

Sept. 4, 1956

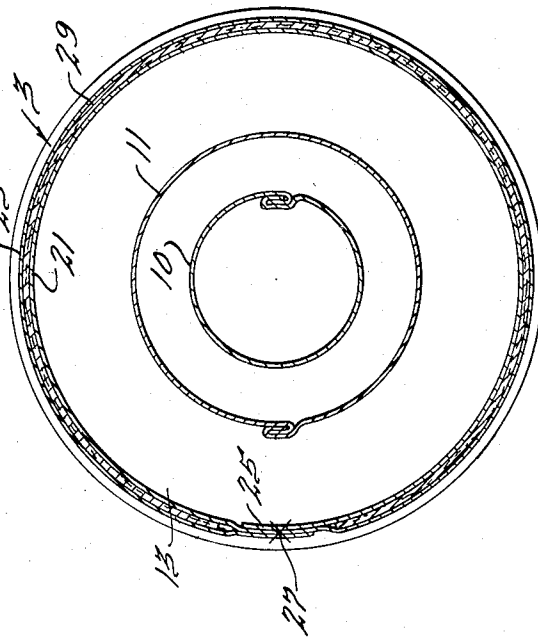
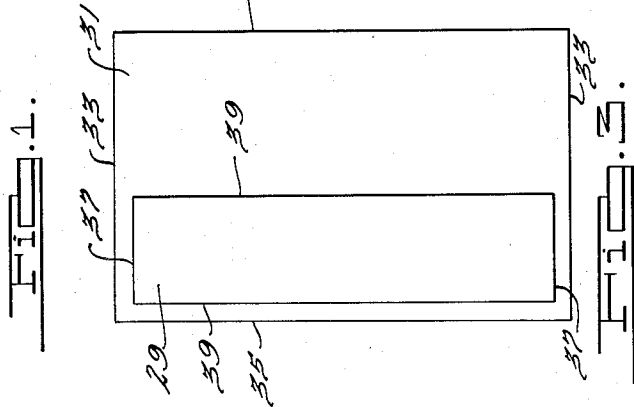
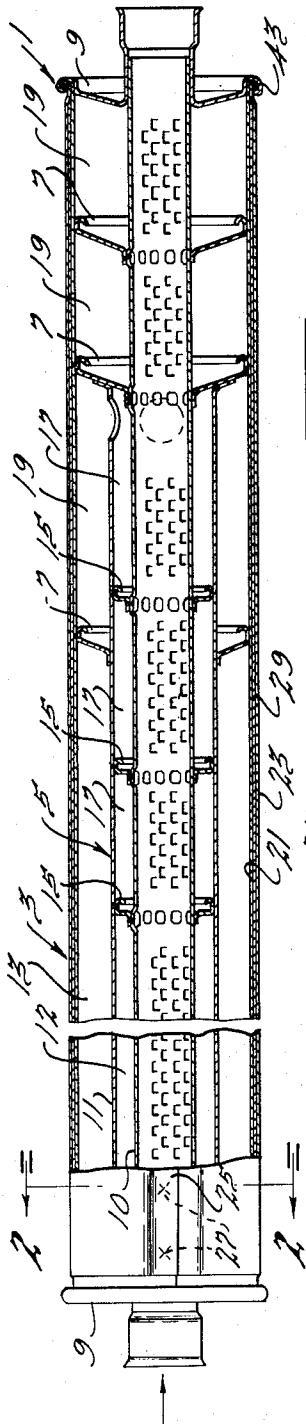
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2,761,525

