

April 17, 1956

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2,742,057

DEVICE FOR VENTILATING ENGINE CRANKCASE

Filed Oct. 22, 1952

2 Sheets-Sheet 1

Fig. 1.

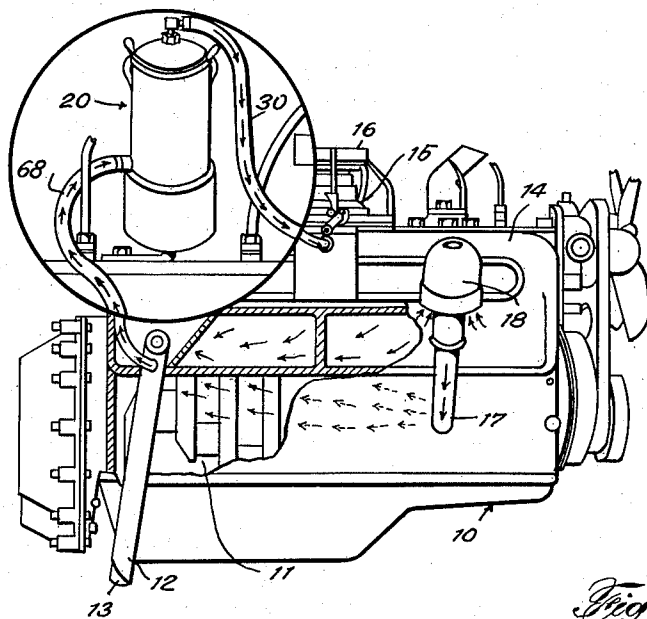


Fig. 3.

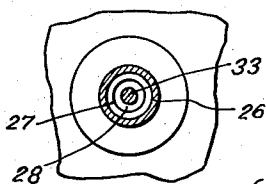


Fig. 4.

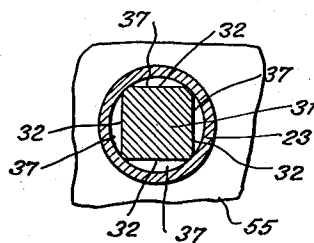


Fig. 6.

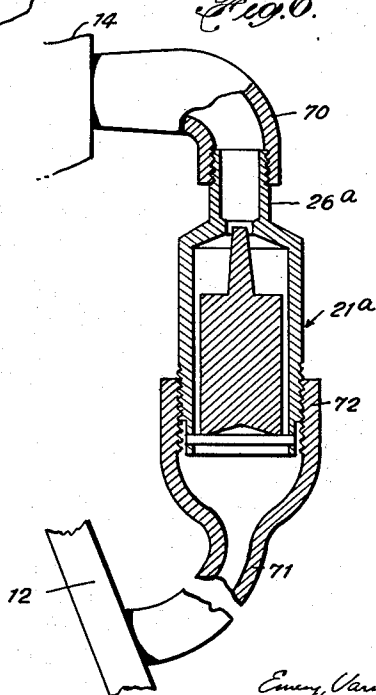
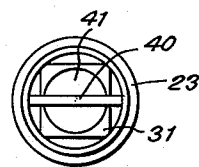


Fig. 5.



