



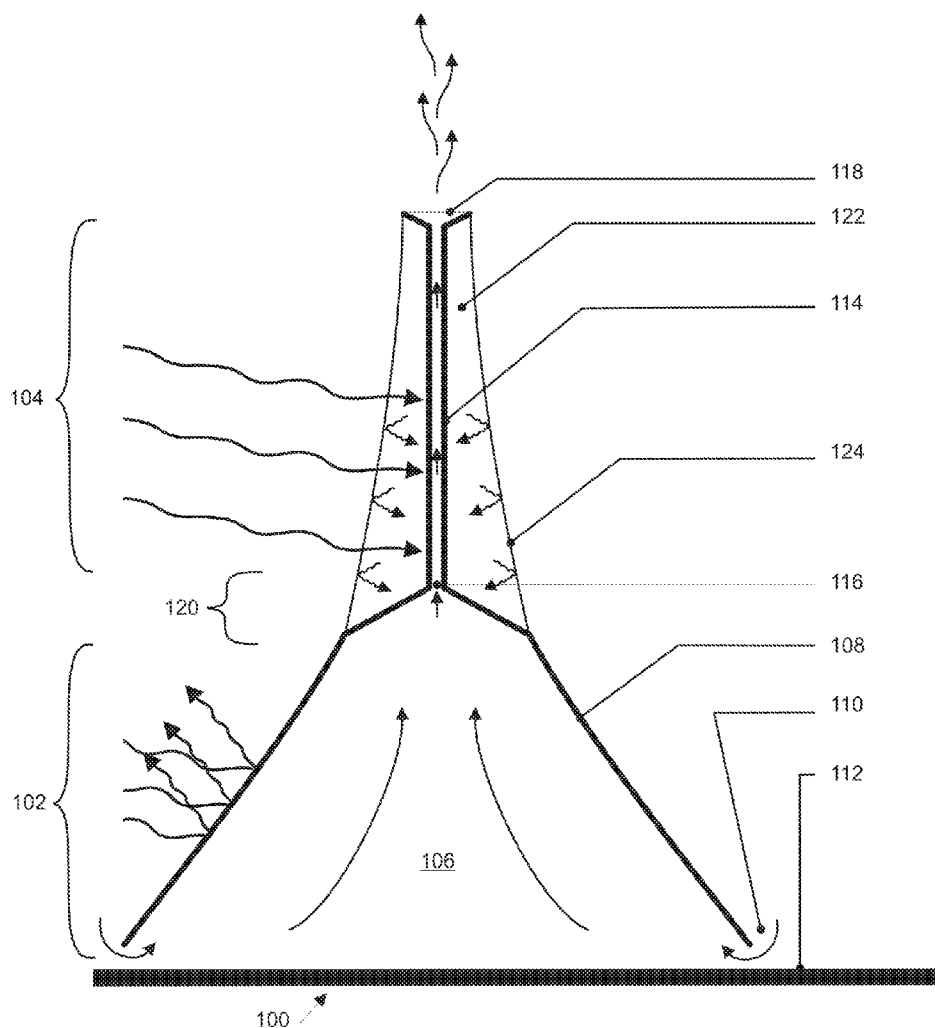
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(19) **United States**(12) **Patent Application Publication**
Miller(10) **Pub. No.: US 2010/0200034 A1**(43) **Pub. Date: Aug. 12, 2010**(54) **VENTILABLE PORTABLE STRUCTURE
ASSEMBLY****Publication Classification**(76) Inventor: **Austen Miller**, Hampshire (GB)Correspondence Address:
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HOUSTON, TX 77208-1389 (US)(51) **Int. Cl.**
E04H 15/16 (2006.01)(52) **U.S. Cl.** **135/94**(57) **ABSTRACT**

A ventilable portable structure arrangement is transformable between a collapsed state and an erected state. The assembly comprises a first portion (102) of foldable material arranged to define, when in the erected state, an interior chamber (106). A second portion (104) of foldable material is also provided and arranged to define, when in the erected state, a thermal chimney having an inlet (116) at one end thereof and an outlet (118) at another end thereof. The first and second portions (102, 104) are arranged so as to permit, when in the erected state, flow of air through the interior chamber (106) into the thermal chimney via the inlet (116) in response to heating of air substantially passing through the thermal chimney, the air entering the thermal chimney being expelled from the thermal chimney via the outlet (118).

