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(54) **FEATURE FOR ACCELERATING EVACUATION OF A VACUUM INSULATED STRUCTURE**

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USPC 312/400, 405
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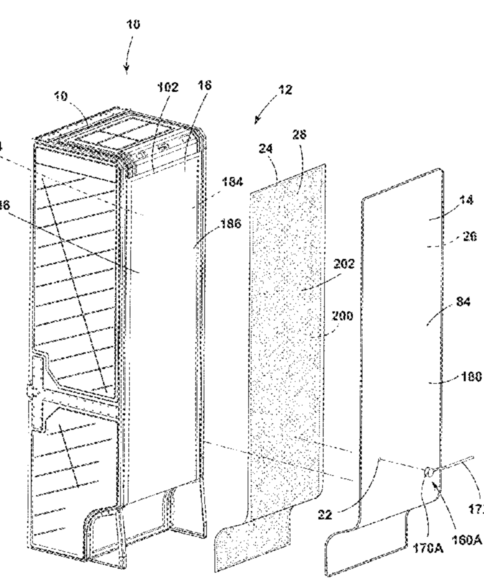
(57) **ABSTRACT**

A vacuum insulated appliance includes a cabinet with an outer wrapper and an inner liner coupled to the outer wrapper. A vacuum insulated cavity is defined between the outer wrapper and the inner liner. A trim breaker is coupled to the outer wrapper and the inner liner and seals the vacuum insulated cavity. An evacuation port is defined by the outer wrapper. An insulation powder is disposed in the vacuum insulated cavity. An open-cell foam is coupled to at least one of an inner surface of the outer wrapper and an inner surface of the inner liner. The open-cell foam defines a first plurality of pores that define a first plurality of airflow paths in fluid communication with the vacuum insulated cavity and the evacuation port for evacuating air from the vacuum insulated cavity, through the first plurality of airflow paths, and through the evacuation port.

13 Claims, 10 Drawing Sheets



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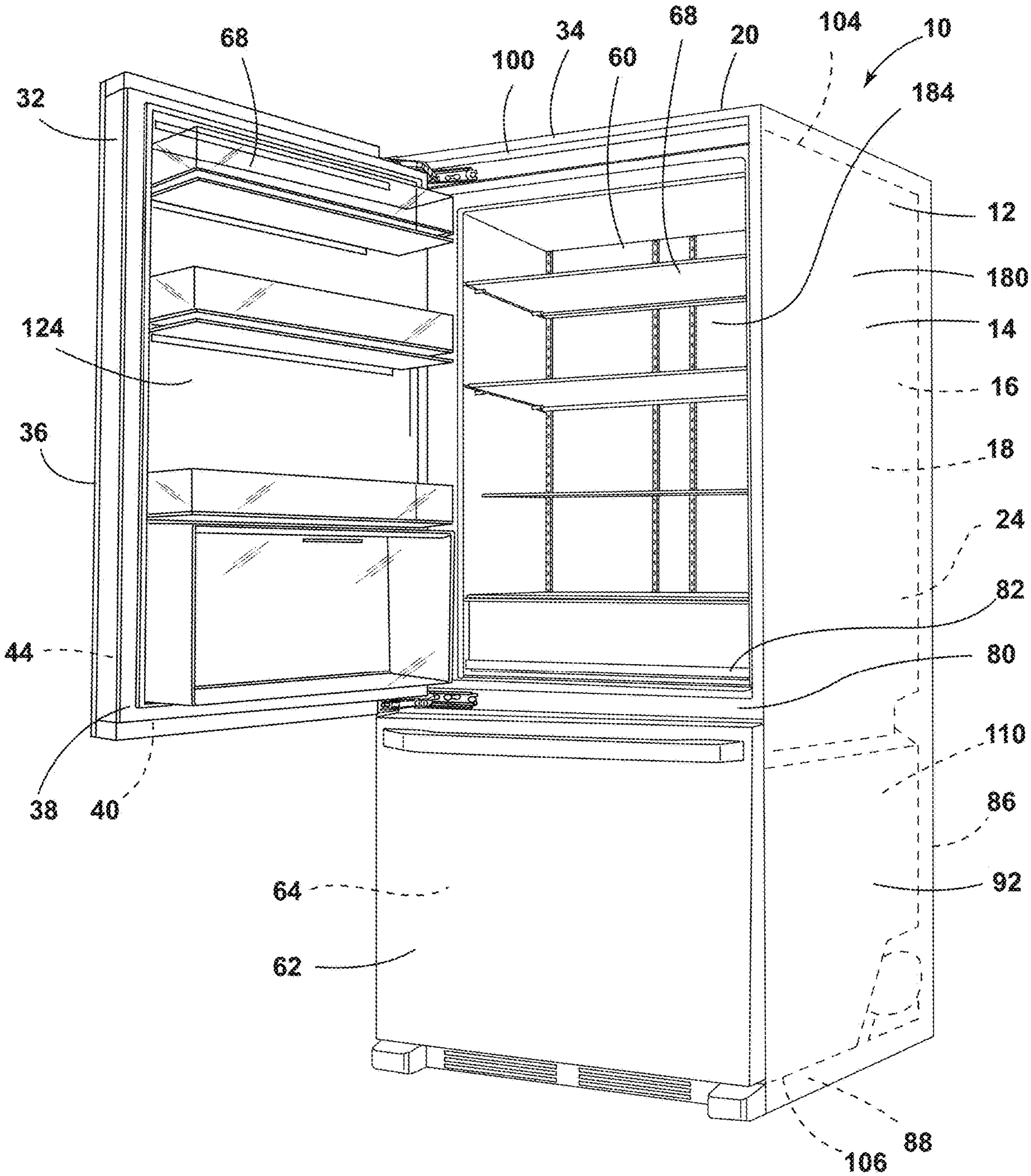
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32
100
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60
68
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10
184
12
180
14
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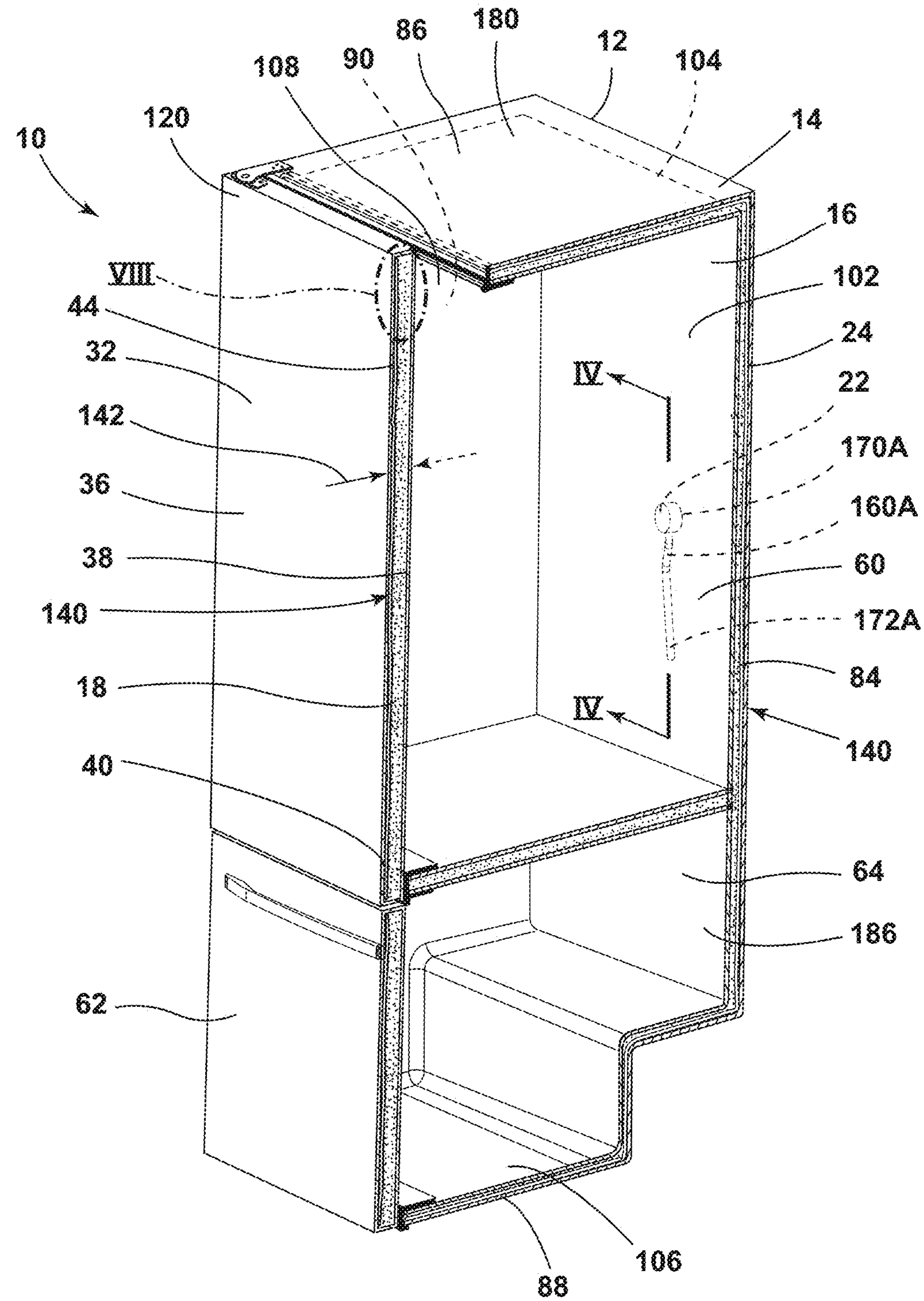
124
36
44
38
40
64
62
88
106