MUFFLER

Filed July 26, 1950

3 Sheets-Sheet 1



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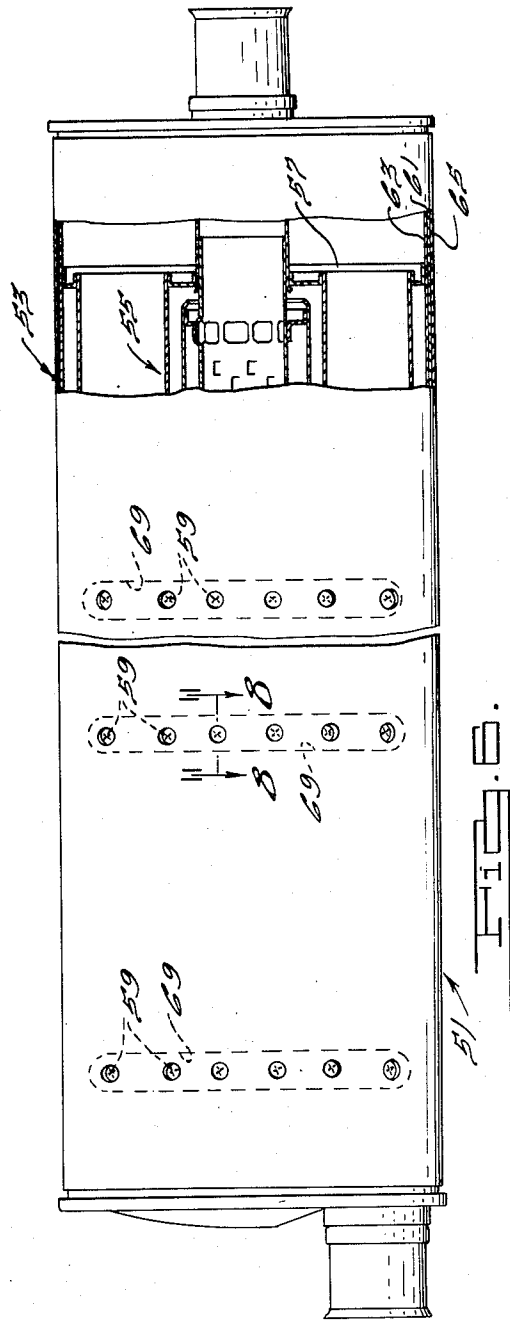
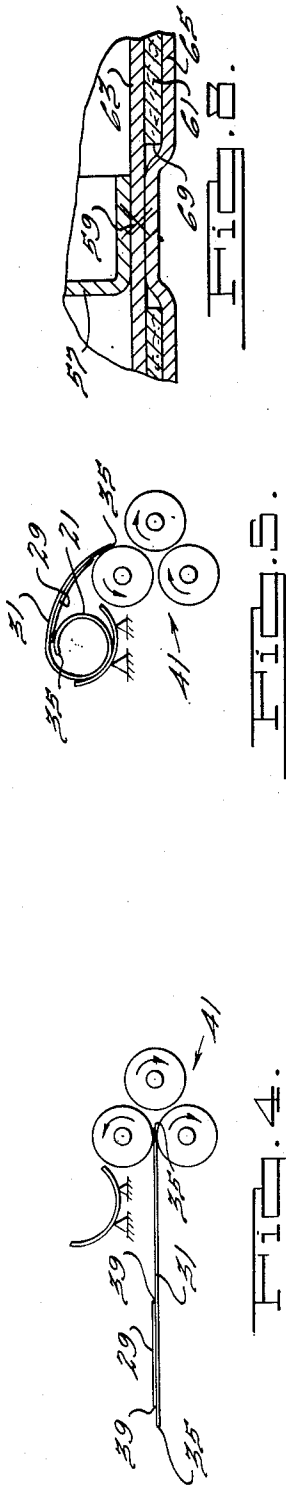
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3 Sheets-Sheet 2



