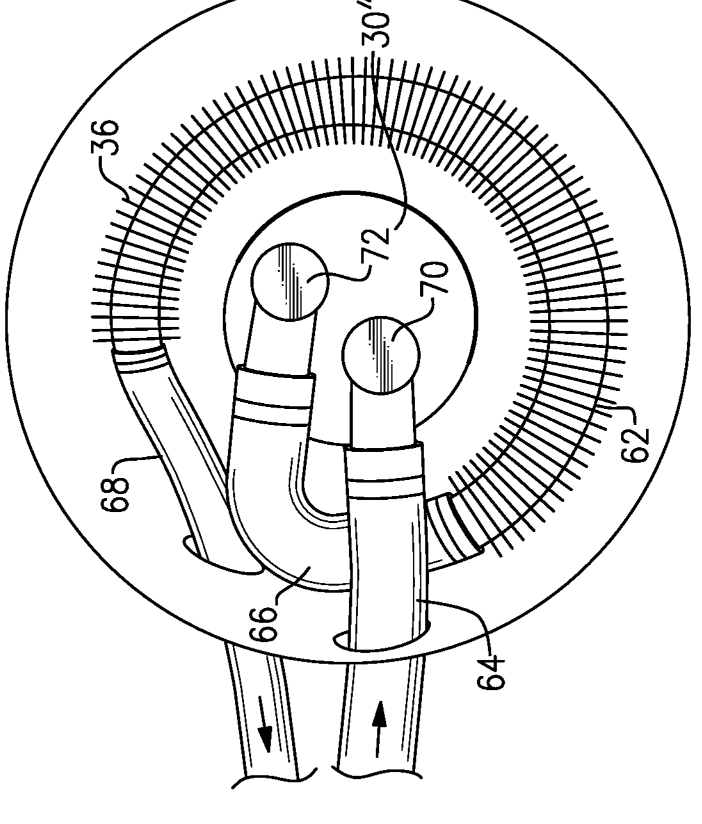

FIG.14

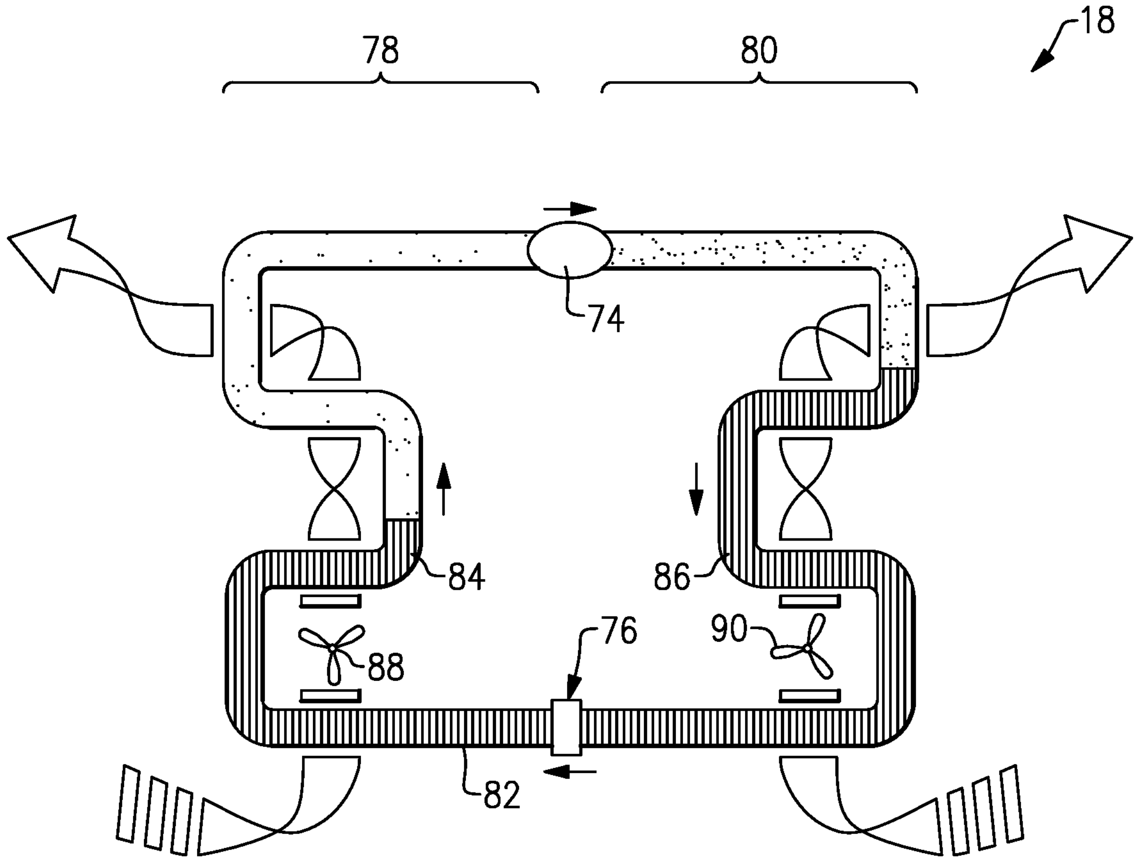

FIG.16

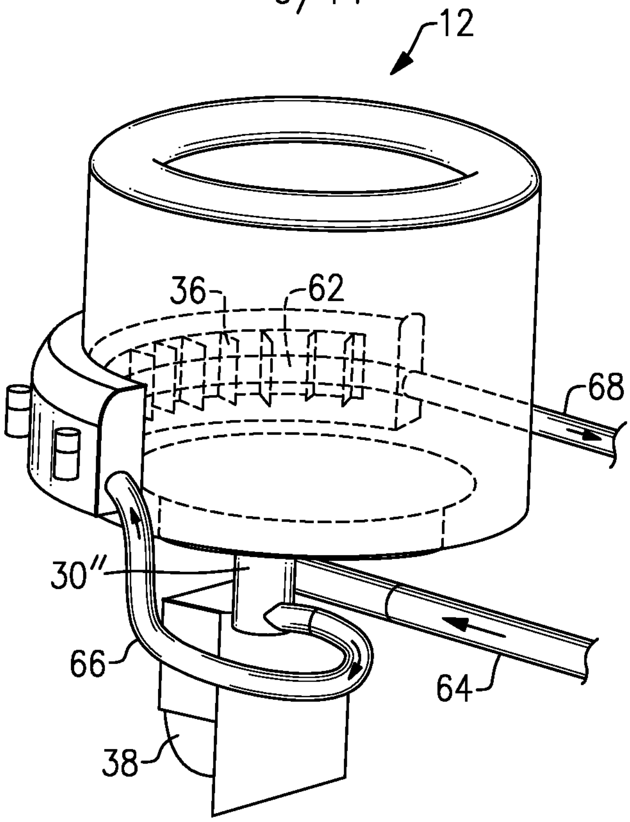

FIG.17

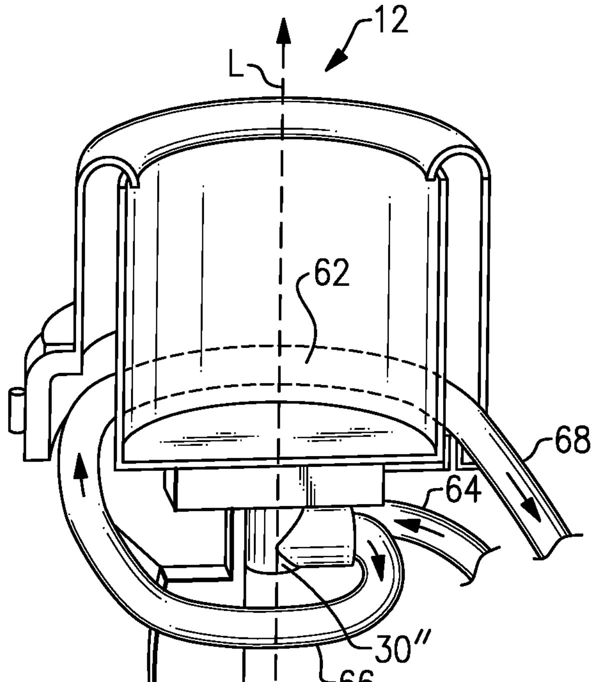

FIG.18

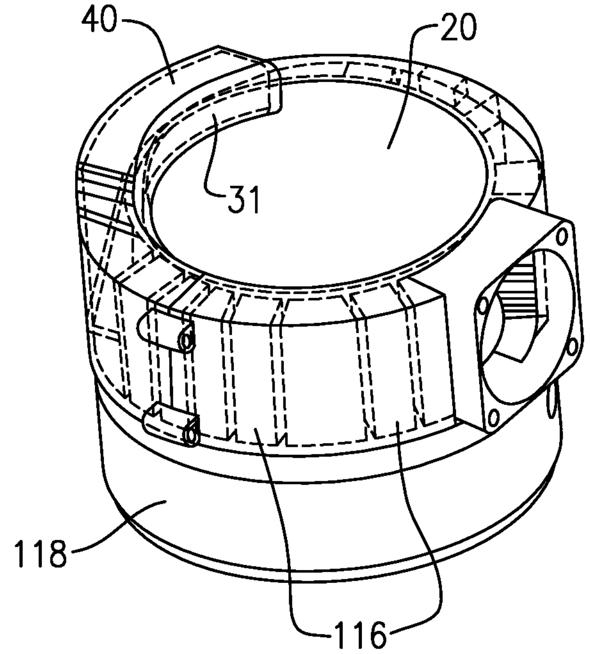

FIG.19

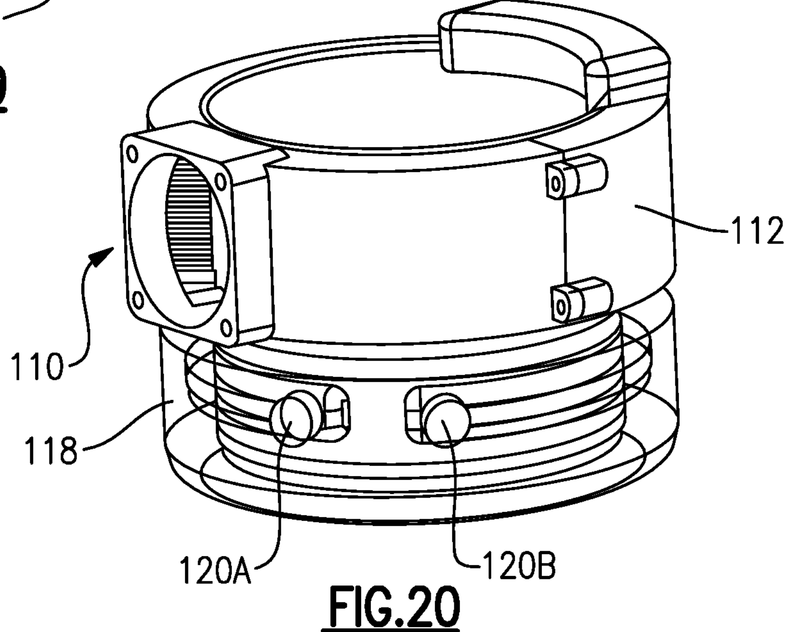

FIG.20

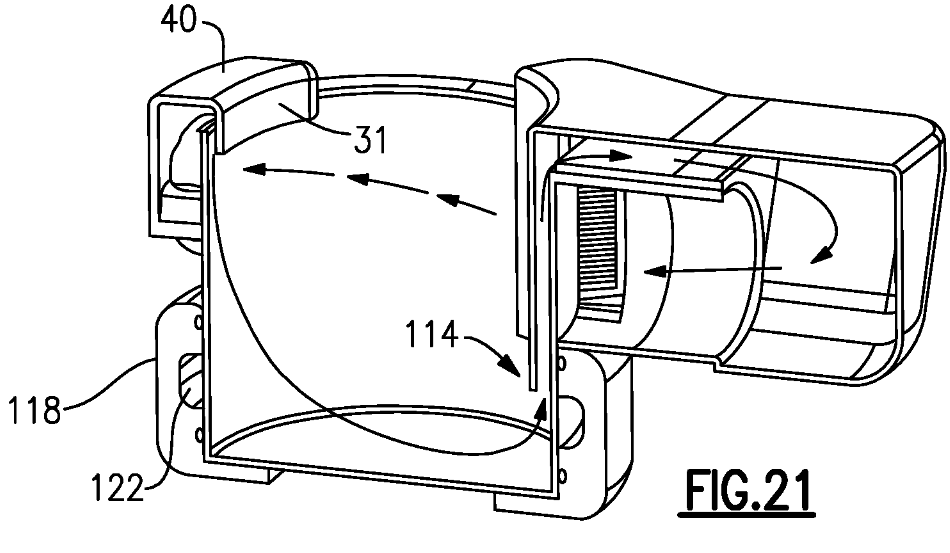

FIG.21

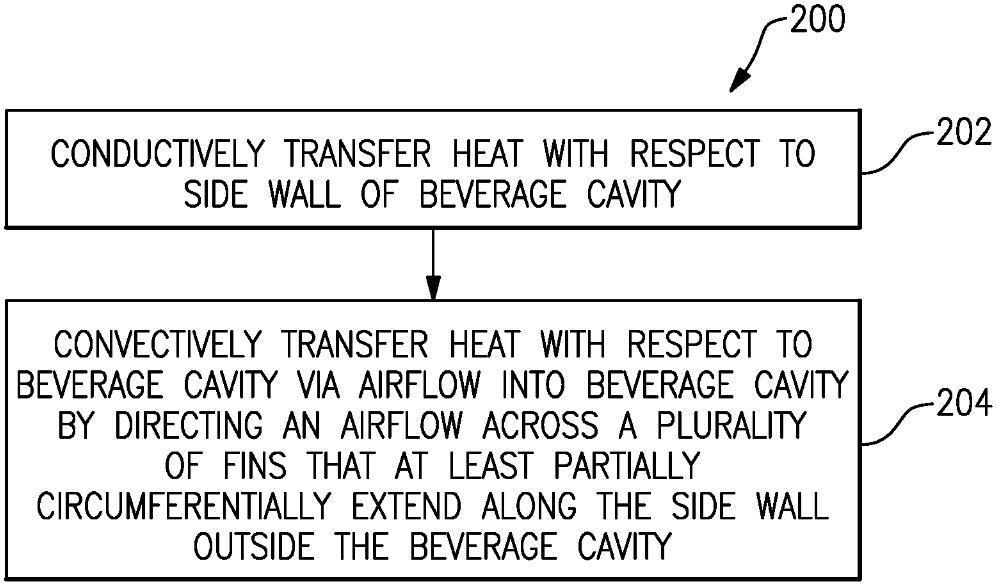
200
CONDUCTIVELY TRANSFER HEAT WITH RESPECT TO SIDE WALL OF BEVERAGE CAVITY