FIG. 1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120
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12
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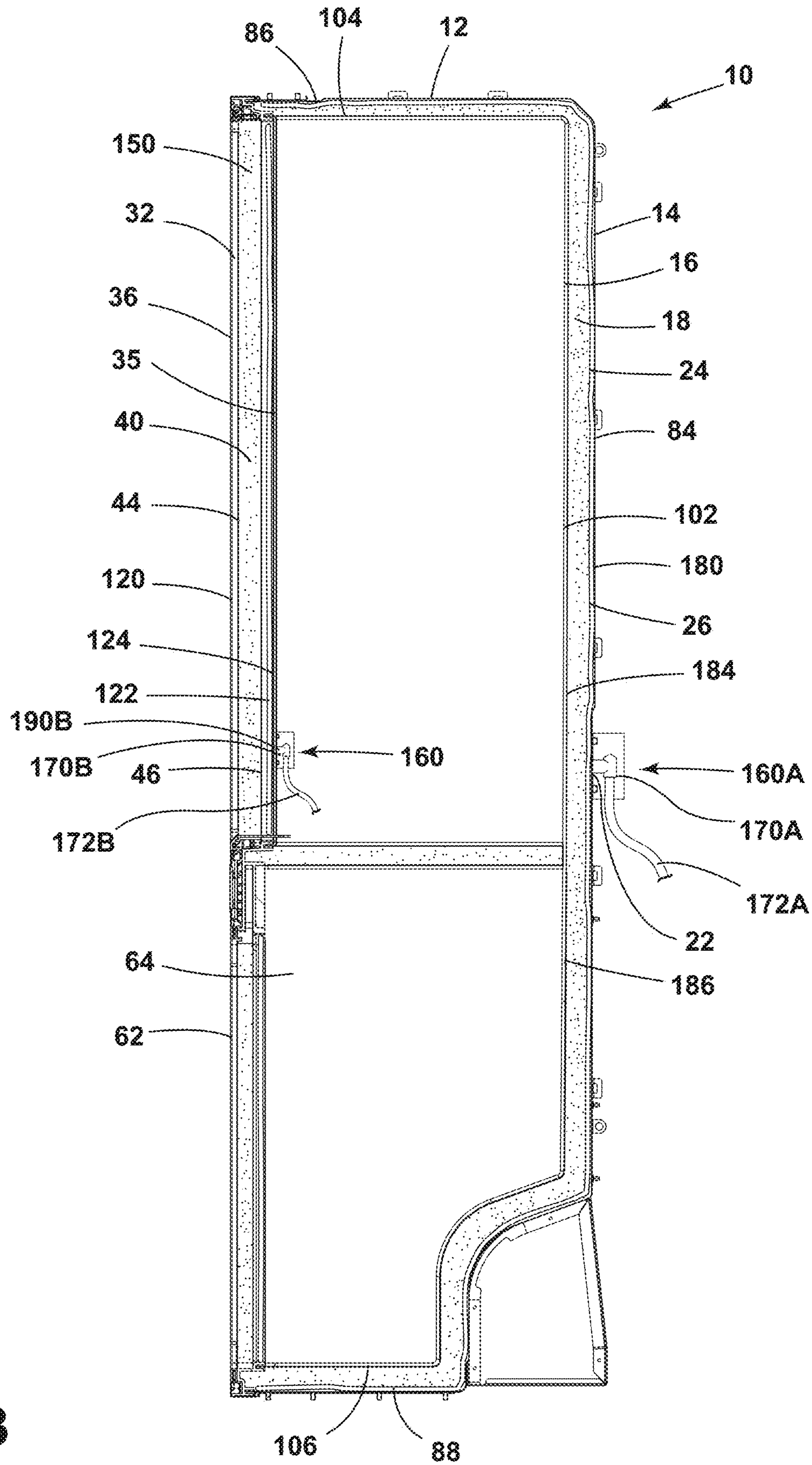
14
16
102
24
22
170A
160A
60
172A
84
140
VIII
44
32
142
36
38
140
18
IV
IV
40
64
186
62
88
106

FIG. 2


86
104
12
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32
36
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44
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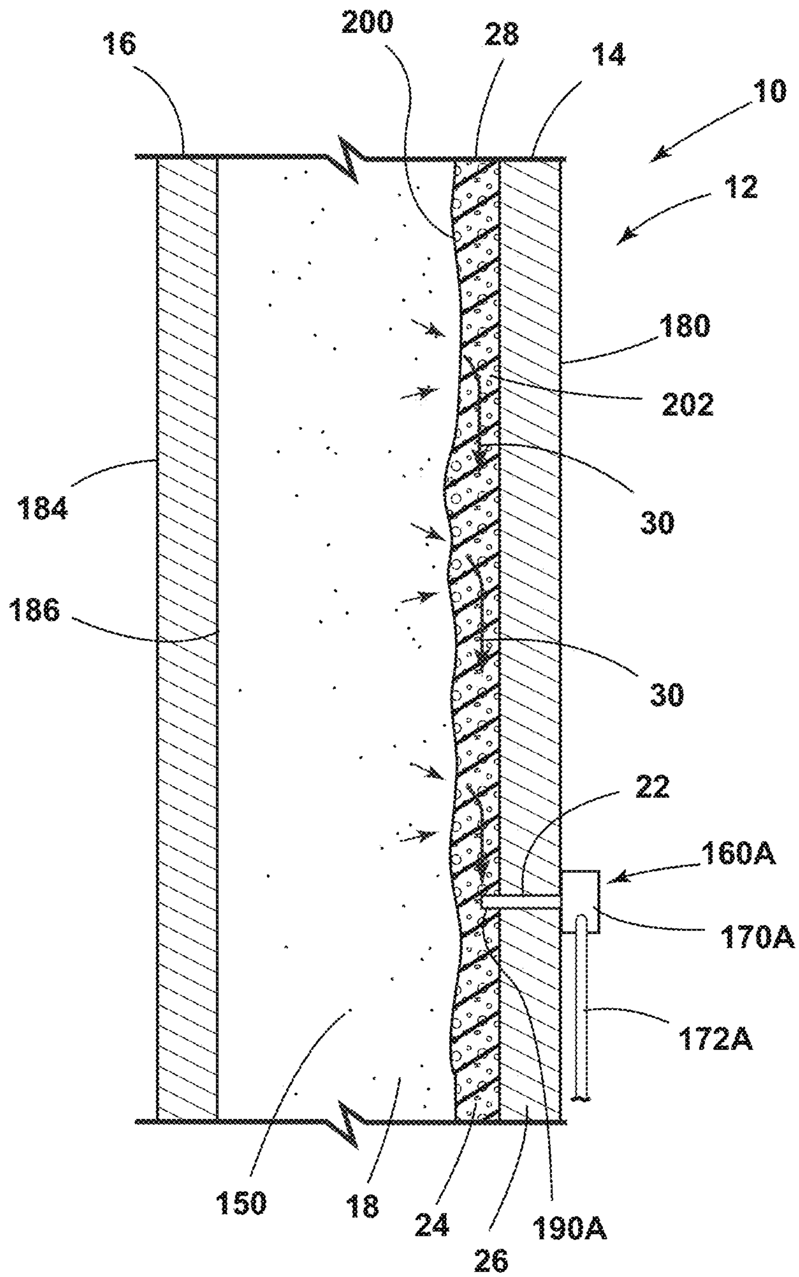
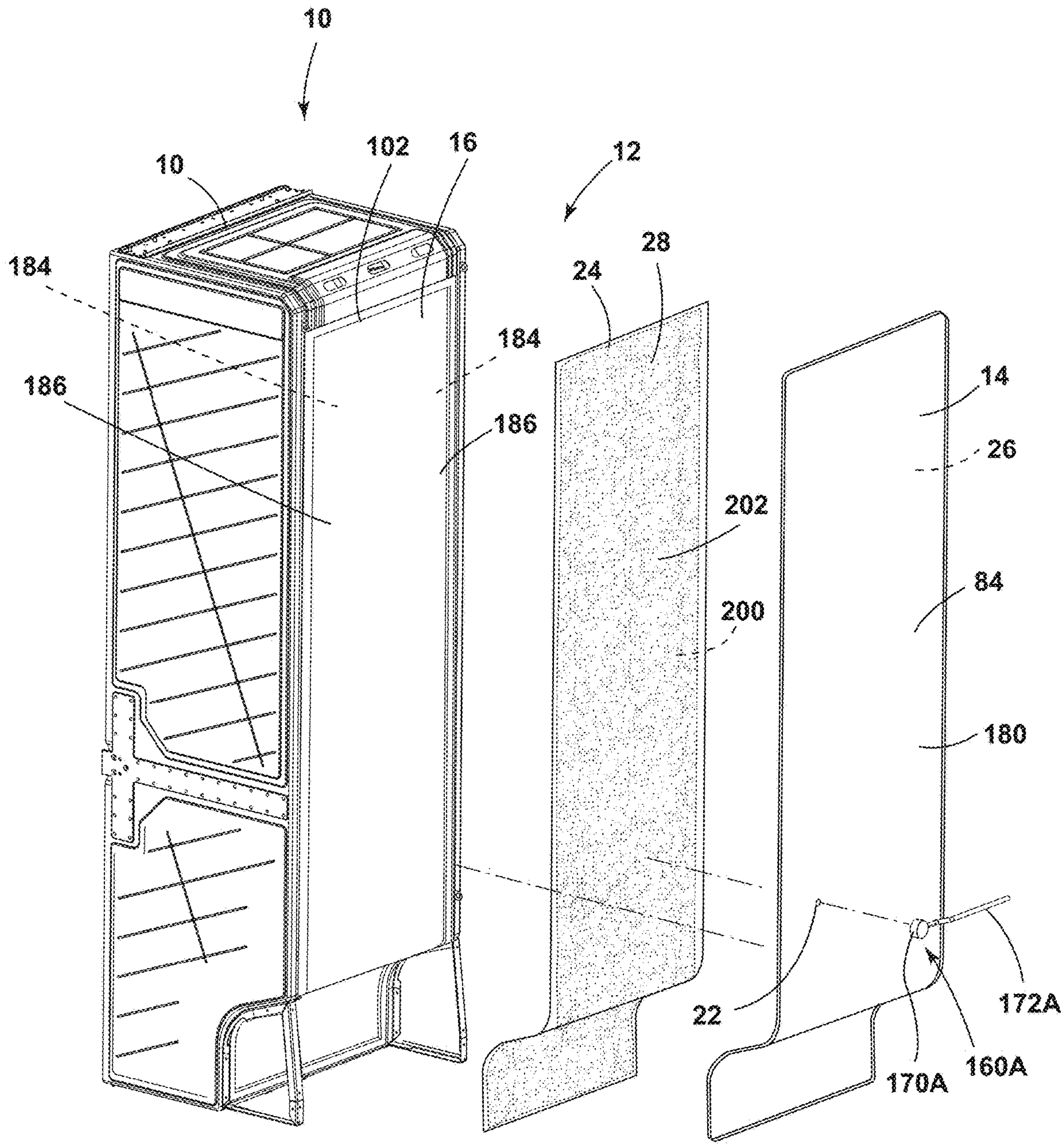
124
122
190B
170B
46
172B
160
14
16
18
24
84
102
180
26
184
160A
170A
172A
22
186
64
62
106
88

FIG. 3



16
200
28
14
10
12
180
202
184
30
186
30
22
160A
170A
172A
150
18
24
26
190A

FIG. 4


10
10
102
16
12
184
24
28
184
186
186
14
26
202
84
200
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22
172A
160A
170A

