# United States Patent

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## [54] AIR CLEANER AND FUEL VAPOR STORAGE ASSEMBLY REMOTELY ASSOCIATED WITH AN ENGINE


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[51] **Int. Cl.**.....**B01d 53/04**, F02m 59/00

[58] **Field of Search**.....55/74, 387, DIG. 28, 316; 123/136



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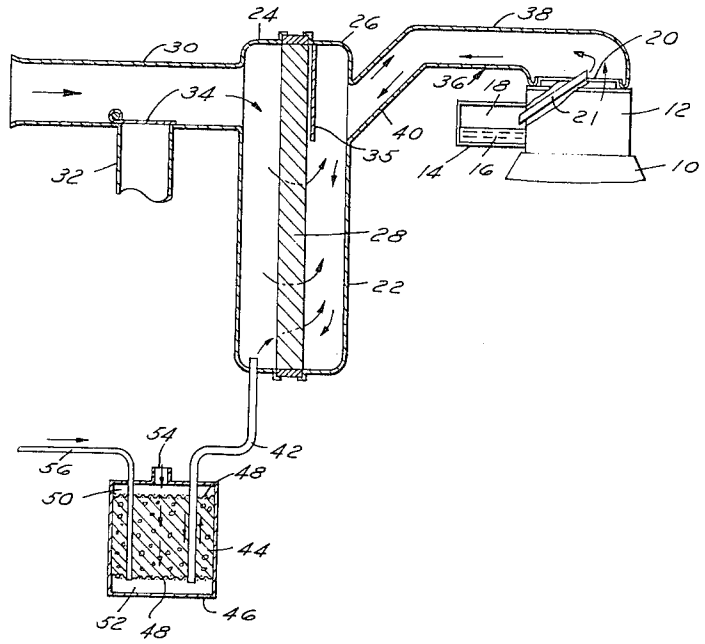
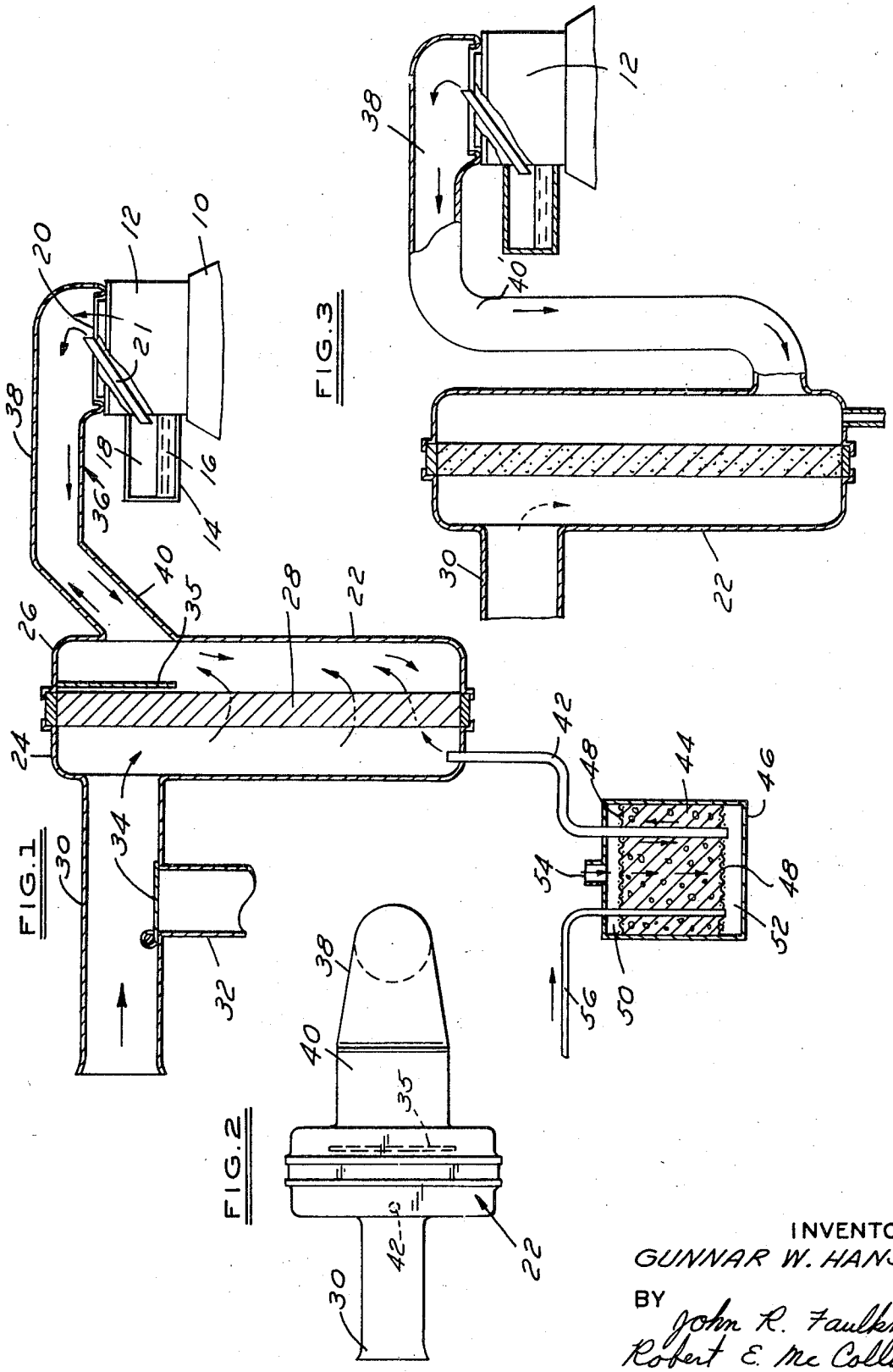
[57] **ABSTRACT**

