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Bluemel(10) **Pub. No.: US 2014/0020785 A1**(43) **Pub. Date: Jan. 23, 2014**(54) **EXHAUST CONDUCTING DEVICE AND
METHOD FOR PRODUCING SAME****Publication Classification**(75) Inventor: **Alfred Bluemel**, Erpfting/Landsberg (DE)(73) Assignee: **FAURECIA EMISSIONS CONTROL
TECHNOLOGIES, GERMANY
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(2013.01)USPC **138/148**; 29/428(21) Appl. No.: **14/007,750**(22) PCT Filed: **Apr. 3, 2012**(86) PCT No.: **PCT/EP2012/001481**

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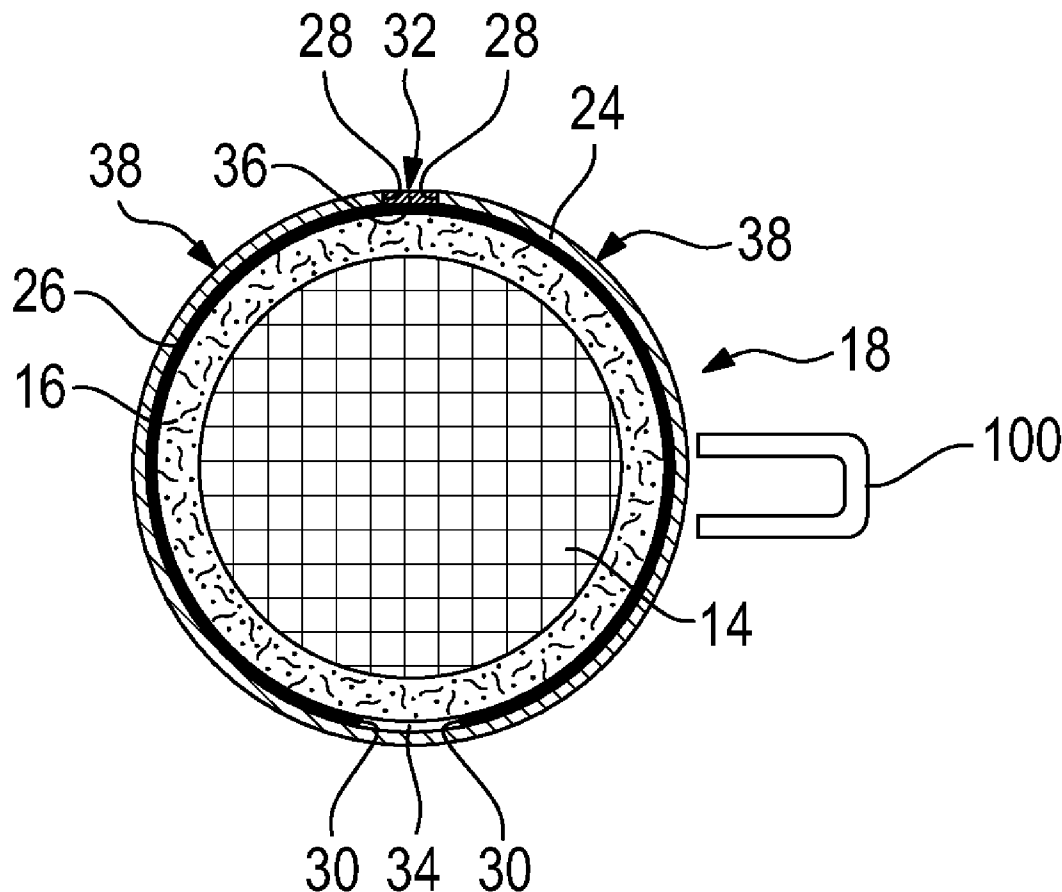
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ABSTRACT

An exhaust-gas conducting device of a vehicle has a cylindrical outer housing which is comprised of an outer shell and an inner shell arranged in an interior of the outer shell. The outer shell forms a larger portion of an outer circumference than the inner shell, or forms an equally large outer circumferential portion. A radial outside of the inner shell is attached to the outer shell, in particular by a material-to-material connection. The outer shell is C-shaped in cross-section, or extends in an annularly closed manner.



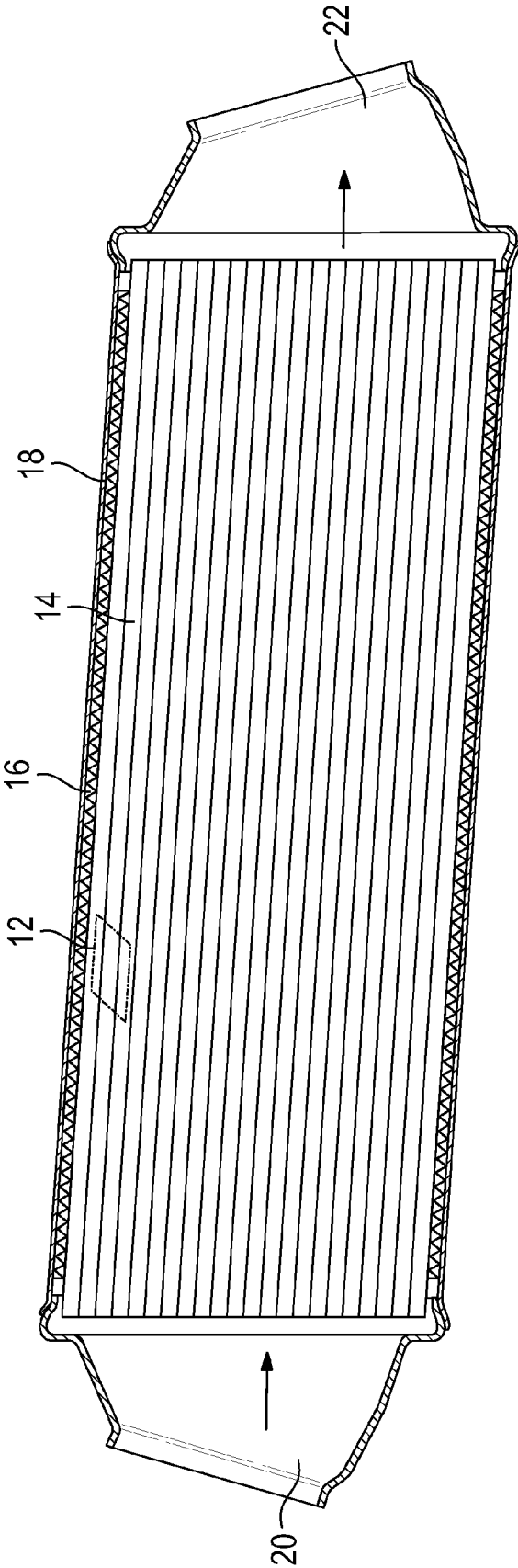
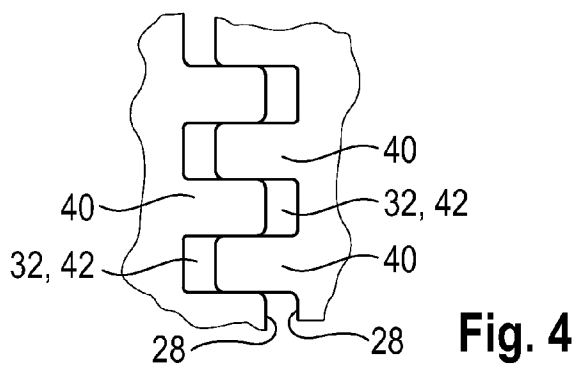
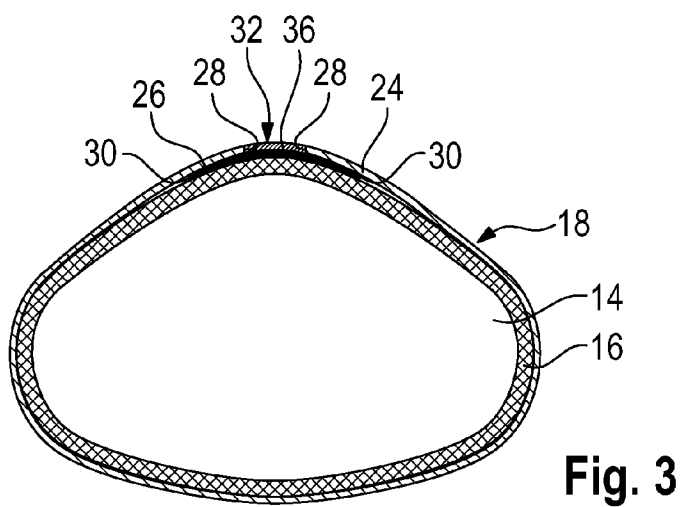
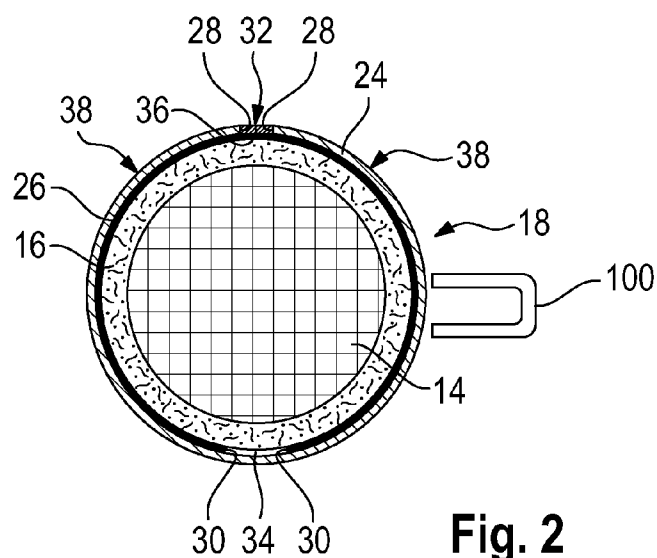