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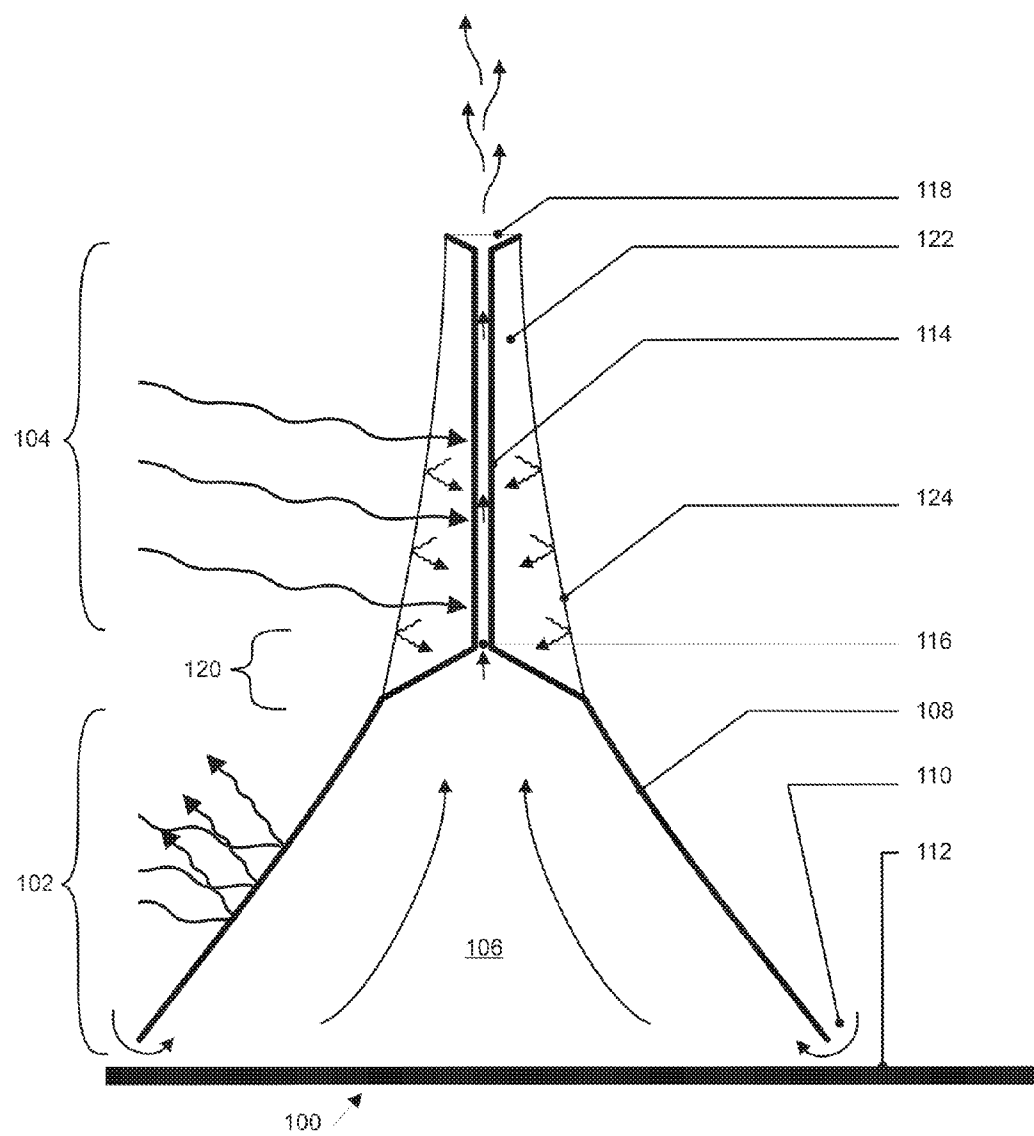


