VENT ASSEMBLY

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ABSTRACT

A vent assembly, suitable for marine use including, for example, venting an enclosure, such as an engine compartment, on a boat. The vent assembly has substantially the external appearance of a cast or machined, one piece, stainless steel vent, at a cost very little more than a molded plastics vent. A molded plastics vent has a head perforated by a pattern of ventilating slots separated by flanking strips. A decorative, corrosion-resistant, sheet metal cover shell lies tight against the front side of the molded plastics vent and has a pattern of slots and strips mapping substantially on the pattern of slots and strips of the molded plastics vent. Snap-fit fasteners fix the cover shell on the vent so that the cover shell slots are a substantially flush continuation of the vent slots, so as to provide the decorative appearance of a solid metal vent at substantially lower cost and without compromising or through flow capability.
VENT ASSEMBLY

FIELD OF THE INVENTION

This invention relates to slotted vents, and more particularly to slotted vents usable in marine applications such as for ventilating a motor enclosure on a boat.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 5,588,908, assigned to the assignee of the present invention, discloses a vent comprising a radially extended, slotted head adapted to rest against the exterior face of the wall to hide an opening therein and a tubular body extending from the rear face of the head through the wall opening, to fix the vent fitting and an attached, rearwardly extending hose to the wall at the opening, to communicate flow through the hose and slotted head. To accomplish its various purposes, such vent fitting is of relatively complex form. Despite this, the assignee of the present invention has succeeded in forming such fittings of molded plastics material at relatively low cost and has successfully marketed units in substantial quantities, for example to boat manufacturers.

However, the present assignee has found that for more extensive lines of boats, boat manufacturers and their buyers prefer more expensive looking fittings, e.g. stainless steel fittings, rather than less expensive looking molded plastics fittings.

With that in mind, the present assignee has marketed molded plastics fittings of this general type with exposed surfaces chromium plated, by a conventional process, to achieve the richer, more expensive appearance of a polished metal fitting. While generally successful commercially, the present assignee has found that continuing contact, over a long period of time, with the elements in a harsh salt water marine environment, may attack, and eventually degrade the appearance of, the plated visible surfaces of such fittings.

Accordingly, the present assignee has considered producing such fittings of corrosion resistant metal, such as stainless steel, as by casting or machining, and while such product is durable and can maintain a rich, expensive appearance over long periods of use, it is many times more expensive to produce than the same product of molded plastics material, and because of this expense would have a very limited market.

The purposes of the present invention include overcoming these conflicting prior difficulties.

SUMMARY OF THE INVENTION

This invention relates to a vent assembly, suitable for marine uses including, for example, ventilating an enclosure, such as an engine compartment, on a boat, which vent assembly has substantially the external appearance of a cast or machined, one piece stainless steel vent, at a cost very little more than a molded plastics vent.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial view of the cover shell of convexly curved shape, taken from the front side thereof, and in accord with a preferred embodiment of the present invention.

FIG. 2 is an enlarged cross-sectional view of the FIG. 1 molded plastics vent.

FIG. 3 is a pictorial view of a cover shell of convexly curved shape, taken from the rear side thereof.

FIG. 4 is a pictorial view of the FIG. 3 cover shell taken from the rear side thereof.

FIG. 5 is a front view of the FIG. 3 cover shell.

FIG. 6 is an enlarged fragmentary cross-sectional view substantially taken on the line 6-6 of FIG. 5.

FIG. 7 is an enlarged, fragmentary cross-sectional view substantially taken on the line 7-7 of FIG. 5.

FIG. 8 is a pictorial view of a preferred embodiment of a molded plastics vent for which the FIG. 3 cover shell is intended.

FIG. 9 shows FIG. 6 cover shell installed on a molded plastics vent like that of FIG. 8.

FIG. 10 shows the FIG. 7 cover shell installed on a molded plastics vent of the type shown in FIG. 8.

FIG. 11 is an enlarged fragmentary cross-sectional view substantially taken on the line 11-11 of FIG. 5, and showing the cover shell installed on the FIG. 8 vent.

FIG. 11A is a fragment of FIG. 11, but showing the FIG. 3 cover sheet tab at a starting position of installation on the FIG. 8 vent.

