An engine assembly may include an engine structure, intake and exhaust valves, hydraulically actuated valve lift mechanisms, and a valvetrain ventilation line. The engine structure may define a combustion chamber, intake and exhaust ports in communication with the combustion chamber, a crankcase, and a valvetrain chamber isolated from the crankcase. The intake valve may be located in the intake port and the exhaust valve may be located in the exhaust port. The hydraulically actuated valve lift mechanisms may be supported on the engine structure within the valvetrain chamber and engaged with the intake and exhaust valves. The valvetrain ventilation line may be in communication with the valvetrain chamber and may provide communication between the valvetrain chamber and the intake port.
CYLINDER HEAD CAVITY VENTILATION FOR CAMLESS ENGINE

FIELD

[0001] The present disclosure relates to engine ventilation systems.

BACKGROUND

[0002] This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] An engine may include a hydraulically actuated valve train that controls intake and exhaust valve opening. Various pressure conditions within the cylinder head cavity may cause exhaust gases to be drawn into the cylinder head cavity or may result in hydraulic fluid from the hydraulically actuated valve train to be drawn into the intake port and ultimately the combustion chamber.

SUMMARY

[0004] An engine assembly may include an engine structure, intake and exhaust valves, hydraulically actuated valve lift mechanisms, and a valve train ventilation line. The engine structure may define a combustion chamber, intake and exhaust ports in communication with the combustion chamber, a crankcase, and a valve train chamber isolated from the crankcase. The intake valve may be located in the intake port and the exhaust valve may be located in the exhaust port. The hydraulically actuated valve lift mechanisms may be supported on the engine structure within the valve train chamber and engaged with the intake and exhaust valves. The valve train ventilation line may be in communication with the valve train chamber and may provide communication between the valve train chamber and the intake port.

[0005] In another arrangement, an engine assembly may include an engine block, a cylinder head, a valve cover, an intake valve, an exhaust valve, hydraulically actuated valve lift mechanisms, a crankcase ventilation system, and a valve train ventilation system. The engine block may define a combustion chamber and a crankcase. The cylinder head may be coupled to the engine block and may define intake and exhaust ports in communication with the combustion chamber. The valve cover may be coupled to the cylinder head. The cylinder head and the valve cover may define a valve train chamber isolated from the crankcase. The intake valve may be located in the intake port and the exhaust valve may be located in the exhaust port. The hydraulically actuated valve lift mechanisms may be supported on the cylinder head within the valve train chamber and may be engaged with the intake and exhaust valves. The crankcase ventilation system may be in communication with the crankcase and may provide communication between the crankcase and the intake port. The valve train ventilation system may be in communication with the valve train chamber and may provide communication between the valve train chamber and the intake port.

[0006] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The drawings described herein are for illustrative purposes only and are not intended to limit the scope of the present disclosure in any way.

[0008] FIG. 1 is a fragmentary view of an engine assembly according to the present disclosure;

[0009] FIG. 2 is a schematic illustration of the hydraulic valve train assembly shown in FIG. 1;

[0010] FIG. 3 is a perspective view of the cylinder head cover assembly and ventilation system included in the engine assembly of FIG. 1; and

[0011] FIG. 4 is a fragmentary plan view of the cylinder head cover assembly shown in FIG. 3.

[0012] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0013] Examples of the present disclosure will now be described more fully with reference to the accompanying drawings. The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses.

[0014] Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different forms and that neither should be construed to limit the scope of the disclosure. In some example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail. As used herein, the term "module" refers to an application specific integrated circuit (ASIC), an electronic circuit, and/or a processor (shared, dedicated, or group) and memory that execute one or more software or firmware programs.

[0015] When an element or layer is referred to as being "on," "engaged to," "connected to" or "coupled to" another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly engaged to," "directly connected to" or "directly coupled to" another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.). As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0016] Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as "first," "second," and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, compo-
ent, region, layer or section without departing from the teachings of the example embodiments.