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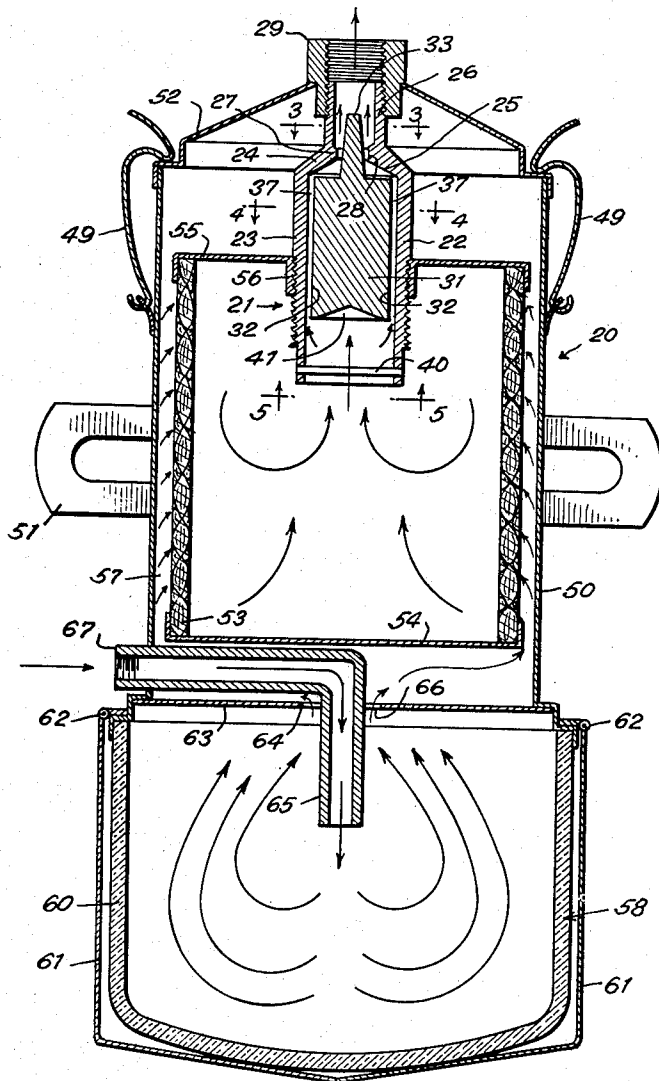
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2 Sheets-Sheet 2

Fig. 2.



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DEVICE FOR VENTILATING ENGINE CRANKCASE

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3 Claims. (Cl. 138—45)

The present invention relates to a valve device especially useful to ventilate the crankcase of an internal combustion engine and is an improvement over the device of the general type shown in my U. S. Patents #1,990,657, issued February 12, 1935; #2,226,405, issued December 24, 1940, and #2,442,696, issued June 1, 1948.

In a crankcase ventilating device for the general type referred to, there is provided a port or orifice valve between the crankcase and the intake manifold, operable automatically under the action of varying suction in said manifold to control gas flow from the crankcase above the sump to said manifold. Air is admitted into the crankcase above the sump, and the venting action of the port or orifice between the crankcase and the intake manifold causes the crankcase to be ventilated. The valve controlling this port or orifice automatically varies the effective size of said port or orifice as the vacuum in the intake manifold varies, thereby minimizing variations in draft conditions through the crankcase and into the engine intake resulting from this variation in the intake vacuum.

The operation of the crankcase ventilating device of the general type referred to prevents build-up of pressure in the crankcase, and as the air is drawn through the crankcase and into the intake, it carries with it the harmful diluent vapors, such as engine "blow-by," acid, varnish, moisture, etc. from the crankcase, thereby filling the crankcase above the sump with fresh air. The valve device described has a filter and a trap associated therewith to remove the heavy particles and impurities in these vapors or gases, such as heavy carbon, sludge and the like, before delivering the vapors into the engine intake. The resulting clean volatile oily vapors containing moisture or steam entering the intake are beneficially consumed in the explosion chambers. As a result of the operation described, there are provided as benefits constant crankcase ventilation, continuous automatic upper engine lubrication, better piston seal and freer valve action, extraction of oil diluting ingredients, detection of leaky or porous cylinders, heads and gaskets and reduction of sludge formation.

One object of the present invention is to provide a crankcase ventilating valve device of the general type described, which is constructed to prevent the movable valve member from getting stuck due to the collection of gummy vapors laden with varnish, sludge, etc., which affords minimum of surface contact between the movable valve member and the valve case and is constructed to prevent wear and/or distortion of the orifice by the contact action of any valve parts rigid with said movable valve member, which is constructed to afford gradual variation in the effective size of the valve port or orifice as the intake suction varies, which has a movable valve member exposed to atmospheric pressure and presenting a comparatively large surface to said pressure, assuring thereby more positive action of the valve, and which is simple of construction and is made up of a minimum number of valve parts, thereby affording economy of

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manufacture and ease in the cleaning and servicing of said valve parts.

