

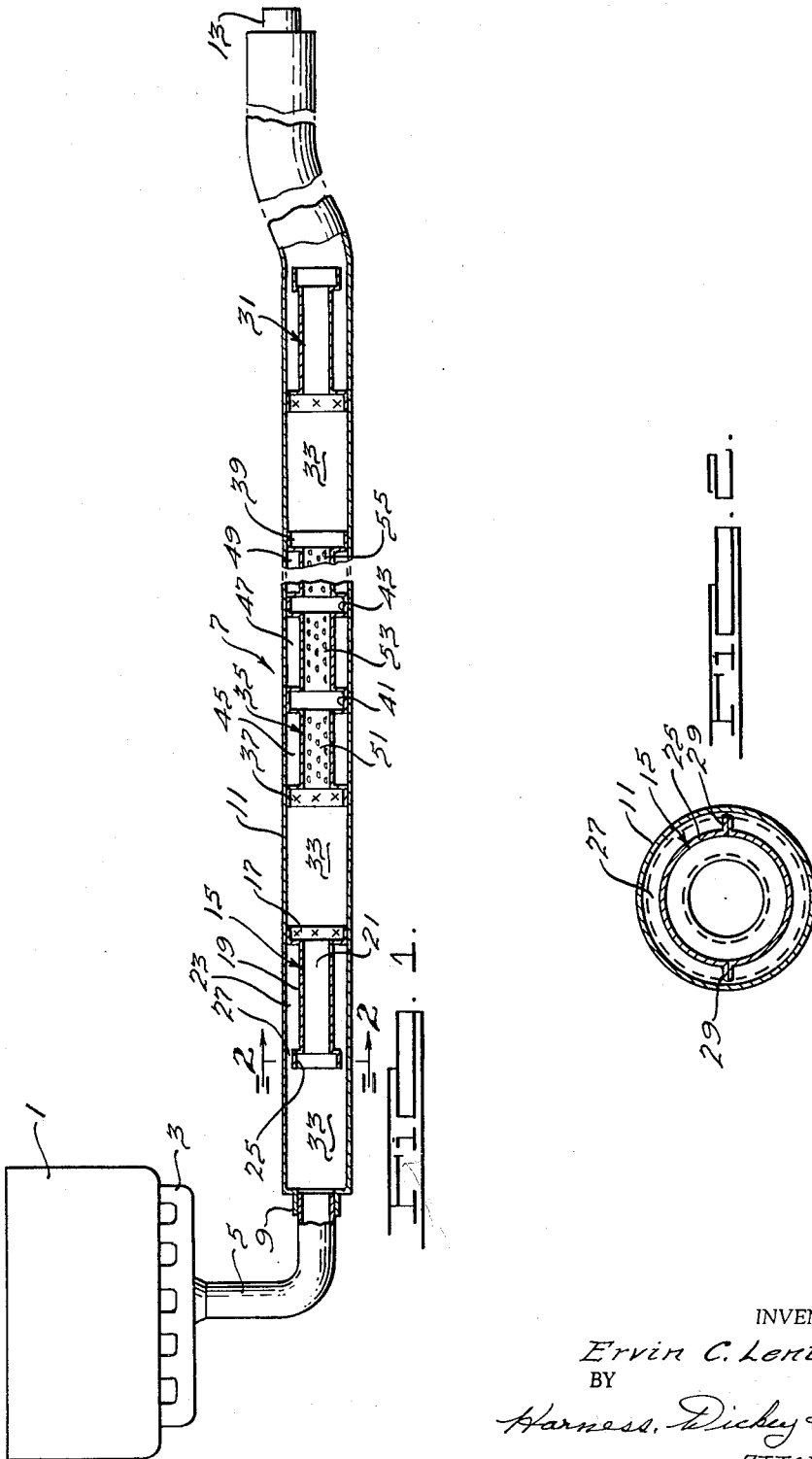
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This invention relates to the handling of exhaust gases and, in particular, concerns a combination exhaust gas conduit and silencer that is well adapted for use as an exhaust system for modern, low-slung automobiles in which relatively little space is available for conventional type mufflers.