The engine air cleaner is essentially vertically disposed in a side-by-side relationship to the carburetor. The two are connected by a conduit in a manner that the lower portion of the air cleaner acts as a vapor trap to prevent excess carburetor float bowl vapors from passing out through the air cleaner air inlet into the atmosphere. A bed of activated carbon is connected to the lower portion of the air cleaner casing to store the excess fuel vapors at times, the vapors being purged therefrom back into the engine during normal engine operation.


**14 Claims, 3 Drawing Figures**



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# AIR CLEANER AND FUEL VAPOR STORAGE ASSEMBLY REMOTELY ASSOCIATED WITH AN ENGINE

This invention relates, in general, to an air cleaner assembly for a motor vehicle. More particularly, it relates to one that is remotely located from a carburetor air horn air inlet opening.

Present-day demands for lower hood lines make it increasingly difficult to use conventional engine constructions having a carburetor and air cleaner superimposed thereon. This invention seeks to remedy the above situation by locating the air cleaner remote from the carburetor inlet, and construct it of a unique design that minimizes the escape of excess fuel vapors into the atmosphere.

The invention consists of an essentially vertically disposed air cleaner assembly having essentially a side-by-side relationship to the engine carburetor air horn. The air cleaner contains a filter element to provide a clean supply of air to the engine; it also is constructed to serve as a natural trap for excess fuel vapors emitted from the carburetor fuel bowl during the hot soak cycle of the engine. The construction is such that the fuel vapors flow by gravity through the air cleaner assembly into an adsorption device for storage and subsequent recirculation through the engine during normal operation.

It is a primary object of the invention, therefore, to provide an air cleaner assembly that is remotely located from the engine; and, is of a unique design that satisfies engine air requirements, while at the same time acts to trap excess fuel vapors emitted from the carburetor fuel bowl so that undesirable elements will not be emitted into the atmosphere.

Another object of the invention is to provide an air cleaner assembly of a design permitting the use of lower profile vehicle hoods, one that is relatively simple in construction, and one that is relatively inexpensive to manufacture.

Other objects, features and advantages of the invention will become more apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating the preferred embodiments thereof; wherein,

FIG. 1 is a cross-sectional view of a portion of an engine air filter assembly and fuel vapor emission control system embodying the invention;

FIG. 2 is a top view on a reduced scale of the assembly shown in FIG. 1; and,

FIG. 3 is a cross-sectional view on a reduced scale of a modification of the FIG. 1 showing.

FIG. 1 shows an air cleaner assembly adapted to be mounted adjacent and connected to a portion 10 of the intake manifold for an internal combustion engine. Secured on top of manifold 10 is a downdraft-type carburetor indicated schematically at 12. It has the usual float bowl 14 containing liquid fuel 16 and a fuel vapor space 18 thereabove. The carburetor contains the usual air horn fresh air inlet portion 20 into which, in this case, excess fuel vapors from the float bowl space 18 are vented through a tube 21. As thus far described, the construction is known and conventional and further details thereof are believed to be unnecessary for an understanding of the invention.