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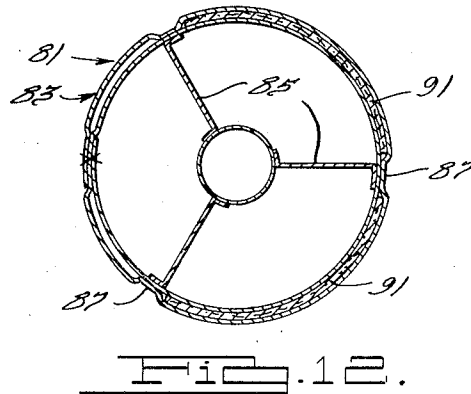
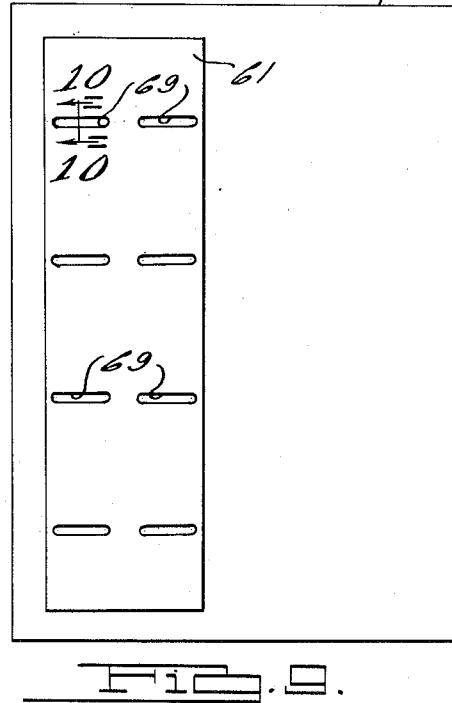
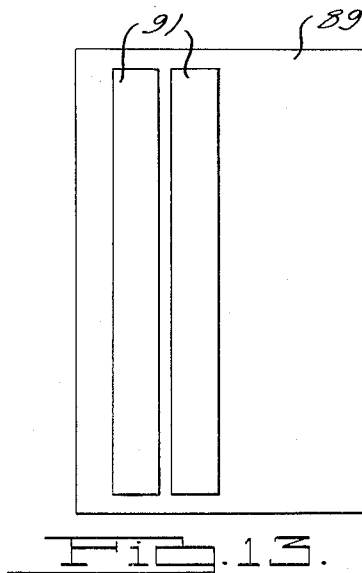
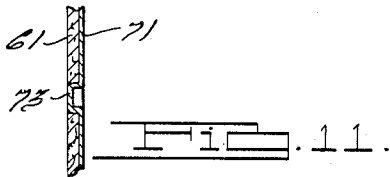
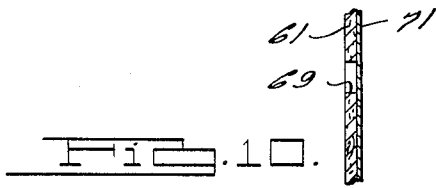
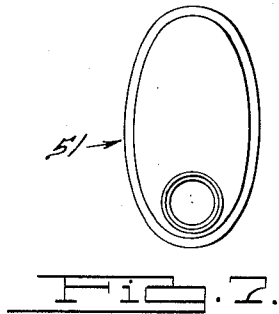
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3 Sheets-Sheet 3



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2,761,525

MUFFLER

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13 Claims. (Cl. 181—62)

This invention relates generally to mufflers for the prevention of noise caused by pulsating gases and, in particular, to the housings or shells of such devices.

Although the invention is useful in devices for muffling pulsating gases generally, e. g., mufflers for the intake and delivery of air compressors, the most severe requirements are met in the prevention of noise caused by the exhaust of internal combustion engines, and especially engines for automobiles or other units that are intended for production on a large scale at a low cost. For this reason, the invention will be illustrated and described herein as applied to automobile mufflers.

It is the object of this invention to reduce "shell noise" in mufflers and/or to reduce the escape of heat through a selected area of the muffler shell.

In order to accomplish this object, the invention provides a new type of outer shell for mufflers. This shell may be used with substantially all types of internal apparatus for eliminating the noise of pulsating gases. It is of the double wrap type, i. e., a double layer shell formed from a single continuous sheet of flat metal, and has a layer of asbestos or similar sound deadening or insulating material between the metal layers. The asbestos layer substantially eliminates "shell noise" due to sympathetic vibration of the shell wall and also reduces the escape of heat through the shell, a feature of importance in some of the late model automobiles.

Layers of asbestos or the like have been applied to muffler shells before. The present shell, however, gives entirely satisfactory performance in all respects and, at the same time, is substantially less expensive to manufacture than the prior lined shells since it is simpler to assemble and requires less metal. In fact, the shell of this invention is inherently stronger than the prior lined shells and is blowout proof and leakproof.

The features of this invention will become more apparent upon consideration of the accompanying drawings, in which:

Figure 1 is an axial section through a muffler having a shell constructed in accordance with the principles of this invention;

Fig. 2 is an enlarged cross-section of the muffler taken along the line 2—2 of Fig. 1;

Fig. 3 is a reduced plan view of the blank from which the muffler shell is formed;

Figs. 4 and 5 are side elevationals of rolling apparatus that may be used to form the shell from the blank of Fig. 3;

Fig. 6 is an axial section through a different type of muffler wherein transverse partitions are welded to the shell;

Fig. 7 is a reduced end view taken from the left of Fig. 6;

Fig. 8 is an enlargement of the structure shown in a section along line 8—8 of Fig. 6 and shows the embossment formed on the shell to facilitate welding of the partitions thereto;

Fig. 9 is a reduced plan view of the blank that may be used to form the shell of Fig. 6;

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Figs. 10 and 11 are sections taken along the line 10—10 of Fig. 9 and show two modified forms of blank, the blank of Fig. 10 having metal which is ordinarily flat so that embossing takes place in welding operation while the blank of Fig. 11 has the embossment already formed in the metal;

Fig. 12 is a section through another type of muffler wherein longitudinal partitions are welded to the shell lengthwise thereof; and

Fig. 13 is a plan view of a reduced blank that may be used to form the shell of Fig. 12.

