A vent assembly includes a base, an intake duct, an exhaust duct, and a cap assembly. The base includes a vertically oriented, outward facing primary surface and defines a duct aperture that extends through the outward facing primary surface. The base includes a metallic material. The intake duct is coupled to the base within the duct aperture, and the exhaust duct is oriented coaxially within the intake duct. An end of the exhaust duct extends distally beyond an end of the intake duct. The cap assembly includes first, second, and third members, wherein at least one of the first, second and third members includes a non-metallic material. The first member includes an intake aperture aligned with the duct aperture of the base and is sized to substantially cover the outward facing primary surface. The second member includes an exhaust aperture sized to receive the exhaust duct. The third member is positioned distally beyond an distal end of the exhaust duct in a flow path of exhaust gases exiting the exhaust duct.
NON-METALLIC VENT CAP

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention generally relates to components of a vent system for heating appliances, and more particularly relates to vent cap structures suited for exhausting combustion products and intake fresh air for the heating appliance.

[0003] 2. Related Art

[0004] Exterior intake and/or exhaust venting systems are generally known for use in buildings and other such structures. Such vents can be used for a variety of venting purposes, for example, to vent fireplaces, furnaces, water heaters, boilers, dryers, exhaust fans, and a many other such appliances and devices. Some such vents are primarily exhaust vents while others are primarily intake vents, and still others include structure that allows them to function as both intake and exhaust vents.

[0005] In one example, chimneyless gas fireplaces often include intake/exhaust venting units that are mounted on the outside of an exterior wall that provide a through-the-wall connection to a double walled collinear ducting of the gas fireplace. The double walled collinear ducting includes an inner duct that serves as an outtake port for exhaust fumes, and an outer duct that serves as an intake port for ambient combustion air. The venting units generally include an inner and an outer duct. Further, the double walled ducting is connected to a series of bases that have deflectors and heat shields. The venting unit has a series of venting apertures with a vent cap attached thereto. The vent cap is utilized to cover both the intake and the combustion product exhaust.

[0006] Regardless of the specific structure or use of the vent, most venting systems generally include a functional vent cap that covers the intake and exhaust portions of the vent. However, many of the existing vent caps are not aesthetically pleasing, may get hot due to high temperature exhaust gases, and are exposed to the ambient atmosphere and therefore may be damaged. An example venting unit that includes a functional vent cap and vent covers is shown and described in U.S. Pat. No. 6,484,712.

SUMMARY OF THE INVENTION

[0007] The present invention relates to vent assemblies that provide proper fluid flow into and out of respective intake and exhaust apertures of a vent, and minimize the flow of fluids exhausted from the exhaust aperture back into the intake aperture. The vent assembly comprises at least one non-metallic member or at least one member that includes non-metallic materials such as a compression molded ceramic fiber and a binder material.

[0008] One aspect of the invention relates to a vent assembly that includes a base, an intake duct, an exhaust duct, and a cap assembly. The base includes a vertically oriented, outward facing primary surface and defines a duct aperture that extends through the outward facing primary surface. The base includes a metallic material. The intake duct is coupled to the base within the duct aperture, and the exhaust duct is oriented coaxially within the intake duct. An end of the exhaust duct extends distally beyond an end of the intake duct. The cap assembly includes first, second, and third members that each include a non-metallic material. The first member includes an intake aperture aligned with the duct aperture of the base and is sized to substantially cover the outward facing primary surface. The second member includes an exhaust aperture sized to receive the exhaust duct. The third member is positioned distally beyond an distal end of the exhaust duct in a flow path of exhaust gases exiting the exhaust duct.

[0009] Another aspect of the invention relates to a vent assembly that includes a base member, an intake duct, an exhaust duct, and a vent cap assembly. The base member is configured for mounting to a wall structure. The intake duct is coupled to the base member. The exhaust duct extends coaxially through the intake duct and extends distally beyond an open end of the intake duct. The vent cap assembly is configured to mount to the base member and the intake and exhaust ducts and includes a plurality of non-metallic structures configured to direct away from each other fluids entering and exiting the intake and exhaust ducts.