FIG. 11B is similar to FIG. 11A, but showing an intermediate position of installation.

DETAILED DESCRIPTION

A vent 40 (FIGS. 1 and 2) is here formed to function as a hose fitting. The vent 40 is formed (preferably molded) of a suitable substantially rigid molded plastics material, such as nylon or polypropylene. The molded plastics vent 40 includes a radially extending head 42, here in the form of a circular face plate. The head 42 has a radially outward facing edge 30 and a continuous peripheral edge portion 43 inboard of the edge 30. The head 42 is perforated by a pattern of elongate ventilating slots 31 extending axially therethrough and laterally to the peripheral edge portion 43. The slots 31 have end walls 32 at the peripheral edge portion 43. The slots are separated by flanking strips 46 defining side walls 33 of the slots 31. The head 42 has front and back sides 20 and 21 respectively separated by the radially outward facing edge 30 and to which the slots 31 open.

The molded plastics vent 40 also has a generally tubular base 50 extending substantially coaxially from the back side 21 of the head 42 at its peripheral edge portion 43. The base 50 is spaced inboard of the radially facing edge 30 by a coaxial, radially extending, rear facing, enclosure wall abutting, annular lip 49 and has a coaxial through passage 51 communicating with the slots 31.

In the embodiment shown in FIGS. 1 and 2, the generally tubular base 50 is circumferentially segmented to form circumferentially closely spaced, alternating lock tabs 45 and locking fingers 52, all of which extend axially
rearwardly from the head back side at the peripheral edge portion 43. The lock tabs 45 and fingers 52 are of arcuate, circumferentially extending cross-sectional profile. The rear edges of the lock tabs 45 are radially inwardly beveled at 47.

[0024] The locking fingers 52 are located slightly radially outwardly from the lock tabs 45. Each locking finger 52 has one or more (here three) axially spaced, radially outwardly protruding, circumferentially extending teeth 54 having a rearward and radially outwardly beveled, generally rearwardly facing surfaces 56. The rearwardmost tooth 54 forms the rear edge of the base 50 and its beveled surface 56a extends the full radial thickness of the tooth. The rearward end portion of each locking tooth 52 is thickened to provide a slightly radially inwardly protruding lip 60. The teeth 54 and lip 60 extend circumferentially the width of the locking finger 52. It will be understood that the locking fingers 52, including their lips 60, are spaced radially outwardly from the outer circumferential plane of the lock tabs 45 and preferably are circumferentially narrower than the circumferential spaces between the lock tabs 45. Circumferentially spaced, axially extending, reinforcing, rib-like webs 58 protrude radially outwardly from the radially outer face of the locking fingers 52 between the back side 21 of the head 40 and the nearest tooth 54.

[0025] The molded plastics vent 40 can be used as an end termination for a ventilation hose 10 (FIG. 2), a ventilating member to provide a finished appearance for a hole 14 in a wall 12, or both. In the embodiment shown, the hose 10 is formed of a flexible material in which a coiled wire 64 is embedded for reinforcement. The front (leftward in FIG. 2) end of the hose is forwardly inserted into the circumferentially continuous, radially narrow, annular space between the lock tabs 45 and locking fingers 52 so as to closely approach or abut the back side 21 of the head 42 of the molded plastics vent 40, as permitted by the limited radial bending capability at least of the fingers 52. So installed, the radially inwardly protruding lips 60 on the fingers 52 axially fix the hose 10 to the molded plastics vent 40 and prevent unintended axial separation thereof. With an intermediate portion of the hose 10 extending through the hole 14 in the wall 12, rearward movement of the molded plastics vent 40 toward the wall 12 coaxially of the head 14, inserts the generally tubular base 50 into the hole 14, such that the teeth 54 slide axially rearwardly along the peripheral edge of the hole 14, camming and bending the fingers 52 radially inwardly as needed, until the radially extending head 42 of the vent 40 abuts the front face of the wall 12, thereby completing installation as seen in FIG. 2.

[0026] During installation, the tapered rearward surfaces of the teeth 54 assist installation of the vent 40 in the wall 12, whereas after installation the forward facing radially planar faces of the teeth 54 resist removal of the vent 40 from the wall 12. The radially inward bending of the locking fingers 52 by the peripheral edge of the hole 14 helps the lips 60 of the fingers 60 fixedly grip the hose 10 between themselves and the circumferentially flanking tabs 45.

