April 20, 1965 W. J. LINN 3,179,095

INTERNAL COMBUSTION ENGINE CARBURETION SYSTEM

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FIG. 1.

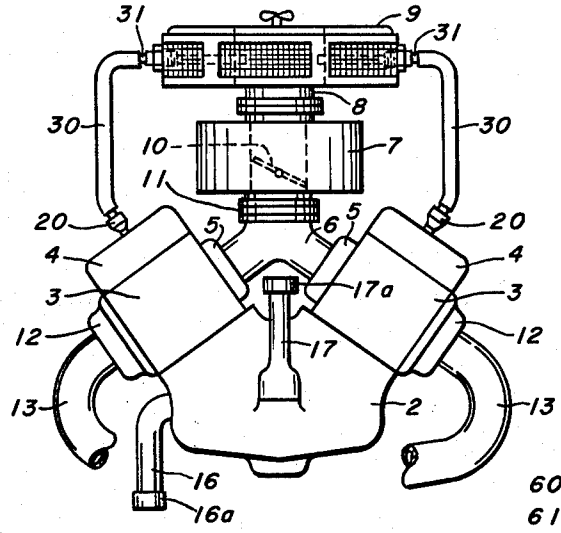


FIG. 2.

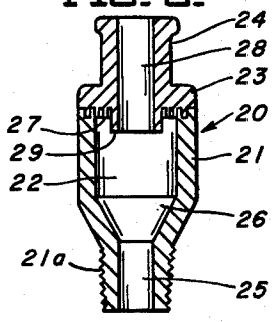


FIG. 3.

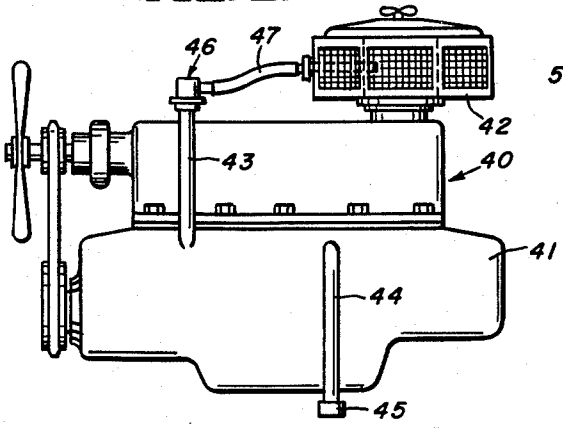


FIG. 4.

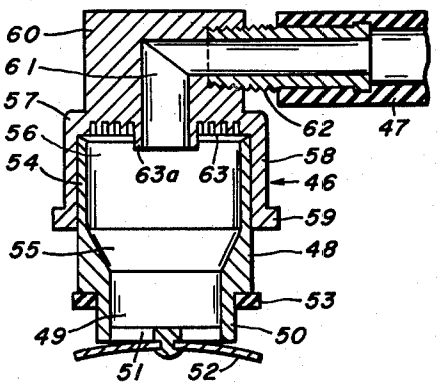


FIG. 5.

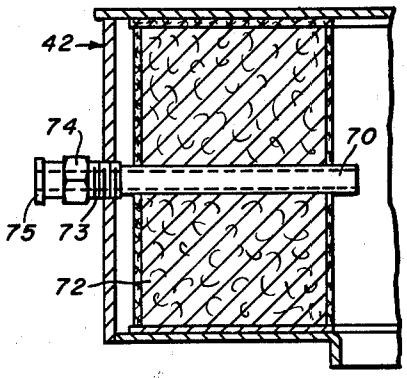
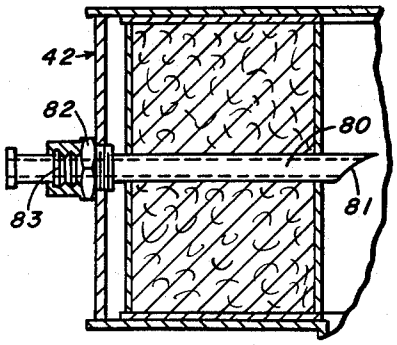


FIG. 6.



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INTERNAL COMBUSTION ENGINE CARBURETION SYSTEM

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FIG. 7.

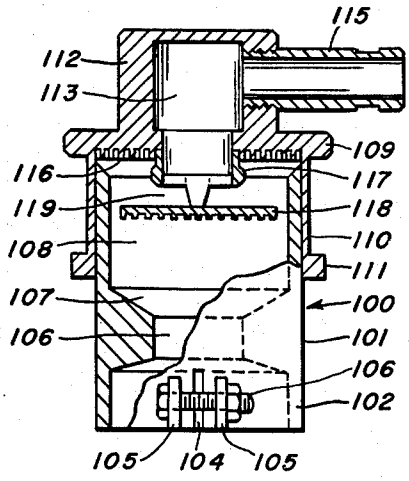


FIG. 8.

