Nov. 20, 1956 G. BURRELL 2,771,064

CRANKCASE VENTILATION

Filed Sept. 30, 1954 3 Sheets-Sheet 1

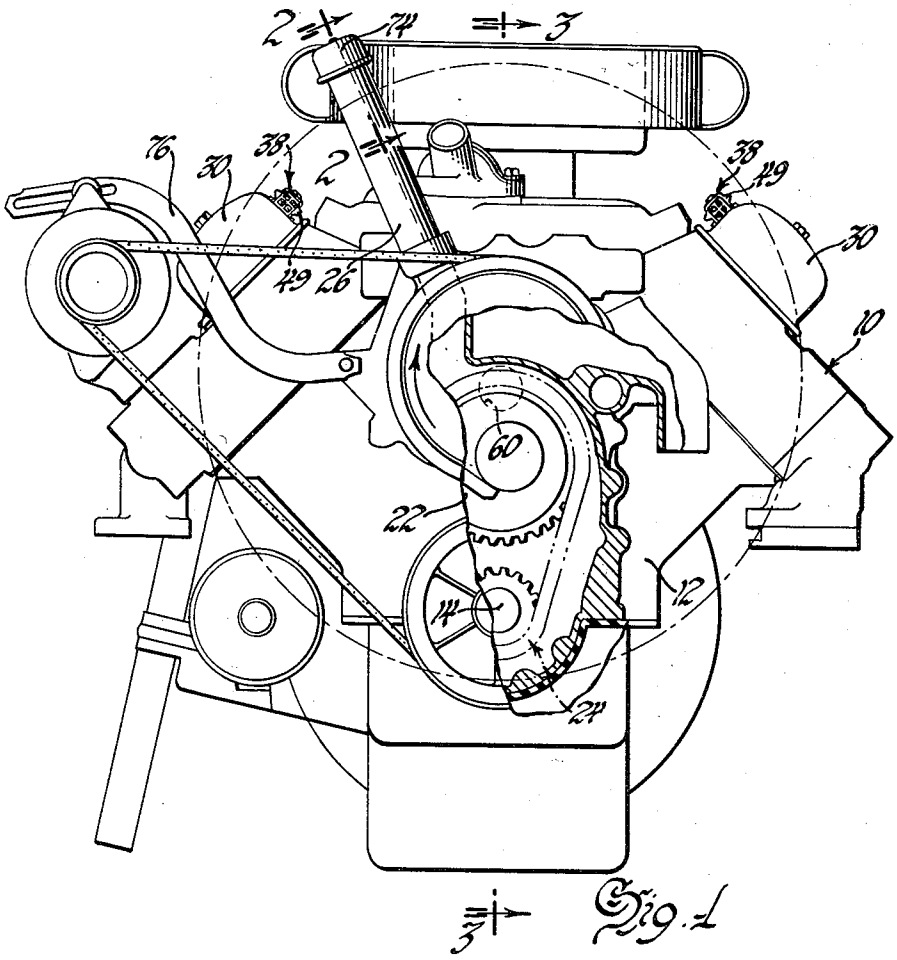


Fig. 1