It is the object of this invention to provide a combination conduit and silencer which is small in diameter, long in length and can be readily bent in order to fit into the places available for it on the chassis of modern automobiles.

The invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a schematic view, partly broken away, showing an exhaust system incorporating the present invention; and

FIG. 2 is a section along the line 2-2 of FIG. 1.

An internal combustion engine 1 is schematically illustrated in FIG. 1 and this has an exhaust manifold 3 which delivers gases to an exhaust pipe 5. A combination exhaust gas conduit and silencer 7, constructed in accordance with the principles of the invention, is provided with a flange 9 at its upstream or inlet end and this is secured to the outlet end of the pipe 5 so as to receive exhaust gases from the pipe 5.

The conduit 7 comprises a long outer shell or tube 11 which may be one or more layers and which may be ceramic coated. The inlet end is swaged down in order to provide the neck 9 and the outlet end may similarly be swaged down to provide an outlet neck 13. It is contemplated that the unit 7 will be many feet long, being sufficient in length to extend from the engine 1, in the front of the vehicle, to a point adjacent the rear bumper of the vehicle where the neck 13 will be located to discharge exhaust gases. It is preferable that the tube 11 be about 3" in outer diameter and it is bendable through the use of suitable equipment so that it can be shaped in the manner of present day tailpipes to fit in the space that is available for it on the individual automobiles.

Located inside the tube 11 is suitable silencing structure which is individually adapted to silence the various engines that will use the present invention. For optimum tuning and silencing it is likely that the silencing structure from one engine to another will be somewhat different though the principles incorporated will remain pretty much the same, as will the silencing structure itself, the major changes ordinarily being in size, shape, number, or location of the individual components. The silencing structure is of such a nature that the unit 7 can be bent, flattened, or shaped out of round, after the unit has been completely assembled with all the structure inside.

The silencing structure within the conduit 7 preferably comprises three different components, namely, resonator chambers with tuning tubes, expansion chambers, and high frequency or spit chambers. These may be located at the proper lengthwise positions in the conduit 7 with due regard to the frequencies to be handled and any special problems involved in bending of the assembly at particular points where internal structure is positioned.

To illustrate the silencing structure that may be used, there is a resonator chamber forming member 15 which comprises a tube having an enlarged diameter 17 at one end which is spotwelded at "x" to the shell 7. The main length 19 of the member 15 is of reduced diameter to provide an internal passage 21 (preferably of the same in-

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ner diameter as pipe 5) and an annular external resonator chamber 23 between the section 19 and the wall 11. The other end of the member 15 is enlarged at 25 and is of sufficient length to provide an annular tuning neck 27 between section 25 and wall 11 constituting the only inlet and outlet to the chamber 23. If desired, projections or folds 29 may be formed to extend outwardly from the flange 25 to fit the inside of the tube 11 and furnish additional support for the member 15. However, the member 15 is rigidly attached to wall 11 only at the one end 17. The length of the chamber 23 is selected to give the desired chamber volume and the length and area of the tuning neck 27 are selected along with the volume of the chamber 23 so that they will attenuate the desired frequency. The unit 15 is shown positioned so that the tuning neck 27 faces upstream. A similar unit 31 is shown which is arranged in the reverse direction so that its tuning neck faces downstream. Known principles of acoustic engineering can be utilized to position the devices 15 and 31 at the optimum points and facing the optimum direction along the length of the unit 7. Because of their single end connection to the shell 11 it is possible to bend the conduit 7 even at the points where the resonator chamber units 15 are located.

Located both upstream and downstream adjacent to the device 15 are expansion chambers 33 which comprise empty spaces inside the shell 11. The resonator chambers provided by units 15 and 31 and the expansion chambers 33 will silence lower frequencies and can be called high pass chambers. In order to attenuate high frequencies, spit chamber units 35 are provided and constitute low pass devices.

