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### Catch Can System and Method

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#### Abstract

An oil and air separator includes a lower housing defining in part a chamber within which oil may collect; an upper housing including a lower end threadingly engaged to an upper end of the lower housing; and a filter assembly threadingly engaged to the upper housing; wherein a lower portion of the filter assembly is disposed within the chamber when the filter assembly is threadingly engaged to the upper housing and the upper housing is threadingly engaged to the lower housing; wherein the filter assembly includes a filter block including a plurality of parallel lumens extending through the block; and wherein a continuous fluid pathway exists through the oil and air separator, the continuous fluid pathway extending from a fluid inlet port disposed in the upper housing, downward through a first passageway about the filter assembly, into the chamber, through a lower end of the filter assembly, upward through the plurality of parallel lumens extending through the filter block, through an upper end of the filter assembly, and through a second passageway leading to a fluid outlet port disposed in the upper housing.

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## **Background/Summary**

### **FIELD OF THE DISCLOSURE**

[0001] The invention relates generally to the removal of crankcase oil from one or more exit airstreams from a crankcase of an internal combustion engine, and more particularly to the use of an oil and air separator or catch can including a filter component including a plurality of parallel fluid channels.

### **BACKGROUND**

[0002] In a combustion engine, blow-by gases typically include unburned gasoline. That is, an amount of air and unburned gasoline from the engine cylinder is pulled past the piston rings and into the crankcase.

[0003] In one instance, blow-by gases might be exhausted to the atmosphere through a breather system coupled directly to an engine oil fill port. See FIG. 1. In another instance, instead of exhausting blow-by gases to the atmosphere, a positive crankcase ventilation (PCV) system recycles the blow-by gases through a PCV valve into the engine's intake manifold. Such recycling occurs when the engine is operating at relatively slow speeds (e.g. idling), i.e., when the air pressure in the crankcase is higher than the air pressure in the intake manifold.

[0004] One problem associated with breather systems and PCV systems and their use involves oil vapors. An engine's crankcase is used to store oil. A pan located below the crankshaft holds oil, and generally oil vapors from the oil in the pan may find their way into the blow-by gases.

[0005] In a combustion engine, crankcase breathers have been used as a replacement for an engine oil fill cap. A crankcase breather creates a fluid pathway for engine combustion gases to travel through the engine oil fill port and through the crankcase breather to the atmosphere. The crankcase breather may include a means for filtering oil from the combustion gases. However, a problem exists in that the top filter means allows oil to blow all over in the engine bay, creating a huge mess. Control of the oil from the exhaust gases is unmanageable. There is no way to prevent the escape of oil to the environment, and no way to prevent oil undesirable oil dripping (e.g., onto driveways, garage floors).

[0006] It is also undesirable for oil to be recycled with blow-by gases into an engine's intake manifold. Such recycled oil may degrade engine performance by lowering the overall octane of the combustion mixture in a cylinder. Such recycled oil also may coat the air intake and prevent airflow. To help combat the presence of oil in blow-by gases, “dirty-side” oil and air separators were developed to remove the oil from the blow-by gases before recirculation through the PCV valve and into the intake manifold. However, when the air pressure in the crankcase is higher than the air pressure in the intake manifold, it is also possible that blow-by gases will travel upstream (or backwards) into the “clean-side” assembly that leads from the PCV valve to the intake manifold.

[0007] There are various different models or types of oil and air separators available. One popular type of oil and air separator involves passing oily blow-by gases through a filter material. The oil

collects in droplets on the filter material, which may be held in place by a screen. The oil is allowed to drop into the bottom of a can where the oil collects for later removal. This “can approach” to oil and air separation is not without its drawbacks, however.