FIG. 5

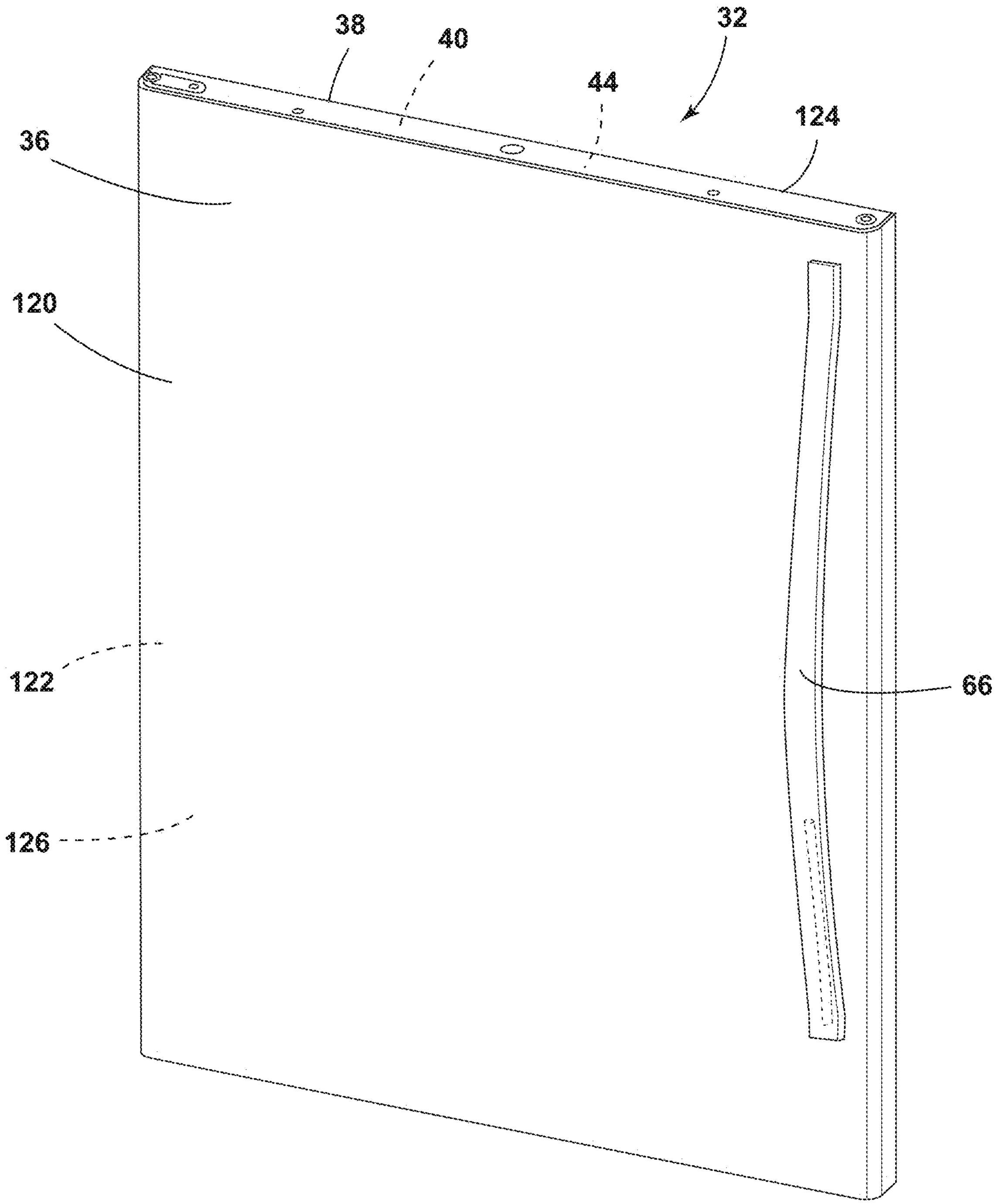

FIG. 6

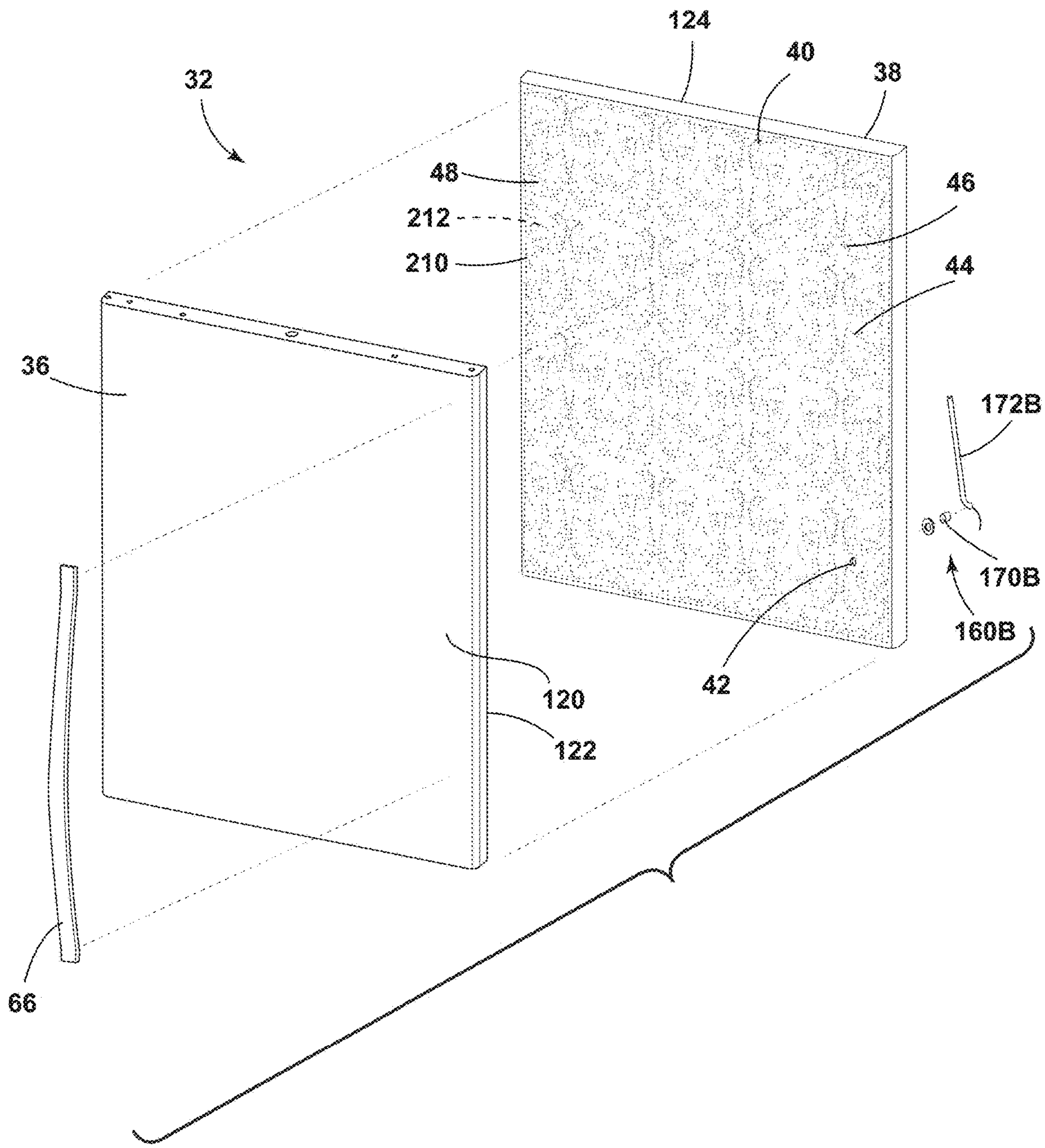

FIG. 7

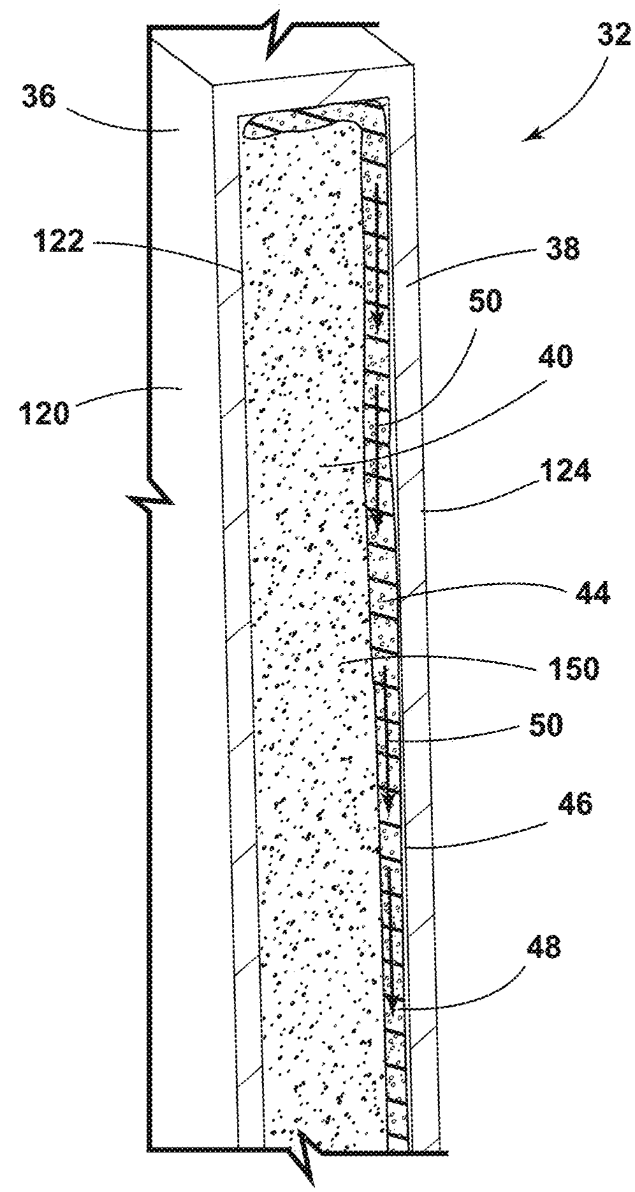

FIG. 8

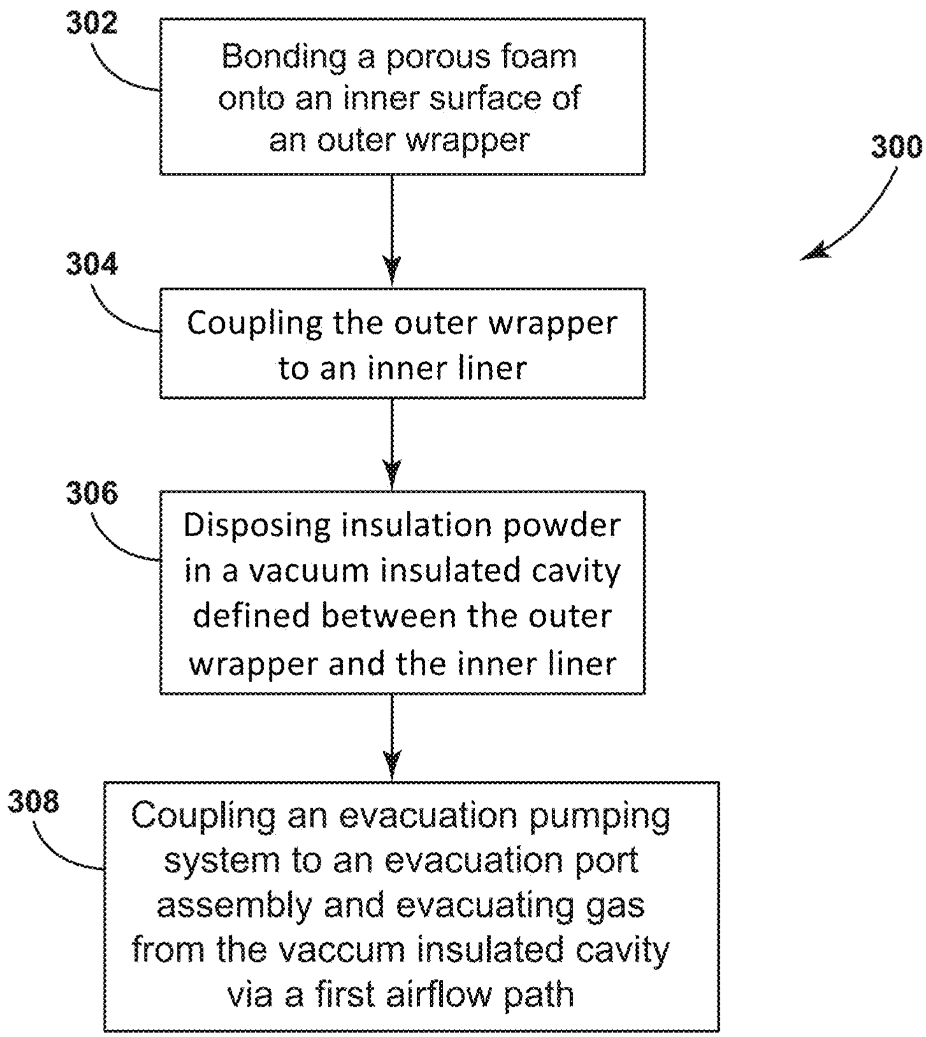
302
Bonding a porous foam onto an inner surface of an outer wrapper
300
304
Coupling the outer wrapper to an inner liner
306
Disposing insulation powder in a vacuum insulated cavity defined between the outer wrapper and the inner liner
308
Coupling an evacuation pumping system to an evacuation port assembly and evacuating gas from the vaccum insulated cavity via a first airflow path