Fig. 1



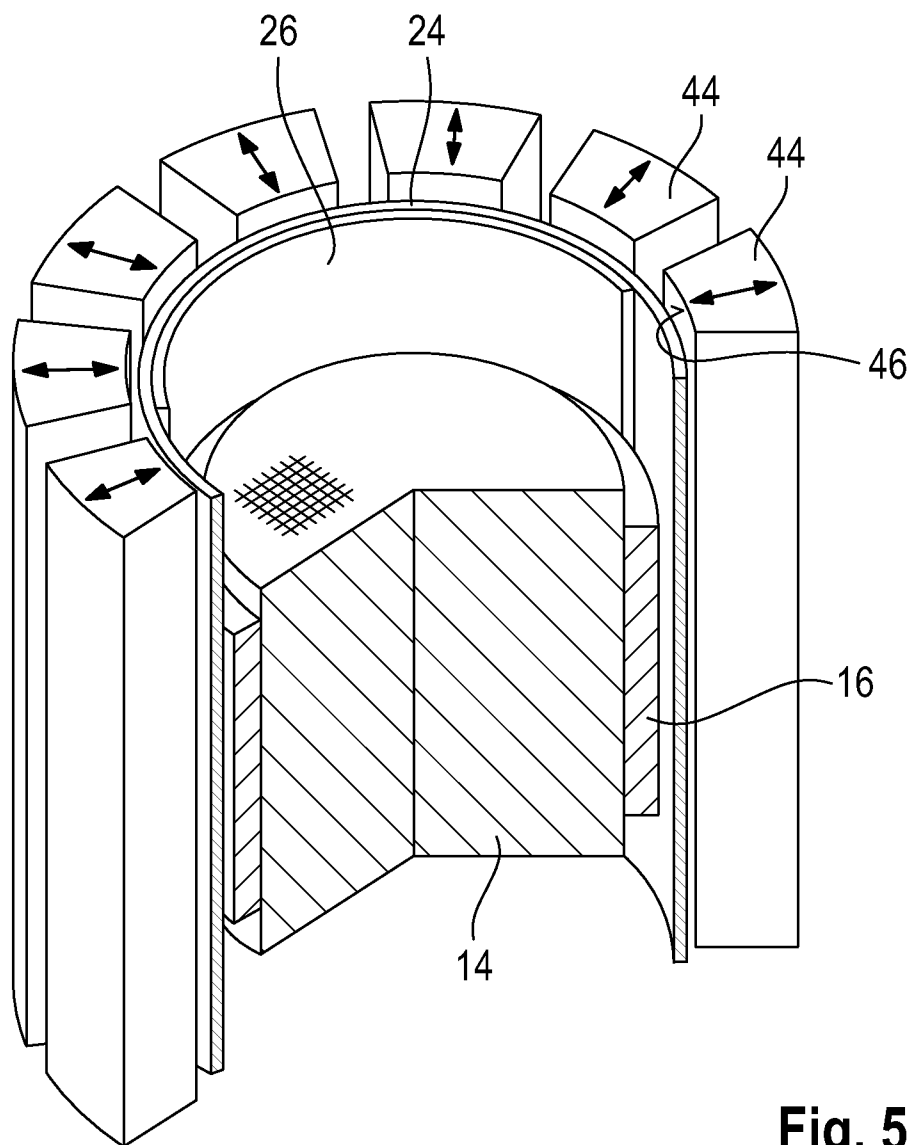


Fig. 5

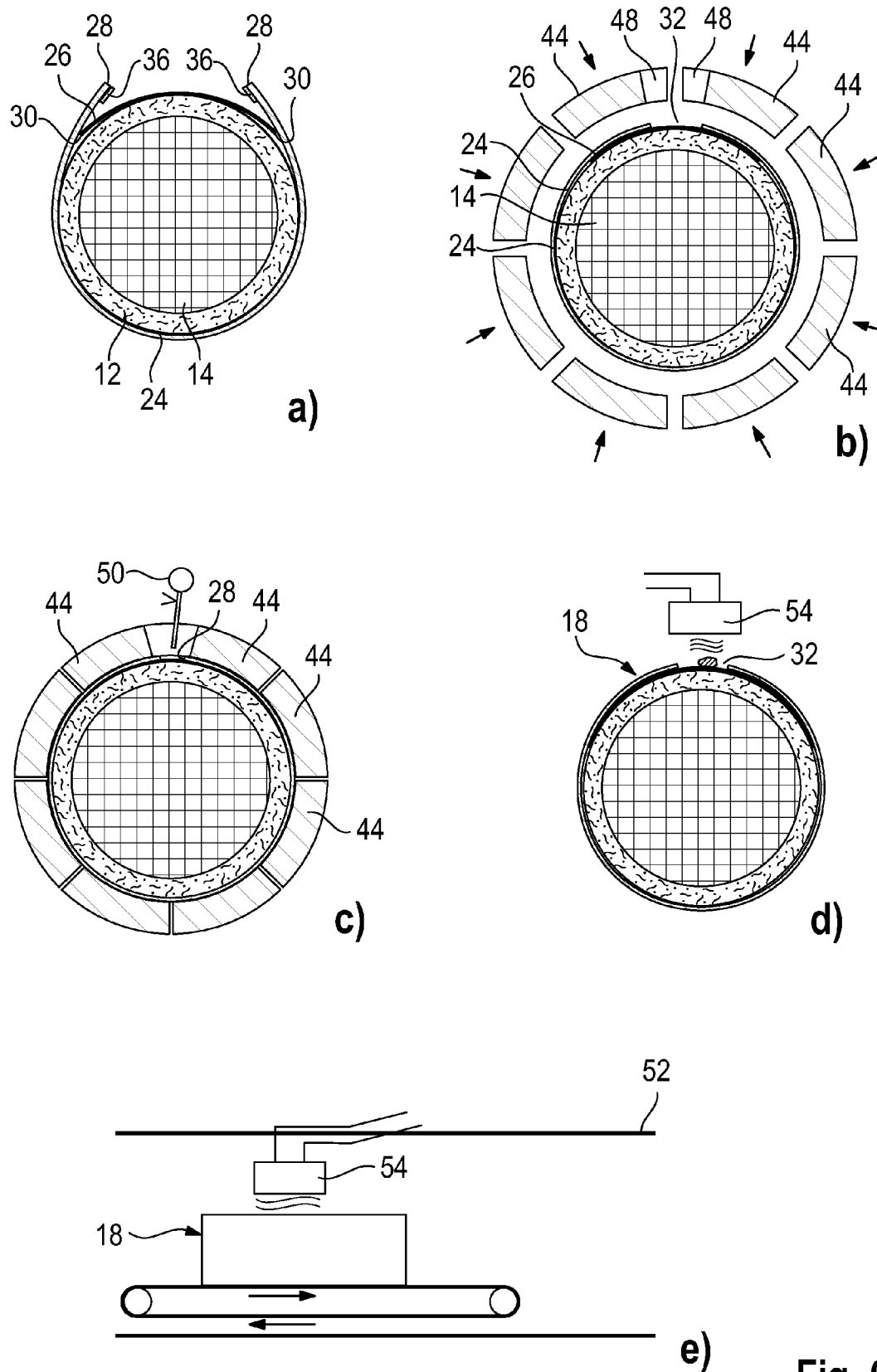


Fig. 6

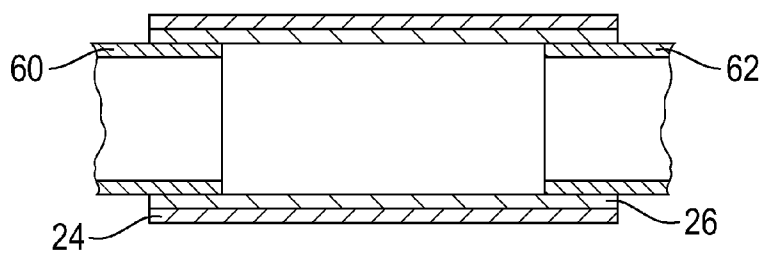


Fig. 7

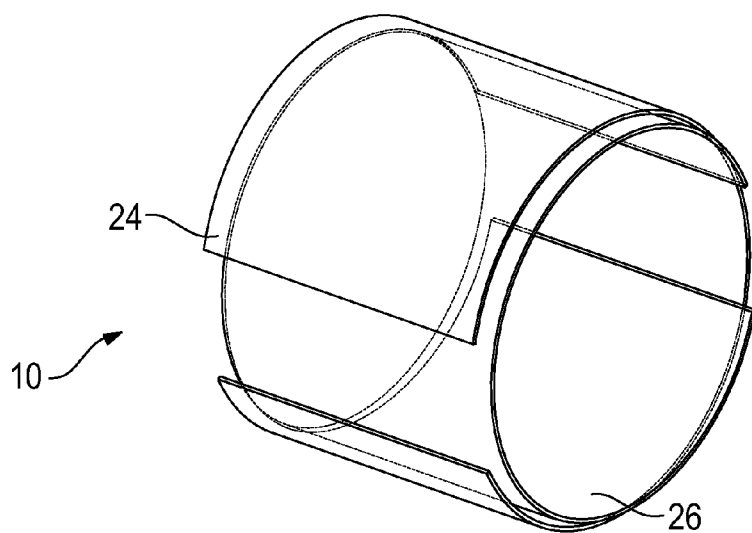


Fig. 8

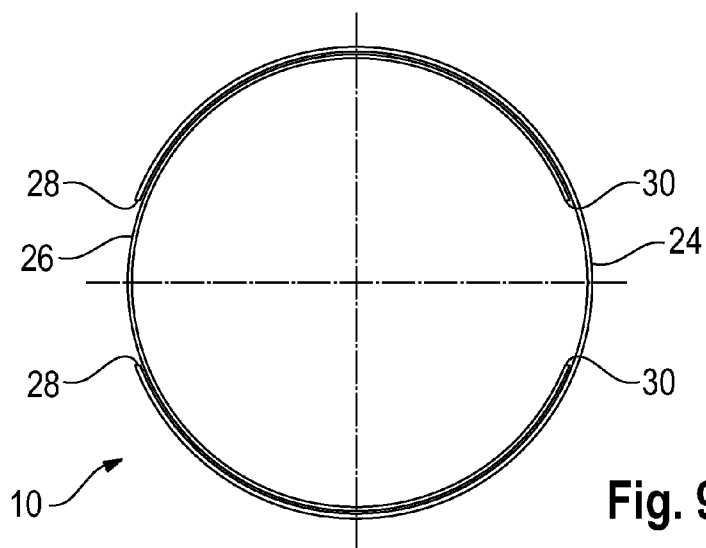


Fig. 9

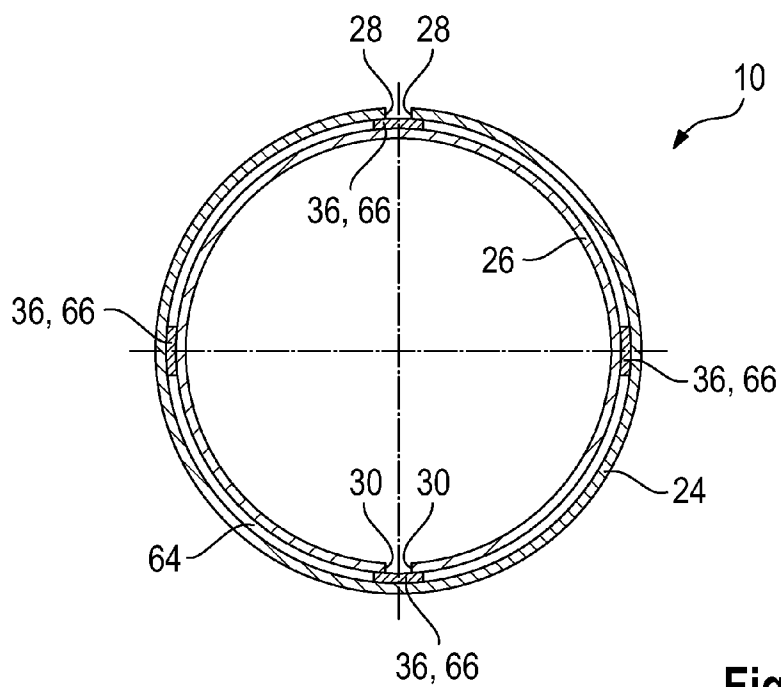


Fig. 10

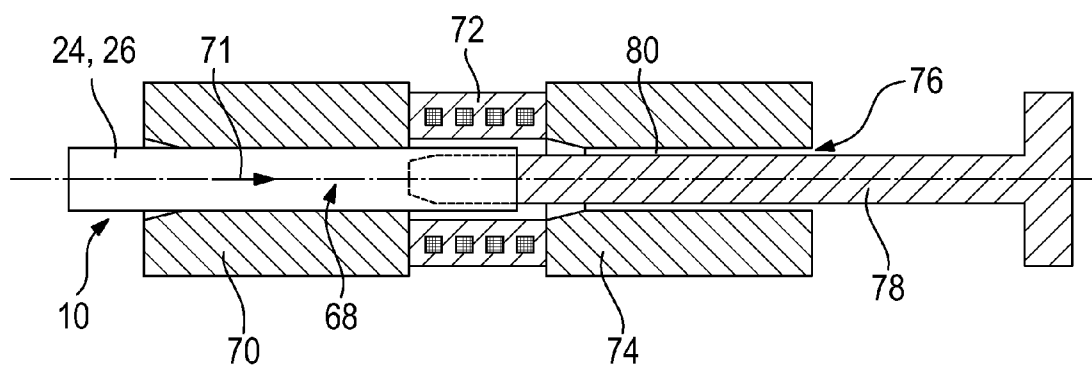


Fig. 11

EXHAUST CONDUCTING DEVICE AND METHOD FOR PRODUCING SAME

RELATED APPLICATION

[0001] This application is the U.S. national phase of PCT/EP2012/001481, filed Apr. 3, 2012, which claims priority to DE 10 2011 016 170.8, filed Apr. 5, 2011

TECHNICAL FIELD

[0002] This invention relates to an exhaust-gas-ducting device of a vehicle, which has a cylindrical outer housing. In addition, this invention also relates to a method for manufacturing such device.