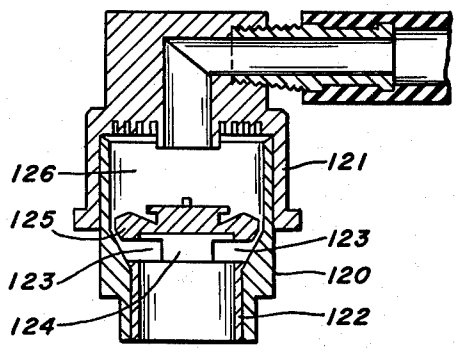


FIG. 9.

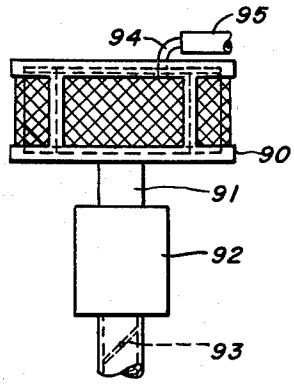
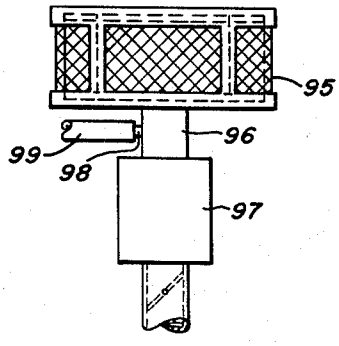


FIG. 10.



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United States Patent Office 3,179,095 Patented Apr. 20, 1965

3,179,095
INTERNAL COMBUSTION ENGINE CARBURETION SYSTEM

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Filed May 23, 1963, Ser. No. 282,716
14 Claims. (Cl. 123—119)

The present application is a continuation-in-part of Serial No. 173,387, filed May 25, 1962, and now abandoned.

This invention relates to internal combustion engines, and is for a carburetion system designed to reduce the noxious and toxic content of gases resulting from the operation of the engine and substantially improve engine performance.

The present application constitutes an improvement over the invention disclosed in my applications for patent, Serial No. 75,504, filed December 13, 1960, now Patent No. 3,059,628 of October 23, 1962.

Much of the annoying and toxic fumes resulting from the operation of an internal combustion engine are the result of gases and unburned fuel blowing by the pistons into the crank case of the engine. Water vapor produced from the burning of hydrocarbons is another constituent of the blow-by gases. In the crank case, oil is whipped about and oil mists and vapors are present which become mingled with the blow-by gases and vapors. In most conventional engines with valves in the head there is a passage through which oil may return from the valves to the crank case and in such cases the crank case gases can flow up into the space under the valve cover.

There is generally provided a breather or vent pipe in the crank case through which crank case gases and vapors may be expelled, usually downwardly into the atmosphere. Usually there is also an oil receiving spout through which oil is poured into the crank case and it is provided with a breather cap of some kind. Not only are these crank case gases expelled into the air, but air circulates into the crank case, leading to oxidation of vapors and gases to produce sludge in the oil. The blow-by gases increase as the engine becomes older, and this represents not only an increase in air pollution but it also means an increase in fuel waste.

While this condition has long been recognized, increasing traffic makes the problem of air pollution more acute, and various systems have been proposed, but for various reasons have proved unsatisfactory or a source of great trouble to the motorist. In some such systems air is drawn through the crank case, resulting in increased accumulation of oxidation products and dirt in the oil. Other systems use spring valves that become clogged, while others waste oil and clog air filters.

The present invention, which is particularly applicable to engines of the conventional type using carburetors to mix fuel and air, may be used with diesel engines, but with diesel engines I prefer to take care of the crank case gases as shown in another application about to be filed, also based on my application Serial No. 173,387 above referred to. According to this invention the crank case is sealed except for a conduit leading from the crank case to the air induction system of the engine in advance of the carburetor throttle plate through which gases from the crank case flow under their own pressure. There is included in this connection a trap to retard the flow of oil out of the crank case into the air induction system. Preferably the crank case gases enter the air induction system at a point in advance of the throttle plate of the carburetor and the entrance of air into the air filter.

The invention has for its principal object to provide an improved apparatus for substantially eliminating pollution of air due to crank case gases and at the same time provides for the effective use of such gases to improve engine performance.

A further object of the invention is to provide means to substantially eliminate or retard any transfer of oil with the crank case gases to the air induction system of the engine.

A further object of the invention is to introduce the crank case gases into the engine at some point within the interior of the air filter and above the carburetor throttle plate so as to avoid clogging the filter by the discharge of the gases and smoke against the exterior of the filter.

My invention will be particularly described in connection with a conventional type of internal combustion engine, but which to some extent is useful with diesel type engines, and it is to be understood that both types are broadly comprehended by the broader aspects of my invention.

