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AIR CLEANER AND SILENCER

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The present invention relates to a device for cleaning the air being taken into a carburetor, particularly of the downdraft type, and for silencing the noises emanating from the intake of an engine as well as produced by the passage of the air through the cleaner and into the carburetor. It is an object of the present invention to provide a carburetor air cleaner and silencer which occupies a minimum height above the carburetor with which it is associated so as to reduce the minimum under-hood height requirements. This object is principally achieved by arranging the air cleaner vertically above the air intake of the carburetor and arranging a silencer laterally of the body of the air cleaner instead of in line therewith as in prior practice. The advantages of such an arrangement include not only the reduction of height of the carburetor assembly but the permission of larger silencers having greater effect than those heretofore possible.

A further object of the present invention is to provide an air cleaner and silencer comprising an open conduit leading directly into the intake tube of the carburetor and extending coaxially thereof so as to eliminate elbows and bends which tend to cause unequal distribution of the air and fuel mixture to the branches of the engine intake manifold. The advantages of the present invention are: increased freedom of air travel due to the elimination of the elbows and other restrictions heretofore thought necessary, improved distribution of fuel mixture into the engine intake manifold due to the straight flow of air concentrically into the intake tube of the carburetor, and improved carburetor performance due to the concentric flow of air through the Venturi throat of the carburetor.

A particular advantage resulting from the present invention is that the use of oil bath filtering devices is greatly increased. Such oil bath devices require more vertical height than dry filters but are far more efficient in removing dust and other foreign material from the air so that the use thereof is of great advantage. The present invention permits the use of an oil bath filtering device in an automobile having under-hood clear height arranged for a dry filter due to the offset lateral arrangement of the silencer.

A further object of the present invention is to provide a silenced, oil-bath air cleaner for carburetors in which the silencer comprises a closed vessel so arranged that oil cannot be pulled over from the oil bath into the silencer as in prior arrangements. The advantages of the present invention include cleanliness and the elimination

of a fire hazard since any oil which might be pulled over from the oil bath is drawn directly into the engine cylinders and burned.

A further advantage of the present arrangement over prior known arrangements, such as horizontal in-line positioning of the cleaner and silencer, or other known prior arrangements, is the elimination of vibration breakage since the only overhanging part is of light but rigid construction.

An additional object of the invention is the provision in an air cleaner and laterally offset silencer assembly of a connecting throat between the cleaner and silencer portions which is so dimensionally predetermined with respect to the volume of the silencer as to serve as the attenuating means thereof, thus obviating the necessity of a separate and additional member for accomplishing this purpose.

A still further object of the invention is the provision in an air cleaner and silencer assembly of this kind of a fire screen to prevent igniting of any fuel mixture which gains access to the silencer under certain operating conditions of an engine.

These and other objects and advantages of the present invention should be more apparent from a study of the following specification taken in connection with the accompanying drawing wherein like numerals refer to like parts throughout.

In the drawing,

Fig. 1 is a view in elevation of an internal combustion engine having the present invention applied thereto;

Fig. 2 is a vertical section through the air cleaning device and silencer of the present invention;

Fig. 3 is a fragmentary sectional view of a modified form of the invention.

The present invention is adapted to be associated with an internal combustion engine 10 comprising intake manifold 11 and exhaust manifold 12 and a downdraft carburetor 13 having an air intake tube 14 incorporated therein. The air cleaner preferably comprises a stamped intake chamber 15 which is divided into upper and lower portions by an oil holder 16 adapted to hold a supply of oil therein. The bottom wall of the intake chamber 15 is provided with a concentric opening 17 and protruding neck 18 adapted to be clamped onto the top of the intake tube 14 by a clamping device 19.