Referring first to Figs. 1—5, a cylindrical muffler 1 is illustrated which has an outer shell 3 and internal sound eliminating apparatus 5. The apparatus 5 has longitudinally spaced transverse partitions (or mounting members) 7 that are slidably mounted within the shell 3. It is also mounted upon transverse covers or headers 9 that are fixedly secured to the opposite ends of the shell 3.

While, generically, the internal apparatus 5 forms no part of the present invention and may be of any desired type, as will hereinafter become more evident, it may be noted that in the muffler 1 it includes two concentric tubes 10 and 11 located within the shell 3. The two tubes form an annular tuning neck 12 and the outer tube forms with the inner surface of the shell 3 a resonating chamber 13. The innermost tube 10 is mounted in the surrounding tube 11 by means of transverse partitions 15 which divide the annular space between these tubes into a series of spit chambers 17 that are extensions of the tuning neck 12. The partitions 7 form a series of silencing chambers 19 for intermediate frequencies which are extensions of the resonating chamber 13.

As best revealed in Fig. 2, the shell 3 is formed from a single sheet of metal that is wound about the axis of the muffler twice so as to form a wall consisting of an inner layer 21 and an outer layer 23. The opposite side edges of the metal which form the shell 3 are overlapped to form a joint 25 and the three thicknesses of metal are spot welded at spaced, longitudinal intervals along this joint, the spot weld being indicated by the numeral 27. Between the inner and outer layers 21 and 23 is a sheet of asbestos 29 or other material which is effective in insulating against sound caused by vibration of the walls 21 and 23 and which, in addition to, or instead of, may insulate the walls 21 and 23 against the passage therethrough of heat dissipated in the muffler. Materials for this purpose are well known in the art and commercially available. However, as indicated, asbestos is, at the present time, preferred.

The shell 3 thus is basically what is referred to as a "double wrapped" shell which has added the insulating sheet 29 thereto between the layers of metal. While the shell may be formed by separately coiling the sheets of metal and asbestos and then inserting asbestos coil between the two layers of the metal coil, it is preferably formed by the method indicated in Figs. 3—5. The shell originates from a flat piece of sheet metal 31 which has its opposite ends 33 spaced apart by the required length of the shell and its side edges 35 spaced apart by a distance equal to substantially twice the circumference at the mean diameter of the shell wall plus the width of the joint 25. The sheet of asbestos or other material 29 is laid on the blank 31 and may be attached thereto by glue, cement, or other convenient means, if desired. The sheet 29 has a length which is a little less than that of the shell 3 and it is placed on the blank so that its ends 37 are spaced inwardly from the ends 33 of the blank, this being done for a purpose which will hereinafter become apparent. The width of the sheet 29 is substantially equal to the circumference of the shell 3 along a mean diameter less the width of the joint 25. The sheet 29 is placed on the blank 31 so that one of its side edges 39 is spaced

inwardly from a side edge 35 of the blank 31 by a distance which is substantially equal to the width of the joint 25.

The flat blank 31 with the sheet 29 attached is then fed into the forming rolls 41 shown in Figs. 4 and 5. A side 35 of the blank 31 which is remote from the sheet 29 is preferably fed into the rolls 41 first so that the sheet 29 is adjacent the trailing edge as indicated in Fig. 4. It is evident from the drawings that the blank will be rolled up so that the forward half of the blank forms the inner layer 21 and the trailing half forms the outer layer 23 with the sheet of asbestos 29 in between. The overlapping side edges 35 of the blank 31 are then pressed against opposite sides of the intermediate layer of metal and spot welded in a suitable jig and in accordance with conventional practice, it being noted that the sheet of asbestos 29 has been located so that it does not lie in the joint 25.

After the shell 3 has been formed in the manner just indicated, the internal apparatus 5 may be slid in place on the inner layer 21. The headers 9 may then be slid onto the tube 10 and secured to the ends of the shell 3 in a joint 43. For the sake of economy and strength, the joint 43 is preferably formed by reverse bending the ends of the shell and the outer periphery of the headers so that they are interlocked as clearly shown in Fig. 1. Either during this operation or prior thereto, the ends of the layers 21 and 23 of the shell 3 are brought into contact by bending the end of the outer layer 23 against the surface of the inner layer 21, this being permitted by virtue of the spacing of the asbestos sheet 29 from the ends 33 of the shell blank 31.

