

Oct. 27, 1936.

E. E. WILSON

2,058,932

MUFFLER

Filed July 17, 1929

2 Sheets-Sheet 1

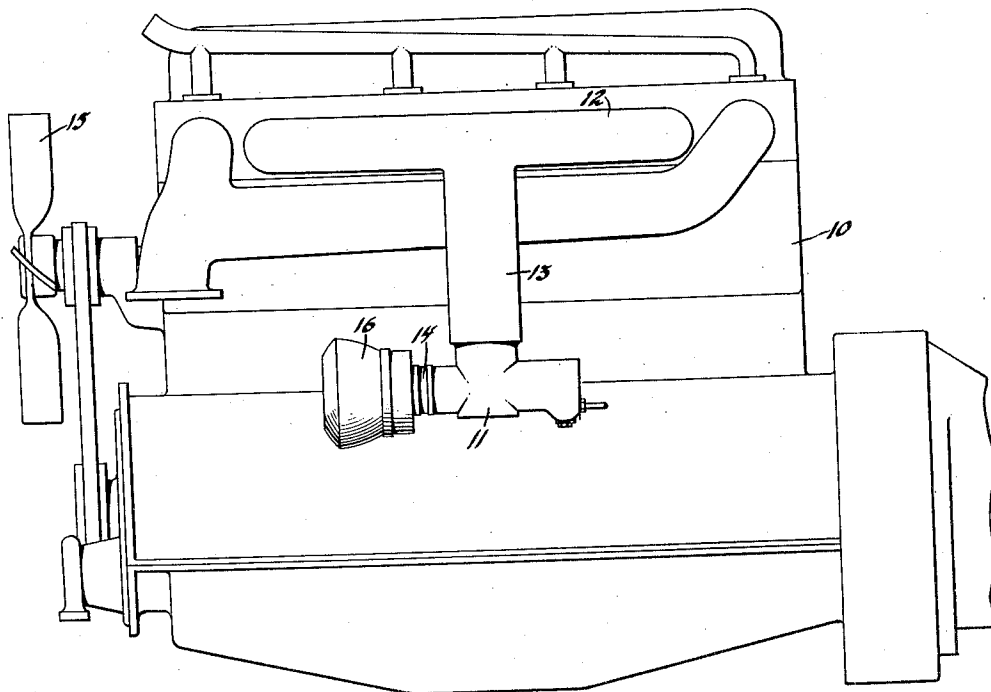


Fig. 1.

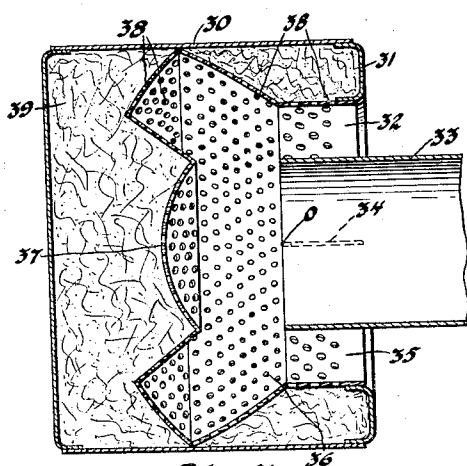


Fig. 3.

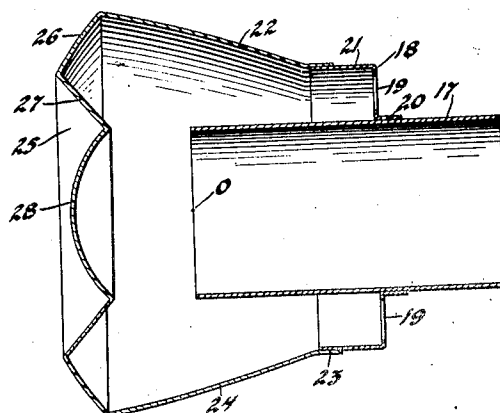


Fig. 2.