## SUMMARY

[0008] The present disclosure provides oil and air separation systems and methods. In one exemplary embodiment, an oil and air separator includes: a lower housing defining in part a chamber within which oil may collect; an upper housing including a lower end threadingly engaged to an upper end of the lower housing; and a filter assembly threadingly engaged to the upper housing; wherein a lower portion of the filter assembly is disposed within the chamber when the filter assembly is threadingly engaged to the upper housing and the upper housing is threadingly engaged to the lower housing; wherein the filter assembly includes a filter block including a plurality of parallel lumens extending through the block; and wherein a continuous fluid pathway exists through the oil and air separator, the continuous fluid pathway extending from a fluid inlet port disposed in the upper housing, downward through a first passageway about the filter assembly, into the chamber, through a lower end of the filter assembly, upward through the plurality of parallel lumens extending through the filter block, through an upper end of the filter assembly, and through a second passageway leading to a fluid outlet port disposed in the upper housing.

[0009] Other benefits and advantages of the present disclosure will be appreciated from the following detailed description.

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## Description

### DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is an exploded, perspective view from above of an exemplary oil and air separator.

[0011] FIG. 2 is an exploded, perspective view from below of the exemplary oil and air separator shown in FIG. 1.

[0012] FIG. 3 is a cross-sectional view of the assembled oil and air separator shown in FIG. 1.

[0013] FIG. 4 is a perspective view from below of the assembled oil and air separator shown in FIG. 1.

[0014] FIG. 5 is a perspective view from above of the assembled oil and air separator shown in FIG. 1.

### DETAILED DESCRIPTION

[0015] Embodiments of the invention and various alternatives are described. Those skilled in the art will recognize, given the teachings herein, that numerous alternatives and equivalents exist which do not depart from the invention. It is therefore intended that the invention not be limited by the description set forth herein or below.

[0016] One or more specific embodiments of the system and method will be described below. These described embodiments are only exemplary of the present disclosure. Additionally, in an effort to provide a concise description of these exemplary embodiments, all features of an actual implementation may not be described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0017] Further, for clarity and convenience only, and without limitation, the disclosure (including the drawings) sets forth exemplary representations of only certain aspects of events and/or circumstances related to this disclosure. Those skilled in the art will recognize, given the teachings

herein, additional such aspects, events and/or circumstances related to this disclosure, e.g., additional elements of the devices described; events occurring related to oil and air separation; etc. Such aspects related to this disclosure do not depart from the invention, and it is therefore intended that the invention not be limited by the certain aspects set forth of the events and circumstances related to this disclosure.

[0018] The present disclosure in one embodiment provides an oil and air separator in fluid communication with an exit airstream from a combustion engine crankcase. As shown in the FIGS. 1-5, the oil and air separator **10** includes an upper housing **20** including an inlet port **30** that is in fluid communication with the exit airstream from a combustion engine crankcase. The lower end **40** of upper housing **20** threadingly engages with the upper end **50** of lower housing **60**. The upper housing **20** and lower housing **60** thus are removably coupled to each other. A first o-ring **70** may be disposed between the upper housing **20** and lower housing **60** to provide a seal to prevent the escape of fluids from the oil and air separator **10**.

[0019] A filter assembly **80** includes a collar **90**, a filter block **100**, a screen **110**, and a lower cap **120**. The upper end **130** of lower cap **120** threadingly engages with the lower end **140** of collar **90**. A lower portion **150** of filter block **100** is disposed within lower cap **120**, with the screen **110** between the lower portion **150** of filter block **100** and a bottom plate **160** of lower cap **120**. As shown in FIGS. 1-3, the bottom plate **160** includes a plurality of holes **170**.

[0020] An upper portion **180** of filter block **100** is disposed in a lumen **190** through collar **90**. In one embodiment, the upper end **200** of collar **90** includes a shoulder extending into the lumen **190** about its periphery, to prevent any upward movement of the filter block **100** out of the upper end **200** of collar **90**. In another embodiment, the upper portion **180** of filter block **100** seats against a surface **210** formed in the upper housing **20**, the surface **210** including a port **220** that is in fluid communication with an outlet port **230** of oil and air separator **10**.