In the accompanying drawings:

FIG. 1 is a more or less schematic front view of a conventional type of V-8 engine with certain parts, not necessary to an understanding of my invention omitted, and certain parts are out of normal position or proportion for clarity of illustration;

FIG. 2 is a vertical section through an expansion chamber element in the line for conducting crank case gases to the air intake;

FIG. 3 is a schematic side view of an engine showing another embodiment of my invention;

FIG. 4 is a vertical section through the expansion element and oil trap, this being a modification of the element shown in FIG. 2, but constructed for more convenient use on the oil filler tube of the engine;

FIG. 5 is a fragmentary vertical section through an air cleaner with one form of discharge terminal passing therethrough into the interior of the air filter;

FIG. 6 is a view similar to FIG. 5 but illustrates a modification of the fitting shown in FIG. 5;

FIGS. 7 and 8 are views similar to FIG. 4 but showing two other modifications of the trap; and

FIGS. 9 and 10 show alternate modifications to FIGS. 5 and 6 for introducing gases into the air induction flow in advance of the carburetor.

Referring first to FIG. 1, which illustrates only schematically a conventional multicylinder internal combustion engine with two rows of cylinders in V formation, as for example a V-8 engine, 2 designates the engine crank case with two rows or blocks of cylinders 3 at an angle to each other. At the top of each row of cylinders is a valve cover 4. The intake manifold for each row of cylinders is designated 5, and 6 is the intake connection extending upwardly from the manifold to the carburetor 7. The carburetor is the usual down-draft carburetor with an air intake 8 at the top on which is an air cleaner of any usual form 9 through which atmospheric air is drawn into the carburetor. This is generally of cylindrical form with air admitting screen in the side walls, a removable cover and a replaceable annular filter cartridge inside the cylinder. The throttle plate is indicated at 10. I find it most helpful to use an auxiliary mixing device, or what I term a "homogonerizer," indicated at 11, between the carburetor and the intake manifold, this being the device shown in my Patent No. 2,889,214, granted June 2, 1959.

The engine shown is a valve-in-head type of engine so that the space under the valve covers 4 communicates with the interior of the crank case 2. The exhaust manifolds are indicated at 12, and 13 represents the exhaust pipes. There is a crank case vent 16 leading downwardly from the crank case above the normal oil level in the crank case, and 17 designates an oil filler pipe or tube. In some engines this goes directly into the crank case, but in some engines it may lead into the space under the

valve covers. This is all conventional or known. According to this invention the crank case is completely sealed by closing the vent 16, as indicated by cap or plug 16*a* and cap 17*a* on the oil filler tube 17. At 20 there is indicated an expansion chamber and trap shown in FIG. 2 having a lower section 21 which terminates in a reduced nipple 21*a* that is screwed into a hole tapped in the valve cover, there being a unit 20 on each cover.

The element 20 also has a top section 23 that has a friction fit on the upper end of section 21. The upper section 27 has a reduced nipple portion 24.

The lower section of the expansion trap has an axial passage 25 leading upwardly through the nipple, this passage having a funnel-like or upwardly-flaring portion 26 within the body 21 leading into a fully cylindrical chamber 22 of a larger internal diameter than the passage 25 so that its cross-sectional area is several times the area of this passageway. The internal diameter of the passage 25 should not be less than 5/16ths of an inch and preferably not less than 3/8ths of an inch, and any other passages in the flow system should not be smaller. This assures that gases move at low velocity and in order that variations in air pressure in the air induction system will have little overall effect in sucking gases from the crank case or creating a subatmospheric pressure therein.

The upper or top section 23 which has a friction fit over the chamber in the bottom section has ridges and grooves over the inner surface thereof, as indicated at 27. These ridges and grooves may be concentrically arranged with a central passage 28 leading axially through the top and its nipple extension 24. The ridge nearest the opening preferably projects further into the chamber 22 than the other ridges, as indicated at 29.

A tube 30 fitted over the nipple 23 extends upwardly to the air cleaner 9 and its other end is fitted over the outer terminal of a tube 31 that opens into the air induction system above the carburetor but inside the filter, as hereinafter more fully explained.

With the crank case sealed, the crank case gases have no escape except to flow by their own pressure into the valve cover and out through the expansion trap 20 through the tube 30 into the interior of the air cleaner. Since all of the air induction system of the engine ahead of the carburetor throttle valve is open to atmosphere at all times, there is little reduction in air pressure below atmospheric pressure even with the engine running with the throttle valve wide open, so that there is little suction to draw the gases from the crank case but their flow is induced only as the pressure of the blow-by gases increases above atmospheric pressure. The conditions of operation therefore are very much different than if the tubes 31 opened into the intake manifold. In the intake manifold there may be a very sudden decrease in air pressure below atmospheric pressure, as for example when the engine is running at high speed and the throttle is closed, or when the automobile of which the engine is a part is going down grade. The apparatus operates therefore primarily by the discharge of accumulated crank case gases from the engine under its own pressure and independently of pressure in the manifold. Hence there is a minimum entrainment of oil mist in the gases, and air is not drawn through the crank case to add to the volume of gases, or introduce atmospheric moisture, and there is no accumulation of air to either produce oxidation or explosive conditions in the crank case.