[0010] A further aspect of the invention relates to a method of mounting a venting assembly to a vertically oriented surface. The method includes mounting a base plate to the vertically oriented surface, the base plate defining a vent aperture, mounting an intake duct to the base plate within the vent aperture, and positioning an exhaust duct within the intake duct with an open end of the exhaust duct extending distally beyond an open end of the intake duct. The method further includes detachably mounting a vent cap assembly to the base plate wherein the vent cap assembly includes at least one cap member that comprise a non-metallic material. The vent cap assembly is configured to direct intake air into the intake duct and direct exhaust gases out of the exhaust duct and away from the open end of the intake duct.

[0011] Another aspect of the invention relates to a method of manufacturing a vent assembly, wherein the vent assembly includes a base member and a vent cap assembly. The vent cap assembly includes at least first and second vent cap members. The method includes coupling the vent cap members together with at least one fastener that extends from the first vent cap member and into engagement with the second vent cap member, and coupling the vent cap assembly to the base member with at least one second fastener that extends through the first vent cap member into engagement with the base member.

[0012] The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. In particular, the example embodiments described below in relation to the Figures are the application of the present invention to a heating appliance vent system, whereas other fields may be applicable to fulfill the purposes and intents of the present invention. Figures in the detailed description that follow more particularly exemplify certain embodiments of the invention. While certain embodiments will be illustrated and describe embodiments of the invention, the invention is not limited to use in such embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention may be more completely understood in consideration of the following detailed description of
various embodiments of the invention in connection with the accompanying drawings, in which:

[0014] FIG. 1 is a perspective view of one example vent assembly according to principals of the present invention;

[0015] FIG. 2 is an exploded perspective view of the vent assembly as shown in FIG. 1;

[0016] FIG. 3 is a side view of the vent assembly shown in FIG. 1;

[0017] FIG. 4 is a front view of the vent assembly shown in FIG. 1;

[0018] FIG. 5 is a cross sectional view taken along cross section indicators 5-5 in FIG. 4;

[0019] FIG. 6 is a cross sectional view taken along cross section indicators 6-6 shown in FIG. 4;

[0020] FIG. 7 is an exploded perspective view of a base assembly portion of the vent assembly shown in FIG. 1;

[0021] FIG. 8 is a rear view of a first cap member of the vent assembly shown in FIG. 1;

[0022] FIG. 9 is a rear view of a second cap member of the vent assembly shown in FIG. 1; and

[0023] FIG. 10 is a rear view of a third cap member of the vent assembly shown in FIG. 1.

[0024] While the invention is amenable to various modifications and alternate forms, specific thereof have been shown by way of example and the drawings, and will be described in detail. It should be understood, however, that the invention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives within the spirit and scope of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] The present invention generally relates to vent systems, vent assemblies and related methods of venting and assembling vent systems and vent assembly components. One aspect of the invention relates to the use of non-metallic materials with a vent assembly, in particular, portions of a vent cap or vent cover of a vent assembly that are exposed for viewing.

[0026] The vent systems and assemblies are typically associated with heating appliances that require at least one of a source of inlet air and an exhaust outlet. The example systems and methods described herein include an exhaust member configured to exhaust combustion products away from the heating appliance through an exhaust portion of the vent assembly, and an intake member configured to provide a source of intake air to the heating appliance. The exhaust and intake members are preferably coaxially oriented with the exhaust member extending within the intake member. This coaxial arrangement (sometimes referred to as a H-vent arrangement) provides cooling of exhaust gases in the exhaust member via heat transfer with the intake air flowing through the intake member. Other embodiments can provide different arrangements of the exhaust and intake members relative to each other, or provide exhaust or intake functions rather than both functions.

[0027] The use of metallic materials for components of a vent assembly is common. Metallic materials can have certain drawbacks related to, for example, safety issues (e.g., related to exposed heated surfaces of the vent assembly), aesthetics and appearance, and replaceability of components. The use of non-metallic materials for at least some of the components of a vent assembly address some or all of the drawbacks of metallic vent assemblies. For example, some non-metallic materials such as the compression molded ceramic materials disclosed in U.S. Patent Application No. 2003/0049575, which patent application is incorporated herein by reference in its entirety, possess heat dissipating properties that result in improved safety.

