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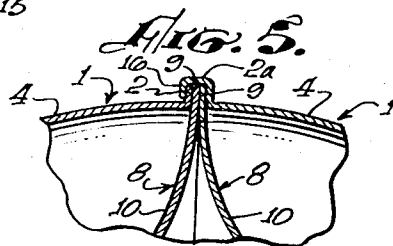
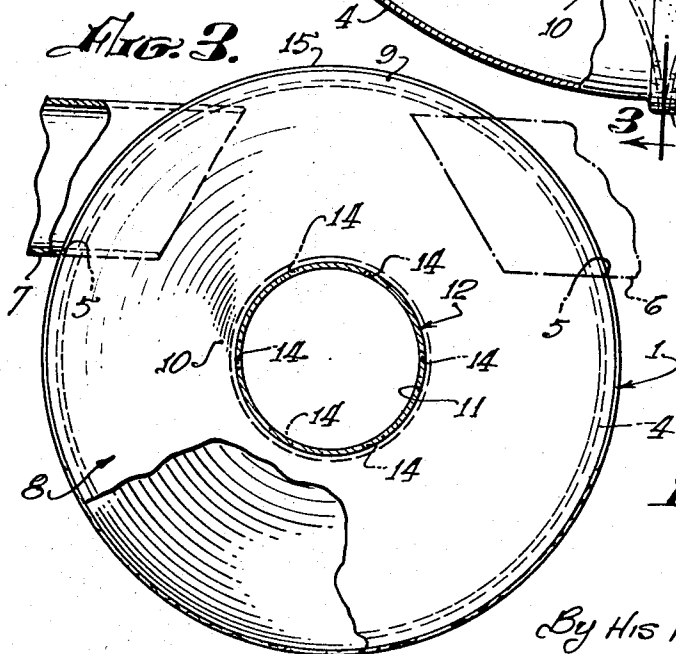
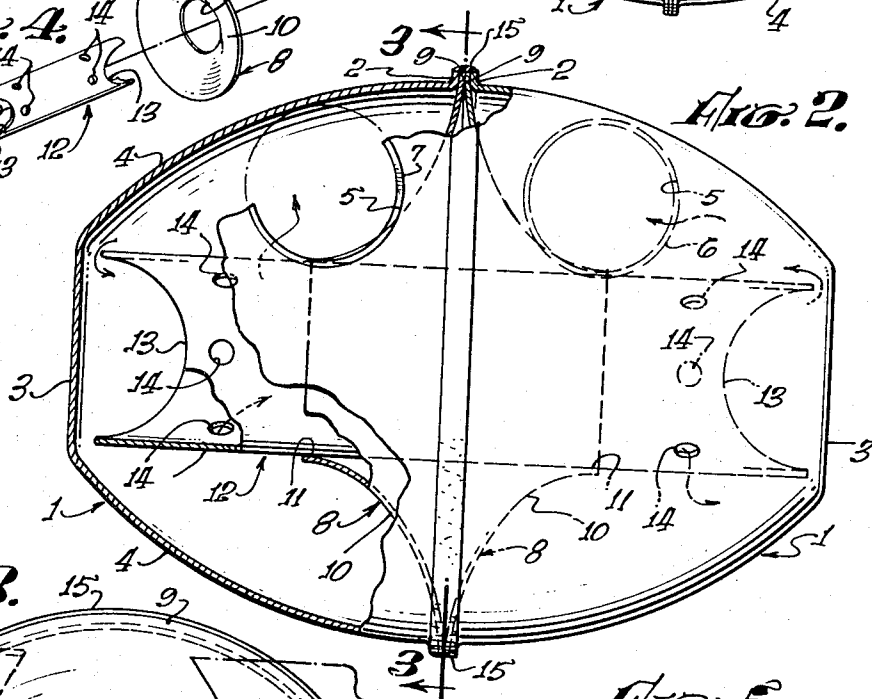
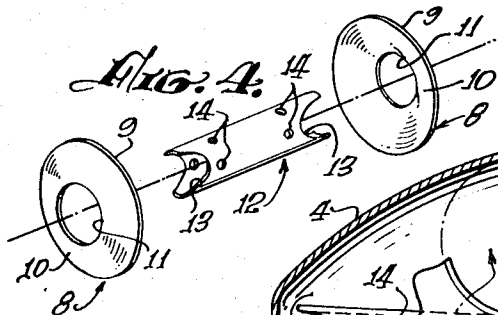
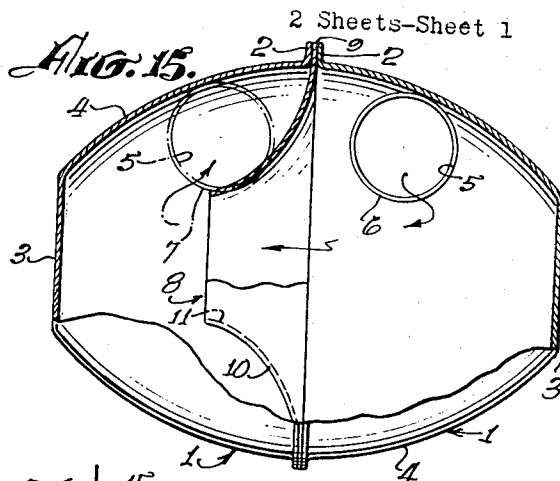
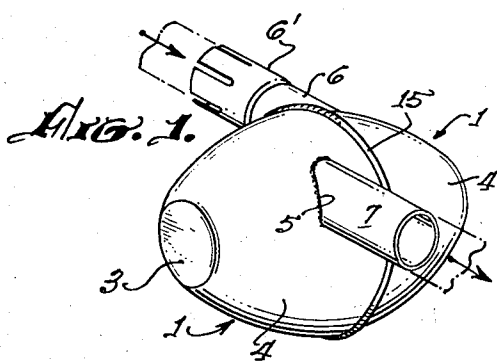
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3,530,953