Since the oil is a high flash point oil, vapors and mist which are entrained in the escaping blow-by gas are slowed in their velocity in the expansion chamber 22 and collect or are condensed in this chamber, particularly where they strike the projections and valleys or ridges and grooves on the inner face of the top section. The condensed oil flows back into the valve cover, the funnel-like interior of the expansion trap facilitating this reflux.

Instead of the arrangement shown in FIG. 1 where the crank case gases are conducted from the valve covers, the same result can be obtained on existing cars by sealing the crank case vent and conducting the crank case vapors to the air induction system from the oil filling spout, as shown in FIGS. 3 and 4.

In FIG. 3 I have shown a simplified modification in which the crank case gases are conducted directly from the crank case through the oil filler pipe to the air filter of the engine, and in FIG. 4 I have shown one form of fitting for accomplishing this purpose. In FIG. 3, 40 designates the engine which is shown schematically, and 41 is the crank case. The air filter is indicated at 42. As is usual in many engines, there is a vertical pipe 43 that extends upwardly alongside of or in front of the cylinder block, and which is usually provided with a removable breather cap. This oil filler pipe is normally located close to the front of the engine where the engine is most effectively cooled, but it, too, may be located on the valve cover.

The engine has a vent pipe 44 extending downwardly from the upper part of the crank case through which vapors from the crank case can be discharged downwardly.

According to the present invention, the crank case vent pipe 44 is tightly closed or capped as indicated by the closure 45 in FIG. 3. The usual removable breather cap on the oil filler tube 43 is removed and is replaced by a fitment comprising an expansion trap. It is designated generally as 46, and a tube 47 leads from this fitment to the air filter 42. The fitment 46, which corresponds in function to the device shown in FIG. 2, is of a character to close the top of the pipe 43 against the entrance of atmospheric air, but to allow gases to flow from the pipe 43 through the fitment and tube 47 to the air cleaner. At the same time it is constructed so as to enable oil to be poured into the tube when this is necessary to fill the crank case to the proper level.

One form of such fitment is shown in detail in FIG. 4. In many cases the breather cap simply has a friction fit on the top of the oil tube, and in other cases it may have an interlocking arrangement with the top of the oil tube similar to the arrangement on the radiator cap where the breather cap must be pushed down into the tube, and then turned to secure it in place. In FIG. 4 I have shown a fitment especially adapted for the latter arrangement. It has a lower section 48 having a vertical passageway 49 therethrough of funnel-like shape. The lower portion 50 of the lower section is of reduced diameter. There is a bridge or spider 51 across the lower part of the opening which does not interfere with the flow of gases upwardly into the passage 49, but which supports a thin leaf spring 52 to interlock with a double thread or lug arrangement inside the tube in a usual manner. There is a sealing gasket 53 around the upper part of the reduced portion 50. The lower section 48 has an upwardly-extending cylindrical wall 54 which is of larger diameter than the part 50, and the upper portion of the passage is flared as indicated at 55 into a cylindrical cup or chamber 56.

The fitment has an upper or cap section 57 with a downwardly-extending cylindrical flange portion 58 that has a close working fit over the exterior of the part 56 of the lower section. This skirt has a knurled flange 59 at its lower edge to enable the top section of the fitment to be grasped and slipped off the lower section. The cap section 57 has an upwardly-extending boss 60 on the top section with an upwardly-extending passage 61 therein. A nipple 62 is entered through the side of the boss and communicates with passage 61 and the hose or flexible tube 47 is fitted over this nipple. On the inner face of the top section there are a series of concentric annular ridges and grooves 63 with an annular ridge 63*a* around the outlet passage 61, so that this device not only serves as a separable connection for conducting gases from the filler tube 43 to the air filter, but also constitutes an expansion or condensing chamber similar to the device shown in FIG. 2 and functioning in the same

way. It, however, gives a greater interior chamber for expansion of gases and enables deeper ridges in the top wall of the caps than is provided in the smaller unit shown in FIG. 2, but still the device takes up no more room than the breather cap which it replaces. The annular ridge 63*a* tends to make the gases that hit the top swirl and retard the straight-through channeling of gases and vapors.

In use, the device 46 is applied to the top of the filler pipe 43 along with its flexible tube or hose 47. The tube 47 is attached to a fitting that opens into the air filter, and preferably in a manner hereinafter described. After the device is applied, and when it is desired to add oil to the crank case, the cap section 57 is simply lifted off the bottom or lower section 48 and the oil may be poured into the enlarged upper cup or chamber 56 of the lower section of the fitment and flow down into the crank case in the usual manner. Moreover, the device 46 may be easily opened up from time to time and wiped clean of any accumulations that may have been trapped in it.

As above indicated, the device 46 therefore serves the dual function of the expansion device of FIG. 2 and also provides a connection for leading gases from the crank case through the air filter that does not require any tapping of holes into the valve covers, and which may be very conveniently applied simply by slipping it onto the top of the pipe 43 in place of the usual breather. The cap section 56 can be die cast and standard for all cars, while the base section can be made in different sizes or designs to adapt the fitment to the particular car or make of car on which it is to be used.