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2 Sheets-Sheet 2

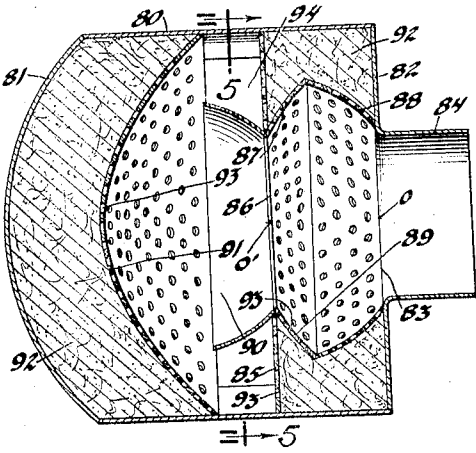


Fig. 4.

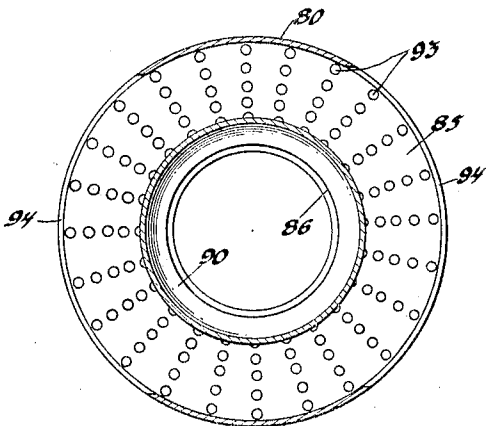


Fig. 5.

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UNITED STATES PATENT OFFICE

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MUFFLER

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21 Claims. (Cl. 181—50)

It is an object of this invention to provide a device which is adapted to be connected to the air intake orifice of the carburetor, or to the exhaust pipe, of an internal combustion engine to silence the intake or exhaust noises.

To be suitable for use in such an installation, a muffler should be of such construction that it will have the maximum efficiency as a silencer, and will offer the minimum resistance to the passage of gases therethrough. I have discovered that, by properly disposing sound-reflecting surfaces of the proper shape around the air intake orifice of the carburetor or the discharge end of the exhaust pipe, a muffling device which will cause the sound waves issuing therefrom to be dissipated, by repeated reflection and the resulting interference, before they can reach the atmosphere, and which will offer practically no resistance to the passage of gases therethrough, may be produced.

To increase the efficiency of the device as a silencer, there may be provided, instead of simple sound-reflecting surfaces, surfaces which will reflect a portion of the sound waves and absorb another portion thereof, so that dissipation of the sound waves will be effected by absorption, as well as by the means indicated in the preceding paragraph.

For a better understanding of the nature and the objects of the present invention, reference is made to the following specification in which are described the several embodiments of my invention which are illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of an internal combustion engine, to the air intake conduit orifice of whose carburetor there is connected a muffling device in which is embodied my invention.

Figure 2 is a longitudinal section taken through the muffling device illustrated in Figure 1.

Figures 3 and 4 are longitudinal sections through modified forms of the muffler illustrated in the preceding figures.

Figure 5 is a section taken on the line 5—5 of Figure 4.

In Figures 1 and 2 of the drawings, the reference character 10 indicates an internal combustion engine on which there is provided a carburetor 11, which is connected to the intake manifold 12 by a riser 13. The carburetor is, as illustrated, of the type in which the air intake conduit 14 extends and opens toward the forward end of the engine and is so located that the current of air generated by the cooling fan 15 passes

thereover. To the conduit 14, there is connected a muffling device 16 which is adapted to prevent any sound waves generated in the induction system from passing out of the conduit 14 into the atmosphere.

The muffling device, which is shown in Figures 1 and 2 of the drawings, and of which all parts are, preferably, formed of sheet metal, includes a short length of pipe 17 which is adapted to telescope snugly over the outer end of the air intake conduit 14 of the carburetor. An annular member 18, in which there is provided an annular series of openings 19, surrounds an intermediate portion of the pipe 17 and is provided on its inner edge with an annular flange 20 which fits snugly around and is suitably secured to the pipe 17. On the outer edge of the member 18, there is provided a second annular flange 21 which is coaxial with the pipe 17 and whose walls are parallel to the walls of the pipe.