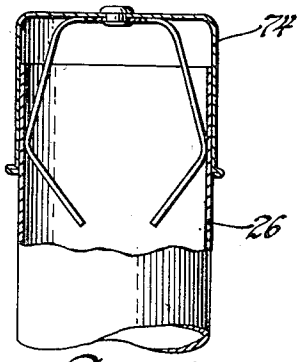


Fig. 2

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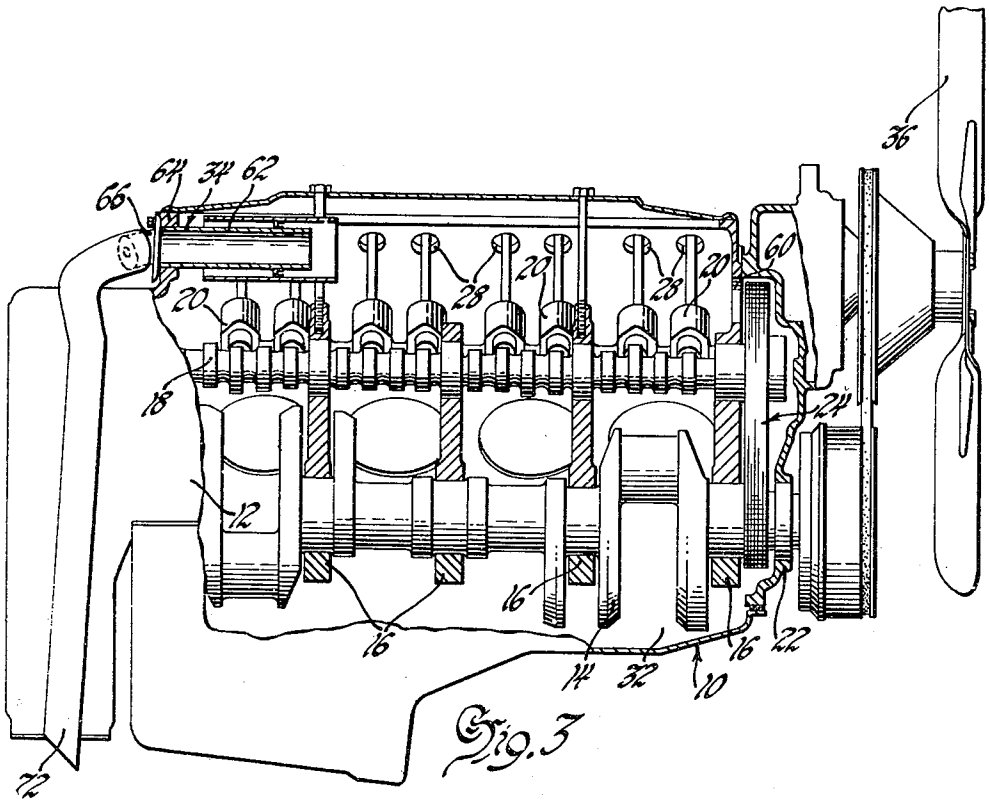


