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AIR CLEANER AND SILENCER ASSEMBLIES

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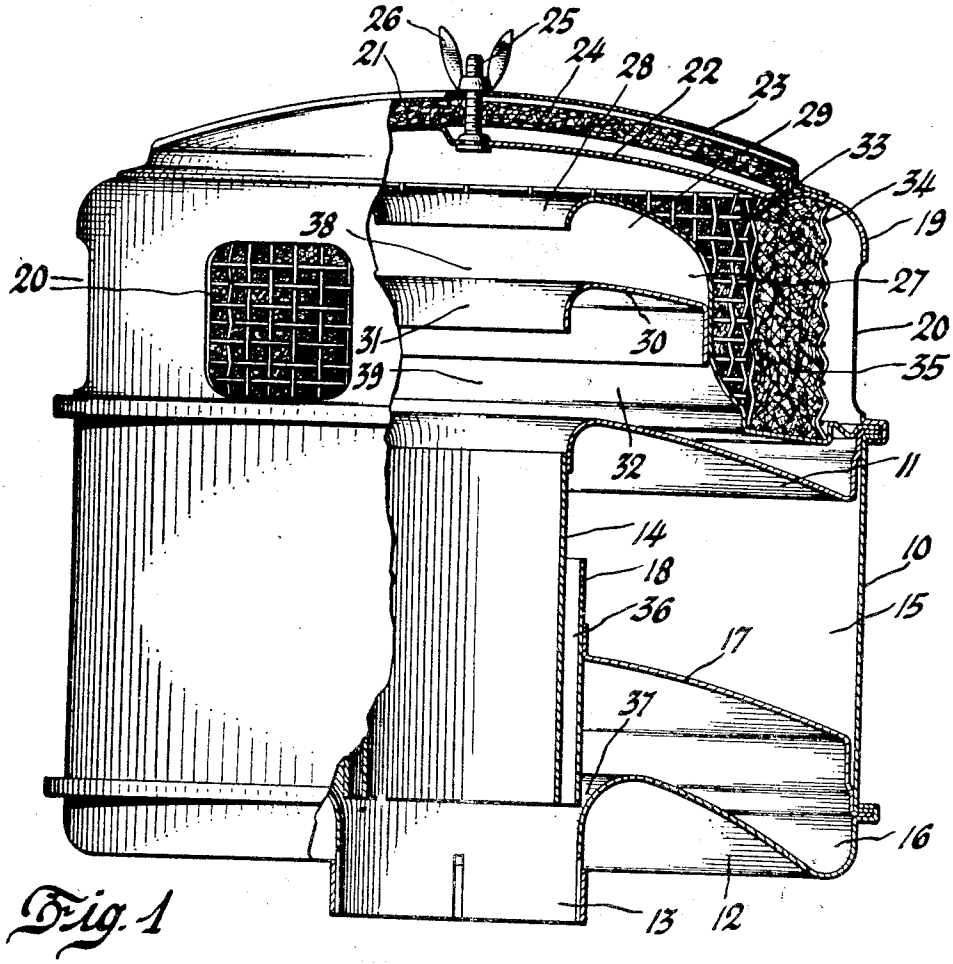


