Feb. 26, 1957 C. B. LEACH 2,782,775

ENGINE INTERIOR VENTILATION SYSTEM

Filed May 17, 1954 2 Sheets-Sheet 1

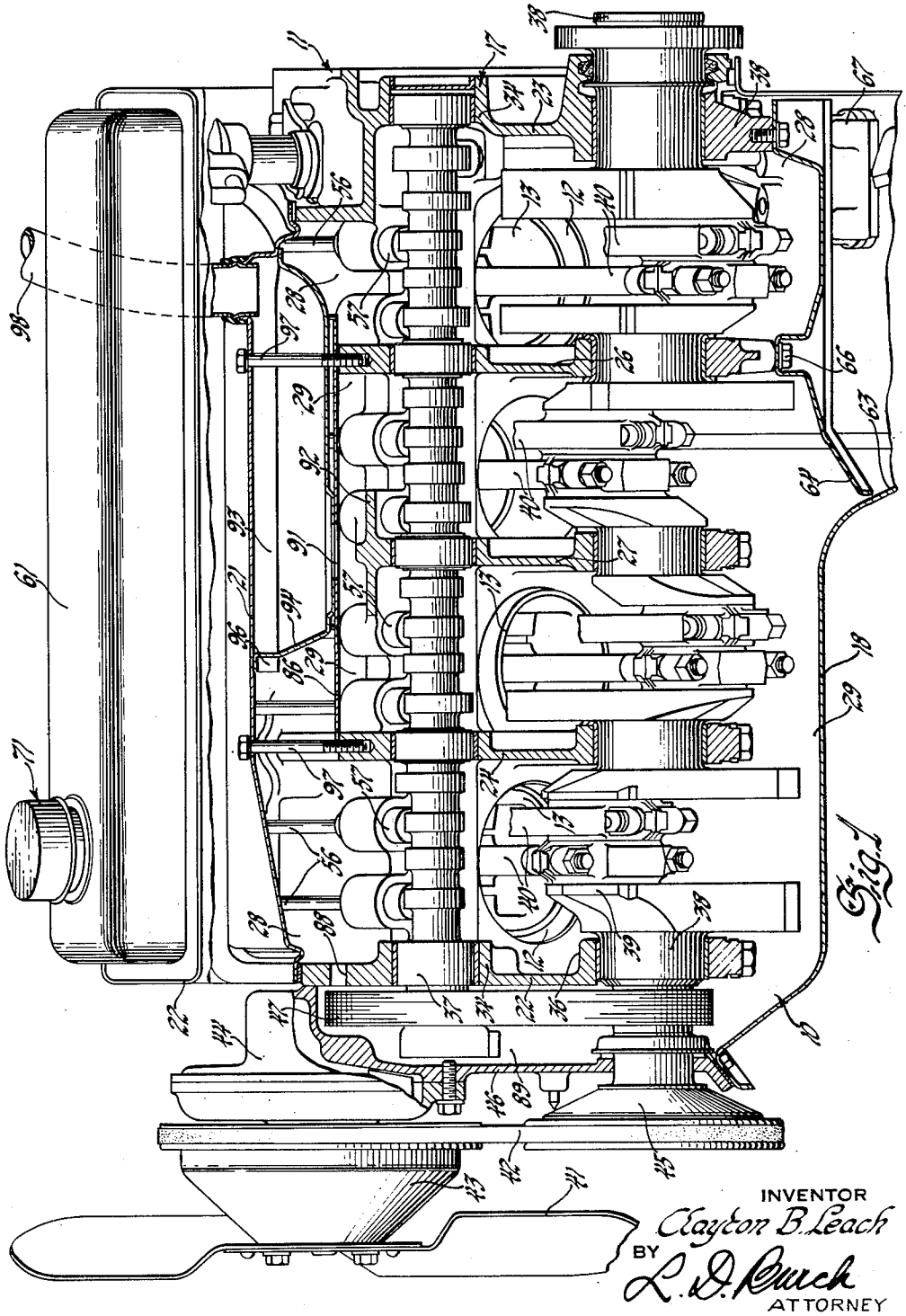


Fig. 1

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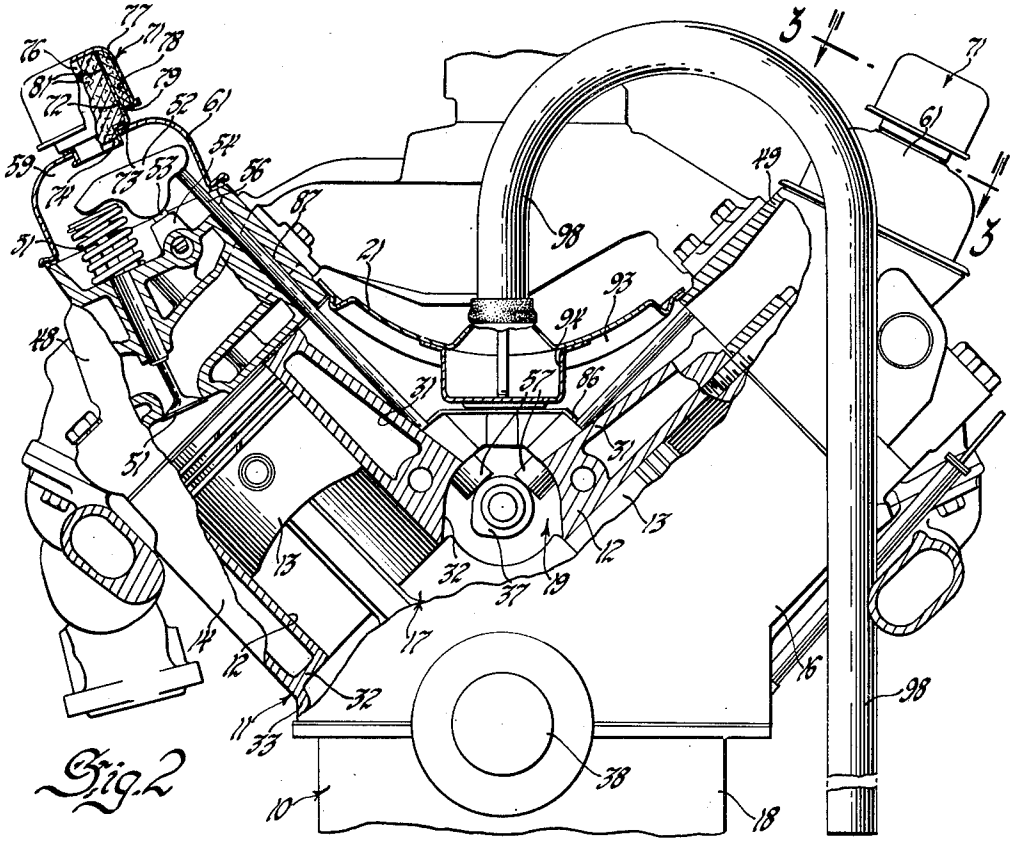


Fig. 2

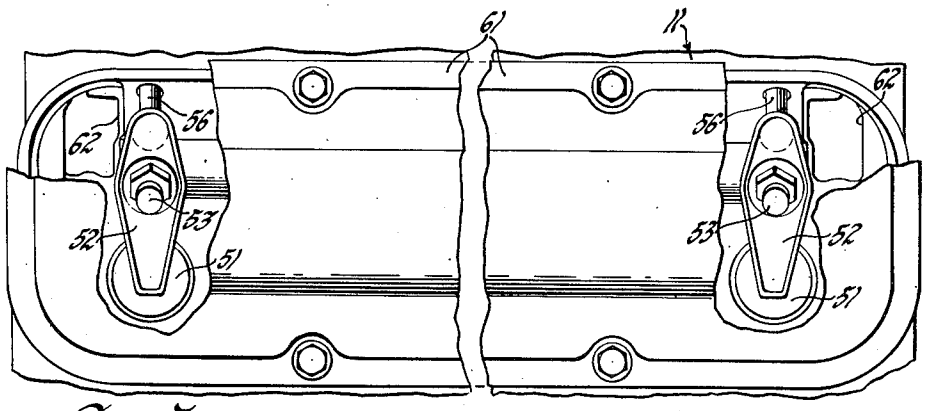


Fig. 3

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United States Patent Office 2,782,775 Patented Feb. 26, 1957

2,782,775

ENGINE INTERIOR VENTILATION SYSTEM

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Application May 17, 1954, Serial No. 430,120
8 Claims. (Cl. 123—41.86)

This invention relates to interior ventilation systems for engines and has particular relation to a system especially applicable for ventilating the rocker arm covers, the camshaft gallery and the crankcase of a V type internal combustion or other engine.