[0027] To the extent of above discussed, the apparatus is substantially that disclosed in the present assignees prior U.S. Pat. No. 5,588,908.

[0028] FIG. 8 shows a further prior art vent 140 which may be generally similar to the vent 40 above discussed with respect to FIGS. 1 and 2, except as follows.

[0029] For example, the head 142 (FIG. 8) of the vent 140 has a front side 120 of shallow, convexly rounded shape. Thus, the strips 146 have correspondingly somewhat convexly rounded front faces 147.

[0030] Turning now to aspects of the apparatus more directly dealing with the present invention, attention is directed to FIGS. 3-11.

[0031] A radially extending cover shell 201 (FIGS. 3-5) is preferably of a decorative, corrosion resistant, relatively stiff material, such as sheet metal. In the preferred embodiment shown, the cover shell 201 is of stainless steel sheet. Marine grade stainless steel sheet is sufficiently corrosion resistant, even in salt water environments, as to maintain a decorative appearance over a long period of time.

[0032] The cover shell 201 has a continuous peripheral edge portion 205 surrounding a central portion 206 comprising a pattern of slots 211 separating by elongate strips 206, whose edges define corresponding edges of the flanking slots.

[0033] The cover shell 201 has a front face 220 (FIG. 3) and a back face 221 (FIG. 4). The cover shell 201 is contoured three-dimensionally to continuously snugly cover, in a skin-like manner, the front side of the head of a corresponding molded plastic vent. Thus, in the embodiment shown, the cover shell 201 of FIGS. 3-5 is three-dimensionally contoured to cover the convex front face 147 of the corresponding vent 140 of FIG. 8, it being understood that similar cover shells can be three-dimensionally configured to similarly fit, in a skin-like manner, the front face of the head of otherwise contoured vents, for example such as the vent 40 in FIGS. 1 and 2 above-described, the front face 20 of which is not convexly rounded, but rather is flat (or might be concavely rounded if desired).

[0034] Returning to the particular cover shell 201 shown in FIGS. 3 and 4, same thus is contoured three-dimensionally in a shallow, cup-like shape having a convexly rounded front wall 226 incorporating the slots 211 and strips 216 and a peripheral wall continued therefrom and terminating in a peripheral edge 228.

[0035] The cover shell 201 is three-dimensionally contoured so that its back side 221 can continuously abut the front face 147 (FIG. 8) of the supporting vent 140, in the manner shown in FIGS. 6, 7 and 9-11. In other words, the cover shell 201 is contoured to fit in a skin-like manner on the front of the supporting vent head 142.

[0036] The pattern of slots 211 and strips 216 of the cover shell 201, as well as the size, shape and placement thereof, are preferably identical to those of the slots 131 and strips 146 of the corresponding vent 140. Thus, with the cover shell 201 properly oriented on the front face 147 of the vent head 142, the vent head 142 is to be entirely hidden from the front by the cover shell 201, as in FIG. 5. Thus, the cover shell 201 is to cover the entire exposed portion (the front and periphery) of the vent head 142, including the front surfaces of the strips 146, the peripheral edge portion 143, and the radially outwardly facing peripheral edge 130. Thus, at least as a casual observer, the external appearance of the vent assembly, comprising the molded plastic vent 140 and cover shell 201, is to be that of a monolithic metal (e.g., stainless steel) vent cast from molten stainless steel or machined from a block of stainless steel. This visual effect can be enhanced
by reducing the visibility of the molded plastics vent 140. For example, by molding the plastics vent 140 of a black material with a non-shiny surface, the sidewalls 133 (FIGS. 8 and 9) of the vent head strips 146 may visually merge into the shadowed interior reaches of the vent slots 131.

[0037] In some embodiments, as for example shown in FIG. 8, at least some of the vent head strips 146 may be, as seen from the front, several times longer than their width. Despite this, such strips 146 may be made especially strong by providing same with substantial front-to-rear depth, as seen for example in FIGS. 8 and 9, wherein the strips 146 crossing the central portion of the head 142, while laterally longer, are also deeper front-to-rear. On the other hand, the cover shell 201 is preferably of constant thickness sheet material and indeed very thin compared to any dimension of the vent strips 146.