Figure 1

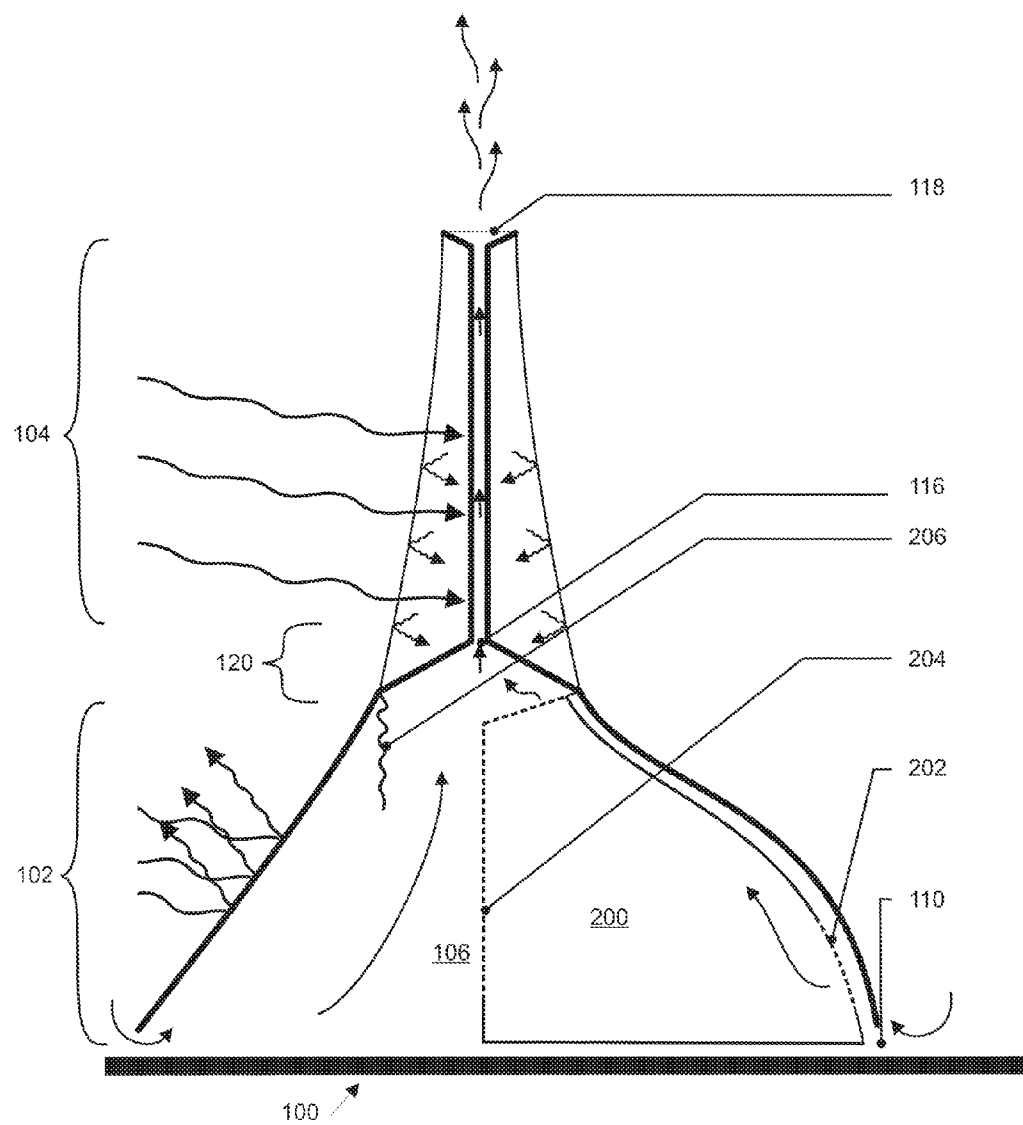


Figure 2

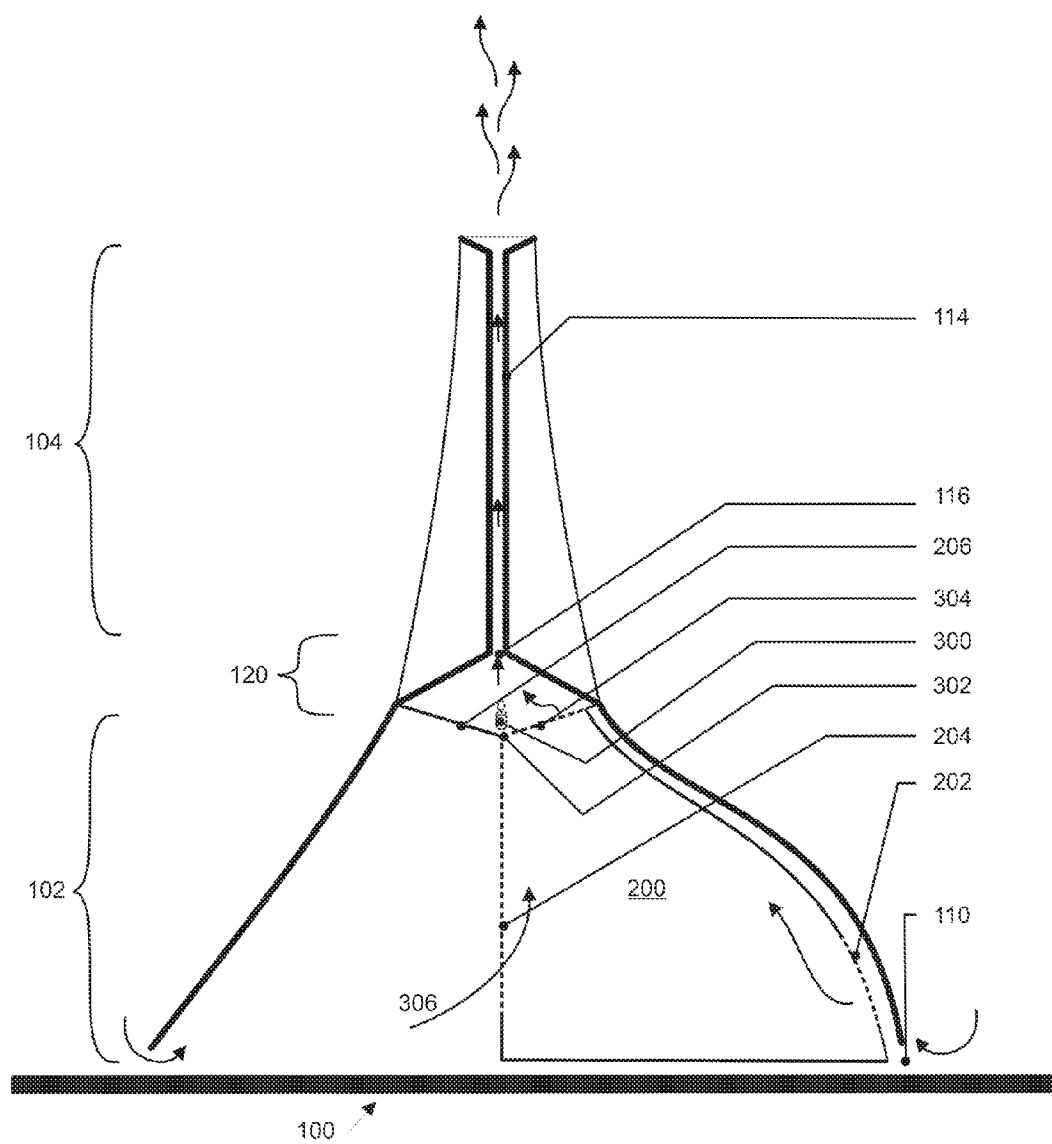


Figure 3

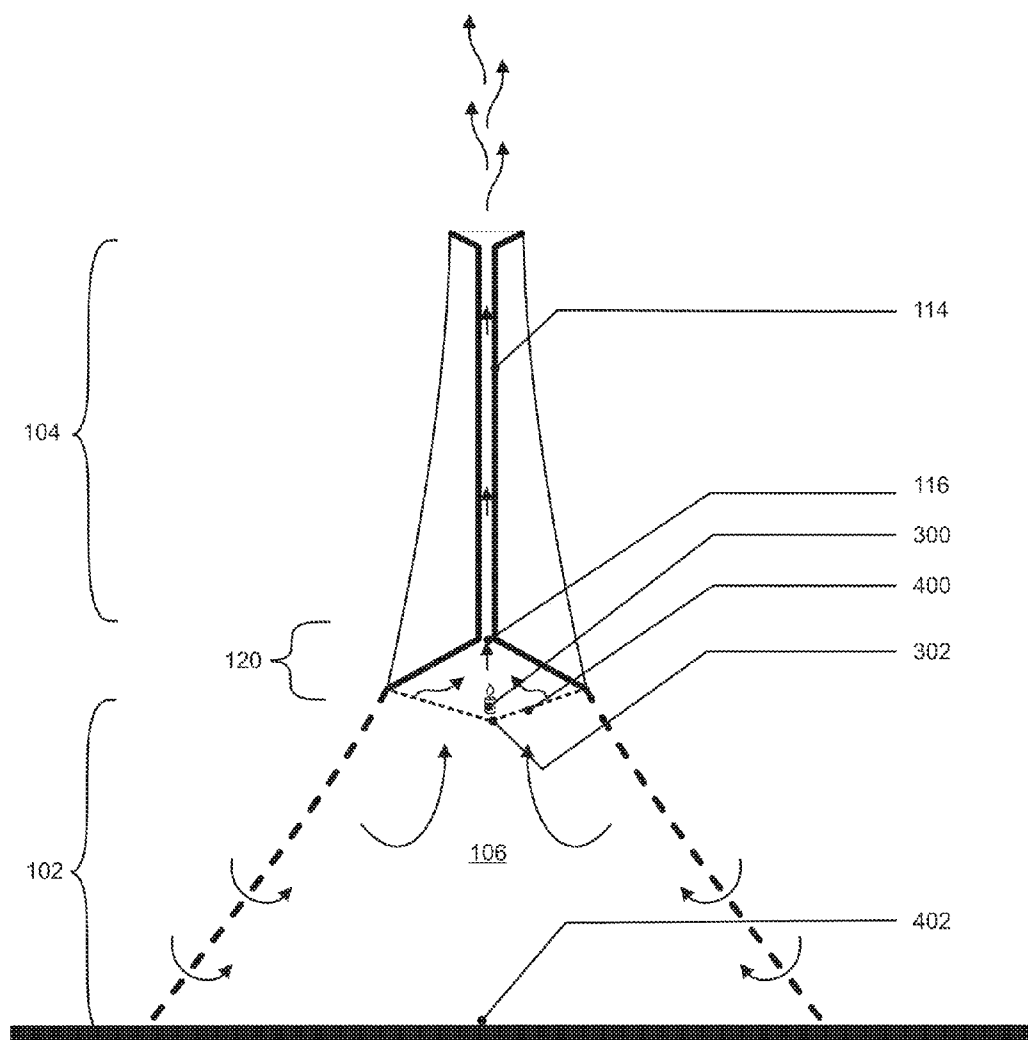


Figure 4

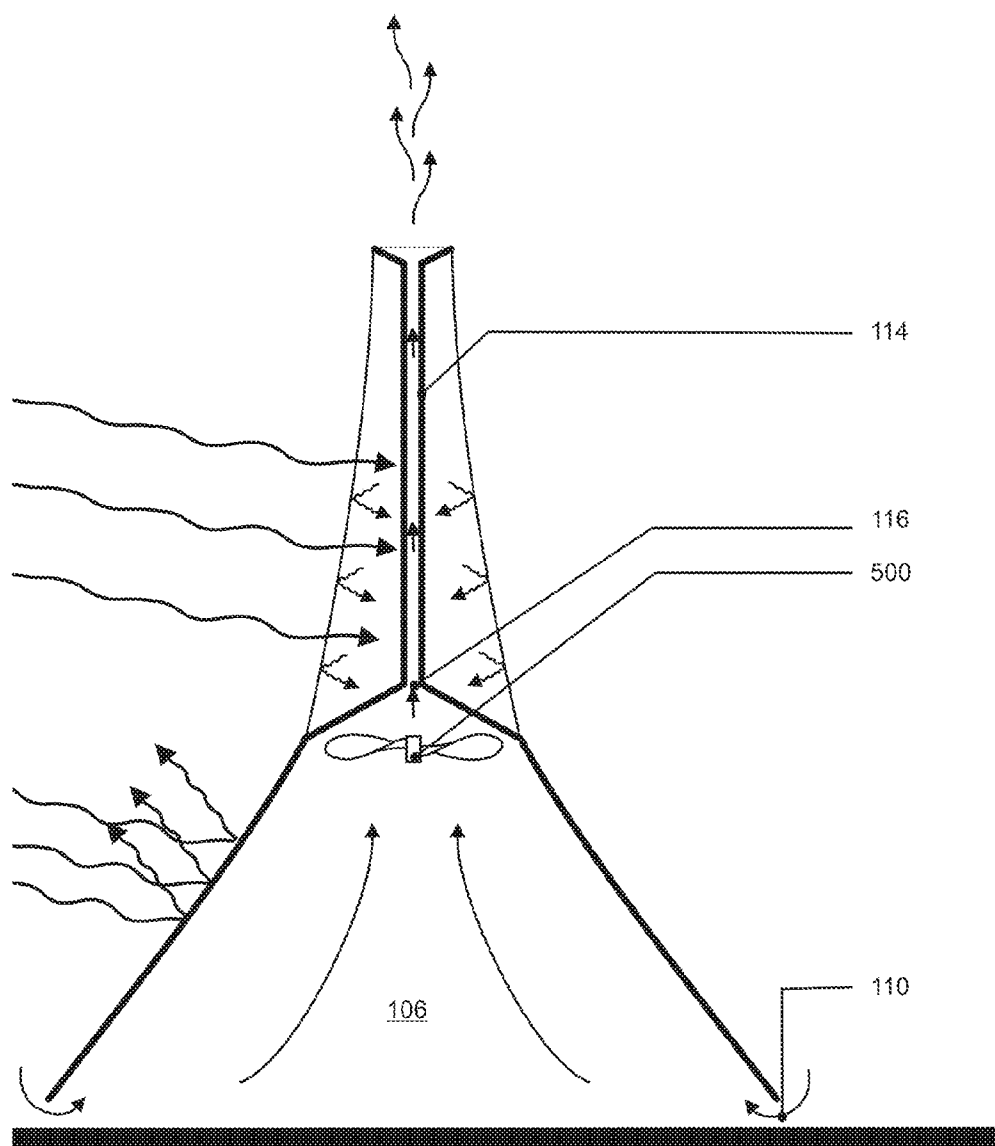


Figure 5

VENTILABLE PORTABLE STRUCTURE ASSEMBLY

[0001] The present invention relates to a ventilable portable structure of the type that, for example, is used as a temporary shelter for an individual, such as a camper.