MUFFLER WITH TANGENTIAL INLET AND OUTLET NIPPLES

Filed July 19, 1968

2 Sheets-Sheet 1



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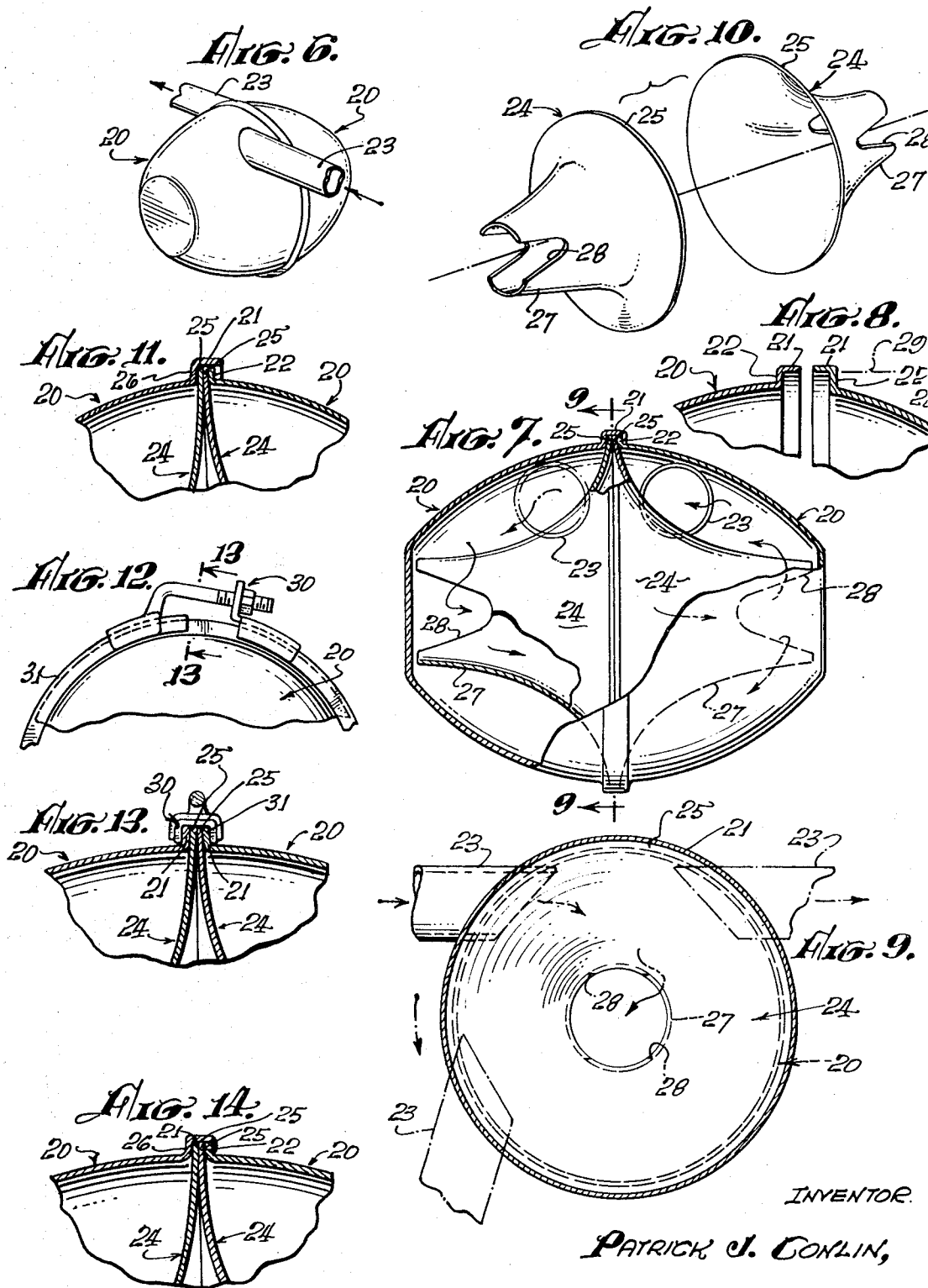
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MUFFLER WITH TANGENTIAL INLET AND OUTLET NIPPLES