Various other objects of the invention are apparent from the following particular description and from inspection of the accompanying drawings, in which:

Fig. 1 is a side view of the internal combustion engine of an automobile, parts of said engine being shown broken away to expose the interior of the crankcase, said engine being shown in connection with a crankcase ventilating system embodying the present invention; the valve, filter and trap unit forming part of said system being shown in perspective within a circle and magnified for clarity;

Fig. 2 is a vertical section of the valve, filter and trap unit embodying the present invention;

Figs. 3 and 4 are sections of the valve part of the crankcase ventilating system taken along lines 3—3 and 4—4 respectively of Fig. 2;

Fig. 5 is an end view of the valve part of the crankcase ventilating system taken along lines 5—5 of Fig. 2; and

Fig. 6 shows in vertical section a valve device alone secured directly to the intake manifold of an internal combustion engine in a simpler form of crankcase ventilating system embodying the present invention.

Referring to Fig. 1 of the drawings, the crankcase ventilating system of the present invention is shown applied to the internal combustion engine 10 of an automobile having the usual crankcase 11, the road draft tube 12 connected to the crankcase but having its discharge end partially shut off by a plug or cork 13 to adapt the engine to said crankcase ventilating system, the intake manifold 14 for delivering an explosive mixture to the cylinders of the engine and the carburetor 15 having an outlet connection to the intake manifold and an inlet connection to an air strainer 16.

The plug or cork 13 has a surface V-groove or a hole extending therealong for two purposes. The opening formed thereby in the plug or cork 13 prevents the pressure in the crankcase 11 from building up, in case the valve, trap and filter unit of Fig. 2 to be described, should fill up sufficiently to hinder free flow of gases there-through, and serves as a drain to prevent collection of condensation in the road draft tube 12 and the return of this condensation to the crankcase.

When no road draft tube is provided, then a T-connection may be provided in the valve inspection or cover plate of the crankcase or wherever the attachment to the crankcase is made and thus provide for a branch pipe which is the equivalent of the road draft tube and a branch lead to the intake of the valve, trap and filter unit of Fig. 2 to be described.

For ventilating the crankcase 11, there is connected to said crankcase near one end and above the sump an oil therein, an air inlet pipe 17 open to the atmosphere through an air filter 18. Near the other end of the crankcase 11, there is mounted between said crankcase and the intake manifold 14, a valve, trap and filter unit 20 operable to remove the impurities from the vapor current induced towards the intake manifold by the vacuum therein and to control the flow of the purified vapors into said intake manifold. Referring to Figs. 1—5, this valve, trap and filter unit 20 comprises a valve 21 having a valve body or case 22 consisting of a main cylindrical section 23, a conical shoulder section 24 defining a conical valve seat 25 and a neck section 26 with a throat 27 defining a cylindrical valve orifice 28. Threaded to the upper discharge end of the neck section 26 of the valve case 22 is a bushing 29 for the screw attachment thereto of a hose 30 connected to the intake manifold 14.

Movable in the valve case 22 is a valve piston 31, which in mounted position of the entire unit 20 extends vertically and is restrained and guided by the valve case to move

vertically in response to the inductive action of the vacuum in the intake manifold 14 transmitted to the valve 21 through the hose 30. This valve piston 31 is substantially of square cross-section to define four similar sides 32 in quadrature relationship, these sides being flat as shown or concave. At its upper end, the valve piston 31 has an axial conoidal plug extension 33 of reduced diameter tapering upwardly or outwardly, and fitted into the orifice 28 to vary its effective opening with changes in lift.