An annular element 22, which consists of a short cylindrical portion 23 and an outwardly flaring portion 24 integral with and extending from one end of the cylindrical portion, is secured to the flange 21 with the cylindrical portion thereof fitting snugly around and secured to the outer end of the flange. The flaring portion 24 is preferably shaped like the surface of a truncated paraboloid which is coaxial with the pipe 17 and whose focal point is located at the point 0, which is in the plane of the end of the pipe 17, and extends outwardly beyond the end of the pipe 17.

The outer end of the element 22 is closed by an element 25 which consists of three portions 26, 27 and 28 which may be separately formed and then united or which may be integrally formed. The outer edge of the outer portion 26, which is annular and outwardly convex and whose projection on a plane at a right angle to the axis of the pipe 17 is substantially coextensive with the projection of the element 22 thereon, is joined circumferentially to the outer end of the element 22. The outer edge of the intermediate portion 27, which is annular and outwardly concave and whose projection on a plane at a right angle to the axis of the pipe 17 is substantially coextensive with the projection of the flange 18 thereon, is joined circumferentially to the inner edge of the outer portion 26. The outer edge of the inner portion 28, which is circular and outwardly convex and whose projection on a plane at a right angle to the axis of the pipe 17 is substantially coextensive with the projection of the space occupied by the pipe 17 thereon, is secured circumferentially to inner edge of the intermediate

portion 27. The outer portion 26, the intermediate portion 27, and the inner portion 28 are preferably shaped like the surface of a truncated paraboloid which is coaxial with the pipe 17 and whose focal point is located at the point 0, like the surface of a truncated cone which is coaxial with the pipe 17 and whose apex is located at the point 0, and like the surface of a paraboloid which is coaxial with the pipe 17 and whose focal point is located at the point 0, respectively.

The modified form of the invention, which is illustrated in Figure 3 of the drawings, includes a cup-shaped casing 30, whose open end is partially closed by an annular wall 31 from whose inner edge there projects into the interior of the casing a short length of cylindrical tubing 32, which is coaxial with the casing. The pipe 33, which is coaxial with the tube 32, extends into the latter to the inner end thereof and is secured thereto by suitable means, such as the spacers 34, so as to provide between the tube and the pipe an annular opening 35. To the inner end of the tube 32 there is secured circumferentially an element 36 which is similar in shape to the portion 24 of the device which is shown in Figure 2, and which is arranged in the same relation to the pipe 33 as the portion 24 is arranged with respect to the pipe 17 in Figure 2. To the outer end of the element 36, there is secured circumferentially an element 37 which is similar in shape to the element 25 which is shown in Figure 2, and whose several portions are positioned in the same relation to the pipe 33 and the element 36 as the corresponding portions of the element 25 are positioned with respect to the pipe 17 and the portion 24 in Figure 2. All parts of the device heretofore mentioned are preferably made of sheet metal. The space between the walls of the casing 30 and the walls of the tube 32, the element 36, and the element 37, through each of which last-mentioned walls there extend a plurality of perforations 38, is filled with a suitable sound absorbing material 39, such, for instance, as a mass of mineral wool.

The muffling device which is shown in Figures 4 and 5 of the drawings includes a cylindrical shell 80 which is closed at one end by an outwardly convex wall 81. Secured over the opposite end of the shell is a plate 82 through which extends an opening 83 which is coaxial with the shell 80 and is surrounded by an outwardly extending neck 84. The shell 80 is divided longitudinally by a plate 85 through which extends a circular opening 86 which is substantially coaxial with, and of substantially the same diameter as, the opening 83. Between the opening 83 and the opening 86, there extends an annular element 87 which consists of two funnel-shaped portions 88 and 89 which may be separately formed and then united or which may be integrally formed. The smaller end of the portion 88, which is preferably shaped like the surface of a truncated paraboloid which is coaxial with openings 83 and 86 and whose focal point is located at the point 0 which is located in the plane of the plate 82, is secured circumferentially to the edge of the plate 82 surrounding the opening 83. The smaller end of the portion 89, which is preferably shaped like the surface of a truncated paraboloid which is coaxial with the openings 83 and 86 and whose focal point is located at the point 0, is secured circumferentially to the edge of the plate 85 surrounding the opening 86, and the larger end thereof is circumferentially secured to the larger end of the portion 88. The smaller end of a funnel-shaped element 90 which is located on the side of the plate