[0002] In the field of tent design, it is desirable to cool an interior of a tent, particularly where the tent is suitable for use in hot climates. In this respect, it is known to provide a tent with a vent in an attempt to permit air in the tent to circulate and change. However, the use of the vent fails to achieve a sufficient degree of air circulation when there is no breeze or wind external to the tent. Consequently, occupants of the tent endure discomfort in hot weather conditions.

[0003] A similar kind of problem exists in some countries where it is desirable to sleep in a space bounded by a "mosquito net" in order to protect an inhabitant within the space from insect bites, particularly mosquito bites. Unfortunately, the presence of the mosquito net serves to impede airflow within the space it bounds and so air moving in a room in which the mosquito net is deployed is not enjoyed within the space, causing the inhabitant to feel hot and uncomfortable. As a result of this sub-optimal cooling within the space, it has been known for the inhabitant to open the mosquito net or even completely remove the protection of the mosquito net, thereby exposing the inhabitant to mosquitoes and other biting insects and also to disease, for example, in the event that mosquitoes in the locality are carrying malaria parasites.

[0004] According to a first aspect of the present invention, there is provided a ventilable portable structure assembly transformable between a collapsed state and an erected state, the assembly comprising a first portion of foldable material arranged to define, when in the erected state, an interior chamber and a second portion of foldable material arranged to define, when in the erected state, a thermal chimney having an inlet at one end thereof and an outlet at another end thereof; wherein the first and second portions are arranged so as to permit, when in the erected state, flow of air through the interior chamber into the thermal chimney via the inlet in response to heating of air substantially passing through the thermal chimney, the air entering the thermal chimney being expelled from the thermal chimney via the outlet.

[0005] A proportion of the air entering the thermal chimney via the inlet may be heated prior to entering the thermal chimney. The thermal chimney may comprise a conduit joining the inlet to the outlet.

[0006] The second portion may be further arranged to define an insulating space adjacent the conduit. The insulating space may substantially surround the conduit. The insulating space may be thermally coupled to the conduit.

[0007] The conduit may be arranged to conduct heat. The conduit may be formed from a heat-conducting material or coated with a heat conducting material. For example, the exterior of the conduit may comprise a pigment conducive to conduction of heat, such as a black colour.

[0008] The insulating space may be inflatable. The insulating space may be filled with a gas.

[0009] The insulating space may be peripherally bounded by a layer of substantially unidirectionally heat-transmissive material. The layer of substantially unidirectionally heat-transmissive material may allow heat to pass therethrough

toward the conduit and impede escape of heat from the insulating space though the layer of substantially unidirectionally heat-transmissive material.

[0010] The interior chamber may have a ventilation inlet. The ventilation inlet may be disposed, when in the erected state, towards a lowermost part of the first portion.

[0011] The interior chamber may comprise a further chamber therein. The further chamber may be used for habitation therein. The further chamber may be formed from foldable material.

[0012] The further chamber may comprise a first reticulated region. The first reticulated region may be disposed opposite the ventilation inlet.

[0013] The foldable material forming the further chamber may be reticulated at least in part.

[0014] The further chamber may comprise a second reticulated region for preventing ingress of an insect into the further chamber. The second reticulated region may serve as a further outlet to permit air flow through the further chamber.

[0015] The assembly as may further comprise a throttle disposed opposite and proximal to the inlet of the thermal chimney.

[0016] The assembly may further comprise a throttle disposed opposite and proximal to the ventilation inlet of the interior chamber.

[0017] The throttle may be arranged to control flow of air into the thermal chimney. The throttle may be formed from a portion of flexible material capable of at least partially covering the inlet of the thermal chimney or the ventilation inlet. The flexible material may be hinged with respect to an internal surface of the interior chamber. A degree of obstruction to air by the throttle relative to the inlet of the thermal chimney or the ventilation inlet may be adjustable.

[0018] The assembly may further comprise a heating device disposed adjacent the thermal chimney.

[0019] The assembly may further comprise a seat for receiving the heating device proximally opposite the inlet of the thermal chimney.

[0020] The heating device may additionally or alternatively be disposed substantially around a longitudinal portion of the thermal chimney.

[0021] The throttle and a wall of the further chamber may be arranged to cooperate so as to form the seat.

[0022] The foldable material forming the first portion may be reticulated at least in part so as to prevent ingress of an insect into the interior chamber.

[0023] The assembly may further comprise a turbine, the turbine being for generating an electric current disposed proximally opposite the inlet of the thermal chimney.

[0024] The assembly may further comprise a turbine, the turbine being disposed proximally opposite the ventilation inlet.

[0025] The first portion formed from foldable material and/or the second portion formed from foldable material may be arranged to funnel, when in use, air into the inlet of the thermal chimney.

[0026] The first portion formed from foldable material may define the interior chamber, when in the erected state, so as to have a tapered volume.

[0027] The assembly may further comprise an energy converter for converting electromagnetic radiation into an electric current.

[0028] The electrical energy generated by the energy converter may be used to power the heating device. The energy converter may be a solar panel.

[0029] The thermal chimney may be a solar chimney.

