ENGINE CRANKCASE BREATHER AND AIR-OIL SEPARATOR

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This invention relates to engine breather constructions and is particularly directed to an engine breather construction incorporating a gas-oil separator.

Internal combustion engines generally have a breather passage through which engine crankcase gases escape into the surrounding atmosphere in order to prevent the build up of pressure within said crankcase. Such breather gases generally contain a substantial amount of oil vapor or mist. Any oil escaping through the engine breather passage represents a loss of oil and in addition this escaping oil deposits on the outside of the engine thereby constituting a fire hazard and causing the engine to become dirty. An object of the present invention comprises the provision of a novel and simple gas oil separator and engine breather.

Other objects of the invention will become apparent upon reading the annexed detailed description in connection with the drawing in which:

Fig. 1 is a partial schematic view of and partial axial section through an internal combustion engine embodying the invention;

Fig. 2 is an enlarged sectional view of the engine breather passage and gas-oil separator incorporated in Fig. 1; and

Fig. 3 is a view taken along line 3—3 of Fig. 2.

Referring now to the drawing, reference numeral 10 designates a conventional internal combustion engine having a crankcase or housing 12 from which a plurality of cylinders 14 extend. Pistons 16 are slideably within the cylinders 14 and are connected to the engine crankshaft 18 by connecting rods 20. Lubricating oil is supplied to the various bearing surfaces of the engine from which the oil drains into the housing 12 and then into a sump 22 located at a low portion of said housing.

During engine operation combustion gases blow by the engine pistons 16 into the engine housing or crankcase 12. In order to permit the escape of these gases from the crankcase into the surrounding atmosphere it is conventional to provide the crankcase with a so-called breather passage. However, a substantial quantity of oil vapor or mist becomes mixed with the engine breather gases at least partly as a result of the rapid rotation of the engine parts. Obviously the escape of oil vapor through an engine breather passage is objectionable because it represents a loss of oil and because it results in the engine becoming dirty.

In accordance with the invention a rotor device 24 has a hollow shaft 26 the interior of which forms the engine breather passage. The shaft 26 is rotatively supported within a preferably vertical bore through a wall of the housing 12 adjacent to the upper portion of said housing. As illustrated the shaft 26 is vertical and is supported within said housing bore by a snap ring 28. The shaft 26 extends into the housing 12 and the device 24 includes a plate 30 secured to but axially spaced from the inner end of the shaft 26 by a plurality of radially disposed blades 32. The blades 32 extend radially along the plate 30 and axially therefrom into abutting engagement with the adjacent end of the shaft 26. Screws 34 hold the shaft 26 and the plate 30 with its blades 32 in assembled relation. The plate 30 extends across the inner open end of the shaft 26 and the blades 32 extend radially outwardly beyond the shaft 26 so that the only communication between the interior of the housing 12 and the vent or breather passage provided by the hollow shaft 26 is through the spaces between the blades 32.

In order to drive the rotor 24 a bevel gear 36 is formed on the shaft 26. The gear 36 is arranged to be driven by a large gear 38 secured to the annular valve cam 40 of the engine. As is conventional the engine cam 40 is driven from the engine crankshaft 18 by gearing 42.

With the aforesaid description, during engine operation the engine breather gases escape from the housing or crankcase by flowing radially inwardly between the rotating blades 32 into the hollow shaft 26 and then out through said shaft into the surrounding atmosphere. Instead of permitting this flow of engine breather gases out of the housing or crankcase 12, the blades 32 appear as if they would pump gases into the housing 12 from the surrounding atmosphere much in the manner of a centrifugal gas pump. The speed of the blades 32 is, however, much slower than that of a centrifugal gas pump whereby said blades offer little or no opposition to escaping gas flow therebetween into the shaft 26 and then into the surrounding atmosphere. The speed of rotation of the blades 32 is sufficiently fast, however, because of their much higher density any liquid particles entrained or mixed with the escaping gas flowing between the blades 32 are thrown back into the housing or crankcase 12 by the centrifugal forces acting on said particles as a result of the rotation imparted to said particles by the blades 32.

Separation of oil from the engine breather gases has an added importance in the case of aircraft engines operated in cold weather. In starting an aircraft engine in cold weather it is common practice to dilute the engine lubricating oil with gasoline to reduce the viscosity of the engine lubricant. After the engine has started the gasoline is boiled off by running the engine at high power for a few minutes. During this process the rapidly evaporating gasoline picks up relatively large quantities of oil which would escape through the engine breather passage if the oil were not separated from the breather gases.

With the proportions of the gas-oil separator device 24 shown on the drawing, it has been found satisfactory to make the diameter across the tips of the blades 32 approximately four inches and to provide for rotation of said device at crankshaft speed. The crankshaft of an aircraft engine of the type for which the device 24 was designed normally operates from 1500 to 2800 revolutions per minute. Said dimension and rotative speed of the device 24 are only given by way of example since said dimension and rotative speed are obviously subject to considerable variation without departing from the invention.

While we have described our invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding our invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. We aim in the appended claims to cover all such modifications.

We claim as our invention:

1. In combination with a housing for a mechanism in which during operation, a mixture of gases and liquids accumulate under a pressure in excess of that in the surrounding atmosphere; apparatus for providing a vent passage for said housing and for separating liquid from
the gases escaping through said vent passage; said apparatus comprising a rotor member having a hollow rotatable shaft and having a plurality of circumferentially-spaced blades secured to said shaft adjacent to one end of said shaft and extending radially outwardly from said shaft; said rotor member having openings providing communication between the radially inner ends of the spaces between said blades and the hollow interior of said shaft; means for supporting said rotor member so that said blades and the adjacent end of said shaft are disposed within said housing with the radially outer ends of the spaces between said blades opening directly into said housing and so that the other end of said shaft extends into an opening through a wall of said housing so that the spaces between the blades together with the hollow interior of said shaft form a vent passage for said housing; and means within said housing drivably connected to said shaft for rotating said shaft and blades.

2. In combination with a housing for a mechanism in which, during operation, a mixture of gases and liquids accumulate under a pressure in excess of that in the surrounding atmosphere; apparatus for providing a vent passage for said housing and for separating liquid from the gases escaping through said vent passage; said apparatus comprising a rotor member having a hollow open-ended shaft with an annular gear co-axially connected thereto at one end; a plate-like member having a plurality of circumferentially-spaced radially-extending blades on one side; means securing said plate-like member to said one shaft end with said blades being disposed between said plate-like member and said shaft end so that the spaces between said blades communicate with the hollow interior of said shaft; means for supporting said rotor member so that said gear, blades and adjacent end of said shaft are within said housing and the other end of said shaft extends into an opening through a wall of said housing so that the spaces between the blades together with the hollow interior of said shaft form a vent passage for said housing; and gear means within said housing meshing with said shaft gear for driving said rotor.

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