With this device it is important that the crank case be sealed so that the flow of gases from the crank case occurs entirely through a positive pressure in the crank case and not by reason of being sucked into the air intake by the reduced pressure in the air intake. Here also the internal diameter of the tubing should be 5/16ths of an inch or greater, as should be all passageways through the fitment. The tube 47 is flexible, of course, to permit the ready separation of the cap fitment from the base part.

Location of the trap or expansion chamber near the front of the engine is especially advantageous since it will be most effectively cooled, resulting in a condition where oil vapors or mist which condense or agglomerate more readily than water vapor are collected and returned to the crank case.

It is important with my invention that the crank case be sealed against atmospheric air; that the crank case gases be conducted through a tube or conduit large enough to assure a low velocity; that their flow be effected by positive pressure in the crank case and not by suction directly induced in the air intake manifold of the engine, and the decompression or expansion trap is important in further preventing usable oil from being carried over into the air intake. Not only does the invention provide fuel economy, but it reduces air pollution.

This invention has a further desirable advantage in diesel type engines through the introduction of combustible fuel in the air intake, but since diesel engines do not have a throttle plate to control air to the intake manifold, I prefer to use the arrangement disclosed in my copending application Serial No. 282,796, filed May 23, 1963.

With all types of engines, the trap or expansion chamber in the passage between the crank case and air intake returns drops of oil to the crank case, and because air circulation in the crank case with its attendant moisture does not occur, there is a definite reduction in sludge and solids in the oil, and water vapor generated by fuel combustion and blowing by the pistons into the crank case is carried over to the air intake, where the added humidity gives beneficial results. Engine performance is not only improved by the carry-over of moisture from the crank case to the air intake, but is also improved from the carry-over of unburned fuel, much of which under operating conditions is an uncondensable gas. Oil drip from the pan under the engine or from the crank case vent which discharges into the pan or toward the ground is avoided.

While I am aware that the conducting of crank case gases and vapors to the air intake is not new, some prior arrangements have functioned to the principle of sucking such vapors from the crank case through a small tube at high velocity into the air intake manifold usually with a vented crank case. This results in a condition where the greatest suction occurs when the engine speed is slowing down, creating maximum vacuum in the intake. If one inspects the tubing on a car so equipped after it has been run, he will find considerable oil in the tubing, fouled spark plugs, and where weighted or spring-loaded valves are used in such systems, the manufacturers recommend cleaning at one thousand mile intervals. With the instant arrangement the tube remains clean and there is no need to clean it.

A particular advantage of the arrangement shown in FIGS. 3 and 4 is that the fitting that is applied to the oil filler tube simply replaces the breather cap now commonly provided, and avoids any need for tapping into the valve covers or crank case as in FIG. 1, and eliminates any need for the separate seal 17*a* of FIG. 1 to close the filler tube.

It has heretofore been pointed out that with either of the arrangements shown in FIGS. 1 and 3 it is desirable that the crank case gas be discharged into the air induction system in advance of the carburetor but interiorly of the filter and not deposited against the outside of the filter. This is because the filters may deteriorate with the collection of liquids and smoke particles in the crank case but which are harmless to the engine.

Referring now to FIGS. 5 and 6 there is shown a fitting or pipe 70, corresponding to tube 31 in FIG. 1 constructed of a rigid material and which serves as a lead-in pipe through the wall of the air cleaner 42 (FIG. 3) joining the flexible hose 47 which opens into the fitment 46, or to the hose 30 joined to the valve cover 4 as shown in FIG. 1. The pipe 70, as indicated in FIG. 5, has its inner end beveled to a sharp edge so that it may be entered into a hole in the air cleaner casing and forced through the annular filter 72 of the air cleaner into its central hollow area. The outer end of the pipe 70 is provided with external threads 73 which engage the walls of an opening formed through the side wall of the air cleaner 42 for anchoring the pipe in position. A nut 74 is threaded over the end of the pipe which is located external to the wall of the air cleaner to fix the pipe into firm engagement with the wall, and an annular shoulder 75 is formed at the end of the pipe outside the cleaner over which may be fitted the flexible pipe 30 of FIG. 1, or the pipe or tube 47 of FIG. 3.

In the modification shown in FIG. 6 the construction is much the same as in FIG. 5, but the gas inlet tube 80 has its inner end cut off on a diagonal, at 81. A sleeve 82 is screwed into the air cleaner shell or casing 42. The tube 80 is passed through the sleeve and has threads 83 thereon that are engaged with internal threads in the sleeve. The tube 80 may be entered in the filter through the sleeve and pushed through the filter cartridge until its inner end extends into the open center of the filter. Then the tube may be rotated to engage threads 83 with the internal threads in the sleeve. To replace a filter cartridge, the tube 80 is unscrewed and pulled out, and the filter cartridge replaced in the usual manner. The outer end of tube 80 is shaped to receive the end of the hose 30 or 47. A pointed end similar to 81 could be provided on the inner end of tube 70 instead of its having a beveled edge. The pointed end, when positioned as shown in FIG. 6, serves to deflect air from blowing back into the tube 80. In either FIG. 5 or FIG. 6 the rigid tube is withdrawn when the filter cartridge is to be changed, and when

the new cartridge is in place the tube is pushed in to penetrate and pass through the filter.