[0030] According to a second aspect of the present invention, there is provided a tent comprising the ventilable portable structure assembly as set forth above in relation to the first aspect of the present invention.

[0031] According to a third aspect of the present invention, there is provided a mosquito net assembly comprising the ventilable portable structure assembly as set forth above in relation to the first aspect of the present invention.

[0032] According to a fourth aspect of the present invention, there is provided a power generator comprising the ventilable portable structure assembly as set forth above in relation to the first aspect of the present invention.

[0033] It is thus possible to provide a portable structure assembly that is ventilable, thereby improving comfort within the portable structure assembly when erected. Additionally, it is also possible to ensure ventilation and/or maintain a degree of air flow when the thermal chimney is not heated directly by sunlight. In relation to the use of the portable structure assembly in relation to prevention of ingress of insects, the inhabitant of the erected portable structure assembly is able to maintain comfort without being unnecessarily exposed to health risks from biting insects.

[0034] At least one embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0035] FIG. 1 is a schematic diagram of a ventilable portable structure assembly constituting a first embodiment of the invention;

[0036] FIG. 2 is a schematic diagram of another ventilable portable structure assembly constituting a second embodiment of the invention;

[0037] FIG. 3 is a schematic diagram of a further ventilable portable structure assembly constituting a third embodiment of the invention;

[0038] FIG. 4 is a schematic diagram of yet another ventilable portable structure assembly constituting a fourth embodiment of the invention; and

[0039] FIG. 5 is a schematic diagram of yet a further ventilable portable structure assembly constituting a fifth embodiment of the invention.

[0040] Throughout the following description identical reference numerals will be used to identify like parts.

[0041] Referring to FIG. 1, a ventilable portable structure assembly, in this example constituting a tent 100, comprises a first portion 102 formed from a foldable material and a second portion 104 formed from the foldable material, for example a fabric, such as Mylar®. Although, in this example Mylar® is employed as the foldable material, the skilled person will appreciate that any other suitable material or mixture of suitable materials can be employed to form the tent 100. For example, it can be desirable for the material or mixture of material to exhibit hydrophobic properties.

[0042] The first portion 102 defines an interior chamber 106, the interior chamber 106 being capable of being used for habitation therein. In this example, the first portion 102 is a canopy having a surface 108 that is tapered, thereby defining a tapered volume beneath the canopy. In this example, the foldable material forming the canopy is heat-reflecting.

[0043] The first portion 102 has a number of reticulated ventilation inlets 110 disposed, in this example, peripherally,

such as circumferentially, about the canopy. However, the skilled person will appreciate that the number of ventilation inlets can be provided by simply providing a gap between the canopy and a surface 112 upon which the tent is to be sited. Further, the canopy and a ground sheet (not shown) can be integrally formed or joined due to the presence of the ventilation inlets 110. Alternatively, the canopy can be suspended above the ground sheet so as to leave a space that can serve to replace the need for the ventilation inlets 110.

[0044] The second portion 104 is disposed adjacent and above the first portion 102. In this example, the first and second portions 102, 104 are removably connected, though the skilled person will appreciate that the first and second portions 102, 104 can be integrally formed. The second portion 104 defines a thermal chimney, for example a solar chimney. The thermal chimney comprises a conduit 114 that fluidly connects an inlet 116 to an outlet 118. The conduit 114 constitutes a flue. The first portion 102 and/or the second portion 104 is/are shaped to provide a funnel from the interior chamber 106 to the inlet 116 of the thermal chimney. In this example, a tapered region 120 is provided to serve as the funnel.

[0045] The conduit 114 is surrounded by an insulating space 122 and thermally coupled thereto, the insulating space 122 being defined by an outer layer 124 of, in this example, foldable material. The outer layer 124 and the insulating space 122 can be provided by a void space that is inflatable. In this regard, any suitable gas can be used to inflate the void space so as to provide thermal insulation, for example argon or carbon dioxide. In this example, the insulating space 122 is shaped to abut the conduit 114 and the outer layer 124 is shaped so as to bound a frustoconical volume, but the skilled person will appreciate that other shapes can be employed, for example non-cylindrical shapes. An example of an alternative conduit shape is a panelled shape, such as one having a triangular lateral cross section so as to provide structural resilience. The outer layer 124 is formed from a heat-transmissive material in order to permit thermal conduction by the conduit 114. In this respect, the conduit 114 is formed from a heat-conducting material or comprises a layer of heat-conducting material. An exterior surface of the conduit 114 can comprise a pigment conducive to conduction of heat, such as a black or other dark pigment. In this example, the outer layer 124 is only unidirectionally heat-transmissive so as to trap heat within the insulating space 122 and prevent escape of heat from the insulating space 122.

[0046] In operation, the conduit 114 conducts heat provided by electromagnetic radiation incident upon the outer layer 124 and an external surface of the conduit 114, thereby causing air within the conduit 114 to increase in temperature. The insulating space 122 maintains, or at least prevents a substantial drop in, the temperature about the conduit 114 caused by, for example, cooling from wind or momentary shading. As a result of the increase in temperature of the air in the conduit 114, the air travels up the conduit 114 and is expelled from, or leaves, the conduit 114 via the outlet 118. In this example, the outlet 118 tapers outwardly from the conduit 114 so as to minimise turbulence caused by air leaving the conduit 114 and hence contribute to improved flow rate consistency in the conduit 114. Further, due to the ability to mitigate external cooling effects, a greater throughput of air in respect of the conduit 114 can be achieved.