The diagonal dimension of the valve piston 31 between opposite corners is slightly smaller than the internal diameter of the main cylindrical case section 23, so that these corners reach the internal wall of said case section and are confined thereby against transverse movement. The valve piston 31 thereby has a snug slide fit in the cylindrical case section 23, permitting said piston to move freely up and down according to the degree of vacuum in the intake manifold 14 with minimum of friction resistance from the internal wall of said case section but with little or no transverse movement.

The orifice 28 is large enough so that even when the valve piston 31 is in uppermost limiting position with the upper edge of said piston seating against the internal conical surface 25 of the shoulder case section 24, said orifice is not entirely closed by the plug 33 on said piston but defines a clearance in said orifice around said plug. The valve piston 31 has such little transverse play in the cylindrical case section 23, that the plug 33 cannot contact the wall of the orifice as a result of such transverse play, even in the upper limited position of the valve piston described.

The sides 32 of the valve piston 31 whether flat or substantially concave extend chordally of the cylindrical inner wall surface of the main case section 23 and define thereby with said surface substantially segmental spaces 37 constituting the passageways for the crankcase vapors in their transit through the valve 21. Even in upper limited position of the valve piston 31, with said piston seated against the inner conical surface 25 of the shoulder case section 24, the upper seating edges of said valve piston define with said surface segmental spaces, thereby maintaining uninterrupted vapor flow through the valve 21 at all times regardless of the position of the piston. Where the sides 32 of the valve piston 31 are concave instead of flat as shown, the passageways defined between said piston sides and the inner peripheral surface of the valve case 22 will be of larger cross-sectional area.

As the vacuum in the intake manifold 14 is reduced, the valve piston 31 drops by gravity until a limiting position is reached. To so limit the drop in the valve piston 31 without closing the lower end of the valve case 22, there is provided a stop pin 40 extending diametrically through the main case section 23 near its lower end. To prevent the valve piston 31 from adhering to this stop pin 40 as the result of gummy or sticky collections thereon, the amount of contact surface between the piston and the stop pin is reduced to a minimum by providing a recess 41 shown of conical form in the lower end of the piston. By this construction, the stop pin 40 in lower limited position of the valve piston 31 engages the valve piston at only two diametrical regions at the foot of the recess 41.

The valve 21 is associated with a filter and a trap to form the unit 20, and to that end, the valve is enclosed in a filter housing 50 carrying a bracket 51 by which the unit may be mounted on and attached to the engine casing or frame. A cover plate 52 is releasably secured to the upper end of the housing 50 by means of spring clips 49 hinged to the sides of said housing. Enclosed in the housing 50 and encircling the lower open end of the valve case 22 is a vapor filter element 53 constructed of suitable design, and made for example of woven textile. In the specific design shown, this filter element is cylindrical and has a bottom impervious rigid wall 54 and a top impervious rigid wall 55 with a center sleeve 56 threaded on the outside of the main valve case section 23. The filter element 53 is smaller in external diameter than the

internal diameter of the housing 50 to define an annular clearance 57 for the passage if crankcase vapors therein discharged from a lower trap 58 to be described.

The trap 58 forming part of the unit 20 is located on the bottom of said unit and comprises a glass jar 60 releasably retained in position against the lower end of the filter and valve housing 50 by a pair of spring hooks 61 hinged at their upper ends at 62 to diametrically opposite sides of the housing and having their lower offset ends releasably caught onto the bottom of the jar. The upper open end of the jar 60 may, if found desirable, be closed by a baffle plate 63 having a center hole 64 through which one leg of an angle pipe 65 extends vertically downward with a clearance 66, the other leg of said pipe extending horizontally above the baffle plate and terminating in a tip 67 outside the housing 50 suitable for the attachment of a hose 68 connecting into the crankcase 11, as for example through the closed road draft tube 12, as shown in Fig. 1.