BACKGROUND

[0003] In vehicles, various devices are present in the exhaust branch, which are arranged between exhaust pipe portions, for example catalysts, particle filters, mufflers or housings, in which so-called thermoelectric generators (TEG modules) are accommodated and with which electric energy is obtained due to a temperature difference. All of these devices are prefabricated units which are incorporated in the exhaust branch of a vehicle and which, between their inlet and their outlet, together form a container in which internals are accommodated (exhaust-gas cleaning inserts, muffler units, TEG modules etc.). Between the inlet and the outlet there is a distinct cross-sectional jump, in order to create a cavity for accommodating the internals. The cylindrical outer housing of such devices can be manufactured in different ways. In a catalyst or a particle filter, for example, the so-called insert, through which the exhaust gas flows and which usually is made of ceramics, is wrapped with a sheet such that via an interposed mounting mat the insert is clamped and positioned in the housing. In addition, there are also outer housings made of two shells U-shaped in cross-section, between which insert and mounting mat are clamped, and which on closing the outer housings are moved together to such an extent that their longitudinal edges overlap, and the longitudinal edges then are welded or soldered.

[0004] From US 2001/0055551 A1 a method for manufacturing a catalyst is known, in which two sheet-metal parts, each extending around the insert by more than 360°, are wound over each other. The same then form the outer housing.

[0005] DE 10 2004 042 078 A1 describes a method for manufacturing a housing for an exhaust-gas-ducting device, in which the outer housing consists of three or more sheet-metal strips which partly overlap and are connected with each other in the overlap region. The cross-sectional shape of the housing is not circular cylindrical, but includes portions with more or less curvature. In the portions curved less, the overlap regions are located.

SUMMARY

[0006] It is the object of the invention to create a device which includes an easily manufacturable outer housing which can be manufactured at low cost and is lightweight. Furthermore, there should be indicated an improved method for manufacturing a device.

[0007] An exhaust gas conductor device for vehicles has a cylindrical outer housing which comprises an outer shell and an inner shell arranged in an interior thereof. The outer shell forms a larger portion of an outer circumference of the outer housing than the inner shell or, alternatively, a portion of the

outer circumference as large as the inner shell. A radial outside of the inner shell is attached to the outer shell, in particular by cohesion. The outer shell extends C-shaped in cross-section or as a closed circle. The outer and the inner shell are separate parts which will be connected with each other only later.

[0008] The device has a very uniform load of the outer housing and a uniform clamping of internal parts, as the outer shell chiefly absorbs the load, and this outer shell forms almost an entire outer circumference of the housing, since it extends C-shaped, or also annularly closed in cross-section, and encloses the internal parts. This is an essential difference to the previous shell solutions, in which the individual shells have a U-shaped cross-section, i.e. no longitudinal edges pointing to the inside, to each other. The two separate shells (i.e. inherently separate parts), which form the outer housing, furthermore can be connected with each other more easily than three or more shells like in the prior art. The inner shell is located in that region of the outer shell, so to speak, in which the same is closed, and secures this region.

[0009] Preferably, the longitudinal edges of the outer shell extend with respect to each other without overlapping. According to this embodiment, the device according to the invention thus has no outer housing which is wound, and in which the longitudinal edges overlap. Such winding can lead to the fact that the interior longitudinal edge, which greatly travels during winding, exerts shear forces on the adjoining part located even further to the inside, for example on the mounting mat. When closing the outer housing of the device according to the invention, the relative movement can spread over two sides, namely in the region of the two longitudinal edges of the inner shell.

[0010] The shells preferably extend steadily curved in cross-section, i.e. there is no abrupt step or the like, as is frequently the case with U-shaped shells in the region of the longitudinal edges in the prior art. This reduces the manufacturing costs and ensures a uniform flexibility of the outer housing, as steps or the like partly reinforce the housing.

[0011] The outer and the inner shell preferably are made of a metal sheet.

[0012] The curvatures of the outer and the inner shell should be adapted to each other in the overlap region, so that the inner shell fully rests against the outer shell with its radial outside.

[0013] According to the preferred embodiment, the longitudinal edges of the outer shell are spaced from each other in circumferential direction, and the resulting gap between the longitudinal edges is closed by the inner shell radially to the inside. In terms of force, the inner shell of the preferred embodiment hence chiefly has the task to close this gap in the outer shell, which should be very small. The presence of the gap has the following important advantage. When the outer housing is meant to clamp an internal part or to closely rest against the same, there always exists the problem that the internal part (for example the insert of a catalyst or a particle filter) is provided with cross-sectional tolerances. Due to the individual manufacture of the outer housing, adjusted to the internal part to be incorporated, the outer shell can individually be closely pressed against and adapted to the internal part by applying a force on the outer shell during the manufacture of the outer housing, so that an optimum cross-sectional shape of the outer housing is obtained. Due to the gap it is excluded that with internal parts small in cross-section the longitudinal edges can abut against each other, so that the

outer housing cannot be manufactured small enough. Thus, a compensation of tolerances becomes possible via the gap. It is, however, conceivable to place the tolerances such that for the smallest tolerable internal part the longitudinal edges just abut against each other. It is preferred, however, that even for the smallest part a gap is provided in the outer housing.

[0014] But since the gap is relatively small, the inner shell can be designed such that it contributes to the stability of the outer housing distinctly less than the outer shell, whereby weight and manufacturing costs for the inner shell can be reduced.

[0015] As seen in cross-section, the inner shell can have a smaller circumferential length than the outer shell, preferably by at least the factor 0.6. Material can be saved thereby considerably.

[0016] There can of course also be used an inner shell which has a similarly large or even larger circumferential length than the outer shell.

[0017] The inner shell also can extend C-shaped in cross-section, i.e. likewise have longitudinal edges drawn further to the inside than this is the case with a U-shape. Alternatively or in addition, the gap between the longitudinal edges of the inner shell should be oriented opposite to the longitudinal edges of the outer shell, in particular to the advantageous gap between the longitudinal edges of the outer shell. In a circular cylindrical outer housing, this can be defined in that the gap between the longitudinal edges of the inner shell is located diametrically opposite to the longitudinal edges of the outer shell, in particular to the gap on the outer shell. This should provide a uniform flexibility of the outer housing.

[0018] The outer shell should be thicker than the inner shell, in particular at least by the factor 1.3. This will save weight and material. In addition, it is avoided that in the overlap region of the shells the outer housing is distinctly less elastic than in the remaining, non-overlapping region.

[0019] In experiments, it was found out that the outer shell can have a thickness of not more than 1.0 mm, in particular not more than 0.8 mm and/or the inner shell can have a thickness of not more than 0.4 mm. These thicknesses are substantially smaller than in the prior art, in which for example in wound housings wall thicknesses of 1.2 to 1.5 mm are employed.

[0020] The preferred embodiment even provides that the outer shell has a thickness of not more than 0.4 mm, in particular 0.3 mm, and the inner shell merely has a thickness of not more than 0.2 mm. The small thickness especially of the inner shell not only has weight advantages, but also ensures that in the region of the longitudinal edges of the inner shell there is only a small jump in thickness of the outer housing. The end faces defining the longitudinal edges thus hardly protrude to the inside as interfering contour or interfering edge for the adjoining part, for example for the mounting mat, so that when closing the outer housing hardly any shear forces are exerted on the adjoining part. Due to the small thickness, the longitudinal edges hardly can get caught at the mounting mat, but slide along the same.

[0021] The small thickness of the inner and the outer shell also leads to the fact that the stress distribution in the outer housing is very uniform, as the same is more flexible than in the prior art and optimally adapts to the tolerance-related different geometries of the internal parts, for example the inserts. This also means that the clamping force is very uniformly distributed to the internal part.

[0022] The small thickness of the outer housing also leads to the fact that the so-called canning process during manufacture of the outer housing is effected more quickly and that no large springback forces are produced, which are to be controlled in the prior art. These springback forces lead to the fact that after opening the tool which exerts a pressing force onto the outer housing during its closing operation the outer housing springs back, assumes another geometry and the clamping forces in the portion springing back more are reduced more.