The muffler 51 of Figs. 6-8 is oval rather than circular in cross-section and thus has an oval shell 53. The oval-shaped shell may be produced conveniently by flattening the opposite sides of a cylindrical shell formed on the rolls 41 of Figs. 4 and 5. The muffler 51 has an internal noise eliminating apparatus 55 which includes transverse partitions 57 that are spot welded at 59 to the shell 53. In order to permit spot welding by passage of electric current through the entire thickness of the shell 53, the asbestos layer 61 between the inner and outer layers 63 and 65 of the shell is adapted by means shown in Fig. 9 (or indicated in Fig. 13) to provide suitable apertures that enable metal-to-metal contact among the shell layers 63, 65, and the partition 57. Thus, the shell 53 may be formed from the blank 71 having the layer 61 placed thereon as indicated in Figs. 9-11. The sheet 61 is located on the blank of shell metal 71 in the same manner as described in connection with Figs. 3-5. The sheet 61 has apertures 69 of a suitable type formed therein to enable welding of both shell layers to the partition, and hence, these are spaced from the ends of the sheet 61 and from the ends of the blank 71 so as to lie in the planes of the partitions 57. The blank 71 may be entirely flat as shown in Fig. 10, and the outer layer 65 pressed against the inner layer 63 during the spot welding operation. Alternatively, as in Fig. 11, the blank 71 may be provided with embossments 73 of a depth that is substantially the same as the thickness of the sheet 61 so that they may extend through the apertures 69 and contact the inner layer 63 without the application of pressure during the spot welding operation, though it may be observed that the thickness of the shell metal is light enough so that no substantial problem is encountered in embossing it during the spot welding operation. When the embossments 73 are formed in the blank 71, these serve to locate the sheet 61 and, to this extent, facilitate the manufacture of the shell.

Figs. 12 and 13 illustrate a muffler 81 having a shell 83 to which longitudinally extending partitions 85 are spot welded along their length in joints 87. The shell 83 is preferably formed from a blank 89 by the method of Figs. 3-5. A single sheet of asbestos 91 may be used and provided with apertures for the spot welds in the manner indicated in Figs. 6-11 or, alternatively, more

than one sheet of asbestos may be used as indicated in Fig. 13, it now being evident that the insulation layer of Figs. 6-11 could also be in the form of spaced sheets to permit spot welding. In the shell 83, the layer does not extend all around its circumference but only in two of the three sections defined by the three longitudinal partitions 85 and thus illustrates that, within the purview of the present invention, the insulating layer may be applied to a selected area of the shell which is less than its entire area. Since two sections are provided with insulation, two sheets 91 may conveniently be employed in the manufacture of the shell. The length of these sheets and their location with respect to the ends of the blank 89 and the sides of the blank are determined in the manner set forth in Figs. 3-5. The blanks 91 have a width which corresponds to the circumferential distance between adjacent joints 87 and the two sheets are spaced apart by the width of a joint 87 so that the outer layer of shell metal may be embossed or deformed inwardly into contact with the inner layer before or during the spot welding operation. The blank 89 with the sheets of insulating material 91 mounted thereon is formed into the shell by suitable means that have been already described.

It will now be observed that the invention provides for the very simple assembly of an insulating layer between two layers of shell metal. The shell is united in only a single joint and this consists of three layers of metal that are securely attached by a spot welding operation so that the shell is blow-out proof as well as leakproof. Transverse partitions may be readily welded to the shell by providing openings in the insulating layer. The insulating layer may function to deaden noise due to vibration of the metal shell layers or to prevent escape of heat from the muffler toward the underside of the automobile body, or the insulating layer may do both. Also, as indicated, the insulating layer need not be used throughout the entire area of the shell, and in some cases, particularly where only heat insulation is desired, it may be the better practice to place the insulation only on the top side of the shell.

What is claimed is:

1. In an exhaust muffler having an inlet and an outlet for gas, the combination of a single sheet of metal spirally wound upon itself to provide a shell having a wall including at least two layers of said sheet, the sides of said sheet overlapping to form a joint of at least three layers of said sheet each in contact with another layer, insulation sheeting in said wall between said two layers, sound silencing and gas conduit structure connected to said inlet and outlet and including a metal mounting member inside of said shell having a layer in engagement with the inner layer thereof to form a joint, said sheeting being apertured on a radius through said joint to permit metal-to-metal contact between the two layers of said wall, and spot welds along both said joints interconnecting the metal layers.