[0017] With reference to FIG. 1, an engine assembly 10 is schematically illustrated. The engine assembly 10 may include an engine structure 12, pistons 14 (one shown), a crankshaft 16, a valvetrain assembly 18, an intake manifold 20 and a ventilation system 22. The engine structure 12 may include an engine block 24 and a cylinder head 26. The engine block 24 may define cylinder bores 28. The pistons 14 may be engaged with the crankshaft 16 and located within the cylinder bores 28. A single piston 14 and cylinder bore 28 are illustrated for simplicity. However, it is understood that the present disclosure applies equally to any number of piston-cylinder arrangements, as well as engine configurations including, but not limited to, inline and V-configurations.

[0018] The cylinder head 26 may be engaged with the engine block 24 and may define intake and exhaust ports 30, 32. The piston 14, the cylinder bore 28 and the cylinder head 26 may cooperate to define a combustion chamber 34. The valvetrain assembly 18 may be supported by the engine structure 12 and may selectively provide communication between the intake and exhaust ports 30, 32 and the combustion chamber 34.

[0019] The valvetrain assembly 18 may include hydraulically actuated valve lift mechanisms including a hydraulically actuated intake valve assembly 36 and a hydraulically actuated exhaust valve assembly 38. The hydraulically actuated intake valve assembly 36 may include an actuation assembly 40 engaged with an intake valve 42 and the hydraulically actuated exhaust valve assembly 38 may include an actuation assembly 40 engaged with an exhaust valve 44. With additional reference to FIG. 2, the actuation assemblies 40 for the intake and exhaust valves 42, 44 may be the same. The structure of the hydraulically actuated intake and exhaust valve assemblies 36, 38 may be generally similar. Therefore, the hydraulically actuated exhaust valve assembly 38 will be described below with the understanding that the description applies equally to the hydraulically actuated intake valve assembly 36. A biasing member 46 may be engaged with the exhaust valve 44 and bias the exhaust valve 44 to a closed position.

[0020] The actuation assembly 40 may include a housing 48 for an actuation member 50 and valve assemblies 52, 54, 56. The actuation member 50 may be engaged with the exhaust valve 44 and may displace the exhaust valve 44 based on the control of the valve assemblies 52, 54, 56. The first valve assembly 52 may be in communication with a pressurized fluid supply 58 and a tank 60. A control module 62 may be in communication with a solenoid 64 to selectively provide communication between the actuation member 50 and the pressurized fluid supply 58 or the tank 60.

[0021] The engine block 24 may define a crankcase 66. The crankcase 66 may contain engine oil and the pressurized fluid supply 58 may include a hydraulic fluid different than the engine oil. The engine structure 12 may additionally include a valve cover 68 fixed to the cylinder head 26 to define a valvetrain chamber 70 that is isolated from the crankcase 66. The hydraulically actuated valve lift assemblies (the hydraulically actuated intake and exhaust valve assemblies 36, 38) may be supported on the engine structure 12, and more specifically the cylinder head 26, within the valvetrain chamber 70.

[0022] During power strokes of the pistons 14, a portion of combustion gases (blowby gases) including un-burnt fuel and products of combustion (such as water vapor) may escape past the pistons 14 and into the crankcase 66. The blowby gases escaping past the pistons 14 may be isolated from the valvetrain chamber 70 due to the valvetrain chamber 70 being isolated from the crankcase 66. However, the blowby gases may also leak past the hydraulically actuated intake and exhaust valve assemblies 36, 38 and enter the valvetrain chamber 70. The ventilation system 22 may purge these gases from both the crankcase 66 and the valvetrain chamber 70.