[0023] A further embodiment of the invention provides that the outer shell is made of another material than the inner shell. Costs can be saved here in addition, in that for example the inner shell is made of a lower-quality material than the outer shell.

[0024] In one example, the outer shell should form at least 90% of the outer circumference of the housing.

[0025] The stability of the outer housing in the region of the longitudinal edges can be increased and the manufacture can be simplified when at least one of the longitudinal edges of the outer shell has at least one protrusion in a circumferential direction, which engages in a recess at the opposed protrusion. Protrusion and recess in particular can be designed complementarily. Via the protrusion and the recess, the longitudinal edges are positively interlocked in axial direction, which reduces the load acting on the material-to-material connection. The preferred embodiment provides that both longitudinal edges can be designed crenellated, so that the pinnacles of the one longitudinal edge engage in complementary recesses between pinnacles of the other longitudinal edge. In particular, however, to maintain the circumferential gap, the tip of the pinnacles should not contact the "bottoms" of the adjacent recesses. A contact in an axial direction, however, can exist at the lateral surfaces of the adjacent pinnacles and recesses.

[0026] The longitudinal edges of the outer shell should be soldered to each other and/or to the inner shell, wherein preferably the outer shell additionally is spot-welded to the inner shell in the region of the longitudinal edges. The inner shell can form a bridge between the longitudinal edges, which is why the longitudinal edges of the outer shell each are soldered to the inner shell. When the gap between the longitudinal edges is very small, this gap also can completely be closed with solder, so that this solder also connects the longitudinal edges of the outer shell with each other. It would be possible that the gap is completely filled with solder.

[0027] Preferably, solder also is provided between the inside of the outer shell in the region of its longitudinal edges and the outside of the inner shell in this region, so that a larger-surface soldered region is obtained. When the inner shell overlaps the outer shell very much, it would be conceivable to provide solder only on the inside near the longitudinal edges of the outer shell, so that not the entire overlap region of the shells is connected with solder.

[0028] The device according to the invention contains an insert for cleaning the exhaust gas (catalyst or particle filter), forms a muffler, and/or contains TEG modules. The device is a prefabricated container which in its interior includes internals by which either the exhaust gas is treated or by which energy from the exhaust gas is converted (acoustic or thermal energy).

[0029] Another embodiment of the invention provides no prefabrication of the device and neither any containers containing internals. The device rather is a pipe socket connec-

tion for two adjacent pipe sockets. The outer and the inner shell surround the two adjacent pipe sockets and couple them in flow connection with each other. The shells preferably are attached by a material-to-material connection to the pipe sockets. Since the pipe sockets do not always have exact outside dimensions and geometries, an optimum, gap-free adaptation to the sockets always can be achieved by the two compressible shells.

[0030] The device according to the invention can however also be an exhaust pipe of an internal combustion engine composed of two shells. Here, it is advantageous when at least the inner shell extends closed in cross-section, i.e. no gap exists between the longitudinal edges of the inner shell, or when this gap is completely closed by solder. It is furthermore advantageous when the shells are made of a different material, so that different corrosion resistances are satisfied. The exhaust pipe thus generally is lighter in weight, as its wall thickness can be smaller than in previous exhaust pipes.

[0031] Preferably, the outer shell substantially completely covers the inner shell in an axial direction. Even with a small thickness of the individual shells, this also provides a device with a comparatively great stability largely homogeneous in an axial direction.

[0032] The inventive method for manufacturing an exhaust gas conducting device, in particular an aforementioned exhaust gas device according to the invention, provides the following steps:

[0033] a) positioning an outer shell and an inner shell relative to each other such that the outer shell extends around the inner shell in a C-shaped manner and the inner shell extends on the inside from one longitudinal edge to the opposed longitudinal edge of the outer shell, and

[0034] b) material-to-material connecting the outer and the inner shell with each other in the region of the longitudinal edges of the outer shell.

[0035] As explained already, the two shells should extend without step in a steadily curved manner, as seen with respect to the cross-section. The outer and the inner shell are not wound, i.e. they extend about less than 360° as seen in cross-section.

[0036] The outer and the inner shell are soldered to each other, in particular in a so-called continuous process, in that they are moved through a continuous furnace in which the solder is liquefied.

[0037] In this case, the outer and the inner shell can be moved in an axial direction first through a first tunnel component, then through the continuous furnace and finally through a second tunnel component. By using the tunnel components the shells can be calibrated in a simple way and at the same time be transported towards the continuous furnace and away from the continuous furnace.

[0038] Preferably, a stabilizing mandrel is provided in addition, which with a tunnel opening of the second tunnel component defines an annular space through which the shells are moved.

[0039] A very effective manufacturing method provides that on the inside of the outer shell in the region of the longitudinal edges and/or on the outside of the inner shell a solder is applied (for example by screen printing), which is cured before the shells are positioned to each other. In the above step b) at least one of the shells then is heated, so that the solder becomes liquid and the shells are soldered to each other.

[0040] As an alternative to imprinting solder, one or more solder foils can also be attached on one or both of the opposed sides of the shells, e.g. by spot welding. The foils then will melt under the influence of heat.

[0041] For reinforcement, the shells can be soldered to each other over the full surface or distributed over their contact surfaces. On one or both of the shells solder is imprinted, e.g. over the full surface or in patterns such as strips, grids, points etc. After heating, a full-surface or sectionwise solder connection is obtained. Even if solder is imprinted in patterns, the same can become a full-surface connection after heating.

[0042] The full-surface or sectionwise solder connection in particular is effected in the region of points to which parts are attached from outside, in order to reinforce the wall in this region.

[0043] Since the tools for closing the shells, which exert a pressure on the shells from outside, mostly are very expensive, so that their cycle time should be as short as possible, the shells can be spot-welded to each other before soldering. Hence, the shells are positioned to each other and can be transported into another tool or another station.

[0044] The cycle times of the so-called canning process for closing the outer housing are reduced from more than 30 sec. to less than 7 sec.

[0045] The shells can be pre-curved, when they are positioned in a tool which includes inwardly movable jaws. When these jaws are moved inwards, at least the outer shell is curved further, so that its longitudinal edges move towards each other. In the tool, at least a preliminary fixation of the shells at each other should then be effected, for example by spot welding.

[0046] In the preferred embodiment, the jaws are moved inwards by a determined, individual path of adjustment from a parameter determined individually for the device to be manufactured. This means that each device has an individually manufactured outer housing, adjusted to parameters of the internal parts, for example to the cross-sectional geometry of the insert or the clamping force applied on closing of the jaws or the area weight of the mounting mat.

BRIEF DESCRIPTION OF THE DRAWINGS

[0047] Further features and advantages of the invention can be taken from the following description and from the following drawings, to which reference is made. In the drawings:

[0048] FIG. 1 shows a longitudinal sectional view through an embodiment of the device according to the invention,

[0049] FIG. 2 shows a cross-sectional view through a first embodiment of the device according to the invention,

[0050] FIG. 3 shows a cross-sectional view through a second embodiment of the device according to the invention,

[0051] FIG. 4 shows a radial view of the devices of FIGS. 2 and 3 in the region of the longitudinal edges,

[0052] FIG. 5 shows a perspective cross-sectional view through a tool for manufacturing the device according to the invention,

[0053] FIG. 6 shows successive method steps for explaining the method according to the invention,

[0054] FIG. 7 shows a longitudinal sectional view through a device according to the invention, which is designed as pipe socket connection,

[0055] FIG. 8 shows a perspective view of the device of FIG. 7,

[0056] FIG. 9 shows an end-face view of a device according to the invention, which is formed as exhaust pipe,

[0057] FIG. 10 shows an end-face view of a device according to the invention, which is formed as exhaust pipe, according to an alternative design variant, and

[0058] FIG. 11 shows a schematic diagram which illustrates a method according to the invention for manufacturing devices as shown in FIGS. 9 and 10.