FIG. 9

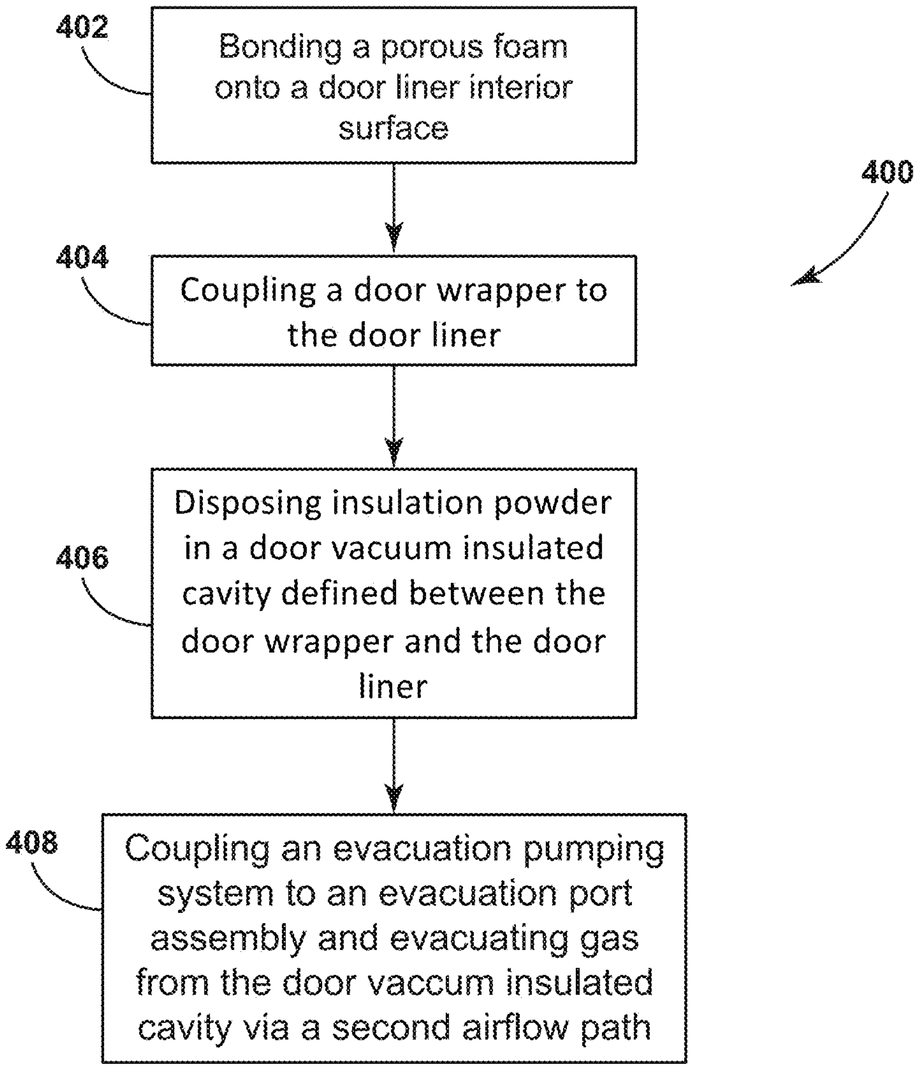
402
Bonding a porous foam onto a door liner interior surface
400
404
Coupling a door wrapper to the door liner
406
Disposing insulation powder in a door vacuum insulated cavity defined between the door wrapper and the door liner
408
Coupling an evacuation pumping system to an evacuation port assembly and evacuating gas from the door vaccum insulated cavity via a second airflow path

FIG. 10

FEATURE FOR ACCELERATING EVACUATION OF A VACUUM INSULATED STRUCTURE

BACKGROUND OF THE DISCLOSURE

The present disclosure generally relates to a vacuum insulated appliance, and more specifically, to a feature for accelerating evacuation from a vacuum insulated appliance.

SUMMARY OF THE DISCLOSURE

According to one aspect of the present disclosure, a vacuum insulated appliance includes a cabinet with an outer wrapper and an inner liner coupled to the outer wrapper. A cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner. A trim breaker is coupled to the outer wrapper and the inner liner, and the trim breaker seals the cabinet vacuum insulated cavity. A wrapper evacuation port is defined by the outer wrapper. The wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity. A first porous foam is coupled to an inner surface of the outer wrapper. The first porous foam defines a first plurality of pores. The first plurality of pores defines a first airflow path that is in fluid communication with the wrapper evacuation port. A door assembly is coupled to a front portion of the cabinet. The door assembly includes a door wrapper. A door liner is coupled to the door wrapper. A door vacuum insulated cavity is defined between the door wrapper and the door liner. A door evacuation port is defined by the door liner. The door evacuation port is in fluid communication with the door vacuum insulated cavity for evacuating air from the door vacuum insulated cavity. A second porous foam is coupled to an inner surface of the door liner. The second porous foam defines a second plurality of pores. The second plurality of pores defines a second airflow path in fluid communication with the door evacuation port.

According to another aspect of the present disclosure, a vacuum insulated appliance includes a cabinet with an outer wrapper and an inner liner coupled to the outer wrapper. A cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner. A trim breaker is coupled to the outer wrapper and the inner liner, and the trim breaker seals the cabinet vacuum insulated cavity. A wrapper evacuation port is defined by the outer wrapper. The wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity. A porous foam is coupled to and extends along an inner surface of the outer wrapper. The porous foam defines a plurality of pores. The plurality of pores defines at least one first airflow path in fluid communication with the wrapper evacuation port for evacuating air from the cabinet vacuum insulated cavity through the at least one first airflow path.

According to yet another aspect of the present disclosure, a vacuum insulated door assembly for an appliance includes a door wrapper. A door liner is coupled to the door wrapper. The door liner defines a door evacuation port. A door vacuum insulated cavity is defined between the door wrapper and the door liner. Insulation powder is disposed within the door vacuum insulated cavity. A porous foam is coupled to an inner surface of the door liner. The porous foam defines a plurality of pores. The plurality of pores defines a plurality of airflow paths in fluid communication with the door vacuum insulated cavity and the door evacuation port for evacuating air from the door vacuum insulated cavity, through the plurality of airflow paths, and the door evacuation port.

These and other features, advantages, and objects of the present disclosure will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. **1** is a front perspective view of a vacuum insulated appliance with a door assembly, according to the present disclosure;

FIG. **2** is a cross-sectional view of a vacuum insulated appliance with a door assembly, according to the present disclosure;

FIG. **3** is a cross-sectional view of a vacuum insulated appliance with a door assembly, showing evacuation port assemblies, according to the present disclosure;

FIG. **4** is a cross-sectional view of a portion of a cabinet of the vacuum insulated appliance of FIG. **2**, taken along the line IV-IV, according to the present disclosure;

FIG. **5** is an exploded side perspective view of a rear panel of a cabinet of a vacuum insulated appliance, according to the present disclosure;

FIG. **6** is a front perspective view of a vacuum insulated door assembly for an appliance, according to the present disclosure;

FIG. **7** is an exploded side perspective view of a vacuum insulated door assembly, according to the present disclosure;

FIG. **8** is a partial cross-sectional view of a vacuum insulated door assembly, according to the present disclosure;

FIG. **9** is a flow diagram of a method of assembling a vacuum insulated cabinet, according to the present disclosure; and

FIG. **10** is a flow diagram of a method of assembling a vacuum insulated door assembly, according to the present disclosure.

The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles described herein.

DETAILED DESCRIPTION

The present illustrated embodiments reside primarily in combinations of method steps and apparatus components related to a vacuum insulated appliance. Accordingly, the apparatus components and method steps have been represented, where appropriate, by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present disclosure so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein. Further, like numerals in the description and drawings represent like elements.

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the disclosure as oriented in FIG. **1**. Unless stated otherwise, the term "front" shall refer to the surface of the element closer to an intended viewer, and the term "rear" shall refer to the surface of the element further from the intended viewer. However, it is to be understood that the disclosure may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

The terms “including,” “comprises,” “comprising,” or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by “comprises a.” does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

Referring to FIGS. **1-10**, reference numeral **10** generally designates an appliance that includes a cabinet **12**. The cabinet **12** includes an outer wrapper **14** and an inner liner **16** coupled to the outer wrapper **14**. A vacuum insulated cavity **18** is defined between the outer wrapper **14** and the inner liner **16**. A trim breaker **20** is coupled to the outer wrapper **14** and the inner liner **16**, and the trim breaker **20** seals the vacuum insulated cavity **18**. An evacuation port **22**, also referred to as a wrapper evacuation port **22**, is defined by the outer wrapper **14**. The evacuation port **22** is in fluid communication with the vacuum insulated cavity **18** for evacuating air from the vacuum insulated cavity **18**. A first porous foam **24** is coupled to an inner surface **26** of the outer wrapper **14**. The first porous foam **24** defines a first plurality of pores **28**. The first plurality of pores **28** defines a first airflow path **30** in fluid communication with the evacuation port **22**.

A door assembly **32** is coupled to a front portion **34** of the cabinet **12**. The door assembly **32** includes a door wrapper **36**. A door liner **38** is coupled to the door wrapper **36**. A door vacuum insulated cavity **40** is defined between the door wrapper **36** and the door liner **38**. A door evacuation port **42** is defined by the door liner **38**. The door evacuation port **42** is in fluid communication with the door vacuum insulated cavity **40** for evacuating air from the door vacuum insulated cavity **40**. A second porous foam **44** is coupled to an interior surface **46** of the door wrapper **36**. The second porous foam **44** defines a second plurality of pores **48**. The second plurality of pores **48** defines a second airflow path **50** in fluid communication with the door evacuation port **42**.

Referring to FIGS. **1-3**, the appliance **10** is illustrated as a refrigerator appliance, however, it is contemplated that the cabinet **12** with the outer wrapper **14**, the inner liner **16**, and the vacuum insulated cavity **18** may be used with a variety of appliances, structures, or insulation purposes other than with an appliance. Moreover, the illustrated refrigerating appliance **10** is a bottom-mount refrigerator. In non-limiting examples, the refrigerating appliance **10** can be a bottom-mount refrigerator, a bottom-mount French door refrigerator, a top-mount refrigerator, a side-by-side refrigerator, a four-door French door refrigerator, and/or a five-door French door refrigerator, each of which can have one or more door assemblies **32**.

With reference still to FIG. **1**, the illustrated appliance **10** includes the door assembly **32** that is pivotably coupled to the cabinet **12**. The door assembly **32** is operable between open and closed positions and selectively provides access to a refrigerator compartment **60**. The appliance **10** also includes a lower pull-out drawer **62** that defines or provides access to a freezer compartment **64**. It will generally be understood that the features, as set forth herein, could be applied to any appliance having any general configuration. Further, the door assembly **32** configuration of the appliance **10** can vary from that shown in FIG. **1**. The door assembly **32**, as illustrated in FIG. **1**, includes a handle **66** configured to allow a user to move the door assembly **32** between the opened and closed positions. The refrigerator compartment **60** and the freezer compartment **64** include shelving **68**, as shown in FIG. **1**, that can be adjusted and moved, depending on consumer preference. It is also generally contemplated that the door assembly **32** disclosed herein may be used with a variety of appliances, structures, or insulation purposes other than with an appliance.