[0023] The engine structure 12 may define an air inlet port 72 to the crankcase 66 in communication with a clean fresh air supply (A) and a vent port 74 in communication with the ventilation system 22. Similarly, the engine structure 12 may define an inlet port 76 to the valvetrain chamber 70 in communication with a clean fresh air supply (A) and a vent port 78 in communication with the ventilation system 22. The inlet and vent ports 76, 78 may be defined in the valve cover 68. The clean fresh air supply (A) may include air from a location upstream of the intake manifold 20. In the present non-limiting example, the air inlet 72 to the crankcase 66 and the inlet port 76 to the valvetrain chamber 70 may be in communication with the intake system at a location between the air cleaner 79 and the throttle valve 81.

[0024] The ventilation system 22 may include a crankcase ventilation system 80 and a valvetrain ventilation system 82. The crankcase ventilation system 80 may include an air-oil separator 84 in communication with the crankcase 66, a fresh air line 85 and a crankcase ventilation line 86. The fresh air line 85 may extend from the air inlet 72 to the intake manifold 20 and may extend from the air-oil separator 84 to the intake manifold 20 and provide communication between the crankcase 66 and the intake port 30. The crankcase ventilation line 86 may additionally include a flow regulator valve 87.

[0025] As seen in FIGS. 1, 3 and 4, the valvetrain ventilation system 82 may include a fresh air line 88, a valvetrain ventilation line 90, a fluid separation mechanism 92, and a pressure regulator valve 94. The fresh air line 88 may be coupled to the inlet port 76 and in communication with a clean fresh air supply (A) and may provide communication between the clean fresh air supply (A) and the valve train chamber 70. More specifically, the fresh air line 88 may extend from the intake port 76 to the valvetrain chamber 70 between the air cleaner 79 and the throttle valve 81. The valvetrain ventilation line 90 may be coupled to the vent port 78 and may be in communication with the valve train chamber 70 and the intake manifold 20. The valvetrain ventilation line 90 may provide communication between the valve train chamber 70 and the intake port 30 via the intake manifold 20. The valvetrain ventilation line 90 may additionally include a pressure regulator valve 91.

[0026] The fluid separation mechanism 92 may be located in the valve train chamber 70 and may be fixed to the valve cover 68 at the vent port 78. The fluid separation mechanism 92 may form a mist separator including a baffle 96 located within the valve train chamber 70 and fixed to the valve cover 68. The baffle 96 may include walls 98 defining a flow path that facilitates removal of fluid entrained within the blowby gases before exiting the valve cover 68. More specifically, when the gases impact the baffle 96, the fluid may be removed from the gas and collect in the valve train chamber 70.

[0027] The pressure regulator valve 94 may be coupled to the valve cover 68 and may vent the valve train chamber 70.
when a predetermined pressure is reached within the valvetrain chamber 70 relative to atmospheric pressure. The pressure regulator valve 94 may take a variety of forms including, but not limited to, a spring-biased check valve such as a spring/diaphragm arrangement. The pressure regulator valve 94 may generally maintain the valvetrain chamber 70 at a predetermined level of vacuum relative to atmospheric pressure.

[0028] During engine operation, the vacuum generated in the intake manifold 20 may draw the blowby gases out of the crankcase 66 and the valvetrain chamber 70 and into the intake manifold 20 to reintroduce the gases to the combustion chambers 34 for subsequent combustion events. Removing the blowby gases from the valvetrain chamber 70 may limit the effects of blowby gases in the valvetrain chamber 70.

What is claimed is:

1. An engine assembly comprising:
an engine structure defining a combustion chamber, intake and exhaust ports in communication with the combustion chamber, a crankcase, and a valvetrain chamber isolated from the crankcase;
an intake valve located in the intake port;
an exhaust valve located in the exhaust port;
hydraulically actuated valve lift mechanisms supported on the engine structure within the valvetrain chamber and engaged with the intake and exhaust valves; and
a valvetrain ventilation line in communication with the valvetrain chamber and providing communication between the valvetrain chamber and the intake port.

2. The engine assembly of claim 1, further comprising an intake manifold in communication with the intake port, the valvetrain ventilation line providing communication between the valvetrain chamber and the intake port through the intake manifold.