DETAILED DESCRIPTION

[0059] FIG. 1 shows an exhaust-gas-ducting device 10 accommodated in a motor vehicle. The device 10 can be an exhaust gas cleaning device, i.e. an exhaust gas catalyst, a particle filter, or a combination of both, or a muffler, or a power-generating device with so-called TEG modules, which are shown by way of example, and are provided with the reference numeral 12.

[0060] Reference numeral 14 defines an elongated, cylindrical substrate which, for example, is made of ceramics or of a kind of wound corrugated board, or another catalytic carrier, or filter material with or without coating. The substrate 14 is surrounded by a mounting mat 16, which forms an elastic compensating element between the substrate 14 and an outer housing 18 made of sheet metal.

[0061] The mounting mat 16 also is present when other internal parts, such as TEG modules 12, are to be clamped onto a carrier, or when sound-absorbing internals are surrounded by the outer housing 18 and clamped therein.

[0062] Upstream and downstream, an inflow funnel 20 and an outflow funnel 22 are respectively connected with the outer housing 18.

[0063] The device is a prefabricated container with internals, with an inlet and an outlet which are formed by the inlet of the inflow funnel 20 and the outlet of the outflow funnel 22, and an interposed portion expanded in cross-section towards the inlet and outlet, in order to form a cavity for receiving the internals.

[0064] The outer housing 18 is thin-walled and will be explained in detail below.

[0065] FIG. 2 shows the construction of the device according to the invention in a cross-section. The outer housing 18 comprises two separate shells, namely an outer shell 24 and an inner shell 26. The outer shell 24 has a substantially C-shaped cross-section and encloses the substrate 14. This means that the outer shell extends around more than 180°, preferably around more than 270° C., in cross-section. In the illustrated embodiment, the inner shell 26 likewise is C-shaped in cross-section.

[0066] The shells 24 and 26 have respective longitudinal edges 28, 30 which are each spaced from each other, so that a gap 32, 34 is obtained between the longitudinal edges 28, 30. This means that the outer shell 24 overlaps in the region of its longitudinal edges 28 just as little as the inner shell in the region of its longitudinal edges 30.

[0067] The outer shell 24 forms the essential part of the outside of the outer housing in circumferential direction, in particular it forms at least 90% of the outer circumference of the outer housing 18. The inside portion of the inner shell 26, which is covered by the outer shell 24, forms no portion at all of the outer circumference of the outer housing 18, but only the portion which closes the gap 32.

[0068] The gap 32 between the longitudinal edges 28 is closed by the inner shell 26 radially to the inside. The alignment of the outer and the inner shell 24, 26 is made such that the gaps 32, 34 are located opposite to each other, in particular diametrically opposite to each other.

[0069] The outer shell 24, just like the inner shell 26, is made of a uniformly thin sheet.

[0070] Since the outer shell 24 forms the essential part of the outer housing 18, also with respect to the stability of the outer housing 18, the inner shell 26 can be made thinner than the outer shell 24.

[0071] The outer shell 24 in particular should be thicker than the inner shell 26 by the factor 1.3.

[0072] In the preferred embodiment it was found that the outer shell can have a thickness of not more than 1.0 mm, but in particular not more than 0.8 mm, preferably in particular not more than 0.4 mm, whereas the inner shell 26 has a thickness of not more than 0.4 mm, in particular not more than about 0.2 mm.

[0073] In the embodiments shown, the outer shell 24 has a thickness of even only about 0.3 mm and the inner shell 26 of 0.2 mm, so that in the overlap region of the shells 24, 26 a total thickness of the outer housing 18 of 0.5 mm is obtained.

[0074] The outer and the inner shell 24, 26 fully rest against each other in the overlap region, which is facilitated in particular by the fact that the outer shell 24 has a small thickness and, on bending, can adapt to the contour of the internal parts. Due to its even smaller thickness, the inner shell 26 in turn is highly flexible and perfectly adapts to the contour of the internal, adjoining parts, here of the substrate 14 and the mounting mat 16 lying above the same.

[0075] Alternatively or in addition, the outer shell 24 can be made of a material other than the inner shell 26, in particular of a higher-quality, for example more corrosion-resistant material.

[0076] The two shells 24, 26 are connected with each other in the region of the longitudinal edges 28 by a material-to-material connection.

[0077] According to the preferred embodiment, the shells 24, 26 are soldered to each other in the region of the inside of the outer shell 24 close to the longitudinal edges 28. According to the preferred embodiment, the solder extends for a maximum of 10 to 20 mm from the respective longitudinal edge 28 along the circumference in the respective overlap region.

[0078] Solder 36 also should fill the gap 32, preferably fill it completely, so that there is no groove in which moisture might accumulate. Solder 36 at least should completely cover the end faces in the region of the longitudinal edges 28, just like the outside of the inner shell 26 in the region of the gap 32, so that there is no attack surface for corrosion and no gaps are present between outer and inner shell 24, 26.

[0079] In addition to the solder connection, the shells 24, 26 are spot-welded at some points located one behind the other in axial direction close to the longitudinal edges 28. The welding points are provided with the reference numeral 38. Such spot welding merely serves for pre-fixation of the shells 24, 26, before the same are soldered to each other over their entire longitudinal extension in the region of the gap 32. Alternatively, the gap 32 might be zero, e.g. when the tolerances during manufacture correspondingly are chosen such that an upper limit of the circumferential length of the outer shell is defined by an abutment of its longitudinal edges against each other. It would also be conceivable that the longitudinal edges 28 of the outer shell 24 overlap each other.

[0080] For reinforcement, the shells 24, 26 can be soldered to each other over the full surface or distributed over their contact surfaces. On one or both of the shells 24, 26 solder is imprinted, e.g. over the full surface or in patterns such as

strips, grids, points etc. After heating, a full-surface or sectionwise solder connection is obtained.

[0081] The full-surface or sectionwise solder connection in particular is effected in the region of points to which parts are attached from outside, in order to reinforce the wall in this region. In FIG. 2, a fixing part 100 is soldered to the outer shell 24. At least over a large surface in the region around these soldering points, the shells 24, 26 are soldered to each other, in order to reinforce the wall where the forces acting due to the fixing part 100 are absorbed.

[0082] For example, when an opening in the wall becomes necessary (e.g. for a sensor), holes located one above the other are provided in both shells 24, 26. At the hole edge, the shells 24, 26 are soldered to each other, in order to increase the rigidity and possibly also achieve a gas tightness.

[0083] The embodiment of FIG. 2 shows a circular cylindrical device. The invention, however, is not only limited to such a device, but also relates to other, substantially round geometries of outer housings 18 or also to substantially angular geometries provided with rounded edges.

[0084] FIG. 3 shows a device with an internal component, for example a muffler internal part, a substrate 14 or other structures, for example with TEG modules 12. Optionally, depending on the internal part, a mounting mat 16 here is also wound around the internal part. The outer housing 18 again comprises only two shells, namely the outer shell 24 and the separate inner shell 26. Here as well, the outer shell 24 almost completely extends around the internal parts in a C-shaped manner.

[0085] As an alternative to the embodiment of FIG. 2, the inner shell 26 however does not extend along the inside of the outer shell 24 in a C-shaped manner, but extends in a V- or U-shaped manner only over a relatively limited angular range in the region of the gap 32, in order to close the outer housing 18 in the gap region. It should be emphasized, however, that in this embodiment, too, a similar design of the inner shell 26 as in FIG. 2 can of course be provided, namely that the inner shell 26 extends around almost all of the internal parts in a C-shaped manner. The advantage of the embodiment of FIG. 3 is that the material expenditure for the inner shell 26 is smaller than in the preceding embodiment. On the other hand, the wall thickness of the outer housing 18 is more uniform due to the overlap of the shells 24, 26 extending over almost 360°, as shown in FIG. 2.

[0086] With respect to thicknesses, materials and extensions of the outer and inner shells 24, 26, the explanations for FIG. 2 also apply for FIG. 3. This also concerns the connection of the two shells 24, 26 made of sheet metal by cohesion. The gap 32 here is also at least lined, preferably filled, with solder 36.