85 opposite that on which the element 87 is located and which is preferably shaped like the surface of a truncated paraboloid which is coaxial with the openings 83 and 86 and whose focal point is located at the point 0' which is located in the plane of the plate 85, is secured circumferentially to the edge of the plate 85 surrounding the opening 86. The space between the plate 85 and the outer end of the shell 80 is divided longitudinally of the shell by an outwardly convex element 91, which is shaped like the surface of a paraboloid which is coaxial with the openings 83 and 86 and whose focal point is located at the point 0'. All of the parts of the device heretofore mentioned are preferably formed of sheet metal. The space enclosed between the side wall and the wall 81 of the shell and the element 91, and the space enclosed between the side wall of the shell, the plates 82 and 85, and the element 87, is filled with a sound-absorbing material 92 of the type hereinbefore mentioned. Through each of the elements 87 and 91, and the plate 85, there extend a plurality of perforations 93. Through the side wall of the shell 80, in the same plane as the element 90, there extend a plurality of openings 94.

Each of the devices hereinbefore described is adapted to be installed on an internal combustion engine with the pipe portion thereof telescoped over and suitably secured to the outer end of the air intake conduit of the carburetor, as illustrated in Figure 1. When any of the devices is installed, as shown in Figure 1, on a carburetor, whose air intake conduit opens toward the front end of the engine and which is so located that the current of air generated by the fan passes thereover, it will function, in a manner which will be understood, to eliminate particles of foreign matter from the air which is to pass therethrough into the carburetor and engine cylinders. However, when any one of the devices, except that shown in Figures 4 and 5, is installed on a carburetor whose air intake conduit opens toward the rear of the engine and the body of the vehicle, it will, obviously, be somewhat more effective in preventing noises which are generated in the induction system from being transmitted to the body of the vehicle due to the presence, directly between the end of the intake conduit and the body of the vehicle, of a solid end wall of the device. When the device which is illustrated in Figures 4 and 5 of the drawings is installed in either of the two positions suggested above, it will obviously function to eliminate particles of foreign matter from the air which is to pass therethrough into the carburetor and engine cylinders.

When the device illustrated in Figures 1 and 2 is installed as described above and illustrated in Figure 1, and the engine is operating, air will be drawn from the atmosphere through the openings 19 into the space between the walls 21, 23 and 22, and the walls of the pipe 17, whence it will pass around the outer end of, and into the interior of, the pipe 17, and, thence, into the carburetor, and the engine cylinders. The surfaces 24, 26 and 28, being made of a material having good sound-reflecting properties and being shaped and located as hereinbefore described, will obviously cause any sound wave, which issues from the pipe 17, in lines parallel to the axis thereof, or radially from the point 0, to be reflected back, to the point 0, or into the pipe 17. It is theoretically impossible for any of the sound waves which issue from the pipe 17 in any of the

directions indicated to escape into the atmosphere from the device through the openings 19. While it is unquestionably quite true that not all, and, possibly, only a small proportion, of the sound waves which issue from the end of the pipe 17 do so in the directions indicated, it has been found that the device is, nevertheless, very effective as a silencer. The effectiveness of the device probably results from the destruction of the audible sound waves by the interference resulting from the repeated reflection thereof from one wall to another and back into the pipe 17, and from the partial absorption of each wave at each reflection. It will be noted that since the several walls of the device are located at different distances from the point 0, the time required for the several sound waves to travel away from and back into the pipe 17 will vary and, consequently, a more aggravated condition of interference will result.