The air cleaner assembly includes a main outer closed shell 22 that is shown preferably as a square or rectangular cross section but could be cylindrical as well. The shell is defined by two cup-shaped portions 24 and 26 that are clamped in a sealing manner around a sheetlike filter element 28. The latter may be of the known paper or other suitable types for filtering particles from air passing therethrough in an axial direction. The filter 28 is vertically disposed and extends across shell or casing 22 so as to force all air passing axially from one side of the casing to the other to be filtered.

The air supply to casing 22 is provided by an inlet duct 30 secured to casing 22 adjacent its upper portion. The duct is open at its nonadjacent end to a suitable source of air at essentially atmospheric pressure. This may be engine air compartment air or air delivered directly thereto by ducting from outside the vehicle, as the case may be. The duct 30 is shown as containing a hot air branch 32 that is adapted to be connected to an exhaust manifold heat stove (not shown) in a known manner and controlled by a pivotal valve 34. The latter would proportion the degree of hot or cold air being supplied to the air cleaner casing 22 from ducts 32 or 30 by movement of the valve in a known manner by a temperature sensitive device (not shown) against the force of a return spring.



Casing 22 is connected to the inlet of the carburetor air horn by a duct 36. The latter includes a horizontally disposed section 38 fitted over air inlet 20 joined in end-to-end relationship to an inclined duct portion 40 that opens up into casing 22, as shown.

The air cleaner, in this case, also contains a flat plate baffle element 35 that acts as a fuel vapor flow barrier, in a manner to be described.

As thus far described, it will be clear that during normal engine operation, the engine suction will draw air through fresh air supply inlet 30, through the filter element 28 to be cleaned, and therefrom through the ducting 40 and 38 into the carburetor and engine proper. During a hot soak cycle of the engine, the engine heat may increase the vapor pressure in float bowl space 18 to a point where the vapors are forced through the vent 21. These fuel vapors will flow leftwardly in duct 38 and thence by gravity through the duct 40 towards the lower portion of the air cleaner casing 22, which constitutes, in effect, a reservoir. The baffle 35 will prevent a flow of the vapors from the duct 40 directly into the air inlet duct 30 and out into the atmosphere. Since the vapors flow like water, however, the baffle may be unnecessary.

It will be seen that the vertically disposed air cleaner casing 22, with its connecting ducting to the carburetor, acts as a trap to contain the heavier than fuel vapors therein. However, the main purpose of the trap is to guide the vapors into an adsorption means that has a storage capacity of say 50–100 times the volume of reservoir 22, that will essentially prevent a spillover of the vapors into the inlet duct 30.

More particularly, connected to the bottom of the casing 22 by tubing 42 is a bed of activated carbon 44. The bed is located within a canister 46 between a pair of screen grid elements 48 to provide air and fuel vapor communicating chambers 50 and 52 respectively. The chamber 50 is open to air at atmospheric pressure through an inlet 54, while the fuel vapor chamber 52 is connected to the end of conduit 42 that projects through the carbon bed. In a similar manner, excess fuel vapors from any other source, such as, for example, the fuel tank of the vehicle (not shown), may be routed to the carbon bed through a suitable tubing 56.

The carbon bed acts to adsorb excess fuel vapors on the carbon particles when they are conveyed to the space 52, and is purged of these vapors by the flow of fresh air through the carbon bed and into the purge tube 42 during normal operation of the engine. That is, when the engine has been restarted, the suction again will draw air through the air cleaner assembly from inlet duct 30 in the normal manner. This will create a pressure differential between opposite ends of tube 42 causing fresh air to flow from inlet 54 through the carbon bed and into tube 42 to purge the bed of the fuel vapors. The vapors then pass through the air filter element 28 and into the carburetor.

It should be noted that the purge flow of air through the canister 46 need only be about say 5–10 percent of the total airflow into the carburetor. Therefore, the inlet duct 30 will be so restricted as to provide only approximately 90 percent of the carburetor requirements, and force the carburetor to obtain the remaining 10 percent by way of the canister inlet 54.