The cabinet **12** is a vacuum insulated cabinet. As illustrated in FIGS. **1-4**, the cabinet **12** includes the outer wrapper **14** coupled with the inner liner **16** to define the vacuum insulated cavity **18** therebetween. The outer wrapper **14** and the inner liner **16** may alternatively be referred to as a structural wrapper that defines the vacuum insulated cavity **18**. The door assembly **32** is a vacuum insulated door assembly. The door assembly **32** includes the door wrapper **36** coupled with the door liner **38** to define the door vacuum insulated cavity **40** therebetween.

In the depicted example of FIG. **1**, the cabinet **12** includes the outer wrapper **14** that is coupled to the inner liner **16** and the trim breaker **20** to define the vacuum insulated cavity **18**, which may alternatively be referred to as the cabinet vacuum insulated cavity **18**. The outer wrapper **14** includes a front edge **80** defining an opening **82**, a rear panel **84** opposing the front edge **80**, a top panel **86** and an opposing bottom panel **88** between the front edge **80** and the rear panel **84**, and a first side panel **90** and an opposing second side panel **92** between the front edge **80** and the rear panel **84**. The outer wrapper **14** may be made from a material at least partially resistant to bending, deformation, or otherwise being formed in response to an inward compressive force **94**. These materials for the outer wrapper **14** include, but are not limited to, metals, polymers, metal alloys, combinations thereof, and/or other similar substantially rigid materials that can be used for vacuum insulated structures.

Referring further to FIGS. **1** and **2**, the inner liner **16** is at least partially enclosed by the outer wrapper **14**. The inner liner **16** includes a front edge **100**, a rear section **102** that opposes the front edge **100**, a top section **104** and an opposing bottom section **106** between the front section **100** and the rear section **102**, and a first side section **108** and an opposing second side section **110** between the top section **104** and the bottom section **106**. Further, as illustrated in FIG. **2**, the inner liner **16** may have intermediate sections extending between the refrigerator and freezer compartments **60**, **64**. One intermediate section may form a lower portion of the refrigerator compartment **60**, with a second intermediate section may form an upper portion of the freezer compartment **64**. The intermediate sections extend from the front edge **100** to the rear section **102** and are configured to separate the compartments **60**, **64** and define a mullion region therebetween. In such configurations, the inner liner **16** may be multiple components.

As illustrated in FIGS. **1-3**, each section **100**, **102**, **104**, **106**, **108**, **110** of the inner liner **16** may be proximate a respective panel **80**, **84**, **86**, **88**, **90**, **92** of the outer wrapper **14**. Similarly, each section **100**, **102**, **104**, **106**, **108**, **110** of the inner liner **16** may have a shape and size that coincides with the shape and size of the respective panel **80**, **84**, **86**, **88**, **90**, **92** of the outer wrapper **14**. The inner liner **16** may be made from a material at least partially resistant to bending, deformation, or otherwise being formed in response to the inward compressive force **94**. These materials for the inner liner **16** include, but are not limited to, metals, polymers, metal alloys, combinations thereof, and/or other similar substantially rigid materials that can be used for vacuum insulated structures.

The trim breaker **20** couples to the outer wrapper **14** to the inner liner **16** to define and seal the vacuum insulated cavity **18**. The trim breaker **20** is generally disposed proximate the opening **82** of the outer wrapper **14**. The trim breaker **20** includes one or more channels that receive the front edge **80** of the outer wrapper **14** and the front edge **100** of the inner liner **16**. An adhesive is then disposed within one or more of the channels to couple the front edge **80** of the outer wrapper **14** and the front edge **100** of the inner liner **16** to the trim breaker **20** such that a sealed interface is defined. The outer wrapper **14**, the inner liner **16**, and the trim breaker **20** are sealed and airtight such that air can neither escape nor enter into the vacuum insulated cavity **18** between the outer wrapper **14** and the inner liner **16**.

Referring still to FIGS. **1-3**, the door assembly **32** is shown coupled to the cabinet **12**. The door assembly **32** includes the door wrapper **36** that is coupled to the door liner **38** to define the door vacuum insulated cavity **40**. The door wrapper **36** and the door liner **38** may alternatively be referred to as a door structural wrapper that defines the door vacuum insulated cavity **40**. The door wrapper **36** includes an exterior surface **120** facing outward from the cabinet **12** and an interior surface **122** opposing the exterior surface **120**, generally facing the door vacuum insulated cavity **40**. The door liner **38** likewise defines an exterior surface **124** configured to face the refrigerator compartment **60** when the door assembly **32** is closed, and an interior surface **46** that opposes the door liner **38** exterior surface **124**, generally facing the door vacuum insulated cavity **40**.

According to various aspects, the interior surface **122** of the door wrapper **36** and the interior surface **46** of the door liner **38** at least partially enclose the door vacuum insulated cavity **40**. The door wrapper **36** and the door liner **38** may be made from a material at least partially resistant to bending, deformation, or otherwise being formed in response to the inward compressive force **94**. These materials for the door wrapper **36** and the door liner **38** include, but are not limited to, metals, polymers, metal alloys, combinations thereof, and/or other similar substantially rigid materials that can be used for vacuum insulated structures.

Referring further to FIG. **2**, an at least partial vacuum **140** is defined within the vacuum insulated cavity **18** and the door vacuum insulated cavity **40**. In the cabinet **12**, the at least partial vacuum **140** defines a pressure differential **142** between an environment external to the cabinet **12** and the vacuum insulated cavity **18**. Similarly, in the door assembly **32**, the at least partial vacuum **140** defines the pressure differential **142** between an environment external to the door assembly **32** and the door vacuum insulated cavity **40**. The pressure differential **142** serves to define the inward compressive force **94** that is exerted on both the outer wrapper **14** and the inner liner **16** of the cabinet **12**, and both the door wrapper **36** and the door liner **38** of the door assembly **32**. The inward compressive force **94** tends to bias the outer wrapper **14** and the inner liner **16** towards the vacuum insulated cavity **18**, and, similarly, the inward compressive force **94** tends to bias the door wrapper **36** and the door liner **38** towards the door vacuum insulated cavity **40**. It is also contemplated that the pull-out drawer **62** may be a vacuum insulated door assembly constructed similarly to the door assembly **32**.

Each of the vacuum insulated cavity **18** of the cabinet **12** and the door vacuum insulated cavity **40** of the door assembly **32** typically includes one or more insulation powders **150** disposed therein. It is generally contemplated that the insulation powder **150** may be a carbon-based powder, a glass-type powder, a silicon oxide-based powder, silica-based powders, and/or other standard insulation powders **150** known in the art. According to various aspects, the insulation power **150** includes a plurality of insulation particles. The insulation powder **150** substantially fills the vacuum insulated cavity **18** and the door vacuum insulated cavity **40**, forming a substantially continuous layer in each cavity **18**, **40**. In the cabinet **12**, the layer may be disposed between the first porous foam **24** and the inner liner **16**. Likewise, in the door assembly **32**, the layer may be disposed between the second porous foam **44** and the door wrapper **36**.

To increase evacuation of fluid, while still ensuring the insulation powder **150** remains disposed within the vacuum insulated cavity **18**, **40**, respectively, the appliance **10** disclosed herein may incorporate the evacuation port **22** that is in fluid communication with the first porous foam **24**, and the door evacuation port **42** that is in fluid communication with the second porous foam **44**. In particular, the use of the first porous foam **24** and the second porous foam **44** permit more uniform and more efficient extraction of the gas from each vacuum insulated cavity **18**, **40**, while still filtering out the insulation powder **150** such that the insulation powder **150** is maintained within each vacuum insulated cavity **18**, **40**. Accordingly, while the gas is evacuated during the evacuation process, the insulation powder **150** is not.

Referring still to FIG. **3**, as well as FIG. **4**, the appliance **10** defines one or more evacuation ports **22**, **42**. In the illustrated example, the outer wrapper **14** defines the evacuation port **22**, which is an opening into the vacuum insulated cavity **18**. The evacuation port **22** may be alternatively referred to as the cabinet evacuation port and/or the wrapper evacuation port. The at least partial vacuum **140** within the vacuum insulated cavity **18** is typically defined by evacuation of gas through the evacuation port **22** via an evacuation port assembly **160**A operably disposed in the evacuation port **22**.

The door assembly **32** defines one or more door evacuation ports **42**. In the illustrated example, the door liner **38** defines the door evacuation port, which is an opening into the door vacuum insulated cavity **40**. The at least partial vacuum **140** within the door vacuum insulated cavity **40** is typically defined by evacuation of gas through the door evacuation port **42** via the evacuation port assembly **160**B.

It is generally contemplated that the appliance **10** may include a plurality of evacuation port assemblies **160**A, **160**B disposed throughout the appliance **10**. For example, the appliance **10** may include a first evacuation port assembly **160**A coupled to the evacuation port **22** and a second evacuation port assembly **160**B coupled to the door evacuation port **42**. In such examples, both evacuation port assemblies **160**A, **160**B may have a structure and size that coincides with or differs from the other evacuation port assembly **160**A, **160**B. For example, the first evacuation port assembly **160**A may be of a greater size than the second evacuation port assembly **160**B. According to various aspects, both evacuation port assemblies **160**A, **160**B are coupled to the outer wrapper **14** and the door liner **38**, respectively, before bonding the porous foams **24**, **44** to the outer wrapper **14** and the door liner **38**.

The first evacuation port assembly **160**A includes a base **170**A and a service tube **172**A extending from the base

170A. In various aspects, the first evacuation port assembly 160A is in fluid communication with the vacuum insulated cavity 18 via the evacuation port 22 to expel gas from the vacuum insulated cavity 18.

The base 170A of the first evacuation port assembly 160A may be coupled to the outer wrapper 14 and is adjacent to the evacuation port 22. Typically, the base 170A extends over and surrounds the evacuation port 22. The base 170A may be coupled to an outer surface 180 or the inner surface 26 of the outer wrapper 14. It is also generally contemplated that the base 170A may be coupled to the inner liner 16. For example, the base 170A may be coupled to an outer surface 184 or an inner surface 186 of the inner liner 16.

As illustrated in FIGS. 2-5, the service tube 172A extends from the base 170A and is external from the vacuum insulated cavity 18. The service tube 172A is in fluid communication with the vacuum insulated cavity 18. The service tube 172A defines an evacuation path such that gas can be exhausted from the vacuum insulated cavity 18.

Referring further to FIG. 4, the first evacuation port assembly 160A may include an evacuation shaft 190A to aid in the removal of gas from the vacuum insulated cavity 18. The evacuation shaft 190A may extend from the base 170A, through the evacuation port 22 and into the vacuum insulated cavity 18.

According to various examples, the evacuation shaft 190A may include one or more apertures that are in fluid communication with the vacuum insulated cavity 18. For example, the evacuation shaft 190A may include one or more apertures disposed along a length of the evacuation shaft 190A, or the evacuation shaft 190A may include a central end opening. Additionally, or alternatively, it is generally contemplated that the evacuation port assembly 160A may include various other components for aiding in the removal and/or filtration of gasses from the vacuum insulated cavity 18. For example, filter paper or a mesh screen may be disposed over the evacuation port 22.

Similarly, the second evacuation port assembly 160B includes a base 170B and a service tube 172B extending from the base 170B. In various aspects, the second evacuation port assembly 160B is in fluid communication with the door vacuum insulated cavity 40 via the door evacuation port 42 to expel gas from the door vacuum insulated cavity 40.

The base 170B of the second evacuation port assembly 160B may be coupled to the door liner 38 and is adjacent to the door evacuation port 42. Typically, the base 170B extends over and surrounds the door evacuation port 42. The base 170B may be coupled to the exterior surface 120 or the interior surface 122 of the door wrapper 36, or that the base 170B may be coupled to the exterior surface 124 or the interior surface 46 of the door liner 38.

