United States Patent

Hansen

[15] **3,678,663**

[45] **July 25, 1972**

[54] AIR CLEANER REMOTE FROM ENGINE AND HAVING INTEGRATED FUEL VAPOR ADSORPTION MEANS

[72] Inventor: **Gunnar W. Hansen,** Ypsilanti, Mich.

[73] Assignee: **Ford Motor Company,** Dearborn, Mich.

[22] Filed: **Sept. 2, 1970**

[21] Appl. No.: **68,839**

[52] **U.S. Cl.** **55/387,** 55/DIG. 28

[51] **Int. Cl.**.....**B01d 53/04**

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

[56] **References Cited**

UNITED STATES PATENTS

3,368,326	2/1968	Hervert	55/387
3,541,765	11/1970	Adler et al.	55/387
2,153,069	4/1939	Barr et al.	285/211

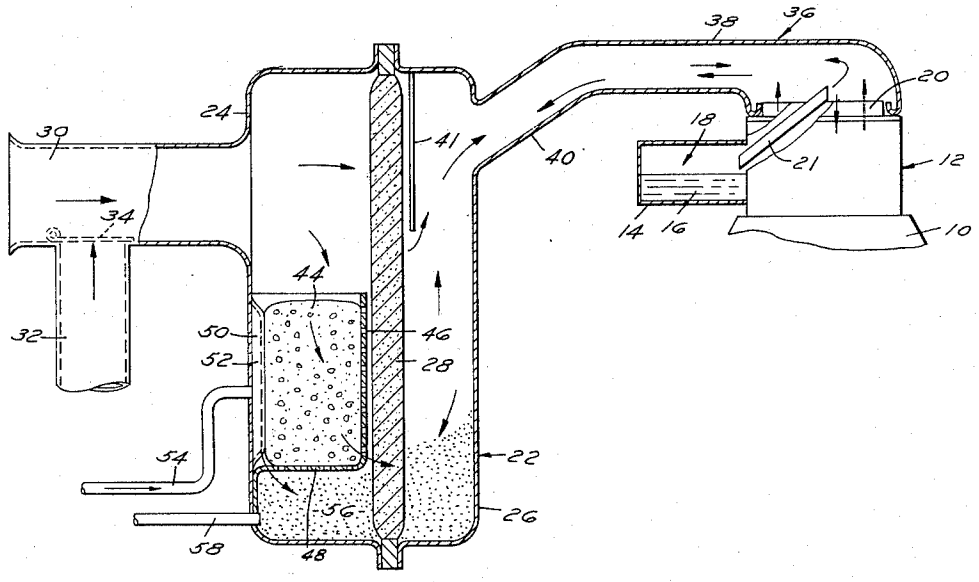
Primary Examiner—Charles N. Hart

Attorney—John R. Faulkner and Robert E. McCollum

[57] **ABSTRACT**

The engine air cleaner is positioned remote from but connected to the engine in essentially a side-by-side relationship. The air cleaner is vertically disposed to define a lower reservoir that traps excess fuel vapors flowing thereinto from the carburetor, and contains a vapor adsorption means to store the vapors and subsequently return them to the engine.