The pipe 70 of FIG. 5 is inserted into the air cleaner by forcing the annular knife edge of the end of the pipe through the external wall of the cleaner and through the filter material axially into the center or hollow section of the air cleaner.

In most cases the arrangement shown in FIGS. 5 and 6 is desirable because of the slight clearance which usually exists between the air filter and the hood of the vehicle, and the congestion of space under the air cleaner and above the carburetor. However, where space permits, gases can be conducted into the air induction system between the filter and the carburetor either at the top or at the bottom of the air cleaner, as well as in the manner shown in FIGS. 5 and 6. This is illustrated in FIGS. 9 and 10. In FIG. 9, 90 designates the air cleaner with a pipe 91 leading down to the carburetor 92. The throttle plate of the carburetor is indicated at 93. The air cleaner which has the usual removable cover and has a filter cartridge on the inside is provided with an elbow fitting 94 that opens into the air space in the air cleaner inside the filter cartridge. The tube 95, corresponding to either the tube 30 of FIG. 1 or the tube 47 of FIG. 3, is fitted over the laterally-turned end of this elbow so as to conduct the crank gas into the air induction system of the carburetor between the inside of the filter and the carburetor.

A reverse arrangement could be employed where the elbow 94 is on the underside of the filter or, as shown in FIG. 10, these gases can be led into the air intake for the carburetor below the air cleaner and above the carburetor throttle plate. In this figure 95 designates the air cleaner, 96 the air intake pipe to the carburetor, and 97 is the carburetor. There is a nipple 98 on the air intake pipe below the air cleaner, and a tube 99 corresponding to the tube 30 of FIG. 1 or 47 of FIG. 3 is fitted over the nipple 98.

The arrangement shown in FIGS. 5, 6, 9 and 10 therefore all provide for the introduction of crank case gases into the air induction system from a point between the filter and above the carburetor. As above pointed out this is of importance in internal combustion engines using carburetors because throttling of the engine speed is controlled by throttling the flow of air to the engine, resulting in wide fluctuations of pressure or suction in the air intake manifold, and this fluctuation is undersirable since a high suction is likely to draw oil mist from the crank case and then when atmospheric pressure exists in the intake manifold, air may be drawn in a reverse direction into the crank case. That situation does not prevail with my invention. In a diesel engine, as described in my copending application Serial No. 282,796, filed May 23, 1963, the speed of the engine is controlled by varying the fuel flow to the fuel injectors, and there is a less wide fluctuation of pressure in the intake manifold so that it is desirable, where possible, to carry the crank case gases in a diesel engine directly to the intake manifold.

The smoke vapors and gases which are carried over from the crank case are harmless when introduced into the engine and are largely consumed in the engine. However, as heretofore indicated, these products are injurious to the filter and one thing that has caused serious trouble in attempts to consume the crank case gases by introducing them into the air cleaner has been that if they are introduced to the outside of the air cleaner much of the products lodge in the air cleaner, accelerating its breakdown and causing clogging. The present invention eliminates this difficulty while in no way interfering with their combustion or resulting in any damage to the engine.

I have found, since filing my previous application, that some engines tend to throw or splash oil very much more than others. In order to more effectively prevent the carryover of oil, particularly where splashing is encountered, the expansion trap may be made as shown in FIG. 7. In FIG. 7 the expansion trap, designated generally as 100, has a lower section 101 of generally cylindrical form with a depending skirt 102 that fits over the oil filling spout of the engine, such as the spout 43 in FIG. 3. There is a slot or kerf 104 in this skirt and lugs are provided at 105 with a take-up bolt and nut 106. This skirt is fitted over the oil filling pipe and then the nut is tightened on the bolt, contracting the skirt 102 about the pipe. On the inside of the lower member 101 there is a vertical passage 106 with an outwardly-flaring upper portion 107 that opens into a cylindrical chamber 108 of substantially larger diameter than the passage 106. The cap or top section, designated generally as 109, has a depending flange or skirt 110 that fits snugly about the cylindrical portion 108 of the lower section. The skirt 110 has a knurled flange 111 to facilitate its being grasped to apply it to or remove it from the lower section. It has an upwardly-extending boss 112 in which is a gas outlet passage 113. A nipple 115 is screwed radially into this boss and opens into the passage 113. A hose such as the hose 47 in FIG. 3 is fitted over this nipple.

The inner face of the top of the cap is provided with concentric ridges and grooves 116 as described in connection with FIGS. 2 and 4, but in addition there is a sleeve 117 frictionally held in the upper portion. On the lower end of this sleeve is a disk 118 that confronts the passage 106 but is of less diameter than the interior of the chamber 108. The tube is cut away at 119 so that only space extensions of the tube provide a connection for the disk 118. The under face of the disk 118 is also provided with roughening or ridges and grooves.