FIG. 3 shows a modification of the invention. In this embodiment, the baffle member 35 of FIG. 1 is eliminated and the connecting inclined portion 40 of FIG. 1 becomes a more elongated duct 40' directed downwardly to a lower portion of the casing 22. This more closely simulates a U-shaped "trap" configuration. It also assures that all excess carburetor float bowl fuel vapors will pass to the lower portion of the air assembly casing 22 and into the fuel vapor adsorption canister 46 via tube 42. The remaining operation is the same as in connection with the embodiment of FIG. 1.

From the foregoing, it will be seen that the invention provides an air cleaner assembly that is remotely located from the engine proper and yet operatively connected thereto, to satisfy all the engine air requirements; and one that also traps excess fuel vapors and subsequently redirects them back into the engine to be consumed therein and thus not be vented to the atmosphere.

What is claimed is:

1. An air supply and fuel vapor control system for an engine having a carburetor secured thereto with an air inlet for receiving a supply of air for said engine, said carburetor also having a fuel bowl with a vent means connecting the vapor space in said bowl to said air inlet, said system including an air cleaner including a hollow like casing essentially vertically disposed with a fresh air inlet in one side adjacent the upper portion thereof, said casing containing an essentially vertically disposed, axial flow type filter element secured therein, said casing being located remotely from said carburetor air inlet and connected thereto by conduit means having in end-to-end relationship an essentially horizontal first portion connected to said carburetor air inlet and a downwardly depending second portion attached to the side of said casing that is opposite to that containing said casing air inlet, said filter element extending

across said casing forcing all airflow from said casing air inlet to said conduit means to pass therethrough, and fuel vapor adsorption means connected to a lower portion of said casing for storing excess fuel vapors from said carburetor fuel bowl during a hot soak cycle of said engine by the flow of said vapors through said bowl vent into said carburetor air intake and therefrom through said conduit means and by gravity flow into said adsorption means.

2. A control system as in claim 1, said adsorption means being purged of the stored fuel vapors during airflow through said casing to said carburetor, said adsorption means comprising a bed of activated carbon having a fresh air inlet at one end and a connection to said lower portion of said casing at its other end.

3. A control system as in claim 2 including vertically extending vapor barrier means located on the clean air side of said filter element at a point below the casing air intake to guide the flow of fuel vapors toward the lower portion of said casing and minimize the bypass of any fuel vapors into said casing air intake.

4. A control system as in claim 1, said casing and carburetor air inlet being disposed in a side-by-side relationship.

5. An air supply and fuel vapor control system for an internal combustion engine comprising in combination, a carburetor air inlet and an essentially vertically disposed air cleaner assembly remotely located from each other, said assembly having an air inlet adjacent the top thereof, a filter element extending from top to bottom thereof, conduit means connecting said carburetor air inlet to a portion of said assembly, the lower portion of said assembly and said conduit means constituting a vapor trap type reservoir for containment of excess fuel vapors passing thereinto, and fuel vapor adsorption means connected to said assembly and operatively associated with said reservoir for storing fuel vapors flowing at times into said reservoir from a carburetor, said fuel vapors being purged from said adsorption means upon airflow in a normal direction from said air cleaner assembly to said carburetor during normal engine operation.

6. A system as in claim 5, said assembly and carburetor air inlet being disposed in essentially a side-by-side relationship.

7. A system as in claim 5, said assembly having a hollow rectangularlike casing closed on opposite sides with said air inlet on one side and the said conduit means connected to the opposite side.

8. A system as in claim 7, including baffle means extending between said casing air inlet and said conduit means to divert fuel vapors into said reservoir.

9. A system as in claim 5, said vapor adsorption means comprising an activated carbon bed.

10. A system as in claim 9, said carbon bed being located remotely from said assembly and having conduit means connecting the fuel vapors in said reservoir thereto for the flow of fuel vapors into said bed and the purge therefrom.

11. A system as in claim 5, said conduit means being connected to said assembly at a point below the assembly air intake and adjacent the reservoir.

12. A system as in claim 7, said casing including a sheetlike axial flow filter means extending across said casing from top to bottom of said casing whereby all airflow and fuel vapor flow from said casing air inlet towards said carburetor air inlet and vice versa passes through said filter element.

13. A system as in claim 12, said adsorption means comprising an activated carbon bed remotely located from said casing and having a fresh air inlet at one end and a fuel vapor line at the other end.

14. A system as in claim 13, the connection of said line to said reservoir being made at essentially the lowest point of said casing whereby fuel vapors will flow by gravity from said reservoir into said carbon bed.

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