The service tube 172B of the second evacuation port assembly 160B extends from the base 170B and is external from the door vacuum insulated cavity 40. The service tube 172B is in fluid communication with the door vacuum insulated cavity 40. The service tube 172B defines an evacuation path such that gas can be exhausted from the door vacuum insulated cavity 40. The second evacuation port assembly 160B may include an evacuation shaft 190B to aid in the removal of gas from the door vacuum insulated cavity 40. The evacuation shaft 190B may extend from the base 170B, through the door evacuation port 42, and into the door vacuum insulated cavity 40.

According to various examples, the evacuation shaft 190B may include one or more apertures that are in fluid communication with the door vacuum insulated cavity 40. For example, the evacuation shaft 190B may include one or more apertures disposed along a length of the evacuation shaft 190B, or the evacuation shaft 190B may include a central end opening. Additionally, or alternatively, it is generally contemplated that the evacuation port assembly 160B may include various other components for aiding in the removal and/or filtration of gasses from the door vacuum insulated cavity 40. For example, filter paper or a mesh screen may be disposed over the door evacuation port 42.

Referring again to FIGS. 2-5, the first porous foam 24 is disposed within the vacuum insulated cavity 18. In the illustrated example, the first porous foam 24 is shown disposed within the vacuum insulated cavity 18 and coupled to the inner surface 26 of the outer wrapper 14. Generally, the first porous foam 24 is directly bonded to the inner surface 26. For example, the first porous foam 24 may be a spray foam that is applied to the inner surface 26 of the outer wrapper 14. The first porous foam 24 may bond to the inner surface 26 of the outer wrapper 14 during a curing process. For example, the first porous foam 24 can be sprayed to the outer wrapper 14 in an uncured state. The first porous foam 24 may then cure to the outer wrapper 14, wherein during the curing process, the first porous foam 24 bonds to the inner surface 26 of the outer wrapper 14. In various aspects, the first porous foam 24 may be bonded to various surfaces within the vacuum insulated cavity 18, such as the inner surface 186 of the inner liner 16.

According to various aspects, the first porous foam 24 may be disposed in the vacuum insulated cavity 18 such that the first porous foam 24 extends along a portion or an entirety of the inner surface 26 of the outer wrapper 14 and/or the inner surface 186 of the inner liner 16. In some examples, the first porous foam 24 may be the spray foam that is bonded to the inner surface 26 of the outer wrapper 14 and extends along an entirety of the inner surface of the outer wrapper 14.

In various aspects, the first porous foam 24 may be bonded to various areas of the cabinet 12. For example, the first porous foam 24 can be bonded to the rear panel 84 of the outer wrapper 14, which may be advantageous when the evacuation port 22 is defined in the rear panel 84. In additional aspects, the first porous foam 24 may be disposed in the vacuum insulated cavity 18 such that one or more patterns are defined. For example, the first porous foam 24 may include a plurality of foam strips extending along the vacuum insulated cavity 18. In such examples, the plurality of foam strips may individually, as a group, and/or as an entirety, define various patterns, such as a grid pattern, an X-pattern, and/or other various patterns.

Referring still to FIGS. 2 and 3, as well as FIGS. 6-8, the second porous foam 44 is disposed within the door vacuum insulated cavity 40. In the illustrated example, the second porous foam 44 is shown disposed within the door vacuum insulated cavity 40 and coupled to the interior surface 46 of the door liner 38. In some examples, the second porous foam 44 is directly bonded to the interior surface 46 of the door liner 38. For example, the second porous foam 44 can be sprayed on the door liner 38 in an uncured state. The second porous foam 44 may then cure to the door liner 38, wherein during the curing process, the second porous foam 44 bonds to the door liner 38. In various aspects, the second porous foam 44 may be bonded to various surfaces within the door vacuum insulated cavity 40, such as the interior surface 122 of the door wrapper 36.

According to various aspects, the second porous foam 44 may be disposed in the door vacuum insulated cavity 40 such that the second porous foam 44 extends along a portion or an entirety of the interior surface **46** of the door liner **38** or the interior surface of the door wrapper **36**. In certain aspects, the second porous foam **44** may be a spray foam that is bonded to the interior surface **46** of the door liner **38** and extends along an entirety of the inner surface **46** of the door liner **38**.

Additionally, or alternatively, the second porous foam **44** may be bonded to various areas of the door assembly **32**. For example, the second porous foam **44** can be bonded to a central region of the door liner **38**, which may align with the door evacuation port **42**. In additional aspects, the second porous foam **44** may be disposed in the door vacuum insulated cavity **40** such that one or more patterns are defined. For example, the second porous foam **44** may include a plurality of foam strips extending along the door vacuum insulated cavity **40**. In such examples, the plurality of foam strips may individually, as a group, and/or as an entirety, define various patterns, such as a grid pattern, an X-pattern, and/or other various patterns.

According to various aspects, the thickness of the first porous foam **24** and the second porous foam **44** may be one of multiple thicknesses. Generally, the first porous foam **24** may have a thickness that is less than the space between the inner surface **26** of the outer wrapper **14** and the inner surface **186** of the inner liner **16**, and the second porous foam **44** may have a thickness that is less than the space between the door wrapper **36** interior surface **122** and the door liner **38** interior surface **46**. For example, the first porous foam **24** and/or the second porous foam **44** may have a thickness of about 5 millimeters (mm). In some examples, the first porous foam **24** may have a thickness that is equal to or less than a thickness of the outer wrapper **14** and/or the inner liner **16**. Similarly, the second porous foam **44** may have a thickness that is equal to or less than the thickness of the door wrapper **36** and/or the door liner **38**.

In various aspects, the first porous foam **24** and/or the second porous foam **44** may define multiple thicknesses. For example, either porous foam **24**, **44** may have a first region with a greater thickness than a second, central region. In such examples, it is contemplated that the varying thicknesses of either porous foam **24**, **44** may define one or more gas extraction channels within the vacuum insulated cavity **18** and/or the door vacuum insulated cavity **40**. According to various aspects, where either porous foam **24**, **44** is a spray foam, the thickness of either porous foam **24**, **44** may be determined by the amount of spray foam applied to various sections of the cabinet **12** and/or door assembly **32**.

Referring again to FIGS. **4** and **5**, and still to FIGS. **7** and **8**, the first porous foam **24** and the second porous foam **44** may each be configured as an open-cell foam that defines a plurality of pores. For example, the first porous foam **24** may be an open-cell foam that defines the first plurality of pores **28** and the second porous foam **44** may be an open-cell foam that defines the second plurality of pores **48**. It is also generally contemplated that the first porous foam **24** and/or the second porous foam **44** may define a partially open-cell foam or a foam having regions of open-cell foam and closed-cell foam.

The first plurality of pores **28** of the first porous foam **24** may define at least one airflow path **30** that is in fluid communication with the vacuum insulated cavity **18** and the evacuation port **22**. For example, the first porous foam **24** may be an open-cell foam that defines the first airflow path **30** from an outer region **200** of the first porous foam **24**, which is distal from the inner surface **26** of the outer wrapper **14** and in contact with gasses retained within the vacuum insulated cavity **18**, to an inner region **202** of the first porous foam **24**, which is proximate the inner surface **26** and extends to the evacuation port **22**. In such examples, the gasses are evacuated out of the vacuum insulated cavity **18** by being pulled along the first airflow path **30**, which pulls the gas from the vacuum insulated cavity **18**, through the first porous foam **24**, and out of the evacuation port **22**, where the gas is then expelled out of the appliance **10**.

According to various aspects, the first airflow path **30** generally directs the fluid being evacuated towards the evacuation port **22**. In some examples, the first airflow path **30** may be defined such that the fluid flows in a direction parallel to the outer wrapper **14** and/or the inner liner **16**. For example, the first plurality of pores **28** may generally align with one another such that the first airflow path **30** travels parallel to the outer wrapper **14**. In this way, the gas from distal locations, such as upper and lower portions of the cabinet **12** may flow through the first airflow path **30** of the porous foam, generally parallel to the outer wrapper **14** to the evacuation port **22**.

In various aspects, the first plurality of pores **28** may define a plurality of first airflow paths. For example, the first airflow path **30** may include a plurality of airflow channels that are each in communication with the vacuum insulated cavity **18** and the evacuation port **22**. In such examples, the plurality of airflow channels of the first airflow path **30** permits the more uniform evacuation of gas out of the vacuum insulated cavity **18** due to the gas being more uniformly pulled along a plurality of inlet points and airflow channels that collectively direct the gas towards the evacuation port **22**.

Further, in such examples, the gas being uniformly pulled along at the plurality of inlet points may flow in various directions. For example, gas being uniformly pulled at an inlet point that is distal from the evacuation port **22** may flow perpendicular to the inner surface **26** of the outer wrapper **14** as the gas enters the inlet point. The gas may then be pulled parallel to the inner surface **26** and combined with other gases, where the combined gas then travels to the evacuation port **22**. Additionally, or alternatively, the first porous foam **24** can be an open-cell foam and the plurality of channels can be defined by the open-cell structure of the first porous foam **24**. In such examples, the plurality of airflow channels may be defined by various factors such as, pores per cell, permeability of the porous foam, and/or various other factors.

The second plurality of pores **48** of the second porous foam **44** may likewise define at least one airflow path **50** that is in fluid communication with the door vacuum insulated cavity **40** and the door evacuation port **42**. For example, the second porous foam **44** may be an open-cell foam that defines the second airflow path **50** from an outer region **210** of the second porous foam **44**, which is in contact with gasses retained within the door vacuum insulated cavity **40**, to an inner region **212** of the second porous foam **44**, which extends to the door evacuation port **42**. In such examples, the gasses are evacuated out of the door vacuum insulated cavity **40** by being pulled along the second airflow path **50**, which pulls the gas from the door vacuum insulated cavity **40**, through the second porous foam **44**, and out of the door evacuation port **42**, where the gas is then expelled out of the door assembly **32**.

According to various aspects, the second airflow path **50** generally directs the fluid being evacuated towards the door evacuation port **40**. In some examples, the second airflow path **50** may be defined such that the fluid flows in a direction parallel to the door wrapper **36** and/or the door liner **38**. For example, the second plurality of pores **48** may generally align with one another such that the second airflow path **50** travels parallel to the outer wrapper **14**. The airflow path **50** may direct the gas in various directions as the gas flows towards the door evacuation port **42**. For example, the second airflow path **50** may be defined such that the gas flows in a direction parallel to the door wrapper **36** and/or the door liner **38**. In this way, the gas from distal locations in the door assembly **32** may be drawn into the second porous foam **44**, flow along the second airflow path **50**, and be expelled through the door evacuation port **40**.

In various aspects, the second plurality of pores **48** may define a plurality of airflow paths. For example, the second airflow path **50** may include a plurality of airflow paths or channels that are each in connection with the door vacuum insulated cavity **40** and the door evacuation port **42**. In such examples, the plurality of airflow channels of the second airflow path **50** permit the more uniform evacuation of gas out of the door vacuum insulated cavity **40** due to the gas being more uniformly pulled along a plurality of inlet points and airflow paths and towards the door evacuation port **42**. Further, in such examples, the gas being more uniformly pulled along at the plurality of inlet points may flow in various directions. For example, gas being uniformly pulled at an inlet point that is distal from the door evacuation port **42** may flow perpendicular to the interior surface **46** of the door liner **38** as the gas enters the inlet point. The gas may then be pulled parallel to the interior surface **46** and combined with other gasses, where the combined gas then travels to the door the evacuation port **42**. Additionally, or alternatively, the second porous foam **44** may be an open-cell foam and the plurality of channels may be defined by the open-cell structure of the second porous foam **44**. In such examples, the plurality of airflow channels may be defined by various factors such as, pores per cell, permeability of the porous foam, and/or various other factors.