4 Claims, 3 Drawing Figures



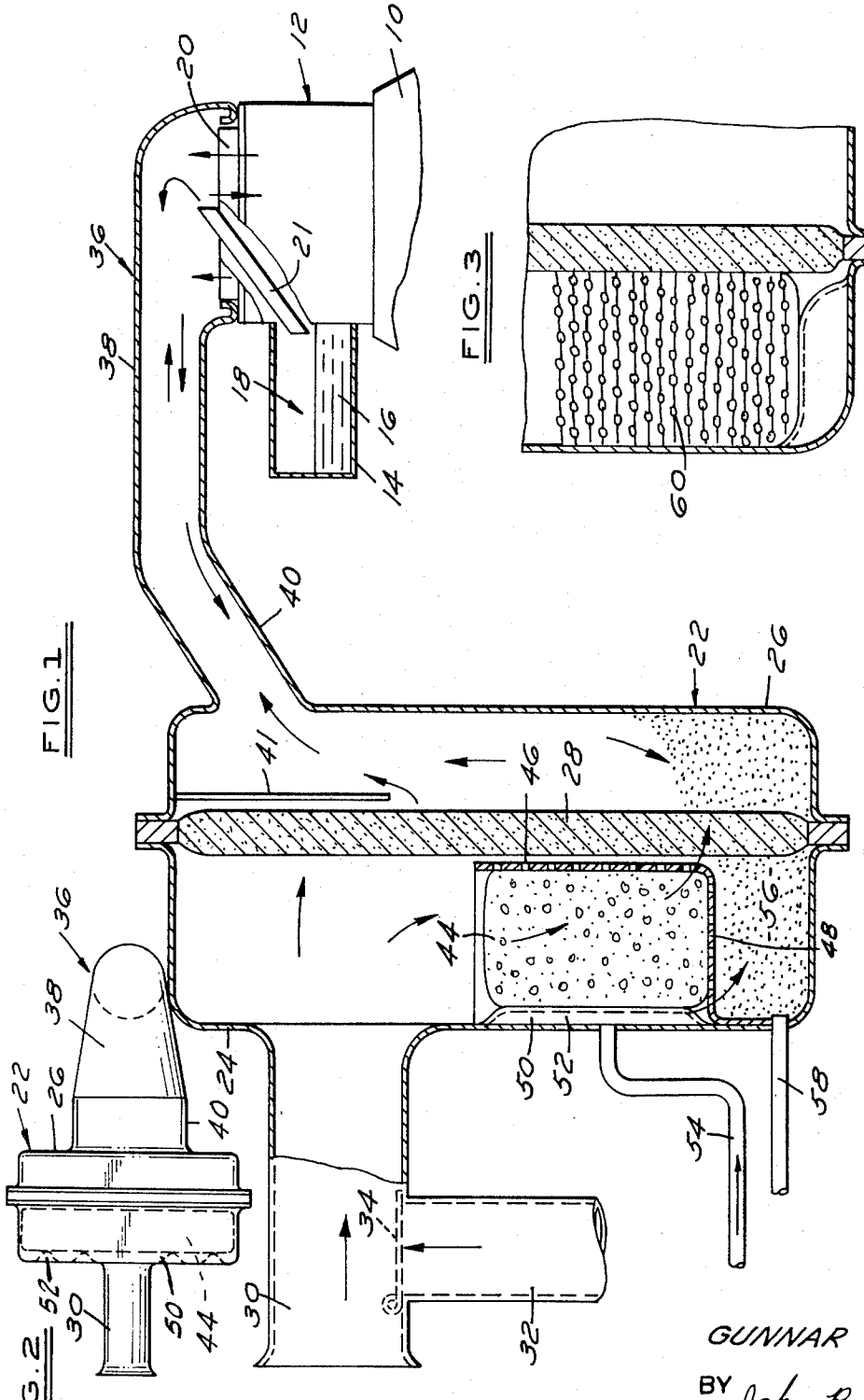


FIG. 1

FIG. 3

FIG. 2

INVENTOR
GUNNAR W. HANSEN
BY John R. Faulkner
Robert E. McCollum
ATTORNEYS

AIR CLEANER REMOTE FROM ENGINE AND HAVING INTEGRATED FUEL VAPOR ADSORPTION MEANS

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, and has integrally associated therewith a vapor adsorption device.

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 into 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 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 to an understanding of the invention.

The air cleaner assembly includes a main outer rectangular or square shaped closed shell **22** defined by two cup-shaped portions **24** and **26** that are clamped in a sealing manner around a sheet-like 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 from the position shown 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 carburetor connected section **38** joined in end-to-end relationship to an inclined duct portion **40** that opens into casing **22**, as shown.