[0038] Thus, to avoid accidental bending after the cover shell 201 is formed, the longer cover shell strips 216 may be reinforced by one or more cross straps 234 (FIGS. 3-7) spanning one or more of the slots 211 and extending transversely from the flanking strips 216. A given cross strap 234 thus acts to prevent twisting (about its length axis) or bending (out of its plane or transversely into or away from a flanking slot) of the attached strip 216. So that the cross straps 234 do not significantly impede flow through the slots 211, the cross straps 234 are preferably minimized in number and length, so that the total frontal area of the cross straps 234 is small compared to the total frontal area of the slots 211.

[0039] The cover shell 201 can be fixed to the front of the vent head 142 as desired, for example by adhesive bonding. However, in the preferred embodiment shown, the cover shell 201 is preferably securely but resiliently releasably snap-fitted to the front of the vent head 142 by its own monolithically integrated fastening structure. In the preferred embodiment shown, that fastening structure comprises resiliently bendable, cantilevered tabs 250 (FIGS. 3, 4, 7, 8, 10 and 11) angled substantiallyrearwardly from edges of corresponding slots 211. Advantageously, the tabs 250 extend from ends 251 of one or more of the shell slots 211 and are hence rearwardly bent from inboard edges of the peripheral edge portion 205 of the cover shell 201. Such tabs 250 are thus located to extend into adjacent vent head slots 131 (FIG. 11), here at opposite ends of the two adjacent longest ones of the vent head slots 131. A given said tab 250 (FIG. 11) has a leg 254 extending rearwardly and positioned to lie along and adjacent the opposed vent head slot end 132. Such tab 250 further includes a heel 256 protruding from the free rear end of the leg 254 and positioned to lie laterally beyond the vent head slot end 132 and snugly behind the vent head peripheral edge portion 143 to lock the cover shell 201 against the front face 147 of the vent head 142. Such tab 250 further includes a foot 258 extending rearward from the radially outboard end of the heel 256 and a toe 260 angled rearward and radially inward from the free, rear end of the foot 258.

[0040] Applicants found that the cover shell 201 can be inexpensively produced from stainless steel sheet by a stamping operation which separates the cover shell 201 from the surrounding portion of the parent metal sheet (not shown), removes material to form the slots 211 and flanking strips 216, forms the mentioned cup-shaped configuration and forms and bends out of plane the mentioned tabs.

[0041] To install the cover shell 201 on the vent 140, the cover shell is moved rearward toward the front of the vent 140 to cammingly engage the rear face of the toe 260 (FIG. 11A) with the front inboard corner of the vent peripheral edge portion 143 at the appropriate slot end wall 132. Continued rearward displacement of the cover shell 201 causes the vent edge portion 143 to cam the cover shell toe 260 laterally inward (leftward in FIGS. 11A and 11B), resiliently bending the tab 250 leftward and allowing the heel 256 to slide rearwardly along the corresponding vent slot end wall 132 toward and past its FIG. 11B partially installed position. Continued rearward displacement of the cover shell 201 brings same into the firm, face-to-face contact with the vent 140, as shown in FIGS. 9-11, whereupon the resiliently bent tab 250 snaps its heel 256 (FIG. 11) laterally outward snugly behind the vent edge portion 143. With the tabs 250 (four being provided in the embodiment shown) thus deployed, same firmly and fixedly retain the cover shell 201 tightly against the front of the vent head 142, as generally shown in FIGS. 9-11.