The disk 118 prevents any direct splashing of oil into the outlet 113 from the oil filler tube. It deflects all of the gas flow radially toward the sides of the chamber 108 around the edge of the disk and the gas then flows radially inwardly to the outlet passage 113. The roughened surface 118 provides additional area on which tiny droplets of oil are deposited where they accumulate until the accumulation is large enough to drop back onto the surface 107 or into the passage 106 and be returned to the crank case.

The arrangement shown in FIG. 8 is somewhat the reverse of the arrangement shown in FIG. 7, in that in stead of the baffle 118 being held in the top section, the baffle in FIG. 8 is held in the bottom section. In FIG. 8 the bottom section 120 is of the general form shown in FIG. 4 to fit inside of the oil filler pipe instead of around the top of it. The upper or cap section 121 is also the same as shown in FIG. 4 and these parts will not be again described in detail. However there is entered in the vertical passageway through the lower section a sleeve 122 which is cut away to leave radial openings at 123 and solid supports at 124 for supporting a baffle disk 125. Gases carrying oil, or oil which is splashed, hit the under side of the baffle plate 125 and the oil may flow back into the crank case through the sleeve 122. Some of the oil droplets will also condense or collect on the baffle 125, and from time to time drops will fall from it back into the crank case. The baffle disk 125, like the baffle disk 118, is of smaller internal diameter than the chamber 126 in the upper part of the lower section so that gases and vapors which hit the baffle are deflected radially to the periphery of the baffle and then flow upwardly to escape through the top section. This baffle therefore serves to prevent the straight flow-through of the gases from the inlet to the outlet. However, when oil is to be poured into the crank case the top section 121 is removed and oil is poured into the cup or cylindrical chamber 126. It flows down around the periphery of the baffle 125 through the ports 123 and down the sleeve 122 into the oil filler pipe as will be readily understood.

It will of course be understood that wherever applicable features shown in one of the several structures illustrated may be used with another. For example, the skirt arrangement 102 with the lugs 105 and the clamping bolt

106 could be used with the arrangement shown in FIG. 4 or the arrangement shown in FIG. 8, and the baffle arrangement shown in FIG. 7 could be just as well used in a fitment such as shown in FIG. 8.

The invention herein described provides for the transfer of crank case gases from the engine into its air intake system at some point between the carburetor throttle plate and the air filter through a closed conduit. With an engine using a throttle to regulate the engine speed by regulating air flow through the carburetor to the intake manifold, it is important that this conduit open into the air system in advance of the throttle plate, so that when the throttle is closed and the amount of blow-by gases produced is lowered, there will be no increase in suction in the conduit. It is important, however, since the blow-by gases are harmless to the engine and do contain fuel constituents, that they enter the air system after the air has been filtered and not discharged onto the filter where they can impair the filter and the fuel content be less advantageously used. The invention also provides a unique trap which, with either gasoline or diesel engines is highly effective in preventing or reducing oil carryover from the crank case to the air intake but which traps entrained oil and reflows it to the crank case. It does interfere with adding oil when necessary or block the flow of gases to the air intake.

While I have shown and described certain specific embodiments of my invention, it will be understood that this is by way of illustration and that various other changes and modifications may be made within the contemplation of my invention and under the scope of the following claims.

I claim:

1. A trap element and expansion chamber for use in a system for carrying crank case gases and vapors to the air intake system of an engine comprising separable upper and lower parts, the lower part having an inlet passage that opens into the bottom of a cylindrical chamber of larger diameter than said passage, the upper part being removably fitted on the lower part with an outlet passage therein of less diameter than the chamber, the upper part having an interior surface confronting the inlet passage in the lower part having ridge and valley-like formations thereover, the inlet passage terminating in the bottom of the cylindrical chamber at a level to reflux condensate back into said passage.

2. A trap element and expansion chamber for use in a system for carrying crank case gases and vapors to the air intake system of an engine comprising separable upper and lower parts, the lower part having an inlet passage that opens into a cylindrical chamber of larger diameter than said passage, the upper part being removably fitted on the lower part with an outlet passage therein of less diameter than the chamber, the upper part having an interior surface confronting the inlet passage in the lower part having ridge and valley-like formations thereover, the outlet passage in the upper part being centered in said interior surface.

3. A trap element and expansion chamber for use in a system for carrying crank case gases and vapors to the air intake system of an engine comprising separable upper and lower parts, the lower part having an inlet passage that opens into a cylindrical chamber of larger diameter than said passage, the upper part being removably fitted on the lower part with an outlet passage therein of less diameter than the chamber, and a baffle element of less diameter than the chamber within the chamber intermediate the inlet and outlet passages and confronting the inlet passage to deflect the flow of vapors from the inlet passage laterally.