[0047] In response to the air travelling up the conduit 114, more air is drawn into the conduit 114 via the inlet 116 from

the interior chamber **106** in order to replace the air that has been expelled from the conduit **114**. The air from the interior chamber **106** that enters the conduit **114** via the inlet **116** is replaced by air drawn into the interior chamber **106** via the one or more ventilation inlets **110**. Consequently, a flow of air is established through the interior chamber **106**.

[0048] The rate of flow of air through the interior chamber **106** is governed by a number of factors. For example, the temperature of the air in the conduit **114** affects the flow rate as does the cross-sectional area of the conduit **114** and/or the length of the conduit **114**. In this example, the conduit has a diameter of about 0.1 m and a height between about 1.5 m and about 1.8 m.

[0049] Turning to FIG. 2, in this embodiment, the interior chamber **106** houses a further chamber formed from a foldable material. The further chamber constitutes, in this example, a habitation chamber **200**.

[0050] The habitation chamber **200** comprises a first region **202** that is reticulated and a second region **204** that is also reticulated. Of course, the skilled person will appreciate that the whole or most of the foldable material forming the habitation chamber **200** can be reticulated.

[0051] The first reticulated region **202** serves as a ventilation inlet for the habitation chamber **200** and the second reticulated region **204** serves as a ventilation outlet for the habitation chamber **200**. The habitation chamber **200** can be provided with any suitable mechanism to allow entry into the habitation chamber **200**, for example a closable flap (not shown). The first and second reticulated regions **202**, **204** also prevent ingress of insects into the habitation chamber **200** whilst permitting air flow therethrough.

[0052] A throttle **206** is provided, in this example hingeably attached, to the first portion **102** and is provided as a flap that is selectively orientatable with respect to the inlet **116** of the thermal chimney. The flap can be held or rolled back from the inlet **116** as desired by a fastener arrangement (not shown). Likewise, the flap can be positioned with respect to the inlet **116** in order to impede or block flow of air into the inlet **116** to varying degrees using the fastener arrangement. The flap can be used to divert flow of the air in the interior chamber **106**. If desired, the throttle **206** can be alternatively disposed opposite and close to the one or more ventilation inlets **110**.

[0053] The use of the throttle **206** is particularly beneficial in cold or freezing conditions where the thermal chimney can be opened, for example when cooking to expel excess heat and fumes and/or prevent moisture forming and possibly freezing on internal surfaces of the interior chamber **106**, and subsequently closed.

[0054] In operation, air is drawn up the conduit **104** of the thermal chimney in the manner already described above in relation to the first example. However, air drawn into the interior chamber **106** via at least one of the number of ventilation inlets **110** flows into the habitation chamber **200** via the first reticulated region **202** and out of the habitation chamber **200** via the second reticulated region **204**, resulting in a flow of air through the habitation chamber. Some of the air flowing through the habitation chamber is funneled into the inlet **116** of the conduit **114**. Other air entering the interior chamber **106** via the ventilation inlets **110**, but not passing through the habitation chamber **200**, also flows out of the interior chamber **106** via the conduit **114**.

[0055] In order to control the amount of air that flows into the inlet **116** of the conduit **114** and is hence expelled via the outlet **118**, the throttle **206** is used to restrict or increase access

of air flow to the inlet **116** of the conduit **114**, thereby controlling the flow of air through the first portion **102**.

[0056] Turning to FIG. 3, in another embodiment, a heating device **300** is disposed, in this example, at the mouth of the tapered region **120** opposite the inlet **116**. In this example, the heating device **300** is an electric heating device. However, although an electric heating device is described here, the skilled person will appreciate that other types of heating device can be employed, for example a spirit burner. The heating device **300** can, if desired, be woven into or integrally formed with or simply surround a longitudinal portion of the conduit **114**, for example electrical heating elements.

[0057] An upper surface **304** of the habitation chamber **200** and the throttle **206** are arranged to cooperate so as to provide a seat **302** for siting the heating device **300**. As the throttle **206** is being used to provide, at least in part, the seat **302**, and the throttle **206** by its very nature resists air flow, the upper surface **304** is reticulated at least in part to permit flow of air in the habitation chamber **200** to the inlet **116** of the conduit **114**.

[0058] In operation, the ventilation effect achieved through use of the thermal chimney is similar to that described in relation to previous embodiments. In this respect, air entering the conduit **114** via the inlet **116** is heated prior to entering and/or whilst travelling along the conduit **114**. The movement of air up the conduit **114** serves to draw more air through the interior chamber **106** from the ventilation inlets **110** and through the habitation chamber **200**. However, since the throttle **206** is being used to provide, at least part of, the seat **302**, the air **306** drawn into the interior chamber **106** that does not enter the habitation chamber **200** via the first reticulated region **202** is drawn to the inlet **116** via the second reticulated region **204** and the third reticulated upper surface **304**. Of course, the skilled person will appreciate that the function of the seat **302** can be provided by an alternative arrangement, for example a suspended cradle arrangement (not shown).

[0059] Of course, if the throttle **206** is not required, the throttle can be replaced by a flap of reticulated material to increase air flow to the inlet **116** of the conduit **114**.

[0060] By providing the heating device **300** in the manner described above, air flow through the first portion **102** can be achieved even when the conduit **114** is not exposed to heat generated by the sun. This is particularly useful on hot, but overcast, days or during the night. If desired, an energy converter or an electric current generator (not shown), for example a solar panel can be provided on one or more exterior surfaces of the tent **100** in order to power the heating device **300**. The presence of the solar panel or the like can sometimes also serve to reflect heat. Hence, if a sufficiently large external surface area of the first portion **102** is covered with one or more panels, additional mitigation of heating of the interior chamber **106** can be achieved. If desired, the electric energy generated by day can be stored for subsequent use by the heating device **300** by, for example, providing a charging circuit and a battery.