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U.S. Cl. 181—58

12 Claims

ABSTRACT OF THE DISCLOSURE

A muffler for internal-combustion engines comprising an enclosed cylindrical body formed with tangentially disposed inlet and outlet ports. The body is formed of identical bowl-like halves or members having cylindrical wall portions in which the ports are formed and thence tapered to end walls of smaller diameter than the meeting edges of the body members. Partition means on the interior of the body are secured in place by the seam or juncture between the body forming members and those members may be secured to each other in any desired relative rotative position to accommodate particular installations.

BACKGROUND OF THE INVENTION

Field of the invention

The field of the invention is that of engine exhaust mufflers of the type generally classified in Class 181, Subclass 58.

Prior art

The most pertinent prior art known to applicant comprises U.S. Pats. Nos. 3,166,152 dated Jan. 19, 1965, and 3,340,958 dated Sept. 12, 1967, granted to the present applicant.

SUMMARY

The present invention, like the inventions disclosed in the above-identified patents, relates to mufflers in which the pulsating gases of an engine exhaust are directed into an entrance chamber of cylindrical configuration and, by reason of the tangentially disposed entrance port, are caused to partake of a whirling motion which increases in rate as the gases reach an axially disposed port in a partition means and pass therethrough to a discharge chamber of substantially the same configuration as the entrance chamber in which, in route to a tangentially disposed discharge port, they partake of a decreasing rate of whirl. This invention differs principally from the said prior patents in that (a) the partition means are secured in place simultaneously with the joining of the body halves, (b) the body halves are identical, (c) the nipples for the entrance and discharge ports may be identical, (d) the partition means includes a pair of identical parts, and (e) the body halves may be secured together in any desired relative rotational position that will best suit a particular installation. In essence, the muffler may be considered as being formed from two subassemblies each comprising a body half, a port nipple, and a portion of the partition means and in which a single closure means serves simultaneously to unite the body halves or members and the partition means in the completed device. Other objects and advantages will appear as the description of certain presently preferred embodiments of the invention proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate certain presently preferred embodiments of the invention which are described in detail in the specification following:

FIG. 1 is a reduced scale, perspective view of a muffler constituting a first presently preferred embodiment of the invention;

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FIG. 2 is an enlarged scale, side elevational view of the said first embodiment with portions broken away to disclose details of the interior construction;

FIG. 3 is a medial transverse section taken on the line 3—3 of FIG. 2 with some parts broken away and the location of one of the nipple elements being indicated in phantom lines;

FIG. 4 is a reduced scale exploded perspective view of the interior components of the first embodiment of the invention;

FIG. 5 is a fragmentary section taken transversely of the body joining seam showing an alternative form of seam;

FIG. 6 is a reduced scale, perspective view of a muffler representing a second preferred embodiment of the invention;

FIG. 7 is an enlarged scale, side elevational view of the second embodiment with certain components partially broken away to disclose details of interior construction;

FIG. 8 is a fragmentary view of the edge portion of a pair of body components of the second embodiment illustrating a modification of one edge thereof to fit within the edge portion of the other body component or member;