It is well known that substances such as oil, water and other vapors can be exhausted from the camshaft galleries and crankcases of engines by circulating air therethrough. In some instances air has been circulated through such enclosures by employing draft tubes positioned to respond to the motion of the vehicle with which the engine is employed. In other instances fans have been employed, particularly the engine fan, for forcing a blast of air into the crankcase and camshaft gallery. The circulation of such air within the engine will remove the vaporous substances therefrom. However, in these instances there has been too much air circulation at high engine speeds and too little circulation of air at low engine speeds.

It is now proposed to employ the engine fan to cause circulation of air through the interior of an engine in such a way that a relatively large amount of air will be circulated at low engine speeds. It is further proposed to provide means for opposing the normal increase resulting from the circulation of air in this manner, as the engine speed increases. In addition it is proposed to circulate air through the rocker arm covers, the camshaft gallery, the engine crankcase and outwardly through an oil or other liquid separating means, all by employing a novel arrangement and construction of various engine parts. Air inlet means is employed on the front end of each rocker arm cover for introducing air supplied by the engine fan to the interior of the covers. The air inlet means employed is of peculiar construction and arrangement such that it provides forwardly facing inlet means in which air is supplied by ram compression from the fan at low engine speeds and with side and rear inlet means which tend to become affected by high velocity and low pressure air at high engine speeds. The arrangement of these intake devices adjacent the front ends of the rocker arm covers also is believed to supply a relatively large amount of air in proportion to the engine speed at low engine speeds and to relatively decrease the amount of air supplied as the engine speed increases.

The air that is supplied to the interior of the rocker arm covers circulates through the rocker arm covers and outwardly into the camshaft gallery at each end of the engine heads through passages formed in the engine heads. From these passages the air circulates downwardly through each end of the camshaft gallery to the opposite ends of the crankcase, thence toward the middle of the crankcase and upwardly and outwardly between intermediate walls extending transversely of the engine. The air then flows outwardly from the middle of the engine through a settling chamber and a draft tube associated with the cover means employed in closing the camshaft gallery

In the drawing:

Figure 1 is a longitudinal view through the camshaft gallery and the crankcase of an engine and indicating the various passages therein where air is circulated to remove from the interior of the engine the vaporous substances resulting from the operation thereof.

Figure 2 is a view partly in cross section and partly in end elevation and taken adjacent the rear end of the engine illustrated by Figure 1.

Figure 3 is a fragmentary plan view with parts thereof broken away to show the interior structure of one of the rocker arm covers employed in the engine illustrated by Figures 1 and 2. Figure 3 is taken substantially in the plane of lines 3—3 of Figure 2 looking in the direction of the arrows thereon.

The engine 10 in which the preferred form of the invention is incorporated, includes an engine block 11 which is formed to provide rows of cylinders 12 in which reciprocating pistons 13 are employed. Any number of the rows of cylinders 12 may be provided in the block 11 although in the present instance there are two obliquely disposed rows of the cylinders 12 formed within cylinder banks 14 and 16 in which the rows of cylinders are disposed substantially at 90° with respect to one another.

Within block 11 and adjacent the lower ends of the cylinders 12 is an engine crankcase 17 the lower open end of which is adapted to be closed by an oil pan or a crankcase cover indicated at 18. Extending upwardly from the crankcase 17 and between the banks of cylinders 14 and 16 is a camshaft gallery 19 the open upper end of which may be closed by a cover 21. The block 11 is formed in such a way as to provide end walls 22 and 23, intermediate walls 24 and 26 and middle wall 27, all extending transversely across the engine 10 and dividing the crankcase 17 and camshaft gallery 19 into parallel front and rear compartments 28 and front and rear intermediate compartments 29. The block 11 is formed to provide upper inner side walls 31, intermediate side walls 32 and lower side walls 33 which limit the compartments 28 and 29 transversely of the engines and between which the end walls 22 and 23, the transverse walls 24 and 26 and the middle wall 27 are supported.