In the operation of the crankcase ventilating system shown in Figs. 1-5, during operations of the engine 10, a vacuum is maintained in the intake manifold 14 preventing build-up of pressure in the crank case 11 and causing fresh air to be drawn into the crankcase through the filter 18 and the pipe 17. The air passing over the sump or oil in the crankcase 11 carries the vapors from said crankcase through the hose 68, through the angle pipe 65 and into the glass jar 60. The heavy impurities in the vapors such as water, heavy carbon, sludge, dirt and the like drop by gravity into the jar 60 accumulating at the bottom thereof. The lighter impurities, in addition to the volatile fumes, moisture or steam and lubricating film travel upwardly through the clearance 66 in the baffle plate hole 65 around the angle pipe 65 and into the housing 50 and pass therein through the filter 53 where the light solid impurities are intercepted. The strained and purified gases are then drawn through the lower open end of the valve case 22, along the passageways 37 on the sides of the valve piston 31, through the restricted orifice 28, through the hose 30 and into the intake manifold 14. The vapors admitted thereby into the intake manifold 14 will contain minute particles of oil or oil vapor which will eventually be deposited in the valve stems, compression rings, cylinder walls and cylinder pistons, thus greatly aiding in their lubrication. Moisture in the vapors admitted into the intake manifold 14 from the crankcase 11 will be deposited in the explosion chambers forming steam and thus reducing the formation of carbon. Cleaned fuel gases mixed with the air drawn into the intake manifold 14 in the manner described, enrich the explosive mixture and thereby improve the efficiency and performance of the engine.

The valve 21 automatically controls the flow of vapors into the intake manifold 14 according to the suction in said manifold. In the absence of the valve 21, as the suction in the intake manifold 14 increases, the amount of vapors drawn from the crankcase 11 increases and may overload said manifold. To offset the effect of varying suction in the intake manifold 14, the valve 21 is provided, operable to decrease its effective orifice opening as the vacuum in said manifold increases. The amount of vapors drawn into the intake manifold 14 remains thereby substantially constant, or may have any desired predetermined quantitative relation to the degree of vacuum in said intake manifold, according to the degree of taper of the valve plug 33. Since the valve plug 33 is conical in shape, variations in effective orifice opening through which said plug extends is gradually progressive and affords gradual volumetric variation at a predetermined rate. Also, any dirt collecting in the orifice 28 around the plug 33 is forced out of the orifice by the pushing action of the flaring sides of said plug as said plug is moved upwardly, thereby maintaining said orifice clear of dirt, even without contacting said plug with the wall of said orifice.

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Since the valve piston 31 is restrained against lateral movement, the valve plug 33 does not contact the wall of the orifice 28, so that this orifice does not become worn and enlarged and the valve plug does not wear out and become reduced in size.

Because of the peculiar shape of the valve piston 31, no pockets are presented thereby in which dirt and gum may collect. Moreover, because of this piston shape and the conical shape of the seat 25, this piston at no time completely closes the valve 21 against flow therethrough.

Also, the lower end of the valve case 22 being entirely open except for the stop pin 40, this affords comparatively small areal contact between the valve piston 31 and its stop and thereby assures against the sticking of the piston in its lowermost stopped position by the collection of gum and the like in the region of contact. Moreover, this open ended construction of the valve case 22 exposes the entire end of the valve piston 31 of comparatively large area to the atmospheric pressure from the crankcase 11, thereby improving the pressure lifting action on said valve piston and rendering said piston more positive in action.

The segmental passageways 37 along the sides of the valve piston 31 are sufficiently large compared with the orifice clearance around the valve plug 33, to assure a smooth steady flow of vapors through said clearance in all positions of said valve piston.

The valve 21 is made essentially of two simple parts 22 and 31 which are economical to manufacture and which may be easily taken apart for cleaning and servicing.