[0028] Some non-metallic materials can be molded, cast, or otherwise formed or shaped to include details and features that improve aesthetics and appearance of a resulting product. The moldability of some types of non-metallic materials provide for flexibility in generating complex component shapes and structures that could be more difficult and costly to produce if using metallic materials. Some types of non-metallic materials are useful for providing desired surface finishes such as texture, color and grain that match the appearance of exposed structures that surround the vent assembly. For example, a vent cap or vent cover made in part from a non-material material such as the compression molded ceramic material mentioned above can be formed with a stucco style exposed surface that matches a stucco surface of the wall structure to which the vent cap/cover is mounted.

[0029] Referring now to FIGS. 1-10, an example vent assembly 10 includes a base 12, an intake duct 14, an exhaust duct 16, and a vent cap assembly 18. The vent cap assembly 18 includes first, second and third cap members 20, 22, 24, first and second screens 26, 28, and an exhaust duct base 30. Preferably, at least one of the cap members 20, 22, 24 comprises a non-metallic material such as the compression molded ceramic material disclosed in U.S. Patent Application No. 2003/0049575. While the vent cap assembly 18 includes three separate cap members, other embodiments may have a similar resulting configuration by integrally forming two or more of the cap members 20, 22, 24 as a single piece.

[0030] Referring to FIG. 2, the base 12 includes a vent aperture 40, a water flashing 42, and an exposed outward facing surface 43. The base 12 may be coupled as a sub-assembly 13 with the intake duct 14 and heat shield 32 (see FIG. 7). The sub-assembly 13 is preferably mounted to an outside surface of a wall structure such as an exterior wall of a living structure (e.g., residential home or commercial building). The wall structure typically includes a hole having a diameter equal to the diameter of the heat shield 32. When the base 12 is mounted against the wall structure, the intake duct 14 is positioned within the wall structure such that an inner open end 44 of the intake duct is in a position for attachment to further ducting extending within the living structure. Typically, the further ducting (not shown) is coupled to a heating appliance that requires intake of air drawn in through the intake duct 14.

[0031] When mounting the base 12 to the wall structure, the base 12 may be permanently or semi-permanently mounted with fasteners, adhesives, or the like, thereby providing a mounting surface for the vent cap assembly 18.
A outer open end 44 of the intake duct 44 terminates at a point distally beyond the outward facing surface 43 of the base 12. The intake duct 14 may also include a flange 46 or other structure to help mount the intake duct 14 to the base 12 within the vent aperture 40.

The exhaust duct 16 is coaxially mounted within the intake duct 14 as shown in FIGS. 3, 5, and 6. An inward open end 50 of the exhaust duct 16 extends axially beyond the inward open end 45 of the intake duct 14 to provide, for example, easier connection to further exhaust ducting that extends within the living structure. An outward open end 50 of the exhaust duct 16 extends distally beyond the outward open end 44 of the intake duct 14 so as to be positioned within the vent cap assembly 18 when the vent cap assembly is mounted to the base (see FIGS. 5 and 6). The exhaust duct 16 may also include a flange member 54 at the outer open end 50 that can be used to help attach the exhaust duct 16 within the vent cap assembly 18. The first cap member 20 includes an outward facing surface 60, an intake vent aperture 62, a water shield 64 formed across the top of the intake vent aperture 62, and first and second sets of fastener apertures 66, 68. The first cap member 20 is sized to substantially cover the outward facing surface 43 of the base 12 (see FIG. 4).

In other embodiments, the first cap member 20 may be sized to overlap and completely conceal and/or cover all of the base 12 from view, in particular from a front view as shown in FIG. 4. In other embodiments, the first cap member 20 may have a smaller size such that portions of the base 12 are exposed. In such an embodiment, the exposed portions of base 12 can be covered by the exterior cover of the building structure such as siding, stucco, or the like to provide a more permanent mounting of the base 12 to the wall structure.