4. An internal combustion engine having a crank case, an air intake with an air filter having an exterior open to the ambient air and an interior constituting a part of the air intake, a tube having one end communicating with the crank case and the other end opening into the air intake and closed against the admission of atmospheric air between its ends whereby it conducts only crank case gases into the air filter, the crank case being sealed against inflow of air or outflow of gases except through said tube, and means providing an expansion chamber and oil trap outside the engine between the discharge end of the tube and the crank case of several times the internal diameter of the tube, said means being positioned vertically on the engine to return oil trapped therein to the engine in countercurrent flow to the gases.

5. The combination with an internal combustion engine having a sealed crank case and an air intake with an air cleaner, of a tube establishing communication between the interior of the crank case and the interior of the air cleaner, and a fitting connected with the tube through which gases must flow from the crank case to the air cleaner, the fitting being in a substantially vertical position with an expansion chamber therein of a section many times the internal diameter of the tube, the fitting having a funnel-like bottom portion for draining liquid toward the engine and a wall opposing the bottom with an outlet passage therethrough, said wall surrounding the outlet passage being provided with ridges and grooves.

6. A fitment for use on internal combustion engines comprising a lower portion for telescopic engagement with the open end of the oil filling pipe of the engine and with a funnel-like passageway therethrough, an upper portion opposite the lower one having an end wall confronting the funnel-like opening, said end wall having a central opening therethrough, the fitment having side walls forming with the upper and lower portions a closed chamber between the upper and lower portions, and a nipple on the upper portion to which said central opening in the end wall leads.

7. A fitment for use on an internal combustion engine as defined in claim 6 in which the upper portion is removably attached to the lower portion.

8. A fitment for use on an internal combustion engine as defined in claim 6 in which the upper portion is removably attached to the lower portion by the side walls of the fitment being formed by telescoping slidably fitted parts on the upper and lower portions that fit together sufficiently closely to exclude atmospheric air.

9. A fitment for use on an internal combustion engine as defined in claim 6 in which the upper portion is removably attached to the lower portion, said end wall of the upper portion having its surface surrounding the central opening provided with ridges and grooves.

10. In combination with an internal combustion engine having a sealed crank case, an air induction system, and an oil filler tube leading into the crank case; an air cleaner having a filter portion and a hollow portion; a fitting for sealing the oil filler tube; a pipe having an annular knife-edge at one end and opening into the air cleaner hollow portion, the pipe extending through the filter and wall of the cleaner to the exterior and having external threads on the pipe other end beyond the cleaner wall; a threaded fastener engaged with the threads on the pipe other end and threaded snugly thereon against the cleaner wall for locking the pipe in fixed position; a shoulder formed on the pipe other end; and a flexible tube fitted at one end over the shoulder and at its other end to the fitting and opening into the oil filler tube for leading gases from the crank case and the filler tube into the hollow portion of the cleaner and the air induction system.

11. The combination as in claim 10 wherein the pipe is beveled diagonally to its longitudinal axis and sharpened at its one end to provide a pointed leading edge, and a niplle having threads at both ends with a shouldered portion therebetween is threaded into an opening formed in the wall of the cleaner, the nipple telescopically receiving the pipe therethrough with a sleeve having an annular in-turned flange fitted over a pipe shoulder and having threads for engaging the nipple external threads at its

end beyond the cleaner wall for locking the pipe into fixed position on the nipple.

12. The combination with an internal combustion engine having a sealed crank case, an oil filler spout through which oil is introduced into the crank case, the engine having a carburetor with a throttle plate, and an air induction system for the carburetor comprising an air duct terminating in an air filter, of a tube having a fitment at one end sealed to the oil filler spout and having a discharge terminal at its other opening into the air induction system between the filter and the throttle plate whereby crank case gases may be discharged into air flowing to the carburetor after the air has passed through the filter wherein the fitment on said tube comprises a bottom part with a funnel-like interior attached to the oil filler tube arranged to drain oil into the filler tube and a separable top part slidably engaged with the lower part to which the tube is connected, said fitment comprising a trap for obstructing oil particles entrained in the gas and returning oil so obstructed to the crank case through said tube.

13. The combination with an internal combustion engine having a sealed crank case, an oil filler spout through which oil is introduced into the crank case, the engine having a carburetor with a throttle plate, and an air induction system for the carburetor comprising an air duct terminating in an air filter, of a tube having a fitment at one end sealed to the oil filler spout and having a discharge terminal at its other opening into the air induction system between the filter and the throttle plate whereby crank case gases may be discharged into air flowing to the carburetor after the air has passed through the filter, said fitment on said tube comprising a bottom part with a funnel-like interior attached to the oil filler tube and arranged to drain oil into the filler tube and a separable top part slidably engaged with the lower part to which the tube is connected, said fitment providing an expansion chamber above said funnel-like interior bottom part, said fitment comprising a trap for obstructing oil particles entrained in the gas and returning oil so obstructed to the crank case through the oil filler tube.

14. The combination defined in claim 13 wherein said fitment has a baffle therein the edges of which are spaced from the walls of the expansion chamber to deflect the crank case gases rising from the funnel-like interior of the bottom part laterally as they flow into the upper part.

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