[0021] The filter block **100** includes a plurality of parallel lumens **240** therethrough. In one embodiment, the lumens **240** have a circular cross-section. In another embodiment, the lumens **240** have a hexagonal cross-section. In other embodiments the cross-section of the lumens have a cross-section with a different geometry. Each lumen **240** may be approximately the same size and shape in diameter. In an alternate embodiment, some lumens **240** may vary in diameter and/or shape.

[0022] As shown in the FIGS. 1-3, a second o-ring **250** may be disposed between the upper end **130** of lower cap **120** and the lower end **140** of collar **90**. When the filter block **100** is positioned within the filter assembly **80**, the upper end **200** of collar **90** threadingly engages with upper housing **20** at surface **210**. A third o-ring **260** may be disposed between the upper housing **20** and the upper end **200** of collar **90**.

[0023] The lower housing **60** defines in part a chamber **270** disposed within the interior of lower housing **60**. When the filter assembly **80** is threadingly engaged with the upper housing **20** and the upper housing **20** is threadingly engaged with the upper end **280** of lower housing **60**, a portion of the filter assembly **80** extends downwardly into the chamber **270**. The lower end **290** of lower housing **60** may threadingly engage with a clean-out cap **300**. The clean-out cap **300** may include an oil exit port **310** through which oil that gathers in the chamber **270** may be removed. In one embodiment, a petcock or valve may be positioned at oil exit port **310** to allow the selective opening and closing of the oil exit as desired. A fourth o-ring **320** may provide a seal between the lower housing **60** and the clean-out cap **300**.

[0024] In operation, the oil and air separator **10** includes a continuous fluid pathway from inlet port **30**, through filter assembly **80**, and to outlet port **230**. Air entrained with oil enters the inlet port **30** and passes through an annular space **330** formed in upper housing **20**. The fluid passes around the filter assembly **80** and into the chamber **270**. From there, the fluid passes upwardly through the holes **170** in the bottom plate **160** of lower cap **120**. The fluid then passes through the screen **110** and through the plurality of lumens **240** in filter block **100**. Exiting the filter block **100**, the fluid then passes through the port **220** in surface **210** of upper housing **20**, and proceeds out the outlet

port **230** of oil and air separator **10** via passageway **340**.

[0025] As the oily fluid passes through the oil and air separator **10**, oil droplets coalesce on the various surfaces of the components that make up the continuous fluid pathway through the device. The oil then travels due to gravity into the chamber **270**, where the oil may be removed as desired via oil exit port **310**. The result is an exit fluid stream from outlet port **230** that includes little or no oil.

[0026] It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art having the benefit of this disclosure, without departing from the invention. Accordingly, the invention is intended to embrace all such alternatives, modifications and variances.

[0027] Certain exemplary embodiments of the disclosure may be described. Of course, the embodiments may be modified in form and content, and are not exhaustive, i.e., additional aspects of the disclosure, as well as additional embodiments, will be understood and may be set forth in view of the description herein. Further, while the invention may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention.

## Claims

1. (canceled)
  2. (canceled)
  3. (canceled)
  4. (canceled)
  5. (canceled)
  6. A filter assembly comprising: a) a cylindrical filter block including a top end surface, a bottom end surface, and a plurality of lumens extending therethrough from the filter block bottom end surface to the filter block top end surface; b) a screen adjacent the filter block bottom end surface; c) a cap including a plate adjacent the screen, the plate including a plurality of holes therethrough; and d) a collar threadingly engaged to the cap, the collar including a surface portion abutting a portion of the top end surface of the filter block.
  7. The filter assembly of claim 6, wherein each lumen extending through the filter block includes a circular cross-section.
  8. The filter assembly of claim 6, wherein each lumen extending through the filter block includes a hexagonal cross-section.
  9. The filter assembly of claim 6, wherein an upper end of the cap is threadingly engaged to a lower end of the collar.
  10. The filter assembly of claim 6, wherein a continuous fluid pathway extends upwardly through the cap, through the screen, through the plurality of lumens through the filter block, and through the collar.
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