[0061] In a fourth embodiment (FIG. 4), the first portion **102** is at least partially reticulated and the habitation chamber of the previous embodiments is absent. In this respect, the first portion **102** is, in this example, sufficiently reticulated to serve as a mosquito net or other barrier to ingress of insects. The first portion **102** continues to define the interior chamber **106**, which is fit for habitation therein. Indeed, the first portion **102** can be disposed over a place to sleep or rest, for example a bed **402**. As a result of the reticulated nature of the

first portion 102, it is not necessary to provide the ventilation inlets 110 described in relation to the previous embodiments.

[0062] In this example, an at least partially reticulated layer 400 of material is provided to serve as the seat 302 for the heating device 300. Although the at least partially reticulated layer 400 of material is foldable herein, the skilled person will appreciate that less flexible materials can be employed.

[0063] In operation, air is drawn into the conduit 114 via the inlet 116 thereof as a result of heating the air close to the inlet 116 or actually in the conduit 114. The air drawn up the conduit 114 is again drawn from the interior chamber 106, resulting in air being drawn into the interior chamber 106 via through the reticulations of the first portion 102.

[0064] Referring to FIG. 5, in a fifth embodiment, the interior chamber 106 of the first embodiment is not necessarily used as a place of rest of habitation, but rather can simply be used to provide a volume of moving air. In this respect, a turbine 500 is disposed opposite the inlet 116 of the conduit 114 and is coupled to a device (not shown) to be powered. Hence it can be seen that, in this example, the ventilable portable structure assembly is being used as a part of a power generator arrangement.

[0065] Of course, if required, the turbine 500 can be coupled to electronic circuitry to condition the electric current generated and, if desired, store the power generated in a battery.

[0066] In operation, air is once again drawn into the conduit 114 via the inlet 116 thereof, the air being drawn from the interior chamber 106. The air in the interior chamber 106 is replaced by air drawn into the interior chamber 106 from the exterior of the first portion 102 via at least one of the number of ventilation inlets 110. Consequently, an air flow through the interior chamber 106 results, the air flowing through the turbine 500 and causing the turbine 500 to rotate. Rotation of the turbine 500 results in the generation of the electric current described above.

[0067] In the above examples, the ventilable portable structure assemblies are initially in a collapsed state, but transformable into an erected state. For the avoidance of doubt, the above examples have been described when the structure assemblies are in the erected state.

[0068] Whilst, in the above examples, the structure of the first and second portions 102, 104 is described with reference to a particular shape, the skilled person will appreciate that other shapes can be employed if desired and where structural integrity considerations permit.

[0069] Although not described herein, it should be understood that alternatives to the inflatable insulating space 122 can be employed. For example, fabric or other suitable material bounding the insulation space 122 and/or the conduit 114 can be suspended from one or more rings attached to and/or suspended from a central pole. Alternatively or additionally, a helical wire frame can be employed to support the second portion 104.

1. A ventilable portable structure assembly transformable between a collapsed state and an erected state, the assembly comprising:

- a first portion of foldable material arranged to define, when in the erected state, an interior chamber; and
- a second portion of foldable material arranged to define, when in the erected state, a thermal chimney having an inlet at one end thereof and an outlet at another end thereof; wherein

the first and second portions are arranged so as to permit, when in the erected state, flow of air through the interior chamber into the thermal chimney via the inlet in response to heating of air substantially passing through the thermal chimney, the air entering the thermal chimney being expelled from the thermal chimney via the outlet.

2. An assembly as claimed in claim 1, wherein a proportion of the air entering the thermal chimney via the inlet is heated prior to entering the thermal chimney.

3. An assembly as claimed in claim 1, wherein the thermal chimney comprises a conduit joining the inlet to the outlet.

4. An assembly as claimed in claim 3, wherein the second portion is further arranged to define an insulating space adjacent the conduit.

5. An assembly as claimed in claim 3, wherein the conduit arranged to conduct heat.

6. An assembly as claimed in claim 4, wherein the insulating space is inflatable.

7. An assembly as claimed in claim 4, wherein the insulating space is filled with a gas.

8. An assembly as claimed claim 4, wherein the insulating space is peripherally bounded by a layer of substantially unidirectional heat-transmissive material.

9. An assembly as claimed claim 1, wherein the interior chamber has a ventilation inlet.

10. An assembly as claimed in claim 1, wherein the interior chamber comprises a further chamber therein.

11. An assembly as claimed in claim 10, wherein the further chamber comprises a first reticulated region.

12. An assembly as claimed in claim 11, wherein the first reticulated region is disposed opposite the ventilation inlet.

13. An assembly as claimed in claim 10, wherein the further chamber comprises a second reticulated region for preventing ingress of an insect into the further chamber.

14. An assembly as claimed in claim 13, wherein the second reticulated region serves as a further outlet to permit air flow through the further chamber.

15. An assembly as claimed in claim 1, further comprising a throttle disposed opposite and proximal to the inlet of the thermal chimney.

16. An assembly as claimed in claim 1, further comprising a throttle disposed opposite and proximal to the ventilation inlet of the interior chamber.

17. (canceled)

18. (canceled)

19. (canceled)

20. (canceled)

21. (canceled)

22. (canceled)

23. (canceled)

24. (canceled)

25. An assembly as claimed in claim 1, wherein the first portion formed from foldable material defines the interior chamber, when in the erected state, so as to have a tapered volume.

26. (canceled)

27. (canceled)

28. An assembly as claimed in claim 1, wherein the thermal chimney is a solar chimney.

29. A tent comprising the ventilable portable structure assembly as claimed in claim 1.

30. A mosquito net assembly comprising the ventilable portable structure assembly as claimed in claim 1.

31. (canceled)

32. (canceled)

* * * * *