

[54] **DEVICE FOR CONTAINING AND SUBSEQUENTLY CONSUMING THE FUEL VAPORS ESCAPING TO THE ATMOSPHERE FOR AN INTERNAL COMBUSTION ENGINE**

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[56]

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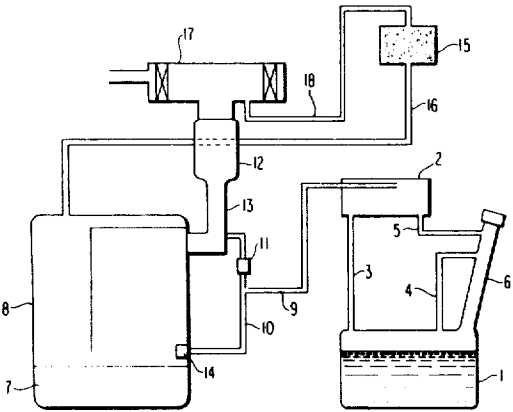
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ABSTRACT

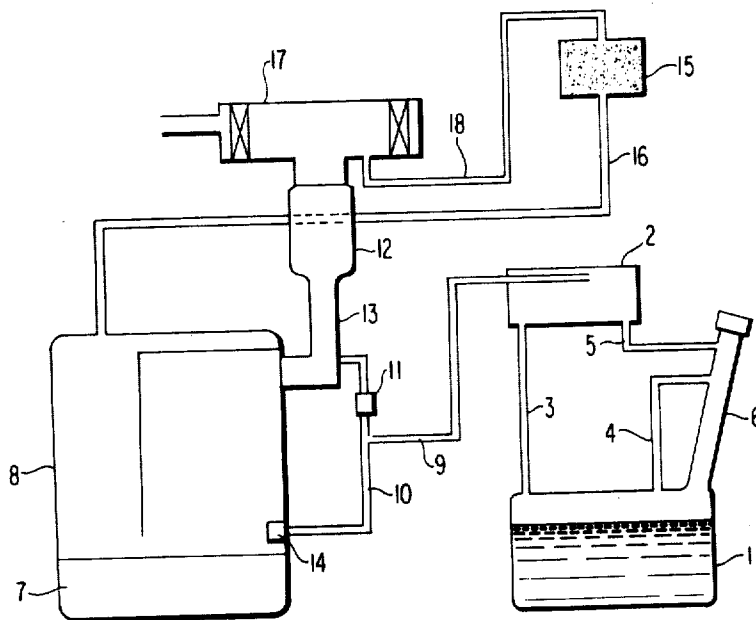
A system for containing and subsequently consuming the fuel vapors escaping to the atmosphere from an internal combustion engine in which a vapor tube of a condense tank connected to a fuel tank is connected to a connection tube connecting the crankcase to an inlet manifold, and having a valve which opens only during engine operation. A canister is connected between the crankcase and an air cleaner.

3 Claims, 1 Drawing Figure



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DEVICE FOR CONTAINING AND SUBSEQUENTLY CONSUMING THE FUEL VAPORS ESCAPING TO THE ATMOSPHERE FOR AN INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a device for an automobile for containing and subsequently consuming the fuel vapor escaping from a fuel tank or carburetor to the atmosphere.

2. Description of the Prior Art

It is very important not only to prevent public pollution by the exhaust gas of an automobile but also to prevent public pollution by fuel vapor. In order to overcome the latter pollution, it has been proposed to provide a condense tank or a canister for absorbing fuel vapor by active carbon, or both. However, in the conventional systems, the life of the active carbon is short, and also the valve and piping for holding the active carbon is complicated.

SUMMARY OF THE INVENTION

This invention completely prevents the fuel vapor from escaping to the atmosphere without the need of a complicated valve by connecting rationally, a condense tank, a crankcase and a canister.

It is, therefore, an object of the present invention to provide a system for containing and subsequently consuming the fuel vapor escaping to the atmosphere from an internal combustion engine which comprises a fuel tank, condense tank, crankcase of the engine, canister and air cleaner, in turn, connected in series. A connection tube connects the crankcase to an inlet manifold and valve means disposed in the connection tube opens the connection tube only during engine operation to prevent fuel vapor from escaping to the atmosphere.

BRIEF DESCRIPTION OF THE DRAWING

The other objects, features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawing, in which the single figure is a schematic view of one embodiment of the system of the present invention for containing and subsequently consuming the fuel vapor normally escaping to the atmosphere from an internal combustion engine.

DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to the drawing, which shows one embodiment of the present invention. A condense tank 2 is disposed above a fuel tank 1. The upper portion of the fuel tank 1 and the lower portion of the condense tank 2 are connected by a connecting tube 3. The upper portion of the fuel tank 1 and a fuel intake tube 6 are connected by tube 4 and the lower portion of the condense tank 2 and the fuel intake tube 6 are connected by a connecting tube 5. A connection tube 10 carrying a ventilator valve 11 is connected between a crankcase 8, above an oil pan 7, and inlet manifold 13 disposed downstream of a carburetor 12. A vapor tube 9 is connected to the condense tank 2 and is connected to the connection tube 10 between the crankcase 8 and the ventilator valve 11. The ventilator valve 11 acts only to prevent the fuel vapor from entering into the inlet manifold 13 upon stoppage of the engine, and this is a so-called P.V.C. valve. An oil separator 14 is provided for the crankcase 8 so as not to feed the oil into the connection tube 10. A canister 15 carrying an absorber of fuel vapor, such as active carbon, is connected to the upper portion of the crankcase 8 through a connecting tube 16, and further the canister 15 is connected through an air connecting tube 18 to an air cleaner 17.

When the engine is stopped, the fuel vapor which fills a space within the fuel tank 1 and the fuel intake tube 6, flows into the condense tank 2 through the connecting tubes 3 and 5 so that most of the fuel vapor is cooled and liquefied in the

condense tank 2 to be returned through the connecting tubes 3 and 5 to the fuel tank 1. After the condense tank 2 is filled with the fuel vapor not liquefied in the condense tank 2, the fuel vapor overflows from the condense tank 2 and flows into the crankcase 8 through the vapor tube 9 and the connection tube 10 because the ventilator valve 11 is closed when the engine is stopped, with the result that it is held therein. Further, any fuel vapor which is not retained therein, flows into the canister 15 through the connecting tube 16 and is completely absorbed by the absorber. Further, the fuel vapor evaporated from the carburetor 12 is partly absorbed by the canister 15 through the air connecting tube 18.

Then, when the engine is operating, part of clean air in the air cleaner 17 passes through the air connecting tube 18 into the canister 15 due to the vacuum at the inlet manifold 13 so that the fuel vapor absorbed by the absorber within the canister 15 is exhausted. The exhausted fuel vapor passes reversely through the connecting tube 16, crankcase 8, oil separator 14, connection tube 10 and ventilator valve 11 into the inlet manifold 13 and is burned within the engine together with the fuel vapor filling connection tube 16, crankcase 8, connection tube 10, and vapor tube 9. The fuel vapor within the condense tank 2 is introduced into the inlet manifold 13 through the vapor tube 9 and connection tube 10 so that it is burned in the engine.

Since, in this invention, the vapor tube 9 is connected to the upper portion of the condense tank and to the connection tube of the conventional forced ventilating system for returning the blow-by gas leaked in the crankcase into the inlet manifold or the vapor tube and the absorber canister is connected between the crankcase and air cleaner, the connections are not restricted by space so that the piping is simple. Particularly, the fuel vapor absorbed by the canister while the engine is stopped is exhausted and replaced by clean air from the air cleaner when the engine is operating. The absorbing capability of the fuel vapor of the canister is maintained very high, and further since the crankcase also acts as the condense tank and the fuel vapor fills, in turn, the fuel tank and finally the canister by means of the series connections between the fuel tank, condense tank, crankcase and canister the retaining of fuel vapor prior to reaching the canister is enhanced and the need of absorbing the fuel vapor by the canister alone is reduced. Accordingly, the capacity of the canister may be lessened so as to provide a very cheap and effective means prevention of exhaust of fuel vapors.

What is claimed is:

1. A system for containing and subsequently consuming the fuel vapor normally escaping to the atmosphere in an internal combustion engine having an inlet manifold for introducing a mixture of fuel and air to said engine, a carburetor for supplying said mixture of air and fuel to said inlet manifold and an air cleaner mounted on said carburetor, said system comprising:

- a fuel tank,
- a condense tank for liquefying and retaining fuel vapor,
- a crankcase,
- a canister for absorbing the fuel vapor,
- first conduit means extending between said crankcase and said inlet manifold,
- control valve means disposed in said first conduit means so as to open said first conduit means only during engine operation,
- second conduit means connecting said condense tank with a portion of said first conduit means between said control valve means and the crankcase, and
- means including said second conduit means and a portion of said first conduit means for connecting said fuel tank, condense tank, crankcase, and canister, in series.

2. The system as claimed in claim 1, wherein said canister is connected between said crankcase and said air cleaner.

3. The system as claimed in claim 1, wherein said fuel tank includes fuel intake tube and means fluid coupling said fuel intake tube to said condense tank.

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