The water shield 64 extends outwardly away from the outward facing surface a distance approximately equal to a width of the inflow opening defined by the second cap member 22 (described in further detail below). The water shield 64 helps to prevent water from flowing into an interior defined by the vent cap assembly 18, the water shield 64 defines a generally curved structure such that any precipitation falling vertically onto a top surface of the water shield 64 is directed laterally to one of the sides of the venting assembly 10 and away from entering into the intake vent 14 via the vent opening 62.

The second set of fastener apertures 68 are sized to receive the second set of fasteners 36, which are used to positively attach the first cap member 20 to the base 12. When the vent cap assembly 18 is assembled together, securing the first cap member to the base 12 results in positive attachment of the entire vent cap assembly 18 to the base 12 and thereby attachment to the wall structure to which the base 12 is also mounted.

The second cap member 22 includes an outward facing surface 70, an exhaust vent aperture 72, a plurality of connecting members 74 that define a plurality of inflow openings 76, and fastener apertures 78. The exhaust vent aperture 72 is sized to receive the exhaust duct 16 with the open end 50 of the exhaust duct being positioned flush mounted with the outward facing surface 70 or extending distally beyond the outward facing surface 70 as shown in FIGS. 5 and 6. The exhaust duct 16 is mounted with a positive connection to the second cap member by coupling the exhaust duct base 30 against the flange 54 of the exhaust duct and then securing the exhaust duct base 30 to the outward facing surface 70 of the second cap member 22 with, for example, fasteners or adhesives.

The connecting members 74 act as, for example, dividers, standoff members or separators that space apart the second cap member 22 from the first cap member 20. A spacing between the first and second cap members 20, 22 is preferred in order for air to flow into the intake duct 14 via the intake aperture 62 of the first vent cap member when the vent cap assembly 18 is assembled together. The connecting member 74, while shown in this embodiment integrally formed with the structure of the second cap member 22 that defines the outward facing surface 70, other embodiments may include a connecting member that is separate and distinct. In other examples, the connecting members may be integrally formed with the first cap member 20. Furthermore, while four connecting members 74 are shown in the present embodiment, other embodiments may include fewer or more than four connecting members while providing separation of the first and second cap members 20, 22.

The fastener apertures 78 extend through the connecting members 74 such that the first set of fasteners 34 can pass through the apertures 78. The apertures 78 align with the first set of fastener apertures 66 in the first cap member 20 so that the fasteners 34 can pass through the apertures 68, through the apertures 78, and be connected to the third cap member 24 (discussed in further detail below) for assembly of the first, second and third cap members 20, 22, 24 as a subassembly of the venting assembly 10.

The third cap member 24 includes an outward facing surface 80, a plurality of connecting members 82, a plurality of outflow openings 84 defined between the connecting members 82, and a plurality of fastener receivers 86 defined within the connecting members 82 (see FIG. 9). The connecting members 82 provide spacing and separation between the second and third cap members 22, 24. Separation between the second and third cap members 22, 24 or at least some openings or apertures should be defined within the second or third cap members 22, 24 to provide a flow path for exhaust gases leaving the exhaust duct 16 via the outward open end 50. In this embodiment, the connecting members 82 define the plurality of outward flow openings 84 around a circumference of the third cap member 24 to provide such a flow path. In other embodiments, the connecting members 82 extend from the outward facing surface 70 of the second cap member rather than from the third cap member 24 as shown in the Figures. In still further embodiments, the connecting members 82 may be separate and distinct members that are coupled between the second and third cap members. In still further embodiments, the second and third cap members are integrally formed as a single piece rather than the two separate pieces illustrated in the figures.

The fastener receivers 86 defined in the connecting members 82 are exposed in a rearward direction so as to receive the fasteners 34 that have been extended through the first and second cap members. In other embodiments, fasteners may be, for example, co-molded into the first, second, or third cap members 20, 22, 24 to provide the desired coupling function of the various cap members.
An advantage of providing separate cap members in the vent cap assembly is to enable positioning of the first and second screens in the space defined between the first and second cap members and between the second and third cap members, respectively. In other embodiments, the screens may be co-molded or otherwise formed within one or more of the cap members. In still further embodiments, wherein two or more of the cap members are integrally formed as a single piece, the screens may be properly positioned during the process of molding those cap members as a single piece. The screens preferably overlap the openings defined in the second and third cap members to prevent objects (e.g., animals and insects) from entering the intake and exhaust vents.