Fig. 1

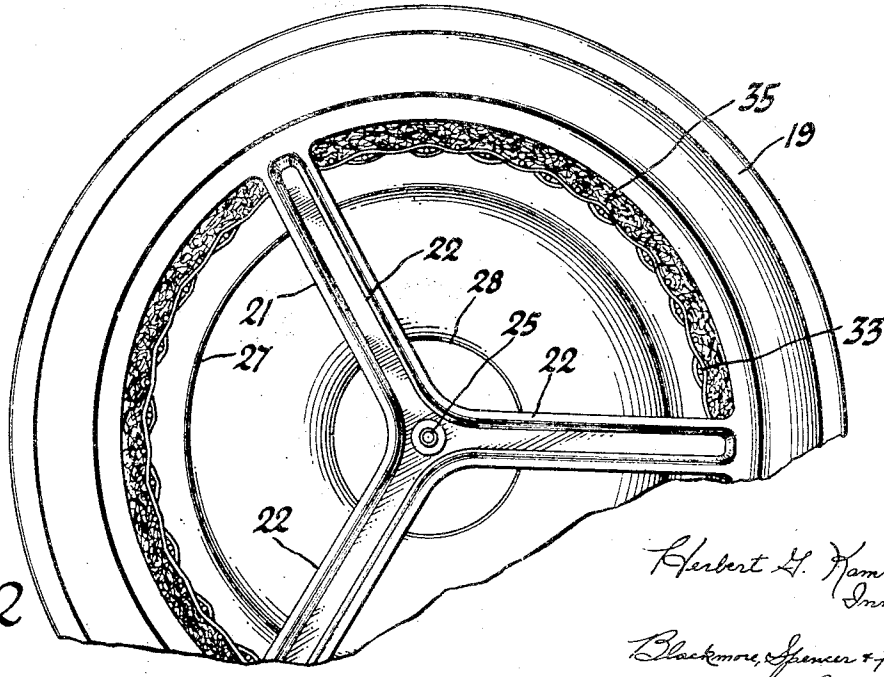


Fig. 2

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AIR CLEANER AND SILENCER ASSEMBLY

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10 Claims. (Cl. 183—44)

This invention has to do with air cleaner and silencer assemblies, particularly for application to the carburetors of internal combustion engines, and resides in an air cleaner and silencer assembly which includes a resonator silencer, a hiss silencer and an air cleaner.

One of the features of the invention is the multiple chamber resonator silencer which is included in the assembly and in this respect the invention resides in the arrangement of passages by which the chambers of the silencer are connected to the duct through which air travels through and sound waves enter the assembly.

Another feature of the invention is the air cleaner which is included in the assembly. And still another feature of the invention is the disposition of the air cleaner with respect to the hiss silencer and the resonator silencer which are included in the assembly.

The hiss silencer which is included in the assembly is not, per se, claimed in this application but in my Patent No. 2,243,866, dated June 3, 1941, of which this application is a division.

For a better understanding of the nature and objects of this invention, reference is made to the following specification wherein is described the preferred embodiment of the invention which is illustrated in the accompanying drawing.

In the accompanying drawing:

Figure 1 is a view, partly in elevation and partly in section, of an air cleaner and silencer assembly in which my invention is incorporated.

Figure 2 is a top plan view of the assembly shown in Figure 1 with the cover removed.

The air cleaner and silencer assembly shown in the drawing includes a cylindrical side wall 10, an upper end wall 11 whose outer edge is seated on an outturned flange on the upper end of the wall 10 and a lower end wall 12 whose outer edge is spun over an outturned flange on the lower end of the wall 10. In the end wall 12, there is formed a central opening which is encircled by an outwardly extending tube 13 which is integral with the wall. In the end wall 11, there is formed a central opening in which there is secured an inwardly projecting tube 14 whose inner end is telescoped within the inner end of the tube 13. The tube 14 is coaxial with and is made of smaller diameter than the tube 13 so that the overlapping portions of the tubes will be spaced apart radially.

The compartment defined by the duct 13—14 and the walls 10, 11 and 12 is divided into upper and lower chambers 15 and 16 by an annular partition 17 whose outer edge is secured in the joint between the outer edge of the wall 12 and the lower end of the wall 10. In the opening in the partition 17, there is secured a tube 18 which encircles the lower end of the tube 14 and extends upwardly into the chamber 15 and downwardly through the chamber 16 into the tube 13 to the same level as the tube 14. The tube 18 is coaxial with and of larger diameter than the tube 14 but is of smaller diameter than the portion of the tube 13 with which it is telescoped and, consequently, defines with the tubes 14 and 13 annular passages 36 and 37 which interconnect the chambers 15 and 16 with the duct 13—14 and with the chambers constitute simple "bottle type" resonators. Although the tubes 14 and 18 are shown coterminous at their lower ends and the tubes 18 and 13 are shown as separate elements in the drawing, it will, of course, be understood that the tube 14 may be extended beyond or terminated short of the lower end of the tube 18 and that the tubes 18 and 13 may be replaced by a single tube secured in the openings in the partition 17 and the wall 12 and pierced by an opening or a number of openings (located at or above or below the lower end of the tube 14) which lead into the chamber 16.

The resonator silencer which has been described is capped by an inverted, generally cup-shaped hood 19. In the side wall of the hood, there are a number of generally rectangular openings 20 and in the top of the hood there are three large sectoral openings 21 which are separated by the legs 22 of a spider which is integral with the hood. The hood is secured to the resonator silencer and the upper and side walls of the resonator silencer are secured together by spinning a flange on the lower edge of the side wall of the hood around the flange on the upper end of the wall 10 of the resonator silencer. The openings 21 in the top of the hood are closed by a cover 23 which is lined with a pad 24 of sound absorbing material, such as felt. The cover 23 is detachably secured to the spider at the junction of its legs 22 by a stud 25 and a wing nut 26.