3. The engine assembly of claim 1, further comprising a crankcase ventilation system in communication with the crankcase and the intake port.

4. The engine assembly of claim 3, further comprising an intake manifold in communication with the intake port, the valvetrain ventilation line providing communication between the valvetrain chamber and the intake port through the intake manifold and the crankcase ventilation system providing communication between the crankcase and the intake port through the intake manifold.

5. The engine assembly of claim 1, further comprising a fresh air line in communication with the valvetrain chamber and a fresh air source.

6. The engine assembly of claim 1, wherein the engine structure includes a cylinder head and a valve cover fixed to the cylinder head to define the valvetrain chamber with the hydraulically actuated valve lift mechanisms supported on the cylinder head within the valvetrain chamber.

7. The engine assembly of claim 6, wherein the valve cover defines a vent port coupled to the valvetrain ventilation line and providing communication between the valvetrain chamber and the intake port.

8. The engine assembly of claim 7, wherein the valve cover defines an air inlet port in communication with a fresh air supply and providing communication between the valvetrain chamber and the fresh air supply.

9. The engine assembly of claim 7, further comprising a fluid separation mechanism located at the vent port and adapted to separate hydraulic fluid from an airflow exiting the valvetrain chamber.

10. The engine assembly of claim 7, further comprising a pressure regulator valve coupled to the valve cover and adapted open and vent the valvetrain chamber when a predetermined pressure is reached within the valvetrain chamber relative to atmospheric pressure.

11. The engine assembly of claim 7, further comprising a crankcase ventilation system, the engine structure including an engine block coupled to the cylinder head and defining the crankcase with the crankcase ventilation system coupled to the engine block and in communication with the crankcase and the intake port.

12. The engine assembly of claim 1, wherein the crankcase contains engine oil and the hydraulically actuated valve lift mechanisms are in communication with a pressurized hydraulic fluid that is different than the engine oil.

13. An engine assembly comprising:
an engine block defining a combustion chamber and a crankcase;
a cylinder head coupled to the engine block and defining intake and exhaust ports in communication with the combustion chamber;
a valve cover coupled to the cylinder head, the cylinder head and the valve cover defining a valvetrain chamber isolated from the crankcase;
an intake valve located in the intake port;
an exhaust valve located in the exhaust port;
hydraulically actuated valve lift mechanisms supported on the cylinder head within the valvetrain chamber and engaged with the intake and exhaust valves;
a crankcase ventilation system in communication with the crankcase and providing communication between the crankcase and the intake port; and
a valvetrain ventilation system in communication with the valvetrain chamber and providing communication between the valvetrain chamber and the intake port.

14. The engine assembly of claim 13, wherein the crankcase and the valvetrain chamber are each in communication with a fresh air supply.

15. The engine assembly of claim 13, further comprising an intake manifold coupled to the cylinder head and in communication with the intake port and a fresh air supply, the crankcase ventilation system and the valvetrain ventilation system with the crankcase ventilation system and the valvetrain ventilation system each being in communication with the intake port via the intake manifold.

16. The engine assembly of claim 13, wherein the crankcase ventilation system is coupled to the engine block.

17. The engine assembly of claim 13, wherein the valve cover defines a vent port providing communication between the valvetrain chamber and the intake port.

18. The engine assembly of claim 17, wherein the valvetrain ventilation system includes a fluid separation mechanism located at the vent port and adapted to separate hydraulic fluid from an airflow exiting the valvetrain chamber.

19. The engine assembly of claim 17, wherein the valvetrain ventilation system includes a pressure regulator valve coupled to the valve cover and adapted open and vent the valvetrain chamber when a predetermined pressure is reached within the valvetrain chamber relative to atmospheric pressure.
20. The engine assembly of claim 13, wherein the crankcase contains engine oil and the hydraulically actuated valve lift mechanisms are in communication with a pressurized hydraulic fluid that is different than the engine oil.

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