[0087] The longitudinal edges 28 can extend linearly or be interlocked with each other, as shown in FIG. 4. FIG. 4 shows a crenellated formation of the longitudinal edges 28, with protrusions 40 extending in circumferential direction, which engage in recesses 42 between the protrusions 40 of the opposed longitudinal edge 28. Due to this construction, which in circumferential direction still provides for gaps 32, the stability of the outer housing 18 is increased in the seam region and the manufacture is facilitated.

[0088] FIG. 5 shows the tool with which the device according to the invention is manufactured. The tool has a plurality of circular-segment-shaped jaws 44 which can be moved to

the inside. The insides 46 of the jaws 44 are adapted to the future shape of the outer housing 18 in the corresponding region.

[0089] The jaws 44 can be moved to the inside differently far (see arrows), so that depending on individual parameters for the device to be manufactured, for example on the clamping force which is exerted on the internal parts, or the geometry of the substrate 14 or the area weight of the installed mounting mat 16, the jaws 44 individually are moved more or less far to the inside. This means that the adjustment path for the jaws 44 preferably is individualized for each device.

[0090] Examples for such custom-made manufacture are explained in WO 2007/115667 A1, to which reference is made in this respect. Alternatively, the tool also can be formed as described in DE 10 2006 049 238 A1.

[0091] In the following, the manufacturing method for the device according to the invention will be described with reference to FIG. 6.

[0092] The two separate shells 24, 26 first are pre-formed transversely to their longitudinal direction, i.e. they do not yet have their final shape as seen in cross-section, but are curved (FIG. 6a).

[0093] Into the tool (FIG. 6b) the outer and the inner shell 24, 26 are pushed and into the same the internal parts. The inner shell 26 likewise is positioned such that its longitudinal edges 30 lie on the inside of the outer shell 24. In the region of the longitudinal edges 28 solder 36, in particular hard solder, is applied onto the inside of the outer shell 24 and/or onto the outside of the inner shell 26, and cured, for example by printing (FIG. 6a).

[0094] The jaws 44 then are moved inwards, so that the outer shell 24 is narrowed and the longitudinal edges 28 move towards each other. The inner shell 26 also is deformed in the process (FIGS. 6b and 6c).

[0095] As soon as the final position (FIG. 6c) is reached, the shells 24, 26 are spot-welded in the overlap region close to the gap 32. For this purpose, adjacent jaws 44 can have corresponding recesses 48 for inserting a welding electrode 50 (FIG. 6c).

[0096] Subsequently, the prefabricated device is moved from the tool through a continuous furnace 52 (FIG. 6e), where it is heated, until the solder 36 melts. In addition, solder also can be added from outside in the region of the gap 32 (FIG. 6d). The two shells 24, 26 hence are connected by a material-to-material connection. A heat source 54 in the continuous furnace 52 also is shown in FIGS. 6d and 6e.

[0097] In the embodiments shown so far, the outer and the inner shell 24, 26 are positioned around the internals and subsequently connected with each other.

[0098] In the embodiment of FIGS. 7 and 8, the device is a pipe socket connection of two exhaust pipes spaced from each other, which end in pipe sockets 60, 62. In the interior of the device no internals are provided, and there is no large jump in cross-section either.

[0099] The outer and the inner shell 24, 26 can be formed such as described in the previous embodiments.

[0100] In the embodiment shown, both shells 24, 26 are C-shaped in cross-section, wherein the slots of the two "C" are located diametrically opposite to each other. The shells 24, 26 are put onto the sockets 60, 62 from outside and pressed radially to the inside, so that they rest against the outer surface of the sockets 60, 62, surround the pipe sockets 60, 62

and couple them in flow connection with each other. The force directed radially to the inside can be applied corresponding to FIG. 5.

[0101] Furthermore, the opposed longitudinal edges of the shells 24 and/or 26 also can have interlocking protrusions, as explained above.

[0102] The shells 24, 26 then are connected by a material-to-material connection with each other at the gap of the outer shell 24. Furthermore, the shells 24, 26 also can be connected with one or both sockets 60, 62 by a material-to-material connection, e.g. by soldering or welding.

[0103] To prevent any leakage of exhaust gas, circumferential soldered or welded joints between the shells 24, 26 and the sockets 60, 62 possibly can also be provided.

[0104] Soldering the shells 24, 26, for example, can be effected in that on the inside of the outer shell 24 and/or on the outside of the inner shell 26, a solder foil each is attached by spot welding. The foils melt under the influence of heat and connect the shells 24, 26.

[0105] The embodiment of FIG. 9 shows an exhaust pipe of an internal combustion engine, which is composed of two separate shells 24, 26. According to the preferred embodiment, no gap is provided between the longitudinal edges 30 of the inner shell 26 or only such a small gap that it is closed completely by the solder 36 or the welded seam. Alternatively or in addition, no gap is present either between the longitudinal edges 28 of the outer shell 24.

[0106] Both shells 24, 26 should have no overlapping edges in themselves. In this embodiment, too, it is advantageous to fix attachment parts similar to the attachment part 100 described in connection with FIG. 1.

[0107] The preferred attachment of the shells 24, 26 to each other is soldering, in particular full-surface soldering. What has been said on the remaining embodiments also applies here, and reference is made thereto, in order to avoid repetitions.

[0108] For all embodiments it applies that the solder 36 can be applied in various ways: in liquid form, by imprinting, by attaching solder foils, etc.

[0109] In all embodiments shown, the outer shell 24 forms a larger portion of the outer circumference than the inner shell 26. Alternatively, the outer shell 24 might however also form an equally large portion of the outer circumference as the inner shell 26.

[0110] Analogous to FIG. 9, FIG. 10 shows a device 10 formed as exhaust pipe, however according to an alternative design variant. In this case, an air gap 64 is provided between the two separate shells 24, 26, which can have a positive effect in terms of heat insulation and noise protection. A desired radial dimension of the air gap 64 (gap thickness) can be adjusted via a radial dimension of the solder 36 and/or other spacers which can be integrally molded or attached to the shells 24, 26.

[0111] According to FIG. 10, the shells 24, 26 are not fully connected by solder 36, but merely by solder strips 66 spaced in circumferential direction. Both in the region of the longitudinal edges 28 of the outer shell 24 and in the region of the longitudinal edges 30 of the inner shell 26 a solder strip 66 each is provided, in order to close an existing gap between the longitudinal edges 28, 30, in particular close the same in a gastight manner.

[0112] Outside the gap regions of the outer and inner shells 24, 26, further solder strips 66 can be present, in order to increase the rigidity of the two-shell exhaust pipe. In FIG. 10,

for example, two further solder strips 66 are provided, which in circumferential direction fully adjoin both the inner shell 26 and the outer shell 24 and substantially serve the pipe reinforcement.

[0113] One possibility for manufacturing devices 10 according to FIGS. 9 and 10 is shown in FIG. 11. The two separate, curved shells 24, 26 initially are prefabricated and preferably cut to a specified axial length.

[0114] Thereafter, the solder 36, as described above, is partly or fully applied onto at least one of the shells 24, 26 and fixed.

[0115] Subsequently, the shells 24, 26 are positioned relative to each other in the desired way and jointly pushed into a tunnel opening 68 of a first tunnel component 70, for example, made of ceramics.

[0116] To facilitate the insertion of the shells 24, 26, the tunnel opening 68 can be formed first funnel-shaped or conical and then substantially cylindrical in axial insertion direction 71 (cf. FIG. 11). The geometry of the tunnel opening 68, in particular of the cylindrical portion of the tunnel opening 68, preferably is chosen such that the shells 24, 26 are calibrated to a desired cross-section.

[0117] The first tunnel component 70 axially is adjoined by a continuous furnace 72, which heats the solder 36 applied onto the shells 24, 26 to such an extent that it melts.

[0118] The continuous furnace 72 axially is adjoined by a second tunnel component 74, whose tunnel opening 76 likewise can be designed first funnel-shaped or conical and then substantially cylindrical in insertion direction 71 (cf. FIG. 11), in order to facilitate the insertion of the shells 24, 26. In particular, the two tunnel components 70, 74 can be formed identical.