The walls 22, 23, 24, 26 and 27 also have transversely extending camshaft bearings 34 and crankshaft bearings 36 formed therein and in which the engine camshaft 37 and crankshaft 38 are supported. The crankshaft 38 has throws or cranks 39 on which connecting rods 40 are supported for operating the pistons 13 in the cylinders 12. The crankshaft 38 also is provided with a pulley 45 at the front end thereof which drives an engine fan 41 through fan belt 42 and a fan pulley 43. The fan pulley 43 is supported by the shaft of water pump 44 which may be formed in the front wall of the timing chain cover 46 which in turn is secured to the front wall 22 of the engine 10. The crankshaft 38 also drives the camshaft 37 through a timing chain 47 and sprockets secured to the front ends of the camshaft 37 and crankshaft 38 and with which the timing chain 47 is operatively engaged.

The inlet and exhaust valves of the engine are located in the heads of the engine which are indicated at 48 and 49. The heads 48 and 49 are adapted to be secured respectively to the blocks 14 and 16 containing the cylinders 12. The inlet and exhaust valves including the springs, washers and other elements of the valve assemblies are indicated generally at 51.

The operating mechanism for operating the valves 51 include rocker arms 52 which may be of any desired construction but which in the present instance are pivotally mounted on pins 53 supported in bosses 54 projecting from the upper walls of the heads 48 and 49. The rocker arms 52 are adapted to be moved on the pins 53 for operating the valves 51 by push rods 56 supported on valve lifters 57 adapted to be engaged by the camshaft 37. Compartments 59 containing the mechanism supported by the heads 48 and 49 for operating the valves 51 are formed by valve operating mechanism cov-

ers indicated at 61. The compartments 59 extend lengthwise of the heads 48 and 49 and are adapted to communicate at the opposite ends thereof with the front and rear compartments 28 of the camshaft gallery 19 and the crankcase 17. Such communication is provided by openings 62 which are formed transversely through each of the heads in such a way that the upper ends of the openings 62 communicate with the compartments 59 and the lower ends with the opposite ends of the camshaft gallery 19 between the walls 31 of the cylinder banks 14 and 16.

In order to provide a supply of oil for operating the engine 10 the rear end of the oil pan 18 may be depressed to form an oil sump indicated at 63. A sufficient supply of oil for operating the engine may be contained within the sump 63. In order to prevent excessive amounts of this oil from splashing out of the sump 63 it is desirable to cover the sump with a splash cover indicated at 64. The cover 64 may be secured across the sump 63 by bolts 66 adapted to secure the cover 64 to the lower extremities of the walls 23 and 26.

A pump 67 located within the sump 63 may be employed in any conventional manner for circulating the oil to various bearings throughout the engine. However, oil escaping from the bearings and returning to the sump 63 often becomes vaporized or atomized to a limited extent and these fluid substances may tend to collect on the walls forming the compartments 59, the camshaft gallery 19 and the crankcase 17. Also various vaporous substances escape beyond the rings of the pistons and may tend to collect in the crankcase 17.

It is desirable to exhaust the various vaporous substances other than oil that may tend to collect within the interior compartments of an engine. It is also desirable to separate and to return to the sump 63 the lubricating oil that may become atomized during the operation of an engine. If the air is properly circulated through the various compartments of an engine the oil will be separated from the undesirable vaporous substances and retained in the engine while the undesirable vaporous substances may be exhausted therefrom. It is desirable to circulate the air relatively slowly at all times and at a rate which is not much greater at high engine speeds than at idling speed.

In order to provide such air circulation it is proposed to provide air inlet means or intake devices indicated at 71 on the front end of each of the covers 61 for the valve operating mechanism within the compartments 59. The intake devices 71 may be provided with suitable fastening means so that the devices may be inserted in openings formed in the covers 61 during the normal operating of the engine and either of the devices removed for the purposes of supplying oil to the engine.