FIG. 9 is a transverse section taken on the line 9—9 of FIG. 7 showing one of the port nipples in phantom lines and also illustrating in phantom lines the capability that the port nipples need not be disposed in parallel relation;

FIG. 10 is an exploded perspective view of the partition components of the second embodiment of the invention;

FIG. 11 is a fragmentary transverse sectional view showing a mode of joining the body forming components or members comprising a spun or rolled seam;

FIG. 12 is a fragmentary side elevational view showing the body forming components or members detachably interconnected by a band clamp;

FIG. 13 is a sectional view taken on the line 13—13 of FIG. 12;

FIG. 14 is a view similar to FIG. 11 showing a welded seam uniting the components of the second embodiment; and

FIG. 15 is a side elevational, partly in section, similar to FIG. 2, but showing a modification particularly suited for use with high speed engines.

DETAILED DESCRIPTION OF PRESENT EMBODIMENT

Referring first to FIGS. 1—5, the illustrated embodiment comprises a body formed by a pair of identical, generally bowl-shaped body members 1 comprising sheet metal stampings, each having an outwardly flared edge 2 and a flat end wall 3 of roughly one-third the diameter of the edge 2, the intervening side wall portion 4 preferably being convexly curved as viewed from the exterior thereof. Adjacent to the said flared edge, the side wall is provided with an oval opening 5 constituting a port in which either an inlet nipple 6 or an outlet nipple 7 is secured in such tangential relation that the outermost surface of the nipple is tangential to the circle of the inner wall of the body member in a plane transverse to the axial line of the body member and intersecting the axial line of the nipple. It is to be noted that the nipples are of substantially equal diameter and so disposed on the respective body members as to accommodate the flow of gas through the device without reversal of the direction of whirling motion thereof. If desired, the inlet nipple may be provided with means to facilitate connection to an engine exhaust pipe as for example, the enlarged 6'.

Associated with each of said body members is one each of a pair of identical partition members 8, 8 of what may best be described as modified funnel-shape. Each of said

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partition members is preferably formed as a sheet metal stamping and includes a flat outer edge portion 9 of substantially the same diameter as the edges 2 of the body member 1 and the partition member is thence curved internally convexly as at 10 to a center opening 11. As best shown in FIG. 2, these partition members are disposed between the edges 2, 2 of the body members 1, 1 with the axially aligned center opening portions 11, 11 thereof projecting into the respective body members and with the faces of said partition members abutting one another.

Prior to assembly into the body members, the partition members are secured to a tubular member 12 extending through the openings 11, 11 thereof and which is of such length as to terminate in slightly spaced relation to the inner surfaces of the end wall portion 3, 3 of the body members, said tube being secured to the partition members by tack welding or brazing at at least a couple of points around the lines of contact therewith with the tube centrally, longitudinally disposed with partition members and with the partition members outer edges abutting one another. Each end of the tubular member 12 is provided with transversely extending U-shaped notches 13 diametrically opposite each other and with a series of perforations 14 disposed inwardly of the said notched ends. The manner in which these notched ends and these perforations operate to increase the noise suppression characteristics of the muffler is not known but extensive repeated tests have shown that in the larger sizes of the mufflers of the present invention, these notches and perforations are important contributors to noise suppression. Additionally, the tubular member 12 is provided with one more opening 14' to equalize pressure between the interior of the tubular member 12 and the space formed by the juxtaposed diverging faces of the portion members 8, 8 and the outer surface of the tubular member.

This subassembly, is then placed between a pair of body members to which the inlet and outlet nipples have been previously brazed or welded and the entire muffler completed by a single circumferential weld or brazed seam 15. This is an important simplification over the muffler disclosed in the said Pat. No. 3,340,958 in which the body is formed of three pieces welded by two peripheral welded seams and the partition means is wholly enclosed within the body and is separately seamed by separate tack welds. Moreover, the partition structure of the present invention affords better radial reinforcement against strains arising from possible explosions of unburned gases within the muffler body and which are necessarily of greater magnitude in the mufflers used with larger engines such as those used on trucks and tractors.