2. The invention of claim 1 wherein said sheeting comprises a single sheet having openings therein to provide the apertures for spot welding.

3. The invention of claim 1 wherein said sheeting comprises a plurality of sheets spaced from each other to provide the apertures for spot welding.

4. The invention of claim 1 wherein said mounting members extend transversely of the axis of the shell.

5. The invention of claim 1 wherein said mounting members extend longitudinally of the axis of the shell.

6. In an exhaust muffler having an inlet and an outlet for gas, the combination of a shell having a wall including at least two layers of sheet metal, a portion of the side of one of said overlapping layers engaging the other and also its own layer to form a joint of at least three layers of said metal each of which is in contact with another, insulation sheeting between said two layers, sound silencing and gas conduit structure connected to said inlet and outlet and including a metal mounting mem-

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ber inside of said shell having a layer in engagement with the inner layer thereof to form a joint, said sheeting being apertured on a radius through said joint, an embossment on the outer layer of said shell extending through the sheeting aperture to contact the inner layer, and spot welds along both said joints interconnecting the metal layers.

7. In an exhaust muffler, the combination of a single sheet of metal spirally wound upon itself to provide a shell having a wall including at least two layers of said sheet, the sides of said sheet overlapping to form a joint of at least three layers of said sheet each of which is in contact with another layer, spot welds uniting said three layers, insulation sheeting in said wall between said two layers and spaced from the ends of the shell, and headers mounted on the ends of the shell and having an interlocked engagement with the ends of the shells beyond the sheeting, the layers of shell metal beyond the sheeting being in contact with each other lengthwise of the shell and in said interlocked engagement.

8. In an exhaust muffler having an inlet and an outlet for gas, a tubular shell comprising two radially spaced layers of metal, at least one of said layers being overlapped so as to have a portion defined by two contacting thicknesses of metal, said portion contacting the other of said layers so as to form a joint between the two layers including at least three thicknesses of metal each of which is in contact with another thickness of metal in the joint, a weld in said joint firmly uniting together all three thicknesses of metal, a layer of insulative material in the radial space between said layers but not in said joint, sound silencing and gas conduit structure connected to said inlet and outlet and including a metal member within said shell and having a flange in contact with the inner of said metal layers, said insulative layer having an opening in radial alignment with the area of contact of said flange and inner layer, the outer of said metal layers having a radial embossment extending into said opening and in contact with the inner layer to form with said inner layer and said flange a joint including at least three thicknesses of metal each of which is in contact with another thickness of metal in the joint, and a weld in said last-mentioned joint firmly uniting together all three thicknesses of metal.

9. The invention set forth in claim 8 wherein said member extends transversely of the axis of said shell and said opening comprises a cutout in a sheet of insulative material.

10. The invention set forth in claim 8 wherein said member extends axially of the shell and said opening is provided by a spacing between the ends of adjacent sheets of insulative material that constitute said insulative layer.

11. In an exhaust muffler having an inlet and an outlet

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for gas, sound silencing and gas conduit structure connected to said inlet and outlet, a shell enclosing said structure and comprising a sheet of metal spirally wrapped upon itself to provide a shell wall having two layers of metal, the ends of said sheet being overlapped and secured together in a joint having at least three thicknesses of metal, said sheet having embossments therein acting to radially space apart said two layers, and insulative material in the radial space between said two layers with aperture means therein through which said embossments extend.

12. In an exhaust muffler, an elongated shell comprising a sheet of metal spirally wrapped upon itself to provide a shell wall having two layers of metal, the ends of said sheet being overlapped in a joint having at least three thicknesses of metal, spot welds in said joint securing said three thicknesses of metal together, said sheet having embossments therein in only one of the layers acting to radially space apart said two layers, the end portions of the layers of metal at opposite ends of said shell being in contact, end headers at opposite ends of said shell and closing the ends thereof and having a reversely bent interlocked engagement with said end portions, each of said headers having an opening therein to provide an inlet and outlet respectively for gas passing through the shell, and sound silencing and gas conduit structure mounted within the shell and supported on the inner periphery thereof and including tube portions mounted in said inlet and outlet of said headers.

13. The invention set forth in claim 12 wherein said sound silencing and gas conduit structure includes a partition aligned with at least one of said embossments and rigidly secured by a spot weld in said embossment to said two layers of metal.

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