One embodiment, the first, second and third cap members each comprise substantially a non-metallic material such as the compression molded ceramic material described above. In some embodiments, the cap members may include a combination of different non-metallic materials. In other embodiments, metallic features may be co-molded or otherwise integrated into one or more of the cap members.

One advantage of the vent cap assembly is that it substantially conceals all metallic features of the venting assembly. In fact, the only metal features that are viewable in the front view of FIG. 4 is the water flashing, a top portion of the base 12 (which would typically be covered by a decorative surface material—e.g., siding, brick, stucco, etc.), and heads of the fasteners. Even in the view of FIG. 3, the only additional metal objects that are viewable are portions of the screens. Thus, the vent cap assembly can provide a more aesthetically pleasing design that blends into the decor of its surroundings (e.g., decorative design or appearance of the wall structure to which the vent assembly is mounted).

Another benefit of using non-metallic material for some or all of the vent cap assembly components is the added safety some non-metallic materials provide. For example, the compression molded ceramic material described above can maintain a relatively safe surface temperature even after extended periods of heated gases being applied to a non-exposed, opposite surface of the cap assembly.

While the present embodiment includes a separate base member to which the intake duct and heat shield are mounted, other embodiments may be possible that do not include such a base member. For example, the intake duct and heat shield may be connected directly to the first cap member of the vent cap assembly and the first cap member is coupled directly to the wall structure for mounting of the venting assembly to a horizontal vent. In other embodiments, the base may be integrally formed into one of the cap members. In still further embodiments, one or more of the cap members may be replaced with a metallic member. For example, the first cap member may be completely eliminated or replaced by a water shield that is coupled to the base, whereas the second and third cap members are connected directly to the base. All of these and other embodiments, configurations, and arrangements may be possible.

One advantage of the embodiment disclosed with reference to FIGS. 1-10 is the ability to easily replace the vent cap assembly portion for any desired reason. Because the base is mounted to a wall structure with a more permanent mounting configuration, the vent cap assembly can be replaced for any number of reasons. For example, a new vent cap assembly can provide a new look and feel for the vent assembly (e.g., a design or pattern being added to the exposed outward facing surface of the third cap member), or be used to replace broken or damaged components of the vent cap assembly.

Another aspect of the disclosed embodiments relates to a method of assembling portions of the venting assembly so as to conceal metal objects such as fasteners that are used to assemble components of the venting assembly. In one example, the vent cap assembly is coupled together using fasteners that extend from a back side of the first cap member wherein they are concealed from view, through the second cap member and into engagement with the third cap member. In this way, a single set of fasteners can be used to couple all of the cap members together. A fastener may also be used to concurrently capture the screens in proper position covering the inflow and outflow openings.

The present invention should not be considered limited to the particular examples or materials described above, but rather should be understood to cover all aspects of the invention as fairly set out in the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the instant specification.

We claim:
1. A vent assembly, comprising:
   a base including a vertically oriented, outward facing primary surface and defining a duct aperture that extends through the outward facing primary surface, the base comprising a metallic material;
   an intake duct coupled to the base within the duct aperture, and an exhaust duct oriented coaxially within the intake duct, wherein an end of the exhaust duct extending distally beyond an end of the intake duct; and
   a cap assembly comprising first, second, and third members that each comprise a non-metallic material, the first member having an intake aperture aligned with the duct aperture of the base and sized to substantially cover the outward facing primary surface, the second member having an exhaust aperture sized to receive the exhaust duct, and the third member positioned distally beyond an distal end of the exhaust duct in a flow path of exhaust gases exiting the exhaust duct.
2. The vent assembly of claim 1, wherein the first, second and third cap assembly members are spaced apart from each other in a direction along an axis of the exhaust duct.
3. The vent assembly of claim 1, wherein the cap assembly is configured for assembly together as a single unit that is coupled to and removable from the base as a single unit.
4. The vent assembly of claim 1, wherein the non-metallic material comprises a ceramic fiber and a binder.
5. The vent assembly of claim 1, wherein the first cap member includes a lip positioned vertically above the intake aperture that protrudes in a direction along a length of the exhaust duct.