Fig. 3

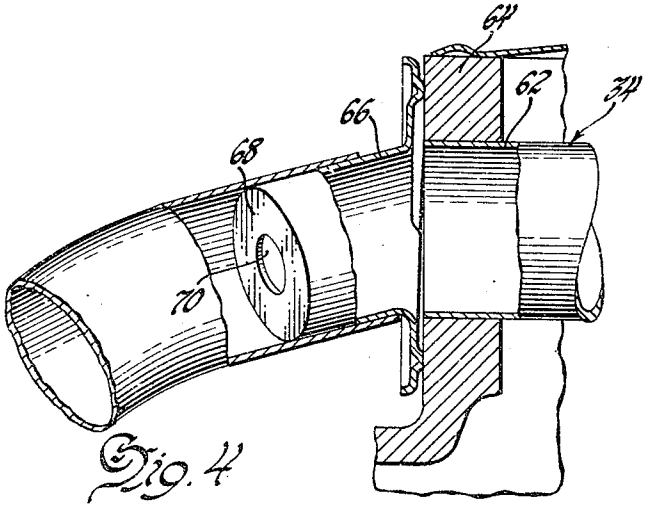


Fig. 4

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CRANKCASE VENTILATION

Filed Sept. 30, 1954 3 Sheets-Sheet 3

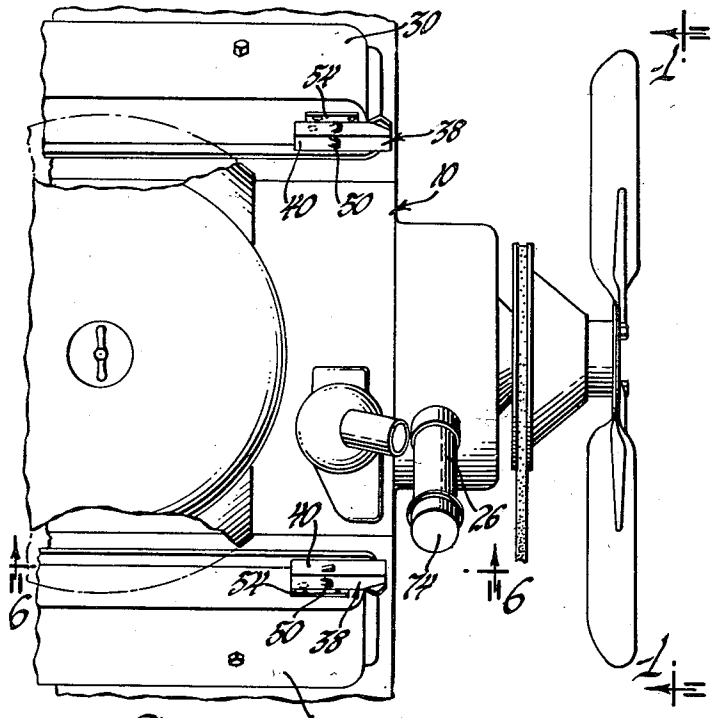


Fig. 5

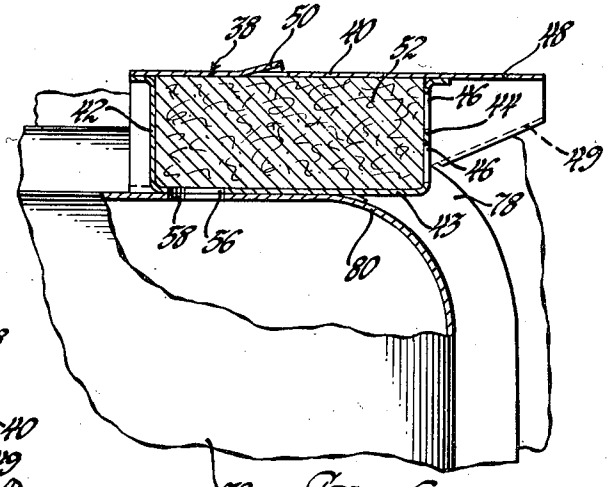


Fig. 6

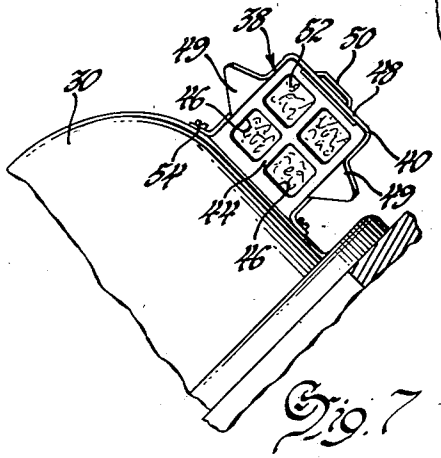


Fig. 7

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2,771,064

CRANKCASE VENTILATION

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14 Claims. (Cl. 123—41.86)

This invention relates to engines and like devices, and more particularly to a crankcase ventilating system for such devices.

The proper ventilation of engine crankcases to remove therefrom combustion chamber fumes blowing by the piston ring seals is an old problem which must always be considered in the designing of engines in order to prevent the deterioration of the lubricating oil and to protect the engine parts.

V-type engines having rocker arm assemblies present special problems which present crankcase ventilating systems and devices have not satisfactorily overcome. In the first place, the rocker arm assemblies of such engines are usually enclosed by sheet metal covers which, whether the engine is operating or not, cool faster than the remaining portions of the engine and crankcase. Since the crankcase fumes contain corrosive condensable vapors, the entry of such fumes into the rocker arm assembly compartments results in the condensation of such vapors on the inside of the covers. Such condensates eventually drip or splash onto the rocker arm assemblies to corrode the same and to contaminate the lubricating oil thereon so that sludge is formed and the oil is deteriorated. It is thus desirable to provide a crankcase ventilating system in which crankcase fumes cannot at any time enter the rocker arm compartments in any substantial amounts.