202
CONVECTIVELY TRANSFER HEAT WITH RESPECT TO BEVERAGE CAVITY VIA AIRFLOW INTO BEVERAGE CAVITY BY DIRECTING AN AIRFLOW ACROSS A PLURALITY OF FINS THAT AT LEAST PARTIALLY CIRCUMFERENTIALLY EXTEND ALONG THE SIDE WALL OUTSIDE THE BEVERAGE CAVITY
204

FIG.22

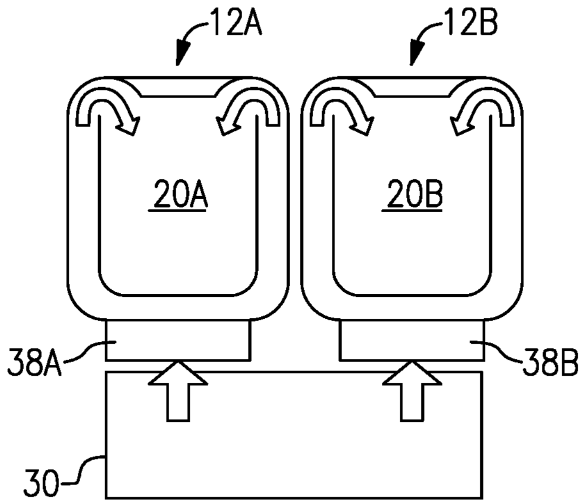
12A
12B
20A
20B
38A
38B
30

FIG.23

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/067933

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60N3/10
ADD.

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)
B60N

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	GB 2 335 307 A (ROVER GROUP [GB]) 15 September 1999 (1999-09-15)	1-23
A	the whole document	24,25
X	US 2015/175046 A1 (OH MAN JU [KR] ET AL) 25 June 2015 (2015-06-25)	1-23
Y	the whole document	24,25
X	DE 10 2014 111541 A1 (HYUNDAI MOTOR CO LTD [KR]) 18 June 2015 (2015-06-18)	1-23
Y	the whole document	24,25
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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
14 March 2017	23/03/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	González Dávila, J

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	the whole document	24,25

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Y	the whole document	24,25

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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

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