6. The vent assembly of claim 1, wherein the second and third cap members each include a primary surface facing away from the base and a plurality of engagement member extending towards the base.

7. A vent assembly, comprising:

   a base member configured for mounting to a wall structure;

   a intake duct coupled to the base member;

   an exhaust duct extending coaxially through the intake duct and extending distally beyond an open end of the intake duct; and

   a vent cap assembly configured to mount to the base member and the intake and exhaust ducts, the vent cap assembly comprising at least one non-metallic structure configured to direct away from each other fluids entering and exiting the intake and exhaust ducts.

8. The vent assembly of claim 7, wherein the vent cap assembly comprises a first non-metallic member that defines an aperture sized to receive the intake duct.

9. The vent assembly of claim 8, wherein the vent cap assembly further comprises a second non-metallic member that defines an aperture sized to receive the exhaust duct, wherein the intake duct terminates between the first non-metallic member and the second non-metallic member.

10. The vent assembly of claim 9, wherein the vent cap assembly further comprises a third non-metallic member that is oriented at least partially in a flow path of exhaust exiting the exhaust duct, wherein the exhaust duct terminates between the second non-metallic member and the third non-metallic member.

11. The vent assembly of claim 7, wherein the non-metallic members comprise a ceramic fiber and a binder.

12. The vent assembly of claim 7, wherein the non-metallic members comprise a compression molded ceramic fiber.

13. The vent assembly of claim 7, wherein the vent cap assembly is configured to substantially conceal the base member from view.

14. A method of mounting a venting assembly to a vertically oriented surface, the method comprising:

   mounting a base plate to the vertically oriented surface, the base plate defining a vent aperture;

   mounting an intake duct to the base plate within the vent aperture;

   positioning an exhaust duct within the intake duct with an open end of the exhaust duct extending distally beyond an open end of the intake duct; and

   detachably mounting a vent cap assembly to the base plate, the vent cap assembly including at least one cap member that comprise a non-metallic material, the vent cap assembly configured to direct intake air into the intake duct and direct exhaust gases out of the exhaust duct and away from the open end of the intake duct.

15. The method of claim 14, wherein the vent cap assembly includes a plurality of cap members that each comprise a non-metallic material, the method further comprising coupling the plurality of cap members to each other before mounting the vent cap assembly to the base plate.

16. The method of claim 14, wherein at least one cap member comprises a compression molded ceramic material.

17. The method of claim 14, wherein the vent cap assembly includes a plurality of cap members, and one of the cap members is mounted to a distal end of the exhaust duct to provide a barrier between the open end of the exhaust duct and the open end of the intake duct.

18. The method of claim 14, further comprising substantially concealing the base member from view when mounting the vent cap assembly to the base member.

19. A method of manufacturing a vent assembly, the vent assembly including a base member and a vent cap assembly, the vent cap assembly including at least first and second vent cap members, the method comprising the steps of:

   coupling the vent cap members together with at least one first fastener that extends from the first vent cap member and into engagement with the second vent cap member, and

   coupling the vent cap assembly to the base member with at least one second fastener that extends through the first vent cap member into engagement with the base member.

20. The method of claim 19, further comprising forming at least one of the vent cap members from a non-metallic material.

21. The method of claim 19, further comprising forming at least one of the vent cap members from a compression molded ceramic material.

22. The method of claim 19, wherein the at least one first fastener is concealed from view when the vent cap assembly is coupled to the base member.

23. The method of claim 19, further comprising mounting an intake duct to the base member in alignment with a vent aperture defined in the base member.

24. The method of claim 23, further comprising aligning an exhaust member co-axially within the intake member, the exhaust member extending distally beyond an open end of the intake member.

25. The method of claim 24, further comprising mounting the second vent cap member adjacent to the open end of the exhaust member at a position between the open ends of the intake and exhaust ducts.

26. The method of claim 19, wherein the vent cap assembly further includes a third cap member, and coupling the vent cap members together includes extending the at least one fastener through the second vent cap member and into engagement with the third vent cap member.

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