The intake devices 71 may be formed by inner sleeves 72 having shoulders 73 adjacent the lower ends thereof which terminate in reduced ends 74. The reduced ends 74 may be inserted in the openings in the covers 61 with the shoulders 73 resting on the upper surfaces of the covers. The sleeves 72 may contain filtering material 76 for the purpose of cleaning the air that may be admitted to the interior of the covers 61 through inlet passages formed within the sleeves 72. The upper ends of the sleeves 72 are adapted to be covered by caps 77 which contain filtering material 78 around the sleeves 72. The caps 77 provide annular openings 79 at the outer extremities thereof and between the sleeves 72 and the upper surfaces of the casings 61. Means of communication between the space between the caps 77 and the the sleeves 72 and the interior of the caps 77 is provided by perforations 81 formed around the upper ends of the caps 77.

It is proposed to locate the intake devices 71 on the front ends of the covers 61 and slightly to the rear of the front end wall 22 of the engine and the front ends of the covers 61. By locating the devices 71 in this manner it has been discovered that the air admitted to the compartments 59 does not increase a rate equal to the increase in the circulation of air over the engine which results from the operation of the engine fan.

One explanation of this phenomenon might be that the fan 41 delivers a blast of air directly against the front end of the engine and the front end walls of the covers 61. It may be when the engine is operating at low speed or idling speed, that the velocity of this blast of air is low enough that the air can move around the ends of the cylinder banks 14 and 16 and into the annular slots 79 at the lower ends of the caps 71 to thereby supply the desired amount of air to the interior of the covers 61. However, as the speed of the engine increases this blast of air may be deflected by the ends of the cylinder banks 14 and 16 and the ends of the covers 71 in such a way as to tend to miss the slots 79, thereby leaving the slots 79 in relatively low pressure areas where some air that otherwise might be admitted to the devices 71 tends to be entrained in the slip stream moving around and above and at each side of the devices 71.

Another explanation might be that the openings 79 by which air is admitted to the interior of the devices 71 may be considered as being several openings. One of these several openings in each of the devices 71 might be considered to be at the front of the device 71 where air supplied by the fan may be delivered against the lower front end of the sleeve 72 and forced into the device 71 by ram compression. Other openings leading to the interior of the device 71 might be considered to be on each side of the front opening or side openings. Another opening forming a part of the inlet 79 might be considered to be at the back of the device 71, this being a part of the opening 79 behind the lower end of the cap 71. Considering each of the openings 79 in this manner it may be that at low engine speed the fan delivers air mostly to the front parts of the openings 79 where the air engages the lower ends of the sleeves 72 and is forced into the devices 71 by ram compression. However, as the engine's speed increases and the amount of air delivered against the lower parts of the sleeves 72 increases the air may be deflected outwardly from the side openings and away from the rear openings to such an extent that the side and rear openings form a relatively low pressure area where air tends to be entrained and to be drawn away from the interior of the devices 71 rather than being admitted thereto. Such a balance between air entrained and air tending to be supplied by ram compression may cause the amount of air delivered by the devices 71 to the interior of the cover 61 to remain relatively constant. In any event with the structure as disclosed by this application the air delivered to the interior of the covers 61 increases in quantity only slightly throughout the entire operating range of the engine and does not increase as the quantity of air delivered by the fan 41 increases.

The air that is supplied to the interior of the covers 61 during the operation of the engine 10 is circulated through the covers from end to end where it picks up and scavenges from the covers the vaporous substances that result from the operation of the valve operating mechanism within the chambers 59 and that might otherwise condense or collect upon the parts of the valve operating mechanism and corrode or otherwise injure the parts. The air so circulated throughout the interior of the covers 61 is discharged downwardly into the front and rear ends of the camshaft gallery 19 through the passages 62 at the front and rear ends of the heads 48 and 49 and adjacent the inner walls thereof. In the camshaft gallery the air so admitted by the passages 62 from the heads 48 and 49 pick up the vaporous substances resulting from the operation of the camshaft, the valve lifters, etc. However, the camshaft gallery is constructed in such a way that the air can leave the camshaft gallery only through the front and rear compartments 28 between the walls 22 and 24 and 23 and 26. The air and vaporous