The mode of operation is believed to be obvious. The incoming gases, entering in a line tangential to a larger diameter of the body being a whirling motion which increases in rapidity as the gases reach the entry point of the tube 12. This whirling motion continuous as they pass through and emerge from the tube and in route to the point of discharge, the rate of whirling gradually decreases. The increase and decrease in the rates of whirling are asynchronous and the pulsations of the entering gases are consequently efficiently absorbed by impingement on each other with the result that the outflow of the gases is at a substantially non-pulsating rate with consequent substantially complete reduction of noise deriving from the gases emerging from the muffler. In this connection, a further improvement over the structure disclosed in the said Pat. 3,340,958 is to be noted, viz, that all wall surfaces are parallel to and afford minimum resistance to the movement of gases through the muffler.

The manner of interconnecting the body members is not necessarily limited to welding. FIG. 5 shows a seam construction in which one of the body members 1a is formed with a skirt portion 2a within which the flange 2 and the edges of the partition members are received, said skirt portion having sufficient length to permit it to be

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spun down on the outer face of the flange edge of the other housing member as shown at 16, thus forming an interconnection between the body members that is the equivalent of welding. This type of seam is economically feasible where the production rate is sufficient to justify the cost of the required special tools and where such cost is not justified, welding or brazing may be employed.

Referring next to FIGS. 6-14, there is shown a somewhat simplified version of the first embodiment which has been found satisfactory for use with smaller engines. In this embodiment, the muffler body is formed of two bowl-like halves 20, 20 each being formed with a peripheral skirt edge portion 21 and said edge is cut away on one of them forming an outwardly flared flanged edge 22 of slightly less diameter than the interior diameter of skirt portion 21 remaining on the other body member 20. As in the first embodiment, each body member is provided with a tangentially projecting nipple 23 disposed adjacent to the edge of the member and said nipples are so disposed as to accommodate the flow of exhaust gases through the device without changing the direction of whirling action of the gases within the housing.

The second embodiment, additionally, includes partition means comprising a pair of identical, shallow, funnel-like members 24, 24 of the same general radial cross sectional configuration as the partition members of the first embodiment and each including a peripheral edge 25 of such diameter as to rest against the shoulder 26, formed by the skirt portion 21. The smaller diameter ends 27, of the partition members are positioned to project into the respective body members and are provided with diametrically opposed slots 28, 28 preferably having rounded inner ends for convenience in tool manufacture. These slots serve the same purpose as the slots 13 in the ends of the tube 12 of the first embodiment. The axially extending tube employed in the first embodiment is omitted, it having been found that the lesser volume of exhaust gases and the reduced pressure involved in the smaller engines, e.g., those having exhaust manifolds served by exhaust pipes of, say, one inch diameter or less, the presence or absence of that tube created no noticeable difference in the extent of noise suppression although in larger engines, particularly those operating in lower speed ranges, the advantage achieved by the tube was significant.

Any desired means of interconnecting the body members with the enclosed partition members may be employed. For example, the retained skirt edge portion 21 may be shortened and an encircling clamp 30 generally resembling a hose clamp but having an internal channel section 31 and stud and nut tightening means 32 may be employed as shown in FIGS. 12 and 13. Alternatively, the retained skirt edge 21 may be spun or rolled down against the enclosed flange edge of the other body member and the interposed edges of the partition means as shown in FIG. 11 or the entire assembly may be welded together in the manner shown in FIG. 2 or 14.

As in the case of the first embodiment, this embodiment possesses the advantages of (a) being united in assembly by a single circumferential closure means, (b) by being adapted to accommodate different angular directions of entering and discharge flow for different installation, and (c) by the construction from parts which initially are identical with resultant economy and manufacture. It will be understood that any structural feature shown in either embodiment or any modification thereof may, if desired, be employed in the other embodiment.

Referring finally to FIG. 15, there is shown a modification which is applicable to either of the two basic embodiments shown in FIGS. 2 and 7, respectively and which has been found to suppress noise more effectively on high speed engines than the embodiments of said FIGS. 2 and 7. Since this illustration derives from FIG. 2, the same identifying numerals will be employed where possible.

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The casing or body is formed from a pair of members 1, 1 which are provided with the ports 5, 5 in which the inlet nipple 6 and outlet nipple 7 are mounted. However, instead of the pair of partition members 8, 8 and the tubular member 12, only a single one of the said funnel-like partition members is employed and that member is disposed with the small diameter end 11 thereof projecting into the interior of the body member 1 in which the outlet nipple 7 is disposed. The peripheral edges of the two body members and of the partition member 8 may be secured together by any of the means heretofore described. Since a similar modification can also be effected with the embodiment shown in FIG. 7, illustration is not deemed necessary.