[0119] In the second tunnel component 74, the device formed as exhaust pipe cools down, wherein the shells 24, 26 now are soldered to each other.

[0120] Optionally, the shells 24, 26 can be spot-welded to each other before soldering, in order to fix the desired position relative to each other.

[0121] The solder strips, for example, can be produced in that a strip of solder material is adhered onto one of the shells 24, 26 in the cold condition and later on melts in the continuous furnace.

[0122] To ensure the dimensional stability of the exhaust pipe heated in the continuous furnace 72, a stabilizing mandrel 78 is provided apart from the second tunnel component 74, which extends through the tunnel opening 76 of the second tunnel component 74 and protrudes into the continuous furnace 72. Particularly preferably, the stabilizing mandrel 78 extends in axial direction through the entire continuous furnace 72. Along with the tunnel opening 76 of the second tunnel component 74, the stabilizing mandrel 78 defines an annular space 80 through which the shells 24, 26 are moved.

[0123] The cross-sections of the tunnel opening 76 of the second tunnel component 74 and of the stabilizing mandrel 78 preferably correspond to the desired external or internal cross-section of the exhaust pipe. For circular pipe cross-sections according to FIG. 11, the diameter of the stabilizing mandrel 78 corresponds to the diameter of the tunnel opening 76 minus twice the outer shell thickness, twice the inner shell thickness, and twice the gap thickness of the air gap 64.

[0124] Instead of cutting the shells 24, 26 to a specified axial length at the beginning of the pipe manufacture, an

“endless manufacture” also is conceivable, in which the exhaust pipe is cut to a desired length only after soldering the shells 24, 26.

[0125] The invention also extends to a continuous furnace unit for manufacturing exhaust pipes, with a first tunnel component narrowing in a funnel-shaped manner for introducing shells, a continuous furnace which adjoins the first tunnel component, and a second tunnel component adjoining the continuous furnace, which is flared in a funnel-shaped manner towards its outlet.

[0126] Although an embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this disclosure. For that reason, the following claims should be studied to determine the true scope and content of this disclosure.

1. An exhaust-gas conducting device of a vehicle comprising:

a cylindrical outer housing which is comprised of an outer shell and an inner shell arranged in an interior of the outer shell, wherein the outer shell forms a larger portion of an outer circumference of the outer housing than the inner shell or an equally large portion of the outer circumference as the inner shell, a radial outside of the inner shell is attached to the outer shell, and the outer shell is C-shaped in cross-section or annularly closed.

2. The device according to claim 1, wherein longitudinal edges of the outer shell extend with each other without overlapping.

3. The device according to claim 1, wherein longitudinal edges of the outer shell are spaced from each other in circumferential direction and a resulting gap between the longitudinal edges is closed by the inner shell radially to the inside.

4. The device according to claim 1, wherein as seen in cross-section the inner shell has a smaller circumferential length than the outer shell.

5. The device according to claim 1, wherein the inner shell is C-shaped in cross-section and/or that a gap between longitudinal edges of the inner shell is aligned opposite to the longitudinal edges of the inner shell, in a circular cylindrical outer housing diametrically opposite to longitudinal edges of the outer shell.

6. The device according to claim 1, wherein the outer shell is thicker than the inner shell.

7. The device according to claim 6, wherein the outer shell has a thickness of not more than 0.8 mm and/or the inner shell has a thickness of not more than 0.4 mm.

8. The device according to claim 1, wherein the outer shell is made of a material other than the inner shell.

9. The device according to claim 1, wherein the outer shell forms at least 90% of the outer circumference of an outer housing in a circumferential direction.

10. The device according to claim 1, wherein at least one longitudinal edge of the outer shell has at least one protrusion in a circumferential direction, which engages into a recess on an opposed longitudinal edge.

11. The device according to any of the preceding claims, wherein longitudinal edges of the outer shell are soldered to each other and/or to the inner shell, and wherein the longitudinal edges are additionally spot-welded to the inner shell.

12. The device according to claim 11, wherein the longitudinal edges of the outer shell are spaced from each other by forming a gap and the gap is filled with solder.

13. The device according to claim 1, wherein curvatures of the inner and outer shells are adapted to each other such that an inside of the outer shell rests against an outside of the inner shell along a complete surface area of the inside of the outer shell.

14. The device according to claim 1, wherein the exhaust conducting device is a prefabricated container with an inlet and an outlet.

15. The device according to claim 1, wherein the exhaust conducting device is a pipe socket connection and the outer and the inner shells surround two adjacent pipe sockets and couples the pipe sockets in flow connection with each other or the exhaust conducting device is an exhaust pipe of an internal combustion engine that includes the outer and the inner shells.

16. The device according to claim 1, wherein the outer shell completely covers the inner shell in an axial direction.

17. A method for manufacturing an exhaust-gas conducting device of a vehicle comprising the following steps:

a) positioning an outer shell and an inner shell relative to each other such that the outer shell extends around the inner shell in a C-shaped manner and the inner shell extends on an inside of the outer shell from one longitudinal edge to an opposed longitudinal edge of the outer shell, and

b) connecting the outer and the inner shell with each other in a region of the longitudinal edges of the outer shell.

18. The method according to claim 17, wherein the outer and the inner shell are soldered to each other.

19. The method according to claim 18, wherein on the inside of the outer shell in the region of the longitudinal edges, and/or on an outside of the inner shell, a solder is applied and cured before the inner and outer shells are positioned relative to each other, and that in step b) the material-to-material comprises solder that becomes liquid by heating at least one of the inner and outer shells, in order to solder the inner and outer shells to each other.

20. The method according to claim 17, wherein the inner and outer shells are spot-welded to each other before soldering.

21. The method according to claim 17, wherein that, wherein the inner and outer shells are pre-curved and positioned in a tool which includes inwardly movable jaws, and wherein the tool moves the jaws inwards against the outer shell, and at least further curves the outer shell, so that longitudinal edges of the outer shell are moved towards each other.

22. The method according to claim 21, wherein the jaws are moved inwards by an individual adjustment path depending on a parameter determined individually for the exhaust conducting device to be manufactured.

23. The method according to claim 21, wherein the outer and the inner shell are spot-welded to each other after moving the jaws inwards.

24. The method according to claim 18, wherein the outer and the inner shell are moved in axial direction first through a first tunnel component, then through a continuous furnace, and finally through a second tunnel component.

25. The method according to claim 24, wherein a stabilizing mandrel is provided, which with a tunnel opening of the second tunnel component defines an annular space through which the inner and outer shells are moved.

26. The method according to claim 17, wherein the exhaust conducting device is a container with internals, with an inlet

and an outlet, and an interposed portion expanded in cross-section towards the inlet and outlet, and wherein the outer and the inner shell are positioned around the internals and subsequently are connected with each other.

27. The method according to claim 17, wherein the exhaust conducting device is a pipe socket connection which is positioned on an inlet-side and an outlet-side cylindrical pipe socket and subsequently connected with each other.

28. The method according to claim 17, wherein the exhaust conducting device is an exhaust pipe of an internal combustion engine, the exhaust pipe comprising the outer and inner shell, which first are positioned relative to each other and subsequently are connected with each other.

29. The device according to claim 1, wherein the cylindrical outer housing is formed only with the outer shell and the inner shell.

30. The device according to claim 1, wherein the radial outside of the inner shell is attached to the outer shell by a material-to-material connection.

31. The device according to claim 1, wherein the outer shell is thicker than the inner shell at least by a factor of 1.3.

32. The device according to claim 14, wherein the prefabricated container contains an insert for cleaning the exhaust gas, forms a muffler, and/or contains TEG modules.

33. The device according to claim 1, wherein as seen in cross-section the inner shell has a smaller circumferential length than the outer shell by at least a factor of 0.6.

34. The device according to claim 11, wherein the longitudinal edges are additionally spot-welded to the inner shell.

35. The method according to claim 17, wherein the outer and the inner shell are soldered to each other in a continuous process.

36. The method according to claim 17, wherein step (b) further comprises material-to-material connecting the outer and the inner shell with each other in a region of the longitudinal edges of the outer shell.

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