substances from the camshaft gallery 19 can circulate downwardly only through the front and rear compartments 28 because of an inner cover 86 which is secured to the upper edges of the intermediate walls 24 and 26 and between the side walls 31 of the cylinder banks 14 and 16 thereby cutting off circulation from the camshaft gallery downwardly between the walls 24, 26 and 27. The inner cover 86 is secured to the upper edges of the walls 24 and 26 in spaced relation to the outer wall 21 and in such a way as to collect air from the middle part of the camshaft gallery that circulates downwardly through the openings 87 extending along the inner edges of the heads 48 and 49 and through which the push rods 56 extend.

Some of the air flowing downwardly from the front compartment 28 also may be supplied to the interior of the timing chain cover 46 through opening 88 in the front wall 22. The lower extremity of the compartment 89 within the timing chain cover 46 communicates with the lower part of the front compartment 28 below the lower edge of front wall 22. The walls 22, 24, 27, 26 and 23 all terminate above the lower wall of the oil pan 18 so as to provide means by which the front and rear compartments 28 may communicate with the intermediate compartments 29 around the lower edges of the intermediate walls 24 and 26 and the middle wall 27. The air and vaporous substances from the front and rear compartments 28 therefore may flow upwardly through the middle compartments 29 around the lower edges of the walls 24 and 26. From the middle compartments 29 the air and vaporous substances may be exhausted to the atmosphere through an outlet opening 91 which is formed in the middle part of the inner cover 86 directly above the middle wall 27. In order to prevent oil from splashing outwardly through the outlet opening 91 it is proposed to provide a transversely disposed web or baffle 92 which extends across the camshaft gallery 19 above the camshaft 37 and between the inner side walls 31 of the cylinder banks 14 and 16. The web or baffle 92 is spaced somewhat below the outlet opening 91 and is considerably wider than the outlet opening 91 so that atomized oil or drops of oil may not flow directly outwardly through the outlet opening 91. Beyond the opening 91 the air and vaporous substances collected from the chambers 59 in the interior of the covers 61, the camshaft gallery 19 and the crankcase 17 pass through a settling or separation chamber indicated at 93. The chamber 93 is formed by a casing 94 having a flanged upper edge 96 adapted to engage the outer cover 21 employed in closing the camshaft gallery 19. The lower wall of the casing 94 rests on the inner cover 86 and has an opening therein adapted to form a part of the opening 91. The casing 94 is held in position between the walls 21 and 86 by one of the bolts 97 employed in securing the cover 21 between the heads 48 and 49 and the curved upper edges of the end walls 22 and 23. The settling chamber 93 is exhausted through a draft tube 98 secured in an opening in wall 21 at the rear end of the chamber 93 in a position remote from the opening 91. The draft tube 98 curves downwardly at one side and at the rear of the engine 10 so as to exhaust the air and vaporous substances scavenged from the engine 10 at a place where these substances will not collect upon and injure the engine or other parts of the vehicle with which the engine may be employed. It is also to be noted that the draft tube 98 terminates in an end opening which is normal to the axis of the tube and substantially parallel to the direction of forward motion in which the vehicle with which the engine 10 may be employed, may be operated. It has been customary in the past to provide an obliquely disposed opening at the end of such draft tubes, such opening being disposed to face rearwardly with respect to the direction of motion of the vehicle. Such obliquely disposed openings tend to entrain the vaporous substances to be discharged and to cause the circulation of air through the interior of engines to increase as the forward motion of

the vehicle increases. In the present instance it is not desirable to have the draft tube 98 operate in this manner. It is preferable to have the draft tube 98 merely discharge the vaporous substances from the interior of the engine and to rely upon the circulation provided by the position and construction of the inlet devices 78 with respect to the fan 41 as previously described.