When the device illustrated in Figure 3 is installed in the manner hereinbefore indicated and the engine is operating, air will be drawn into the interior thereof through the opening 35, and will pass therefrom into the carburetor and engine cylinders. As a silencer, the device illustrated in Figure 3 functions similarly to that shown in the Figure 2, except that, on account of the fact that portions of the sound waves will pass, through the perforations 38 in the element 37, the element 36 and the tube 32, into the mass 39 of sound absorbing material and will thereby be attenuated, the volume of sound dissipated by absorption is greater, and the device is consequently more efficient.

When the device illustrated in Figures 4 and 5 of the drawings is installed in the manner described above and the engine is operating, air will be drawn into the interior of the shell through the openings 94 and will pass therefrom through the conduit 84 into the carburetor and engine cylinders. The device is, in effect, a two stage silencer. Any sound waves issuing from the induction system which are not dissipated by the element 87 and the adjacent mass 92 of sound-absorbing material, in a manner which will be understood from what has hereinbefore been said, will pass through the opening 86 and will be subjected to the destructive action of the elements 93, 90, 85 and the adjacent masses 92 of sound absorbing material.

In the modifications of the invention illustrated in Figures 3, 4, and 5 of the drawings, instead of perforated metal reflecting surfaces backed by sound-absorbing material, a body of molded sound-absorbing material may be used. In intake mufflers, any of the common sound-absorbing materials may be used for this purpose. In exhaust mufflers, it is preferable to use an incombustible sound-absorbing material, such as a porous ceramic material.

Although I have shown and described preferred embodiments of my invention with great particularity, as regards the shape and location of the several elements, it is to be understood that this has been done by way of example and not by way of limitation, and that various changes in the shapes and relations of the several elements may be made without departing from the spirit of the invention.

It will, of course, be understood that devices made in accordance with the present invention are not limited to use in muffling the intake noises of internal combustion engines, but may also be

employed to muffle the exhaust noises, and for other analogous purposes.

I claim:

1. In a device of the class described, a conduit, and a shell in which there are provided a plurality of surfaces of paraboloidal shape telescoped over the end of the conduit and so arranged that the focal point of each of the surfaces is located in the axis of the conduit and in the plane of the end thereof.

2. The invention claimed in claim 1, in which one of the mentioned surfaces is concave in a direction opposite that of the other or others.

3. In a device of the class described, a conduit, a shell secured to the conduit, a plurality of surfaces of paraboloidal shape having their focal points located in the axis of the conduit and in the plane of the end thereof, and a plurality of surfaces of paraboloidal shape having their focal points located in the axis of the conduit, at a distance from the plane of the end thereof and within the shell.

4. In a device of the class described, a passage through which sound waves are adapted to pass, and a surface of paraboloidal shape which has appreciable sound-absorbing properties arranged so that it is adapted to reflect back into the passage sound waves which issue therefrom.

5. In a device of the class described, a passage through which sound waves are adapted to pass, and a plurality of surfaces of paraboloidal shape so arranged with respect to the passage that they are adapted to reflect sound waves issuing from the passage back into the passage.

6. The invention claimed in claim 5 in which the surfaces are arranged at different distances axially from the passage and in which there is provided between the surfaces a passage which communicates with the previously mentioned passage.

7. The invention claimed in claim 3 in which the surfaces are perforated, and in which sound absorbing material is arranged between the surfaces and the shell.

8. The invention claimed in claim 5 in which the surfaces are arranged at different distances from the axis of the passage.

9. In a device of the class described, a passage through which sound waves are adapted to pass, and a reflector of paraboloidal shape so arranged that the focal point thereof is located in the axis of the passage and in the plane of the end thereof.

10. In a device of the class described, a passage through which sound waves are adapted to pass, and a plurality of pairs of oppositely concave reflectors, through one of which the passage extends, so arranged with respect to the passage as to prevent the emission of sound waves from the device.