According to various aspects, each pore of the first plurality of pores **28** and the second plurality of pores **48** has a width that is less than a width of each particle of the insulation powder **150**. In particular, each pore may have a width of 5 microns (μm) or less. The lessened width of each pore relative to each particle of the insulation powder **150** is such that gasses within the vacuum insulated cavity **18** and the door vacuum insulated cavity **40** may pass through each pore while each insulation particle is prevented from passing through each pore. In this respect, the first plurality of pores **28** and the second plurality of pores **48** may serve as a filter for larger particles, such as the particles of the insulation powder **150**.

It is generally contemplated that each cell of the first porous foam **24** and the second porous foam **44** may define one or more pores per cell. In some examples, the first porous foam **24** and/or the second porous foam **44** may define channels within the porous foam for the flow of gas by having regions with varying numbers of pores per cell. For example, the first porous foam **24** and/or the second porous foam **44** may have a central region, where each cell in the central region has a greater number of pores per cell such that gases may flow at a greater rate in the central region. In such examples, the greater number of pores and the greater flow rate of gas is such that the central region defines a channel with a greater flow rate. It is also generally contemplated that each pore of the first plurality of pores **28** and/or the second plurality of pores **48** may have a width that varies or is consistent with the other pores of the first plurality of pores **28** and/or the second plurality of pores **48**.

The first porous foam **24** and the second porous foam **44** may be formed from various materials. For example, each porous foam **24**, **44** may be made out of a reticulated form, a polyurethane foam, an open cell rubber, other various polymers, and/or combinations thereof. According to various aspects, the first porous foam **24** and the second porous foam **44** may be substantially rigid or elastic, with varying levels of material toughness. For example, the first porous foam **24** and/or the second porous foam **44** may be rigid with a greater degree of material toughness such that the first porous foam **24** and/or the second porous foam **44** stays in a static state as gas is evacuated out of the vacuum insulated cavity **18** or the door vacuum insulated cavity **40**. In various examples, this high rigidity and material toughness may be advantageous for maintaining flow paths during the evacuation of gas and/or during a subsequent evacuation of gas, as well as providing strength to the cabinet **12** or door assembly **32**.

In another example, the first porous foam **24** and/or the second porous foam **44** may be rigid with a lesser degree of material toughness such that each cell of either porous foam **24**, **44** progressively closes as gas is evacuated out of the vacuum insulated cavity **18**. In such examples, the first porous foam **24** and/or the second porous foam **44** may have a first thickness of about 5 mm before the gas is evacuated from the vacuum insulated cavity **18** or the door vacuum insulated cavity **40**, and then a second thickness of about 0.4 mm after the gas is evacuated from the vacuum insulated cavity **18** and/or the door vacuum insulated cavity **40**.

In various aspects, this lessened rigidity of the porous foam **24**, **44** may advantageously provide for an open-cell foam that assists in evacuating fluid from either vacuum insulated cavity **18**, **40**, while also increasing a width of the vacuum insulated cavity **18**, **40**, which in turn may reduce thermal transfer between an external environment and the interior of either vacuum insulated cavity **18**, **40**. In some examples, this lessened rigidity may be due to a rapidly curing open-cell foam. In such examples, the rapidly curing open-cell foam may advantageously permit increased efficiency in the manufacture of the appliance **10**. It is also generally contemplated that the first porous foam **24** and/or the second porous foam **44** may be an elastic foam such that the first porous foam **24** and/or the second porous foam **44** compresses to varying degrees, depending on the magnitude of the inward compressive force **94**.

Referring to FIG. **9**, as well as FIGS. **1**-**8**, a method **300** of assembling the cabinet **12** includes step **302** of bonding the first porous foam **24** onto the inner surface **26** of the outer wrapper **14**. The outer wrapper **14** is provided with the evacuation port assembly **160**A coupled thereto over the evacuation port **22**. In this way, the outer wrapper **14** is partially assembled prior to the first porous foam **24** being sprayed on the inner surface **26**. In step **302**, the outer wrapper **14** is provided and the first porous foam **24** is sprayed onto the inner surface **26** of the outer wrapper **14**, where the first porous foam **24** is then cured and bonded to the outer wrapper **14**.

In step **304**, the outer wrapper **14** is then coupled to the inner liner **16** and the trim breaker **20** to form the cabinet **12** and seal the vacuum insulated cavity **18**. In step **306**, the insulation powder **150** is disposed in the vacuum insulated cavity **18** between the outer wrapper **14** and the inner liner **16**.

In step **308**, an evacuation pumping system is coupled to the servicing tube **172**A of the evacuation port assembly **160**A and gas is evacuated out of the vacuum insulated cavity **18** via the first airflow path **30**. In the first airflow path **30**, the gas is pulled from the vacuum insulated cavity **18** and passes through the first porous foam **24**. The gas then flows out of the evacuation port **22**, through the service tube **172**A, and is expelled out of the cabinet **12**. The service tube **172**A can then be crimped to maintain the at least partial vacuum within the vacuum insulated cavity **18**.

Referring to FIG. **10**, as well as FIGS. **1-8**, a method **400** of assembling the door assembly **32** includes step **402** of bonding the second porous foam **44** onto the interior surface **46** of the door liner **38**. The door liner **38** is provided with the evacuation port assembly **160**B coupled thereto over the door evacuation port **42**. In this way, the door liner **38** is partially assembled prior to the second porous foam **44** being sprayed on the inner surface **46**. In step **402**, the door liner **38** is provided and the second porous foam **44** is sprayed onto the interior surface **46** of the door liner **38**, where the second porous foam **44** is then cured and bonded to the door liner **38**.

In step **404**, the door liner **38** is coupled to the door wrapper **36** to seal the door vacuum insulated cavity **40**. In step **406**, the insulation powder **150** is disposed in the door vacuum insulated cavity **40** between the door wrapper **36** and the door liner **38**.

In step **408**, an evacuation pumping system is coupled to the servicing tube **172**B of the evacuation port assembly **160**B and gas is evacuated out of the door vacuum insulated cavity **40** via the second airflow path **50**. In the second airflow path **50**, the gas is pulled from the door vacuum insulated cavity **40** and passes through the second porous foam **44**. The gas then flows out of the door evacuation port **42**, through the service tube **172**B, and is expelled out of the appliance **10**. The service tube **172**B can then be crimped to maintain the at least partial vacuum within the door vacuum insulated cavity **40**. The steps **302-308**, **402-408** of the methods **300**, **400** may be performed simultaneously, performed in any order, omitted, and/or repeated without departing from the teachings herein.

Referring to FIGS. **1-10**, the appliance **10** having the vacuum insulated cavity **18** with the first porous foam **24**, and the door assembly **32** having the door vacuum insulated cavity **40** with the second porous foam **44**, provides for an appliance **10** that can more uniformly extract air from either or both vacuum insulated cavity **18**, **40**, while still keeping the insulation powder **150** disposed in the vacuum insulated cavity **18** and the door vacuum insulated cavity **40**. In particular, each pore of the first plurality of pores **28** of the first porous foam **24** and the second plurality of pores **48** of the second porous foam **44** has a width less than the width of each particle of the insulation powder **150**. This difference in width between each pore and each particle is such that gas is permitted to pass through either porous foam **24**, **44**, through the first airflow path **30** and/or the second airflow path **50**, while the insulation powder **150** is filtered out of either airflow path **30**, **50** and maintained within the respective vacuum insulated cavity **18**, **40**. Moreover, the airflow paths **30**, **50** decrease the time to fully evacuate the respective cavities **18**, **40**, thereby maximizing efficiency of the manufacturing process.

According to various examples, the vacuum insulated cabinet **12** and the vacuum insulated door assembly **32** can be used in various appliances. These appliances can include, but are not limited to, refrigerators, freezers, coolers, ovens, dishwashers, laundry appliances, and other similar appliances and fixtures within household and commercial settings. Additionally, the insulation powder **150** can be a free-flowing material that can be poured, blown, compacted, or otherwise disposed within either vacuum insulated cavity **18**, **40**.

Referring further to FIGS. **1-10**, the present disclosure provides for a variety of advantages. For example, the use of the first porous foam **24** and the second porous foam **44** provides a filter such that gas may be evacuated from either vacuum insulated cavity **18**, **40**, without removing the insulation powder **150**. Similarly, the filtration of the insulation powder **150** out of either airflow path **30**, **40** advantageously provides for the increased rate of fluid evacuation, as fluid is permitted to freely flow through either porous foam **24**, **44** without being encumbered by particles of the insulation powder **150**.

Additionally, both porous foams **24**, **44** advantageously provide for a more uniform and effective extraction of gas from either vacuum insulated cavity **18**, **40**, due to both porous foams **24**, **44** being open-cell and defining the plurality of airflow paths that extract gas at multiple points along the outer region **200**, **210** of either porous foam **24**, **44**. This more uniform extraction of gas likewise permits the reduction of evacuation ports **22** or door evacuation ports **42**, as the gas may be more uniformly extracted from a single evacuation port **22** that is in fluid communication with the first porous foam **24** or from a single door evacuation port **42** that is in fluid communication with the second porous foam **44**.

Similarly, the more uniform extraction of gas via the plurality of channels and plurality of inlet points defined by either porous foam **24**, **44** advantageously provides for the evacuation of gas along a flow path **30**, **50** that extends parallel to the outer wrapper **14** or the door liner **38**. This parallel flow of the gas advantageously permits greater evacuation control and uniformity of gas evacuation, as the gas being evacuated combines and travels along a single flow path **30**, **50**. Furthermore, the use of the first porous foam **24** and the second porous foam **44** advantageously reduces the assembly time of the appliance **10** with the door assembly **32**. In particular, by spraying the first porous foam **24** to the inner surface **26** of the outer wrapper **14** and the second porous foam **44** to the interior surface **46** of the door liner **38**, both porous foams **24**, **44** are quickly bonded, and airflow paths are provided, without additional manufacturing steps. Additional benefits or advantages of using this appliance **10** may also be realized and/or achieved.

The device disclosed herein is further summarized in the following paragraphs and is further characterized by combinations of any and all of the various aspects, described herein.

According to one aspect of the present disclosure, a vacuum insulated appliance includes a cabinet with an outer wrapper and an inner liner coupled to the outer wrapper. A cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner. A trim breaker is coupled to the outer wrapper and the inner liner, and the trim breaker seals the cabinet vacuum insulated cavity. A wrapper evacuation port is defined by the outer wrapper. The wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity. A first porous foam is coupled to an inner surface of the outer wrapper. The first porous foam defines a first plurality of pores. The first plurality of pores defines a first airflow path that is in fluid communication with the wrapper evacuation port. A door assembly is coupled to a front portion of the cabinet. The door assembly includes a door wrapper. A door liner is coupled to the door wrapper. A door vacuum insulated cavity is defined between the door wrapper and the door liner. A door evacuation port is defined by the door liner. The door evacuation port is in fluid communication with the door vacuum insulated cavity for evacuating air from the door vacuum insulated cavity. A second porous foam is coupled to an inner surface of the door liner. The second porous foam defines a second plurality of pores. The second plurality of pores defines a second airflow path in fluid communication with the door evacuation port.

According to another aspect, an insulation powder is disposed within a cabinet vacuum insulated cavity and a door vacuum insulated cavity of a door assembly.