Such ventilating systems have been proposed, but there have been certain objections in the use of these systems. One of the main objections arises out of the fact that the effect of engine contours on the helical air blast from the engine fan has not been sufficiently considered. Thus, in structures where air inlets have been provided in the rocker arm covers or in the crankcase on either side of the engine, the amounts of air received by each cover or side of the crankcase due to the movement of the vehicle may be substantially equal, but the amounts of air received from the engine fan, especially when the vehicle is not moving, are unbalanced. This causes a pressure differential between the two sides of the crankcase so that crankcase fumes may be exhausted at least in part through one of the rocker arm covers or other air intakes. Furthermore, in present systems wherein lubricating oil filler tubes having breather caps thereon are provided, the natural conditions of convection of air and fumes through the crankcase are such that cool air entering through the lower breather cap flows upwardly through the crankcase so that crankcase fumes are again exhausted into the rocker arm compartments on both sides of the engine. Also, engine accessories are often located at the front of the engine in a manner to create local disturbances of air driven by the engine fan, again causing different amounts of air to be blown to various portions of the engine.

To eliminate the above objections, it is now proposed to provide a crankcase ventilating system, especially for V-engines, in which the construction and arrangement of the elements of the system and of various engine parts is such that both rocker arm covers receive substantially equal amounts of air. It is also proposed to provide such a structure in which the natural conditions of convection of fumes through the crankcase is such that these fumes will not be carried upwardly into the rocker arm assembly covers.

The above objects are accomplished by the novel design

and location of various engine parts so that the fresh air intakes of the crankcase ventilating system are not subject to obstructions and local air current disturbances between the fan and such intakes which would affect the amount of air received by each intake. Further, the air intakes are provided with visorlike portions designed to take advantage of the helical path of the air blast from the engine fan and to thus insure the equal receipt of air by each of the intakes. The natural convection conditions are improved by providing a non-breathing oil filler tube and by raising and restricting the diameter of the fume exhaust outlet.

In the drawings:

Figure 1 is a front end elevational view, with portions thereof cut away to better illustrate internal details of construction, of an engine and a crankcase ventilating system therefore embodying the invention.

Figure 2 is a cross-sectional view taken in the plane of line 2—2 of Figure 1 and looking in the direction of the arrows.

Figure 3 is a fragmentary cross-sectional view taken in the plane of line 3—3 of Figure 1 and looking in the direction of the arrows.

Figure 4 is a cross-sectional view partly in elevation of the crankcase fume exhaust outlet employed in the engine shown by Figure 3.

Figure 5 is a fragmentary top plan view of the engine shown by Figures 1 and 3.

Figure 6 is a cross-sectional view taken in the plane of line 6—6 of Figure 5 and looking in the direction of the arrows.

Figure 7 is an enlarged fragmentary front elevational view of the rocker arm cover and air inlet assembly shown at the left hand side of Figure 1.

Referring to the drawings in greater detail, Figures 1, 3 and 5 illustrate an engine 10 having a crankcase 12 having mounted therein the usual crankshaft 14 supported by the main bearing supports 16, a cam shaft 18 and push rods 20. A timing gear housing 22 encloses the timing gear assembly 24 and receives the filler tube 26 to which lubricating oil is added to the crankcase 12. The push rods 20 extend through the push rod openings 28 to the rocker arm assemblies enclosed by the rocker arm assembly covers 30. The engine shown is typical of the usual V-type of engine to which the invention is particularly adapted but not necessarily restricted. A crankcase breathing system incorporating the invention contemplates the entry of clean fresh air into the crankcase 12 by way of the rocker arm assembly covers 30, downwardly through the push rod openings 28 and to the bottom of the crankcase at the crankshaft galleries 32, and thence upwardly to the crankcase fume exhaust outlet 34 to be discharged to the atmosphere.

Before describing the invention further, it is desirable to point out that the front end of the engine and the various accessories mounted thereon present a variety of configurations and surfaces from which air blown from the engine fan 36, as well as air moving as a result of the movement of the vehicle driven by the engine, will be deflected and by which such air will be disturbed from its helical or other path. Unless tests are made to determine the quantity and direction of air being supplied to any given point on the engine, it is difficult to determine where to place such air inlets so that they will receive equal amounts of air.