In the joint between the hood 19 and the resonator silencer, there is secured the outer edge of the brim of a member 27 which is shaped generally like a brimmed hat. Because of its shape and the fact that the wall 11 is stepped downwardly just within the wall 10, the member 27 is spaced well above the upper wall of the resonator silencer except at the outer edge of its brim. In the top of the crown of the member 27, there is formed an opening 28 which is coaxial with and of about the same diameter as the tube 14 and bounded by an inwardly and downwardly

curved flange. To the inner wall of the crown of the member 27, about midway between its top and bottom, there is secured the outer edge of an annular element 30 whose central opening 31 is coaxial with and of about the same diameter as the opening 28 and bounded by a similar inwardly and downwardly curved flange. The element 30 subdivides the recess defined by the member 27 and the wall 11 into recesses 29 and 32 which communicate with the axial passage in the member 27 and the resonator silencer through the apertures 38 and 39 between the inner edges of the elements 27 and 30 and the wall 11. These apertures, together, with the recesses into which they lead are known as and will be hereinafter referred to as "hiss gaps."

The crown of the member 27 is encircled by a filter member which consists of inner and outer cylindrical screens 33 and 34 whose interspace is filled with a suitable filtering medium 35. The lower end of the filter member is seated in an annular channel in the brim of the member 27 and the top of the hood bears against the upper end of the filter member and holds it in place. It will be noted that the inner wall of the filter member is spaced from the generally upright wall of the crown of the member 27 by reason of the fact that the latter is offset inwardly just after it departs from the rim.

The air cleaner and silencer assembly which is shown in the drawing was designed for installation on an internal combustion engine with the tube 13 connected to the air intake orifice of the carburetor so that it cleans the air which enters the carburetor and silences the intake noises of the engine. Although the assembly has been described as if it were to be installed in the upright position in which it is shown in the drawing, it may, of course, be installed upside down or with the duct 13—14 extending horizontally or at any inclination.

When the assembly is installed in the described manner and the engine on which it is installed is operating, the suction of the engine draws air from the atmosphere through the openings 20 into the hood 19 and, thence, through the filter member 33—34—35, over the member 27 and through the openings 28 and 31 and the duct 13—14 into the carburetor and cylinders of the engine.

The filter element frees the air of foreign matter and the sound absorbing material 24, the hiss gaps 38—29 and 39—32 and the resonators 36—15 and 37—16 eliminate the intake noises of the engine.

While, of course, the presence of the several elements of the assembly which are located on the atmospheric side of the resonators increases the silencing efficiency of the resonators by decreasing the accoustical conductivity of the portion of the passage from the engine to the atmosphere which is located on the atmospheric side of the resonators, essentially, each of the silencing elements has its own job to do. The sound absorbing material 24, of course, eliminates components of the intake noises which are due to sound waves of high frequency.

The components of the intake noises due to sound waves of high frequency which are not sufficiently attenuated by the sound absorbing material are eliminated by the hiss gaps 38—29 and 39—32 whose silencing characteristics depend upon the volumes of the recesses 29 and 32 and the dimensions of the apertures 38 and 39. It will be noted that the hiss gaps 38—29 and 39—32 are differently tuned, i. e., different in recess volume and aperture dimensions, so that each of them removes a different component of the intake noises. It will, of course, be understood that the number of hiss gaps which should be employed on any given silencing job, and their recess volumes and aperture dimensions, depends upon the characteristics of the noises which are to be eliminated thereby and, consequently, that, while in the assembly which is shown in the drawing there are incorporated two hiss gaps of particular recess volumes and aperture dimensions, a greater or lesser number of hiss gaps with different recess volumes and aperture dimensions may be found necessary or sufficient in similar assemblies designed for use on other engines.

The components of the intake noises which are due to sound waves of relatively low frequencies are eliminated by the resonators 36—15 and 37—16 of which each is tuned, in the manner set forth in the Wilson application, Serial No. 470,700, filed July 25, 1930, so that it resonates to and thus attenuates certain of the sound waves from which these components of the intake noises result.