According to another aspect, an insulation powder includes insulation particles, and each insulation particle of the insulation powder has a width greater than a width of each pore of a first plurality of pores and a second plurality of pores.

According to another aspect, a first porous foam and a second porous foam are an open-cell spray foam.

According to another aspect, a first porous foam is disposed along an entirety of the inner surface of an outer wrapper.

According to another aspect, a first porous foam is disposed along a rear panel of an outer wrapper.

According to another aspect of the present disclosure, a vacuum insulated appliance includes a cabinet with an outer wrapper and an inner liner coupled to the outer wrapper. A cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner. A trim breaker is coupled to the outer wrapper and the inner liner, and the trim breaker seals the cabinet vacuum insulated cavity. A wrapper evacuation port is defined by the outer wrapper. The wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity. A porous foam is coupled to and extends along an inner surface of the outer wrapper. The porous foam defines a plurality of pores. The plurality of pores defines at least one first airflow path in fluid communication with the wrapper evacuation port for evacuating air from the cabinet vacuum insulated cavity through the at least one first airflow path.

According to another aspect, a porous foam is an open-cell foam, and the open-cell foam is bonded to an inner surface of an outer wrapper.

According to another aspect, an insulation powder includes insulation particles, and each insulation particle of the insulation powder has a width greater than a width of each pore of a plurality of pores.

According to another aspect, at least one first airflow path includes a plurality of first airflow paths each in fluid communication with the wrapper evacuation port.

According to another aspect, a door assembly is coupled to a front portion of an outer wrapper. The door assembly includes a structural wrapper defining a door vacuum insulated cavity. The structural wrapper defines a door evacuation port in fluid communication with the door vacuum insulated cavity. Insulation powder is disposed within the door vacuum insulated cavity, and a second porous foam is coupled to an inner surface of the structural wrapper. The second porous foam defines a second plurality of pres. The second plurality of pores defines a second airflow path in fluid communication with the door evacuation port for evacuating air from the door vacuum insulated cavity, through the second airflow path, and through the door evacuation port.

A door wrapper and a door liner coupled to the door wrapper. A door vacuum insulated cavity is defined between the door wrapper and the door liner. A door evacuation port is defined by the door liner. Insulation powder is disposed within the door vacuum insulated cavity. A second porous foam is coupled to an inner surface of the door liner. The second porous foam defines a second plurality of pores. The second plurality of pores defines a second airflow path in fluid communication with the door evacuation port for evacuating air from the door vacuum insulated cavity, through the second airflow path, and through the door evacuation port.

According to another aspect, a porous foam is a spray foam bonded to an inner surface.

According to another aspect, a porous foam is disposed along an inner periphery of a rear panel of an outer wrapper.

According to another aspect of the present disclosure, a vacuum insulated door assembly for an appliance includes a door wrapper. A door liner is coupled to the door wrapper. The door liner defines a door evacuation port. A door vacuum insulated cavity is defined between the door wrapper and the door liner. Insulation powder is disposed within the door vacuum insulated cavity. A porous foam is coupled to an inner surface of the door liner. The porous foam defines a plurality of pores. The plurality of pores defines a plurality of airflow paths in fluid communication with the door vacuum insulated cavity and the door evacuation port for evacuating air from the door vacuum insulated cavity, through the plurality of airflow paths, and the door evacuation port.

According to another aspect, a plurality of airflow paths directs an airflow toward a door evacuation port, and the airflow at least partially flows in a direction parallel to an inner surface of a door liner.

According to another aspect, an insulation powder includes insulation particles, and each pore of a plurality of pores has a width less than a width of each particle of the insulation powder.

According to another aspect, a door assembly is coupled to a cabinet. The cabinet includes an outer wrapper. An inner liner is coupled to the outer wrapper. A cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner. A wrapper evacuation port is defined by the outer wrapper. The wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity. A second porous foam is coupled to and extending along an inner surface of the outer wrapper. The second porous foam defines a second plurality of pores. The second plurality of pores defines a second plurality of airflow paths in fluid communication with the wrapper evacuation port for evacuating the air from the cabinet vacuum insulated cavity through the second plurality of airflow paths.

According to another aspect, a porous foam is disposed along an entirety of an inner surface of a door liner.

According to another aspect, a thickness of a door wrapper is greater than a thickness of a porous foam.

According to another aspect, a porous foam is an open-cell spray foam bonded to an inner surface of a door liner.

It will be understood by one having ordinary skill in the art that construction of the described disclosure and other components is not limited to any specific material. Other exemplary embodiments of the disclosure disclosed herein may be formed from a wide variety of materials, unless described otherwise herein.

For purposes of this disclosure, the term "coupled" (in all of its forms, couple, coupling, coupled, etc.) generally means the joining of two components (electrical or mechanical) directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two components (electrical or mechanical) and any additional intermediate members being integrally formed as a single unitary body with one another or with the two components. Such joining may be permanent in nature or may be removable or releasable in nature unless otherwise stated.

It is also important to note that the construction and arrangement of the elements of the disclosure as shown in the exemplary embodiments is illustrative only. Although only a few embodiments of the present innovations have been described in detail in this disclosure, those skilled in the art who review this disclosure will readily appreciate that many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes, and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter recited. For example, elements shown as integrally formed may be constructed of multiple parts or elements shown as multiple parts may be integrally formed, the operation of the interfaces may be reversed or otherwise varied, the length or width of the structures and/or members or connector or other elements of the system may be varied, the nature or number of adjustment positions provided between the elements may be varied. It should be noted that the elements and/or assemblies of the system may be constructed from any of a wide variety of materials that provide sufficient strength or durability, in any of a wide variety of colors, textures, and combinations. Accordingly, all such modifications are intended to be included within the scope of the present innovations. Other substitutions, modifications, changes, and omissions may be made in the design, operating conditions, and arrangement of the desired and other exemplary embodiments without departing from the spirit of the present innovations.

It will be understood that any described processes or steps within described processes may be combined with other disclosed processes or steps to form structures within the scope of the present disclosure. The exemplary structures and processes disclosed herein are for illustrative purposes and are not to be construed as limiting.

What is claimed is:

1. A vacuum insulated appliance, comprising:

a cabinet including:

an outer wrapper having a top panel, a rear panel, and a bottom panel;

an inner liner coupled to the outer wrapper, wherein a cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner;

a trim breaker coupled to the outer wrapper and the inner liner, the trim breaker sealing the cabinet vacuum insulated cavity;

a wrapper evacuation port defined by the outer wrapper, wherein the wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity; and

a first porous foam coupled to an inner surface of the outer wrapper, the first porous foam defining a first plurality of pores, wherein the first plurality of pores define a first airflow path in fluid communication with the wrapper evacuation port, wherein the first porous foam forms a continuous layer spanning the top, rear, and bottom panels of the outer wrapper, the continuous layer being spaced from the inner liner and lining at least two corners of the cabinet; and

a door assembly coupled to a front portion of the cabinet, the door assembly including:

a door wrapper;

a door liner coupled to the door wrapper, wherein a door vacuum insulated cavity is defined between the door wrapper and the door liner, and wherein the door liner includes a peripheral wall;

a door evacuation port defined by the door liner, wherein the door evacuation port is in fluid communication with the door vacuum insulated cavity for evacuating air from the door vacuum insulated cavity; and

a second porous foam coupled to and spanning an inner surface of the door liner, the second porous foam defining a second plurality of pores, wherein the second plurality of pores defines a second airflow path in fluid communication with the door evacuation port, and wherein the second porous foam defines a ridge layer extending between the door wrapper and the inner surface of the door liner along the peripheral wall.

2. The vacuum insulated appliance of claim **1**, further comprising:

an insulation powder disposed within each of the cabinet vacuum insulated cavity and the door vacuum insulated cavity.

3. The vacuum insulated appliance of claim **2**, wherein the insulation powder includes insulation particles, and wherein each insulation particle of the insulation powder has a width greater than a width of each pore of the first plurality of pores and the second plurality of pores.

4. The vacuum insulated appliance of claim **1**, wherein the first porous foam and the second porous foam are an open-cell spray foam having a plurality of cells, wherein the plurality of cells in a central region of at least one of the top, rear, and bottom panels of the cabinet and the door assembly includes a greater number of pores per cell than end regions thereof, and wherein each of the first and second porous foams has a thickness configured to be reduced in response to an evacuation of the air from the cabinet vacuum insulated cavity and the door vacuum insulated cavity, respectively.

5. The vacuum insulated appliance of claim **1**, wherein the first airflow path includes a plurality of path portions that extend along an entirety of the inner surface of the outer wrapper.

6. The vacuum insulated appliance of claim **1**, wherein the first porous foam is disposed along the rear panel of the outer wrapper, the rear panel defining an indent along which the first porous foam extends.

7. A vacuum insulated structure for an appliance, comprising:

an outer wrapper including a top panel, a rear panel, and a bottom panel, the rear panel defining a sloped indent;

an inner liner coupled to the outer wrapper, wherein a cabinet vacuum insulated cavity is defined between the outer wrapper and the inner liner;

a trim breaker coupled to the outer wrapper and the inner liner, the trim breaker sealing the cabinet vacuum insulated cavity;

a wrapper evacuation port defined by the outer wrapper, wherein the wrapper evacuation port is in fluid communication with the cabinet vacuum insulated cavity for evacuating air from the cabinet vacuum insulated cavity; and

a porous foam coupled to and extending along an inner surface of the outer wrapper, the porous foam defining a plurality of pores, wherein the plurality of pores define a plurality of first airflow paths in fluid communication with the wrapper evacuation port for evacuating the air from the cabinet vacuum insulated cavity through the plurality of first airflow paths, wherein the porous foam forms a continuous layer spanning the top, rear, and bottom panels of the outer wrapper including along the sloped indent, the continuous layer lining at least two corners of the outer wrapper, and wherein the plurality of first airflow paths spans across the top, rear, and bottom panels.

8. The vacuum insulated structure of claim **7**, wherein the porous foam is an open-cell foam, wherein the open-cell foam is bonded to the inner surface of the outer wrapper, and wherein the plurality of first airflow paths of the porous foam uniformly spans across the top, rear, and bottom panels.

9. The vacuum insulated structure of claim **7**, further comprising:

an insulation powder disposed within the cabinet vacuum insulated cavity, wherein the insulation powder includes insulation particles, and wherein each particle of the insulation powder has a width greater than a width of each pore of the plurality of pores.

10. The vacuum insulated structure of claim **7**, further comprising:

a door assembly coupled to a front portion of the outer wrapper, the door assembly including:

a structural wrapper defining a door vacuum insulated cavity, wherein the structural wrapper defines a door evacuation port in fluid communication with the door vacuum insulated cavity;

insulation powder disposed within the door vacuum insulated cavity; and

a second porous foam coupled to an inner surface of the structural wrapper, the second porous foam defining a second plurality of pores, wherein the second plurality of pores define a second airflow path in fluid communication with the door evacuation port for evacuating air from the door vacuum insulated cavity, through the second airflow path, and through the door evacuation port.

11. The vacuum insulated structure of claim **7**, wherein the porous foam is a spray foam bonded to the inner surface.

12. The vacuum insulated structure of claim **7**, wherein the porous foam is disposed along an entirety of the inner surface of the rear panel of the outer wrapper.

13. The vacuum insulated structure of claim **7**, wherein the porous foam spans the rear panel of the outer wrapper, and wherein the rear panel and the porous foam spanning the rear panel proximate the bottom panel are horizontally offset from the rear panel and the porous foam spanning the rear panel proximate the top panel.

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