The interior ventilation system embraced in the engine 10 operates at all times when the engine 10 is operating. When the engine 10 is idling the fan 41 will be driven at a relatively low speed and will discharge a blast of air upon the front end of the engine 10. Such blast of air at idling speed will not be great in quantity and the velocity of air will not be great but it has been found that such air under such circumstances will flow into the intake devices 71 to an extent that will provide a considerable circulation of air throughout the cover 61, the camshaft gallery 19, the crankcase 13, the outlet opening 91, the settling chamber 93 and the draft tube 98. The quantity of air circulated in this manner will not be sufficient to carry away an excess amount of atomized oil but it will exhaust steam and other vaporous substances that might otherwise condense in the engine and into the working parts thereof. As the speed of the engine increases, it is desirable to increase to some extent the amount of air circulated through the interior of the engine but it is not desirable to increase the amount of air circulated in proportion to the increase in engine speed or to the increase in the amount of air discharged by the fan 41 upon the front end of the engine. It is here that the location of the intake devices 71 or the construction thereof in the manner described produces a circulation of air through the engine that is not greatly in excess of the circulation of the air carried through the engine at idling speed. As previously explained, this is believed to be because the increasing blast of air discharged upon the front end of the engine and the front ends of the covers 61 and upon the front wall of the sleeve 78 adjacent the opening 79 produces turbulent and deflected blasts of air that provide a balance between the ram compression of air that may flow into the devices 78 through the openings at the front thereof and the air flowing around the devices and forming a low pressure area at the sides and rear thereof. This balance between ram compression and entrainment apparently tends to decrease the relation between the amount of air discharged by the fan 41 and the amount of air supplied to the interior of the chamber 61 through the intake devices 71 as the speed of the engine increases. This tends to cause a circulation of air throughout the interior compartments of the engine that is not substantially greater at high than low engine speeds and is not in excess of the amount required at high engine speeds. However, the amount of air circulated throughout the engine interior at low engine speeds or idling speed is sufficient to properly scavenge the interior compartments of the engine.

The claims:

1. An interior ventilation system for engines comprising an engine frame having a row of cylinders formed therein and a head and a crankcase for said cylinders, valves for said cylinders in said head, valve operating mechanism mounted on said head, a cover for said valve operating mechanism, passage means for connecting the interior of said cover to the interior of said crankcase, means for supplying air to said cover and through said passage means to said crankcase for scavenging therefrom vaporous substances resulting from the operation of said engine, said cover being closed to the atmosphere except through said air supplying means and said passage means, and outlet means for said crankcase for exhausting said vaporous substances and said air from said crankcase.

2. An interior ventilation system for engines comprising an engine frame having a row of cylinders formed therein and a head and a crankcase for said cylinders,

valves for said cylinders in said head, valve operating mechanism mounted on said head, a cover for said valve operating mechanism, passage means connecting the space around said valve operating mechanism and within said cover with the interior of said crankcase, an intake device positioned on said engine to discharge air into the space around said valve operating mechanism and within said cover and through said passage and into said crankcase for scavenging vaporous substances from said cover and said crankcase, outlet means from said crankcase for exhausting said vaporous substances and said air from said cover and said crankcase, and means responsive to the speed of said engine for supplying air to said intake device.

3. An interior ventilation system for engines comprising an engine frame having obliquely disposed rows of cylinders formed therein and having a camshaft gallery formed between an adjacent pair of said rows of cylinders, a cover enclosing said camshaft gallery, a crankcase formed adjacent the inner ends of said cylinders and having crankcase bearing means enclosed therein for supporting the crankshaft for said engine, said frame being formed to provide transversely disposed end walls and intermediate walls extending across said crankcase and said camshaft gallery and supporting said bearings for said crankshaft, a baffle disposed within said camshaft gallery and extending between a pair of said intermediate walls and obstructing flow of air upwardly between said intermediate walls and downwardly into said camshaft gallery from above said baffle, outlet passage means leading from said camshaft gallery and communicating with an opening formed in said baffle, means extending across said camshaft gallery for shielding said opening from the interior of said cranckcase, and means for circulating air downwardly in said camshaft gallery and said crankcase between said end walls and said intermediate walls and upwardly between said intermediate walls and outwardly from said engine around said shielding means and through said opening and through said outlet passage means.