I claim:

1. In an assembly of the type described, a silencer element which includes a duct, a wall which encircles and is radially spaced from a portion of the duct, and walls which with the first specified wall and the duct define a compartment which communicates with the duct as a side branch, a dome-like member which is secured to the silencer element and covers one end of the duct, an opening in the dome-like member which is aligned with the duct, an annular filter element which encircles the dome-like member, a hood of inverted cup-shape which is secured to the silencer element and encloses the dome-like member and the filter element and is seated on the outer end of the latter and spaced from the outer end of the former, and an opening in the side wall of the hood which communicates with the space between the outer ends of the dome-like member and the hood through the filter element.

2. In a unit of the type described, a generally hat-shaped member, a member which overlies the open end of the hat-shaped member, aligned openings in the crown of the hat-shaped member and the second specified member, an annular filter element which encircles the crown and is seated on the brim of the hat-shaped member, and a cover which is seated on the other end of the filter element.

3. In an air cleaner, a member shaped generally like a brimmed hat and imperforate except for an orifice in the top of its crown, an annular channel in the brim of the member, an annular filter element which encircles the crown and is seated in the channel in the brim of the member, and a cap between which and the member the filter element is held, said cap being seated on the end of the filter element farthest from the brim of the member and spaced from the top of the crown thereof.

4. In air air cleaner, a member which is shaped generally like a brimmed hat in whose crown there is a substantially upright section and is imperforate except for an orifice in the top of its crown, an annular filter element which is seated on the brim and encircles and is radially spaced from the upright section of the crown of the member, a cap, between which and the member the filter element is held, said cap being seated on the end of the filter element farthest from the brim and spaced from the top of the crown of the member

to define with it an aperture through which air passes in the course of its travel from the filter element to the orifice in the top of the crown of the member.

5. In an air cleaner, a domed member shaped generally like a brimmed hat with an orifice in the top of its crown, an annular filter element which is seated on the brim and encircles the crown of the member, a hood shaped generally to conform with the hat shape of and slightly larger than the member, for internesting relation therewith, in whose side wall there is formed an orifice, said hood being telescoped around the filter element with its open end joined to the brim of the member and its end wall seated on the end of the filter element which is farthest from the brim and spaced from the top of the crown of the member to define with it an aperture through which air passes in the course of its travel from the filter element to the orifice in the top of the crown of the member.

6. In an appliance of the class disclosed, a domed member shaped generally like a brimmed hat with an orifice in the top of its crown, a member shaped generally like said domed member for internesting relation therewith, with orifices in its end and side walls, telescoped around and radially spaced from the crown of the first-specified member with its open end joined to the brim and its closed end spaced from the top of the crown of the first-specified member, an annular filter element which encircles the crown of the first-specified member and is encircled by the side wall of the second-specified member and whose ends are seated, respectively, on the end wall of the second-specified member and the brim of the first-specified member, and a cap removably secured over the orifice in the end wall of the second-specified member.

7. In an air cleaner and silencer, a duct through which gases and sound waves may travel, walls which with the duct define a compartment which encircles and communicates with the duct as a side branch, a member shaped generally like an inverted cup with an orifice in its end wall mounted on the compartment and disposed over one end thereof with the orifice aligned with the duct so that it defines with the nearest end wall of the compartment an annular inwardly opening recess, an annular filter element which encircles the member, and a cap which is seated on the outer end of the filter element and spaced lengthwise of the silencer from the outer end of the member.

8. In an appliance of the class disclosed, a silencer which includes a shell through which air may travel, a member shaped generally like a brimmed hat secured over one end of the shell with an orifice in the top of its crown through which air may enter the shell, an annular filter element which encircles the crown with one of its ends seated on the brim of the generally hat-shaped member, and a cover which is spaced from the top of the crown of the generally hat-shaped member with its rim seated on the other end of the annular filter element and defines with the generally hat-shaped member a passage through which air may travel from the atmosphere through the filter element and over the crown of the generally hat-shaped member into the orifice in the top of the latter.

9. The appliance claimed in claim 8 in which the inner wall of the annular filter element is spaced from the crown of the generally hat-shaped member.

10. In a device of the character described, a pair of axially spaced walls, a vault member of substantially Z-shape in diametrical half section axially dividing the space between said walls and including a cylindrical shell terminating at one end in a domed ceiling positioned adjacent one of said walls to cooperate therewith in affording a radial passage leading to a central aperture in the domed ceiling and terminating at its other end in an outwardly projecting mounting rim, a ring filter telescopically skirting said shell to leave an axially extending circular passage in communication with said radial passage and seating at opposite ends on said rim and the last mentioned wall and an internal partition carried within the shell and separating the interior vault space into different silencing chambers.

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