Although the valve 21 is shown in Figs. 1-5 associated with the filter 53 and the trap 58 to form the unit 20, as far as certain aspects of the invention are concerned, the valve may be employed between the crankcase 11 and the intake manifold 14 without the auxiliary filter and trap devices. In Fig. 6, the valve 21a similar to the valve 21 is shown employed in the modified manner described. This valve 21a has the neck section 26a of its case or body 22a threaded into one end of an elbow 70, the other end being screwed into the intake manifold 14. The lower section of the valve case 22a has a direct connection to the closed road draft tube 12 through a pipe 71 having an enlarged sleeve 72 at one end threaded over said valve case and having its other end secured to said draft tube by a screw connection. In all other respects, the valve 21a is the same as the valve 21 in the construction of Figs. 1-5.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not to be limited thereto but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. A valve structure adapted to be mounted in a conduit through which a gas passes at varying rates which affect the operation of a valve to control the quantity of gas passing through said conduit, the combination of a valve casing connected in said conduit, said casing having a small aperture in the top thereof connecting into said conduit and an aperture at its base connected into said conduit, said casing being tapered at the top to form a stop at a point below said aperture, a pin across the bottom portion of said valve casing to hold a valve piston when in lowermost position, a valve piston mounted in said casing and adapted to be floated therein only by reason of the variations in pressures of gas passing through said conduit, said valve piston having four edges along its side for engaging the side of said casing for guiding said piston, said piston having a tapered portion mounted at the top thereof and movable into and out of said aperture without touching the side walls thereof, said tapered

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portion being of varying diameters throughout its length to afford variations between minimum and maximum openings of said aperture to vary the effective opening thereof.

2. In combination, a valve casing mounted in a conduit having gas passing therethrough at varying rates and volumes, said casing having openings at each end and with one of said openings forming a small orifice, a piston mounted in said valve casing and being automatically movable therein in response to pressure changes of gas flowing through said casing, said piston having a tapered portion which extends into said orifice without touching the walls of said orifice, said tapered portion and said orifice cooperating to control the quantity of flow of gas through said orifice as said tapered portion moves into and out of said orifice, a shoulder formed in said casing near said orifice for engaging a part of the upper portion of said piston to limit the movement thereof in one direction, said tapered portion of said piston being in non-engagement with the walls of said orifice at all times when said piston engages said shoulder thereby controlling the amount of gas irrespective of rate of flow of said gas to pass around said tapered portion and through said orifice, the cubic capacity of said casing adjacent and above said shoulder when said valve piston is in its uppermost position being greater than the area across said orifice when the valve is in its uppermost position.

3. In combination a valve casing, mounted in a conduit having gas passing therethrough at varying rates, said valve casing having a substantially cylindrical inner wall surface and having a shoulder formed therein near its upper end and having an orifice adjacent said shoulder, a piston mounted in said valve casing and automatically movable up and down therein in response to pressure changes in the gas flowing therethrough, said piston having square edges slidable along the inner wall surface of said casing for maintaining axial alignment of said piston in said valve casing, said piston having indented side walls between said edges to provide gas passageways leading to said orifice, said piston having an elongated tapered portion integral with the top thereof and constructed with a taper throughout its length and extending through said orifice to continually vary the opening of said orifice with pressure changes in said conduit by moving its tapered surface to effectively vary the quantity of gas moving through said orifice, said elongated tapered portion always remaining out of contact with the walls of said orifice and never closing said orifice tightly, and stop means adjacent the bottom edge of said casing for limiting the downward movement of said piston, the bottom of said valve piston being concave and only engaging said stop means at least at one point of engagement therewith, thus preventing sticking of said valve piston on said stop.

References Cited in the file of this patent

UNITED STATES PATENTS

1,049,992	Catchings	Jan. 7, 1913
1,100,761	Mueller et al.	June 23, 1914
1,242,003	Lewis	Oct. 2, 1917
1,498,399	Parker	June 17, 1924
1,529,384	Adams	Mar. 10, 1925
1,990,657	Kriek	Feb. 12, 1935
2,093,035	Davies	Sept. 14, 1937
2,359,485	Lowther	Oct. 3, 1944
2,367,662	Baxter et al.	Jan. 23, 1945
2,450,864	Calloway	Oct. 5, 1948
2,550,373	Orloff et al.	Apr. 24, 1951

FOREIGN PATENTS

437,161	Great Britain	Oct. 24, 1935
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