The proposed crankcase ventilating system employs separate specially formed air inlet members 38 of identical design, one of which is mounted at the front end of each of the rocker arm assembly covers 30. Each of these air inlet members may comprise a channel casing 40 closed at the rear end thereof by a wall 42, at the bottom by wall 43 and at the front end thereof by a wall

44, with the front wall 44 having air inlet openings 46 under the visorlike extension 48 of the channel casing 40 beyond the front wall 44 of the inlet member 38. The visorlike extensions 48 may have transversely extending flaps 49 to aid in the control of the amounts of air received by the openings 46. Additional air scoops or louvres 50 may be provided at the top surfaces of the air inlet members 38, and any suitable air filtering material 52 may be provided within the air inlet members 38 to clean the air as it passes therethrough. One of the air inlet members 38 may be secured in any manner, as by flanges 54, to each of the rocker arm covers so that the aperture 56 in the bottom wall 43 registers with the aperture 58 in the rocker arm cover in order that air may pass through the air inlet member into the rocker arm cover. As shown by Figure 3, the air then passes from the rocker arm cover 30 downwardly through the push rod openings 28 and into the crankshaft galleries 32 of the crankcase. Clean air also may pass downwardly through the timing chain housing 22 by way of the aperture 60 in the front wall of the crankcase and into the crankshaft gallery 32 at the front of the crankcase. The constant stream of fresh air is swirled within the crankcase by the rotation of the crankshaft and eventually forces the crankcase fumes to be vented out through the crankcase fume exhaust outlet 34. The fume exhaust outlet may include an inner cylindrical tube 62 terminating flush with the rear wall 64 of the crankcase and an external flanged conduit 66 mounted in any suitable manner, as by welding, opposite the tube 62 with the free end of the flanged pipe having a wall 68 across the diameter thereof with a smaller opening 70 therein to restrict the passage of fumes through this outer tube and to prevent the excessive carry-over of lubricating oil particles in the crankcase fumes. The last portion 72 of the fuel exhaust outlet 34 may extend downwardly from the flanged conduit 66 to permit the fumes to be drawn therethrough when the vehicle is in motion. It will be noted that the highest point in fume exhaust outlet 34 is substantially at a lever near the level of the clean air inlet members 38 so that when the engine is hot but not running, the natural convection currents of the air and fumes in the crankcase are not such that crankcase fumes naturally enter into the rocker arm cover compartments. This is further enabled by the use of the non-breathing cap 74 on the lubricating oil filler tube 26 and by the restricted passage 70 in the flanged conduit 66.

It will also be noted that all attempt is made to place engine accessories away from the area directly in front of the clean air inlet members 38 to prevent the causing of local disturbances in front of these clean air inlet members. For this reason, the generator arm bracket 76 may be formed in an ogee shape to prevent its obstructing the front of the air inlet member 38 on the right hand side of the engine. It will further be noted that when the engine fan 36 rotates in the direction of the arrows, as shown by Figure 1, that the air entering the air inlet member 38 on the right hand side of the engine 10 is moving upwardly and would be deflected from the front curved surface of the right hand rocker arm cover were it not for the visorlike extension 48 and the flaps 49 provided on the air inlet member 38 to entrap some of the engine fan air. It will be further noted that on the left hand side of the engine 10 the air leaving the fan is directed downwardly and would be normally entrapped in the space 78 between the side 80 of the rocker arm cover 30 and the front wall 44 of the air inlet member 38 so that an excessive amount of air would be driven through the openings 46. Though the left hand air inlet member 38 is constructed for the sake of convenience identically to the right hand member 38, the visorlike extension 48 in the case of the left hand member serves the opposite purpose as it does on the right hand member, that of preventing the entry of as much air as normally would enter the left hand member 38 without the visorlike extension 48. This construction and placement of the air inlet members has been found to equalize the quantities of air entering the air inlet members so that differential pressure between the two rocker arm covers is prevented. In this manner, the crankcase fumes are forced to be vented out the fume exhaust outlet 34 rather than through one or the other of the air inlet members 38.