The upper extremity of the wall of the intake chamber 15 is provided with a plurality of air

collecting ports 20 located above the oil holder 16, and the wall terminates in an annular flange 21. The intake chamber is adapted to be closed by a dome-shaped cover 22 having its edge crimped over and retaining a filter holding device comprising a depending flange portion 23 and upper and lower retaining grids 24 and 25, respectively, suitably attached to the upper and lower edges of the flange portion 23. The grids 24 and 25 are provided with concentric central apertures in which is mounted a sleeve 26' through which is passed a tube 26. The space between the grids is packed with a quantity of filtering material 27, such as mineral or vegetable fiber, curled hair, woven metal ribbon, crimped wire or fiber glass. The cover 22, carrying the associated filtering device while the tube 26 is fixed to the oil holder 16 and remains in place when the cover and filter are removed. The cover and filter are clamped against the flange 21 of the intake chamber 15 by means of a bolt 28 having a winged head 29, the lower end of which is threaded into a member 30 traversing the opening 17.

The tube 26 forms an open conduit concentrically aligned with the intake tube 14, the lower end of the tube terminating centrally of the lower open portion of the intake chamber 15 so as to be spaced from the upper end of the intake tube 14. The lower portion of the wall of the intake chamber 15 is provided with an opening 35 surrounded by a protruding flange 36, and a silencer comprising a closed vessel 37 is associated with the intake chamber by welding neck 38 thereon to the flange 36. The flange 35 and neck 38 constitute a restricted connection generally designated by the numeral 38' between the interior of the silencer 37 and the space surrounding the passage from the air cleaner through which air is supplied to the engine. The silencer 37 is preferably cylindrical, and the neck 38 and flange 36 are also preferably cylindrical for ease of manufacturing and assembling. It may be seen that the silencer comprises a very light shell of rigid construction which may be rigidly united to the air cleaning device and may be of considerable size without requiring an increase in underhood free height.

Engine air intake silencers have heretofore been provided with an attenuating passage or passages which have for their sole purpose the function of eliminating the objectionable effects of sounds having wave length within predetermined limits which have been found to be particularly disturbing. Such attenuating passages are so predetermined in length and cross sectional dimensions with respect to the volume and dimensions of the silencer as to cause the sound wave reflected by the silencer to occur in an out-of-phase relationship with respect to the original sound waves emanating from the engine.

When the silencer is laterally offset as illustrated in the drawing, the restricted connection 38' between the silencer 37 and the space surrounding the passage from the air cleaner may be relied upon to provide the attenuating passage. This connection 38' is accordingly so predetermined in length and cross sectional dimensions with respect to the volume of the silencer 37 as to cause the sound waves reflected by the silencer to occur in an out-of-phase relationship with respect to the original sound waves emanating from the engine the objectionable effect of which it is desired to mitigate. While there has been devised, and may be em-

ployed, mathematical formulas for calculating the dimensions of attenuating passages of this character, satisfactory results are, in actual practice, obtained by trial and error methods. In the latter way, an air cleaner and silencer assembly may be accurately constructed to eliminate the objectionable sound waves emanating from an internal combustion engine of predetermined design and duplications of the assembly will serve for all engines of the same design. The restricted connection 38' thus serves the dual function of communicatively connecting the silencer with the engine inlet air passage and attenuating sound waves of a selected range thus obviating the requirement of an additional member to accomplish the latter purpose.

The present invention, when in operation, causes air to pass through a labyrinth including the openings 20, the space between the flange portion 23 and the shell of the intake chamber, across the surface of the oil in holder 16 and through the interstices of the filtering material 27, then into the upper end of the tube 26. The filtering material 27 is impregnated or coated with oil which is carried from the sump 16 by the air stream which passes through the filter so as to increase the filtering efficiency of the device. Most of the heavy particles of foreign matter, such as dust and grit will be trapped in the oil held in the holder 16, and those finer particles which might flow across the surface of the oil and upward with the airstream will be trapped by the coated filtering material. A substantially equal quantity of air traveling at substantially the same velocity will flow evenly into every equal segment of the intake tube 26, and the tube 26 is of considerable length so that the air flow therethrough tends to be further evenly distributed. The member 30 preferably comprises a central enlarged portion, as shown in Fig. 2, and supporting arms of small diameter (not shown) so that the air flow into the intake tube 14 is not disturbed thereby.

It may be seen that it would be impossible for oil, which might be carried from the oil holder 16 up through the filter and down the tube 26, to become trapped in the silencer or vessel 37 since the particles of oil would be carried directly into the carburetor and from there into the cylinders where they would be burned.