The direction of travel of the gases through this third embodiment is believed to be obvious. Entering gases are caused to partake of a whirling movement in the chamber bordered by the inner face of the partition member by reason of the tangential direction of entry. They then pass through the opening 11 still whirling and thence, whirling at a decreasing rate, pass to atmosphere through the outlet port.

As to the exact reason for the improved noise suppression characteristics of this third embodiment, it must be admitted that the reason is not known. It seems logical to assume that with the higher rate of received impulses in the engine exhaust output, those pulses tend more readily to cancel out each other in the initial whirling movement given to the incoming gases. It is known by repeated experiments that mufflers embodying this last modification of the invention are less satisfactory on lower speed engines and that, conversely, the first and second embodiments are less satisfactory when applied to high speed engines.

While in the foregoing specification, certain presently preferred embodiments of the invention have been disclosed such disclosure will be understood to be by way of example, wherefore, the invention shall be understood to include all such changes and modifications in the parts, and in the construction, combination and arrangement of parts as shall come within the purview of the appended claims.

I claim:

1. In a muffler for the exhaust of an internal-combustion engine, a hollow body structure of cylindrical cross section and being of greater diameter at its mid-length than at the ends thereof, said body structure being formed of a pair of substantially identical, bowl-like body members each having a cylindrical side wall portion and said members, further, having their peripheral edges juxtaposed, a partition means having a peripheral edge interposed between said juxtaposed edges of said body members dividing the interior of said body structure into two substantially identical compartments, said partition means having gas passage means interconnecting said compartments, said gas passage means extending substantially to the ends of said body members and being spaced from the ends of said body members, means simultaneously interconnecting the peripheral edges of said body members and said partition means, an inlet nipple means entering the side wall of one of said body members and disposed to deliver exhaust gases into the compartment formed by said one of said body members and said partition means in a tangential direction with respect to the configuration of the side wall through which it extends with resultant impartation of a whirling motion to the gases, and a discharge nipple means similarly extending through the side wall of the other of said body members and disposed in a tangential relation to the interior of the compartment formed by the other of said body members and said partition means for receiving gases centering said last named compartment through said gas passage means, said tangential relation of said discharge nipple means being complementary to the di-

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rection of whirling motion of the gases in said first named compartment and said inlet and discharge nipple means having substantially equal diameters.

2. A muffler as claimed in claim 1 in which said partition means includes a tubular member constituting said gas passage means.

3. A muffler as claimed in claim 1 in which said partition means comprises a funnel-like member having a peripheral edge interposed between the juxtaposed edges of said body members and having a smaller diameter end projecting into the portion of said hollow body formed by one of said body members.

4. A muffler as claimed in claim 1 in which said partition means includes a pair of funnel-like members which are disposed with the smaller ends thereof directed toward the ends of said body members and having the larger diameter portions thereof abutting at the point of juxtaposition of the edges of said body members.

5. A muffler as claimed in claim 1 in which the peripheral edges of said body members and of said partition means are permanently interconnected.

6. A muffler as claimed in claim 1 in which the peripheral edges of said body members and of said partition means are connected by means permitting the rotative shifting of one body member relative to the other body member about the common axial line of said body members.

7. A muffler as claimed in claim 1 in which said partition means comprises a pair of substantially identical, interiorly convexly curved funnel-like members disposed with the larger diameter portions thereof abutting and with said abutting portions interposed between the said juxtaposed edges of said body members.

8. A muffler as claimed in claim 3 in which said smaller end of said partition means projects into the one of said body members to which said outlet nipple means is connected.

9. A muffler as claimed in claim 4 in which said funnel-like members support a tubular member in the axial line of said body structure constituting said gas passage means.

10. A muffler as claimed in claim 4 in which said smaller ends of said funnel-like members are disposed adjacent to the respective ends of said body structure and are provided with a pair of diametrically opposite notches.

11. A muffler as claimed in claim 6 in which one of said body members is provided with an extended edge portion within which the edge portions of said partition means and of the other of said body members are housed, and in which said extended edge portion is bent inwardly to provide a seam uniting said body members and said partition means in assembly.

12. A muffler as claimed in claim 6 in which the juxtaposed edges of said body members and of said partition means are interconnected by a clamp band including an encircling body member of inverted U-shape in cross section and embracing said juxtaposed edges, and a manually operable means for tightening and loosening said clamp band.

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U.S. Cl. X.R.

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