The unit 35 comprises an annular member that has a peripheral flange 37 at its inlet end and another one 39 at its outlet or downstream end. Only one of the ends 37 and 39 is spotwelded to the shell 11, the end 37 being so illustrated. Intermediate sections of the member 35 are enlarged in diameter to contact the shell as indicated at 41 and 43. The sections 37, 39, 41, and 43 define between them and with wall 11 three or more chambers 45, 47, and 49. The inside diameters of these chambers are provided by the perforated tubular sections 51, 53, and 55 which are preferably of the same diameter as the section 21 and the exhaust pipe 5. Each of the chambers 45, 47, and 49 is preferably about the same length as the diameter of the shell 11, that is about 3" long. The openings in the pipe sections 51, 53, and 55 may be mere perforations formed in the shell or they may be louvers as often used in the spit chambers of automotive mufflers. The spit chambers 45, 47, and 49 will silence the high frequencies in the gases in a known manner.

While the pattern may be varied to suit specific applications, in general, I prefer to have the silencing components (namely the expansion chamber 33, the resonator chamber unit 15, and the spit chamber unit 35) arranged in the pattern indicated. That is, the expansion chamber, followed by the resonator chamber, followed by an expansion chamber, followed by a spit chamber, followed by an expansion chamber, followed by a resonator chamber, and so on. The silencing components indicated have the capacity to remove both high and low frequencies. Suitable modification of the units 15 and 31 will enable them to eliminate even the very low notes and frequencies sometimes found in modern automobiles. The expansion chamber 33 will tend to eliminate the moderately low and intermediate frequencies whereas the spit chambers 35 will, of course, eliminate the higher frequencies and roughness.

The gases can flow straight through the unit 7 without any obstruction. Since the passages 21, 51, etc., are of substantially the same size as the inlet pipe 5 and the outlet

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13, there is an absolute minimum of back pressure. Additionally, because the units 15 and 35 are secured to the shell 11 at only one end, the unit may be bent after it is completely formed and assembled so as to assume the peculiar configurations required to fit in place on the particular automobile to which the unit 7 is tuned.

Modifications in the specific structure shown may be made without departing from the spirit and scope of the invention.

I claim:

1. A several foot long combined conduit and silencer for exhaust gases of the internal combustion engines of automobiles or the like comprising an outer tube of substantially uniform diameter from end to end which is approximately three inches in diameter and long enough to extend from the engine compartment at the front of an automobile to the rear end of the automobile, said tube having an inlet at one end and an outlet at the other end, and a plurality of smaller diameter elongated high pass tubes inside of the outer tube and each having an enlarged end fitted within and spotwelded to the wall of the outer tube, each said inside tube having a major portion of the length thereof smaller in diameter than the outer tube to provide a gas passage approximately the same in diameter as said outer tube inlet, the other end of each inside tube being enlarged so that it is larger than said gas passage but smaller than said outer tube and being spaced from the outer shell and long enough to provide a tuning passage, the space between the major length of each inside tube and the outer tube providing a resonator chamber communicating with the inside of the outer tube only through said tuning passage.

2. The invention set forth in claim 1 wherein the tuning passage end of said inside tube has projections thereon which fit slidably against the inside wall of the outer tube

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to furnish support in a radial or lateral direction for the inside tube.

3. A combined tailpipe and exhaust silencer comprising a long outer tube of substantially uniform diameter from end to end and adapted to extend from the front to the rear of a vehicle, first and second annular silencing devices secured inside of the tube, each at one end only, said first silencing device comprising a resonator chamber forming means including an enlarged end secured to the outer tube and a reduced end forming a tuning passage with the outer tube, the inside of the means between said two ends comprising a flow passage for gas and the outside forming with said tube a resonator chamber, the other of said means comprising a tubular device having an enlarged end secured to the outer wall and additional enlargements slidably fitting the outer wall, the inner portion of said other means being perforated and forming with the enlargements and outer tube a plurality of chambers for silencing high frequencies.

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