4. An interior ventilation system for engines comprising an engine frame having a row of cylinders formed therein and a head for said cylinders, valve operating mechanism mounted on said head, a cover for said valve operating mechanism, a crankcase formed in a lower part of said frame and having a crankshaft rotatable therein for operating the pistons associated with the cylinders of said engine, passage means connecting the opposite ends of said crankcase with the interior of said cover at the corresponding ends of said cover, means for supplying air to the interior of said cover for circulation through said cover and said passages and into the opposite ends of said crankcase, and means at the middle of said crankcase for exhausting said air and the vaporous substances in said cover and said crankcase and resulting from the operation of said valve operating mechanism and said crankshaft.

5. An interior ventilation system for engines comprising an engine block having a camshaft gallery and a crankcase formed therein, said block being formed to provide a front wall, a rear wall, a middle wall and two intermediate walls extending transversely across said camshaft gallery and said crankcase and providing bearing means for the camshaft and crankshaft of said engine, an outer cover for said camshaft gallery and formed to extend across said block between said end walls of said block and the side walls of said block forming the sides of said camshaft gallery, an inner cover for said camshaft gallery and disposed within said camshaft gallery in spaced relation to said outer cover and extending across the middle part of said camshaft gallery between said side walls and said intermediate walls of said block, means for supplying air to the upper part of said camshaft gallery at each end of said block and for circulating said air downwardly at each end of said block and outwardly of said intermediate walls extending across said block and upwardly within said block and within said intermediate walls, passage means for exhausting said air and the vaporous substances resulting from the operation of said engine from the space between said intermediate walls and extending through said inner cover and said outer cover, and baffle means extending across said camshaft gallery above said middle wall and below and in spaced relation to said opening in said inner cover for preventing the splashing of oil from said camshaft gallery and said crankcase and through said passage in said inner wall.

6. An interior ventilation system for engines comprising an engine block having a camshaft gallery and a crankcase formed therein, said block being formed to provide end walls and a middle wall and a pair of intermediate walls extending transversely across said camshaft gallery and said crankcase and between the side walls of said block forming said camshaft gallery and and crankcase, a cover for said camshaft gallery and extending across said block between said side walls and said end walls of said block, a draft tube secured to an opening at one end of said cover and communicating with said camshaft gallery within said cover, settling chamber means communicating with said draft tube and extending lengthwise of said camshaft gallery cover and forming a settling chamber within said camshaft gallery, means for securing said camshaft gallery cover against an open side of said settling chamber means and to said block, said settling chamber means being formed to provide an opening in the end thereof opposite said draft tube and leading to the interior of said camshaft gallery and said crankcase of said engine, and means for supplying air to said camshaft gallery and said crankcase for scavenging vaporous substances from said engine and through said settling chamber means and said draft tube.

7. An interior ventilation system for engines compising an engine frame having a row of cylinders therein and a head for said cylinders, valves for said cylinders in said head, valve operating mechanism mounted on said head and operating said valves, a cover for said valve operating mechanism, inlet passage means leading to the interior of said cover and projecting therefrom, a cap disposed on the outer end of said inlet passage means and spaced therefrom to provide an annular inlet around said inlet passage means communicating with the interior thereof, and means responsive to the speed of said engine for discharging a blast of air into said inlet passage means and on said cap and said cover, said inlet passage means and said cap being positioned on said cover to deflect a relatively large amount of said air into said annular passage at low engine speeds and to deflect increasing amounts of said air away from said annular passage at higher engine speeds.

8. An interior ventilation system for engines comprising an engine frame having a row of cylinders therein and a head for said cylinders, valves for said cylinders in said head, valve operating mechanism mounted on said head and operating said valves, a cover for said valve operating mechanism, inlet passage means leading to the interior of said cover and projecting therefrom, and means responsive to the speed of said engine for discharging a blast of air into said inlet passage means, said inlet passage means being formed to provide an opening facing said engine speed responsive means, said inlet passage means being positioned on said cover to receive a relatively large amount of said air at low engine speeds and to deflect increasing amounts of said air away from said opening at higher engine speeds, said cover being formed to provide an abutment positioned with respect to said opening to deflect increasing amounts of air away from said opening as the velocity of said air increases.

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