It will be apparent from the above specification and drawings that there has been provided a crankcase ventilating system for delivering substantially equal amounts of air from the engine fan through air inlets in the rocker arm covers, downwardly through the push rod openings into the lower portions of the crankcase and thence outwardly through a fume exhaust outlet at the top rear of the crankcase. Since the amounts of air received by both sides of the crankcase from the engine fan are equal, the possibility of crankcase fumes being vented out one of the air inlets is eliminated. Further, due to the location of the outlet exhaust passage with respect to the air inlet members and due to the non-breathing oil filler tube cap, the natural convection characteristics of the crankcase are such that fumes are not likely to be vented in any great quantity into the rocker arm covers.

What is claimed is:

1. In an internal combustion engine having spaced rocker arm compartments, a crankcase ventilating system adapted to prevent the entry of crankcase fumes into said rocker arm compartments and to permit the entry of air directly into said compartments and thence to other parts of the crankcase of said engine with which said compartments communicate, said system comprising means associated with each of said rocker arm compartments for collecting and filtering air including the air driven by the engine fan and carrying said air into each of said rocker arm compartments of said engine, said collecting means being formed and positioned to include means for equalizing the quantities of clean air received by each of said collecting means, said ventilating system including a non-breathing lubricating oil filler tube communicating with said crankcase and having a cap to prevent the induction of air through said filler tube.

2. An internal combustion engine having a crankcase, a timing chain compartment at the front end of said crankcase, a pair of rocker arm assemblies extending along said crankcase one on each side thereof, a cover for each of said rocker arm assemblies, push rod openings leading from said rocker arm assemblies to the inside of said crankcase, a crankcase fume exhaust outlet disposed at the rear end of said crankcase near the top thereof, and a crankcase ventilating system for said crankcase comprising passages permitting air including air from the engine fan to pass into said rocker arm assembly covers, downwardly into said crankcase through the push rod openings therein and thence upwardly at the rear of said engine, said air forcing the crankcase fumes out through the fume exhaust outlet in said crankcase, said passages including a passage near the top of the front crankcase wall permitting said air to pass through said passage and downwardly through said timing chain compartment to the front of said crankcase, said passages and said flow of air therethrough being such that said fumes in said crankcase may not pass upwardly through said push rod openings and into said rocker arm assembly covers.

3. An internal combustion engine such as that defined by claim 2 and being further characterized by said crankcase ventilating system including a pair of air collecting means each comprising a tubular member having the rear end thereof closed and the front end thereof perforated to permit the passage of air through the openings therein, said tubular members being provided with filtering material, one of said tubular members being adapted to be secured to a suitable surface of each of said rocker arm covers of said engine in a manner to per-

mit air including engine fan driven air to pass through said front perforated end thereof, through said filtering material, downwardly through aligned apertures in said tubular member and said rocker arm cover and into said crankcase, said tubular members also having visor-like portions formed therefrom at the front ends and at the tops and sides thereof to better entrap air driven by said engine fan in the case of one of said members and to exclude some of said air in the case of the other of said members.

4. An internal engine having oppositely disposed valve operating means including push rods and rocker arm assemblies associated with the crankcase thereof, rocker arm covers provided with means for entrapping and filtering air including air driven by the engine fan, and an air outlet for said crankcase, said entrapping and filtering means being elements of a crankcase ventilating system for said engine wherein air is collected by said entrapping means and directed into said rocker arm cover and thence downwardly through said push rod openings to the bottom portions of said crankcase of said engine to exhaust the crankcase fumes through a fume outlet without permitting said fumes to pass upwardly into said rocker arm compartments and to thus prevent the condensation of moisture on said rocker arm assemblies.

5. An engine such as that defined by claim 4 and being further characterized by said fume outlet being restricted in diameter at a point along the length thereof and being disposed near the top of said crankcase to reduce the amount of lubricating oil vapors carried therethrough and to minimize the convection of air through said outlet and into said crankcase when said engine is hot but not running.