The air cleaner, in this case, also contains a flat plate baffle element **41** 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 fresh air through 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** into the lower portion of the air cleaner casing **22**, which constitutes in effect, a reservoir. The baffle **41** 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 air 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 lower side portion of casing **22** is a bed of activated carbon **44**. The bed is located within a U-shaped trough **46** having a perforated metal side and bottom wall **48** and a corrugated or wavy non-perforated side wall **50**. The latter provides air bypass passages **52** (FIG. 2) between the portions secured to casing **22** for a purpose to be described. A tube **54** can be connected to the bed **44** so that 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.

The carbon bed adsorbs excess fuel vapors on the carbon particles which are purged of these vapors by the flow of fresh air through the carbon bed during normal operation on the engine. That is, when the engine has been started, the suction will draw air through the air cleaner assembly from inlet duct **30** in the normal manner. A portion of the air will flow from duct **30** through filter **28** to duct **40**, bypassing the carbon bed **44**. Another portion of air will flow through passages **52** around the carbon bed, pick up any fuel vapors that are in the bottom of casing **22** and carry them through the filter to the duct **40**. In this case, additional vapors, such as crankcase blowby, may be vented to the lower space **56** via a tube **58**. Finally, the remaining air portion will pass through bed **44**, purging it of the stored fuel vapors, and carry them through the air filter element **28** and into the carburetor. The carbon bed in this case is located above the crankcase vapor space so as not to contaminate the carbon with oil mist, etc., that is contained in the crankcase vapors.

The carbon bed increases the storage capacity of the assembly. If the volume of the reservoir **22** were relied upon alone to contain excess fuel vapors, it would fill in a short period with fuel vapors during a hot soak to a level where the vapors would pass out through inlet **30**. However, the adsorption device, with its multitude of carbon particles providing an infinite contact and adsorbent area, can adsorb a quantity of fuel vapors equal to 50–100 times the volume in the reservoir **22**.

It should be noted that the restriction to flow through filter element **28** will be chosen so as to force an adequate supply of purge air to flow through the carbon bed **44**. The cross sectional areas of passages **52** and the clearance spaces between the wall **46** of the trough and the filter **28** also will be controlled to assure adequate purge flow while at the same time assuring an adequate supply of air to meet all engine requirements, without undue restriction.

FIG. **3** shows a modified construction of the adsorption means in which a carbon embedded mat **60** having low air restriction characteristics is used. Due to the lack of loose carbon particles, the metal trough **46** of the FIG. **1** embodiment can be eliminated. The operation otherwise is the same as described in connection with the FIG. **1** embodiment.

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 full vapors and subsequently redirects them back into the engine to be consumed therein and thus not be vented freely to the atmosphere.

It will also be seen that the invention eliminates the need for a carbon canister to be located outside of the air cleaner. Further, it will be seen that a hot air purge is available during cold engine starts due to the hot air duct **32** of the air supply system providing substantially all of the engine requirements during cold starts.

I claim:

1. An engine air cleaner assembly that is remotely located from the air inlet portion of an engine carburetor but connected thereto by duct means, comprising an essentially vertically disposed casing having a horizontal axis and an air inlet adjacent the top thereof on one side and an outlet on the other side connected to the duct means, and a depending body portion, a filter element extending from top to bottom of the casing for axial flow through the casing and means for creating flow through the casing in essentially a U-shaped path, the lower portion of said assembly constituting a vapor trap type reservoir for containment of excess fuel vapors adapted to pass thereinto from said outlet, and fuel vapor adsorption means associated with the said reservoir in the depending portion for storing the fuel vapors flowing at times by gravity into said reservoir from said outlet and carburetor, said fuel vapors being purged from said adsorption means upon air flow in a normal direction from said air cleaner assembly to said outlet during normal engine operation.

2. A system as in claim **1**, including baffle means extending between said casing air inlet and said outlet to divert fuel vapors into said reservoir.

3. A system as in claim **1**, said vapor adsorption means comprising an activated carbon bed.

4. A system as in claim **1**, said adsorption means comprising an activated carbon bed having a fresh air inlet at one end and being operatively associated with the fuel vapors at the other end.

* * * * *