In order to prevent ignition of fuel mixture in the silencer and consequent injury to the latter during back firing of the engine and other unusual operating conditions thereof, a fire screen 40 of frusto-conical shape is disposed between the lower end opening of the tube 26 and the end opening of the intake tube 14. This screen serves to prevent flame propagation to the space surrounding the tube 26 as well as to the interior of the silencer 37 without obstructing the free flow of air to the engine.

In the form of the invention illustrated in Fig. 3 of the drawings, the air cleaner and silencer assembly is substantially identical to that shown in Figs. 1 and 2 with the exception that a fire screen 41 is provided across the passage of the restricted connection 38'. This serves to prevent flame propagation into the interior of the silencer 37 and may be used alone or in combination with the screen 40 shown in Fig. 2.

Having illustrated and described the preferred embodiments of my invention, it should be apparent to those skilled in the art that the same permits of modifications in arrangement and details. All such modifications as come within the

scope of the following claims are considered to be a part of my invention.

I claim:

1. An internal combustion engine air supplying system including a vertically extending substantially cylindrical casing comprising side, top and bottom walls, a horizontal partition in said casing between said top and bottom walls providing upper and lower chambers within said casing, said upper chamber having an atmospheric air inlet and including means for cleaning the incoming air, a clean air conduit supported by said partition extending centrally within said casing and establishing communication between said upper and lower chambers, said conduit terminating short of the bottom wall of said casing, said bottom wall having a central opening providing an outlet for said lower chamber, said opening being axially aligned with said conduit, the space between said bottom wall and the lower extremity of said conduit accommodating lateral flow of sound waves emanating from said engine into said lower chamber, a silencer acoustically cooperating with said lower chamber comprising a casing having an end wall provided with an opening facing a side wall of said lower chamber, said silencer casing having its longitudinal axis extending horizontally from said lower chamber and including an impervious opposite end wall and impervious side walls, said lower chamber having an opening in its side wall registering with the opening of said silencer end wall and having a substantial portion of its area horizontally aligned and in direct unobstructed sound wave communication with the space in said lower chamber between said bottom wall of said casing and the lower extremity of said conduit, and a sleeve rigid with, and extending between, said air cleaner and silencer casings and communicating with the registering openings thereof, said sleeve having a sound attenuating passage therethrough so predetermined in length and cross sectional area with respect to the volume of the interior of said silencer casing as to cause the sound waves reflected by the silencer to occur in out-of-phase relationship with respect to the original sound waves emanating from the engine.

2. An internal combustion engine air supplying system including a vertically extending sub-

stantially cylindrical casing comprising side, top and bottom walls, a horizontal partition in said casing between said top and bottom walls providing upper and lower chambers within said casing, said upper chamber having an atmospheric air inlet and including means for cleaning the incoming air, a clean air conduit supported by said partition extending centrally within said casing and establishing communication between said upper and lower chambers, said conduit terminating short of the bottom wall of said casing, said bottom wall having a central opening providing an outlet for said lower chamber, said opening being axially aligned with said conduit, the space between said bottom wall and the lower extremity of said conduit accommodating lateral flow of sound waves emanating from said engine into said lower chamber, a silencer acoustically cooperating with said lower chamber comprising a casing having an end wall provided with an opening facing a side wall of said lower chamber, said silencer casing having its longitudinal axis extending horizontally from said lower chamber and including an impervious opposite end wall and impervious side walls, said lower chamber having an opening in its side wall registering with the opening of said silencer end wall and having a substantial portion of its area horizontally aligned and in direct unobstructed sound wave communication with the space in said lower chamber between said bottom wall of said casing and the lower extremity of said conduit, a sleeve rigid with and extending between said air cleaner and silencer casings and communicating with the registering openings thereof, said sleeve having a sound attenuating passage therethrough so predetermined in length and cross sectional area with respect to the volume of the interior of said silencer casing as to cause the sound waves reflected by the silencer to occur in out-of-phase relationship with respect to the original sound waves emanating from the engine, and a tubular fire screen concentric with said conduit and extending between the lower end of the latter and the bottom wall of said air cleaner casing for protecting the interior of said air cleaner casing as well as said silencer.

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