6. In an internal combustion engine having a crankcase, an engine fan and a separate rocker arm assembly together with a cover therefor extending along each side of said engine, a crankcase ventilating system including an air scoop at the leading end of each of said rocker arm assembly covers for collecting and directing air including air from the engine fan into the compartment provided by said rocker arm assembly covers and thence into said crankcase, said scoops being formed with visor-like extensions so that they receive equal quantities of air notwithstanding their position at the top of the engine and the helical path of the air blast from said engine fan, one of said visorlike extensions serving to reduce rather than to increase the amount of air received by said scoop.

7. An engine such as that defined by claim 6 and further characterized by said engine having a generator mounting bracket, said generator mounting bracket of said engine being formed in ogee shape in order to be disposed as far below said air scoop on the generator side of said engine as practicable to minimize local turbulent conditions of the air driven by said engine fan in front of said air scoop and to thus further facilitate the equal distribution of air to said air scoops disposed on said rocker arm assembly covers.

8. In an internal combustion engine having a crankcase ventilation system, a rocker arm assembly cover on each side of said engine, a clean air inlet disposed at the leading end of each of the rocker arm assembly covers, said inlets being formed to provide visorlike extensions at the leading ends thereof.

9. In an internal combustion engine having a crankcase ventilation system, a fan delivering a helical air stream, a rocker arm assembly cover on each side of said engine, a clean air inlet at the leading end only of each of the rocker arm assembly covers, said inlets being formed to provide identical visorlike extensions at the leading ends thereof, said visorlike extensions either scooping or deflecting fan air depending upon their disposition in an air stream, said extensions equalizing the quantities of air received by said air inlets from said engine fan notwithstanding the tendency of the inlet on the left hand side rocker arm assembly cover to receive more air due to the downward flow of the air on said left hand side of said engine as a result of the helical flow of said air from the fan of said engine.

10. An internal combustion engine, comprising a cylinder block having walls formed providing crankthrow compartments and a timing gear compartment, said timing gear compartment communicating with said crankthrow compartments, a cooling fan mounted on said block, a pair of spaced heads mounted on said block, each of said heads having rocker arm assemblies enclosed by a cover to provide closed rocker arm compartments, said rocker arm compartments communicating with said crankthrow compartments, air collecting and filtering means mounted near the front of each of said covers, said means including means for equalizing the amounts of air received by said covers from said fan, an oil filler tube leading to said crankthrow compartments, said tube being closed with a cap so that air cannot pass therethrough unless said cap is removed, and an exit passage leading from said crankthrow compartments, said passage having restrictive means therein to reduce the carry-over of oil mist from said crankthrow compartments.

11. An internal combustion engine or the like having a cylinder block formed to provide crankthrow compartments, a cooling fan adapted to supply a helical air blast over said engine, cylinder heads mounted on each side of said block and having rocker arm assemblies associated therewith, said rocker arm assemblies being enclosed by covers to provide rocker arm compartments, said rocker arm compartments communicating with said crankthrow compartments, and an air receiving device associated with each of said covers, said devices including visor-like means adapted to block fan air from the device normally receiving more fan air and to collect fan air for the device normally receiving less fan air.

12. An internal combustion engine or the like having a cylinder block formed to provide crankthrow compartments, a cooling fan adapted to supply a helical air blast over said engine, a cylinder head mounted on each side of said block, each of said heads having a rocker arm assembly associated therewith, each of said rocker arm assemblies being enclosed by a cover to provide a rocker arm compartment, each of said rocker arm compartments communicating with said crankthrow compartments, and an air receiving device associated with each of said covers, said devices including means adapted to block some fan air from the device otherwise receiving more fan air and to collect additional fan air for the device otherwise receiving less fan air.

13. In an internal combustion engine having a cooling fan delivering a helical blast of air against the front of the engine and spaced rocker arm assembly covers, inlet means on each of said covers for receiving fan air for said covers, one of said means having means for reducing the amount of fan air received and the other of said means having means for increasing the amount of fan air received.

14. In an internal combustion engine having a cooling fan delivering a helical blast of air against the front of the engine and spaced rocker arm assembly covers, inlet means on each of said covers for receiving fan air for said covers, one of said means having means for reducing the amount of fan air received and the other of said means having means for increasing the amount of fan air received, said reducing and increasing means equalizing the amounts of fan air received by said inlet means.

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