[0042] Thus installed, it will be noted that the back side 221 (FIGS. 9-11) of the cover shell 201 tightly continuously abuts the front side 147 of the vent head 142, with the continuous peripheral edge portion 205 of the cover shell mapping on the head peripheral edge portion 143 and the shell peripheral edge 228 lying flush with the rear facing lip 149 of the vent head 142, as seen in FIGS. 9 and 10. Moreover, the pattern of cover shell slots 211 maps on the pattern of vent head slots 131 in shape, size and relative location (FIGS. 9 and 11) and the cover shell strips 216 map on the vent head strips 146 in shape, size and relative location. Thus, the edges of the shell slots 211 are a substantially flush forward continuation of the walls of the corresponding head slots, so as to minimize disruption of air flow through the vent head 142 despite the covering thereof by the cover shell 201. In the FIGS. 3-11 embodiment, one or more of the cover shell strips 216 is relatively long and narrow, and one or more rigidifying cross straps 234 are integrated in the cover shell 201 and span one or more cover shell slots 211 and corresponding vent slots 131 but, as indicated in FIG. 9, the cross straps 234 are minimized in width and number, and so do not significantly, if at all, impede air flow through the vent 140.

[0043] In a preferred embodiment of the invention, the cover shell 201 was stamped of grade 316 stainless steel sheet material of thickness about 0.5 mm, though use of similar material of thickness in the range 0.2-1.0 mm is contemplated.

[0044] The use of thicker material may be desirable where the cover shell is of greater diameter, has a more flat or otherwise less inherently rigid cross-sectional shape, has longer and/or narrower strips 216, has longer and/or wider slots, or has fewer (or no), narrower and/or longer cross straps 234. The cover shell thickness may also be varied to compensate for variations in rigidity as between different cover shell materials.

[0045] While the vent 140 and cover shell 201 here shown by way of illustration have a pattern of substantially parallel, chordally extending, uniform width slots 211, the pattern of slots 211 may be varied as desired in shape, size and relative location within the broader scope of the invention. For example, the slots 211 could take the form of a plurality of
circular or irregularly shaped holes, and/or nonparallel (e.g. radiating) elongate openings as desired.

[0046] In accord with the present invention, the rigidity, frontal impact resistance, and resistance to denting of the vent assembly 140, 201 is provided primarily by the relatively inexpensive, rigid molded plastics vent 140 which firmly backs the cover shell 201. Thus, the thickness of the cover shell 201, including its strips 211, may be a very small fraction (e.g. 1/10 to 1/50) of the thickness of the vent head strips. For example, in the embodiment shown, the cover shell strip thickness is about 1/40th of that of the thickest vent head strips 146.

[0047] Thus, the vent assembly 140, 201 according to the present invention, as compared to a monolithic cast or machined vent of solid stainless steel, is substantially more economical both in terms of substituting less expensive plastics material for the great majority of more expensive stainless steel, and in substituting less costly fabrication methods (e.g., relatively inexpensive plastic molding and sheet metal stamping operations) for more expensive stainless steel casting or solid-block machining.

[0048] Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

I claim:

1. A vent assembly, suitable for mounting in a hole in a wall of an enclosure, to vent such enclosure, and comprising:
   a molded plastics vent having a radially extending head, said head having a radially outward facing edge and having a continuous peripheral edge portion inboard of said edge, said head being perforated by a pattern of elongate ventilating slots extending axially there-through and laterally to said peripheral edge portion, ones of said slots having end walls at said peripheral end portion, said slots being separated by flanking strips defining sidewalls of said slots, said head having front and back sides separated by said radially outward facing edge and through which said slots open, said molded plastics vent having a generally tubular base extending substantially coaxially from said head back side at said peripheral edge portion, said base being spaced inboard of said radially facing edge by a coaxial, radially extending, rear facing, enclosure wall abutting, annular lip and having a coaxial throughpassage communicating with said slots;
   a radially extending, decorative, corrosion resistant, sheet metal cover shell lying tight against said front side of said vent head, said shell having a continuous peripheral edge portion mapping on said head peripheral edge portion and a pattern of slots mapping on said pattern of vent head slots in shape, size and relative location, said cover shell slots being separated by strips substantially mapping on said vent head strips in shape, size and relative location, an edge of a given cover shell slot being a substantially flush, forward continuation of the adjacent edge of the corresponding vent head slot to minimize disruption of airflow through the vent assembly, said cover shell including resiliently bendable, cantilevered tabs angled substantially rearwardly from ends of ones of said shell slots and extending into adjacent vent head slot ends, a given said tab having a leg extending along and adjacent the opposed vent head slot end wall, a heel protruding from the free end of said leg beyond said vent head slot end and snugly behind said vent head peripheral edge portion and locking said cover shell on the front face of said vent head, a foot extending rearward from the radially outward end of said heel, and a toe angled rearward and radially inward from the free end of said foot, said toe having a cover shell installing position bearing cammingly on the front of said vent head peripheral edge portion to assist snap-fit installation of said tab in its said vent head slot, said cover shell being contoured three dimensionally in a shallow, cup-like shape having a front wall incorporating said slots and strips and a peripheral wall covering said radially outward facing edge of said vent head to give the outside appearance of a solid metal vent, said peripheral wall having an enclosure wall approaching, free, peripheral edge rearwardly approaching the plane of said vent head annular lip.
   2. The apparatus of claim 1 in which the axial thickness of said head strips and cover strips is approximately in the range of ratios 1/20 to 1/80.
   3. The apparatus of claim 1 in which said cover is a stainless steel stamping.
   4. The apparatus of claim 2 in which said front side of said vent head is convexly rounded and said cover shell is correspondingly convexly rounded and lies tight against said front side of said vent head.
   5. The apparatus of claim 4 in which said head slots extend substantially parallel and widthwise of said head, said shell slots extending correspondingly parallel and widthwise of said head.
   6. The apparatus of claim 1 in which said cover shell has at least one cross strap extending across at least one of said shell slots and between flanking strips, said strap connecting and minimizing deflection of said flanking shell strips.
   7. The apparatus of claim 6 in which the width of said strap is at most substantially the width of a said flanking shell strip to minimize interference with flow through said head.
   8. The apparatus of claim 1 in which the thickness of said cover shell is in the range 0.2 mm to 1.0 mm.
   9. The apparatus of claim 8 in which the thickness of said cover shell is about 0.5 mm.
   10. The apparatus of claim 1 in which said cover shell is of type 316 stainless steel sheet.
   11. A vent assembly, suitable for marine use and the like, for covering a vent opening while permitting air flow therethrough, and comprising:
   a vent comprising a radially extending head perforated by a pattern of ventilating holes extending axially there-through, said holes being separated by flanking portions defining side walls of said holes, said head having front and back sides through which said holes axially extend, said head having a radially outwardly facing edge and a peripheral edge portion inboard of said edge;
   a radially extending, decorative, corrosion-resistant, cover shell of substantially rigid sheet stock, said cover shell lying tight against the front of said vent head, said
shell having a peripheral edge portion mapping said head peripheral edge portion and a pattern of holes mapping on said pattern of vent head holes in shape, size and relative location, said cover shell holes being separated by flanking portions substantially mapping on said vent head portions in shape, size and relative location, an edge of a given cover shell hole being a substantially flush, forward continuation of the adjacent edge of the corresponding vent head hole to minimize disruption of air flow through the vent assembly, said cover shell being fixed on said vent head, said cover shell forwardly and sidewardly covering said vent head.

12. The apparatus of claim 11 in which said cover shell has a rear facing peripheral edge and said vent head has a rear facing surface substantially flush with said cover shell rear facing edge, the latter two being adapted to substantially abut an environmental surface having a vent hole to be covered by the vent assembly.

13. The apparatus of claim 11 in which said vent is a molded plastics mass and said cover shell comprises a sheet metal stamping perforated by said holes, said sheet metal stamping including integral rearward extending fastener elements in snap-fit engagement with said mass.  

14. The apparatus of claim 13 in which said fastener elements are tabs bent rearward from the peripheral portion of the sheet metal at edges of said holes, said tabs being elongate leaf spring-like elements, a given said tab comprising an elongate rearward extending leg received at the edge of a corresponding vent head hole, said leg extending rearward through said corresponding vent head hole and having a heel engaging a rearward surface of said vent head at said corresponding vent head hole end to positively hold said cover shell tight against the front of said vent head in a positive yet resiliently releasable manner.

15. The apparatus of claim 11 in which said vent head has a substantially dome shaped front portion, said cover shell being three-dimensionally shaped to conform to said dome shape, said cover shell continuously abutting and covering said vent head forwardly and sidewardly.

16. The apparatus of claim 11 in which at least one of said vent head and corresponding cover shell holes are elongate slots.

17. The apparatus of claim 16 in which said cover shell slots are mutually parallel.