11. A muffler for carburetors comprising, a member having an outwardly extending flange and adapted to be secured to the air intake member of the carburetor, spacing members on said flange, a dome-shaped shell secured to said spacing members in spaced relation to said first named member to permit a substantially free passage of air between said flange and said shell from beyond the circumference of said flange, into said carburetor, and a lining for said shell composed of a non-inflammable sound absorbing material.

12. A muffler for carburetors comprising, a member having an outwardly extending flange and adapted to be secured to the air intake mem-

ber of the carburetor, a dome-shaped shell surrounding said member secured thereto in spaced relation to said flange to permit substantially unobstructed passage of air into said carburetor, non-inflammable sound absorbing material in said shell, and a non-inflammable support for said material.

13. A muffler for carburetors comprising, a supporting member having an outwardly extending flange and adapted to be secured to the air intake member of the carburetor, spacing members on said flange, a dome-shaped shell secured to said spacing members in spaced relation to said flange to permit substantially unobstructed passage of air between said flange and said shell from beyond the circumference of said flange into the carburetor, a porous non-inflammable mass in said shell, and a screen secured to said shell for securing said mass therein.

14. A muffler for carburetors comprising, a member adapted to be secured at one end directly to the air intake member of the carburetor, said member having an edge of greater periphery than the end directly secured to the carburetor, a casing covering said member secured thereto in spaced relation to the edge thereof, and a lining for said casing composed of a mass of non-inflammable material capable of breaking up sound waves carried by the air currents passing to said carburetor.

15. In a silencer, a generally tube-like element which constitutes a passage through which gases and sound waves are adapted to travel, an outwardly extending flange on the element, a head substantially coextensive with and so constructed and supported from the flange as to provide therebetween a passage through which gases may travel from the atmosphere to a point within the boundaries of a projection of the generally tube-like element without suddenly changing their direction of flow or encountering substantial obstruction, and a lining of sound absorbing material for the head.

16. The silencer specified by claim 15 plus a lining of sound absorbing material for the outwardly extending flange on the generally tube-like element.

17. The silencer specified by claim 15 plus sound absorbing material disposed around a portion of the passage which the generally tubular element constitutes.

18. The silencer specified by claim 15 plus sound absorbing material which is disposed around a portion of the passage which the generally tubular element constitutes and consti-

tutes a lining for the outwardly extending flange on the generally tubular element.

19. The silencer specified by claim 15 plus an annular flange on the outwardly extending flange on the generally tube-like element, and a lining of sound absorbing material for the annular flange.

20. In a silencer, a generally tube-like element which constitutes a passage through which gases and sound waves are adapted to travel, an outwardly extending flange on the generally tube-like element, a wall which extends outwardly from the generally tube-like element and is spaced lengthwise thereof from the flange, a wall which encircles and is radially spaced from the portion of the generally tube-like element which is interposed between the flange and the first-specified wall and with the generally tube-like element, the flange and the first-specified wall defines a sound wave attenuating compartment which encircles and communicates with the generally tube-like element, a head which is substantially coextensive with the first-specified wall and is so constructed and supported from a wall of the compartment as to provide between the head and the first-specified wall a passage through which gases may travel from the atmosphere to a point within the boundaries of a projection of the generally tube-like element without suddenly changing their direction of flow or encountering substantial obstruction, and a lining of sound absorbing material for the head.

21. In a silencer, a generally tube-like element which constitutes a passage through which gases and sound waves are adapted to travel, an outwardly extending flange on the generally tube-like element, an annular element which is joined to the flange but spaced therefrom lengthwise of the generally tube-like element at its inner edge so that it defines with the flange an annular sound wave attenuating recess which communicates with the generally tube-like element, a head which is substantially coextensive with the annular element and is so constructed and supported from a wall of the annular recess as to provide between the head and the annular element a passage through which gases may travel from the atmosphere to a point within the boundaries of a projection of the generally tube-like element without suddenly changing their direction of flow or encountering substantial obstruction, and a lining of sound absorbing material for the head.

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