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[Continued on next page]

(54) Title: EXHAUST TREATMENT DEVICE WITH INTEGRAL MOUNT

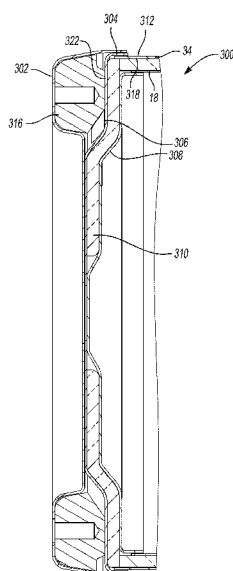


Fig-9

(57) Abstract: An exhaust treatment device includes an inlet tube having an end in communication with a cavity within a housing. An exhaust treatment component for treating engine exhaust is positioned within the housing. A metal mounting member includes a mounting provision. A retaining plate is engaged with the metal mounting member and fixed to the housing to retain the mounting member between the housing and the retaining plate.



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EXHAUST TREATMENT DEVICE WITH INTEGRAL MOUNT

FIELD

5 **[0001]** The present disclosure relates to an exhaust treatment device for reducing undesirable emissions from an internal combustion engine and, in particular, to a robust, integrated mounting system for supporting the exhaust treatment device on a vehicle.

BACKGROUND

10 **[0002]** This section provides background information related to the present disclosure which is not necessarily prior art.

[0003] Exhaust gas treatment devices such as catalytic converters, diesel oxidation catalysts, diesel particulate filters, and the like, may be employed in various applications to treat exhaust gasses emitted from internal
15 combustion engines. Many of the exhaust gas treatment devices include relatively heavy components such as a ceramic substrate or a catalyst bed for treating the exhaust. The system for coupling the exhaust treatment device to the vehicle must withstand a wide range of external inputs such as when a vehicle wheel enters and exits a pothole in the road.

20 **[0004]** Typical exhaust treatment devices are fixed to the vehicle underbody or frame with a number of welded brackets or straps. While these arrangements may have sufficiently supported the exhaust treatment device in the past, the cost and complexity of individually welding support brackets to the exhaust treatment device is undesirable. Depending on the number of brackets
25 used and their location, stress concentrations may be introduced that may negatively affect the useful life of the exhaust treatment device. In addition, the use of clamps may introduce additional challenges in mounting to assure the proper orientation of the exhaust treatment device and the clamp in order to clear other vehicular components.

30 **[0005]** One known exhaust treatment device includes an inlet end formed as a casting that is subsequently coupled to a sheet metal housing. The casting includes a mounting provision for the exhaust treatment device.

Unfortunately, as the entire inlet assembly is formed from a cast component, heat is transferred readily from the interior of the exhaust treatment device to an exterior surface of the cast inlet assembly. Most end users and Original Equipment Manufacturers prefer an insulated arrangement where the external temperature of the treatment device remains below a predetermined maximum temperature. Furthermore, the casting is relatively large, heavy and costly. Accordingly, it may be beneficial to provide an improved exhaust treatment device including a cost effective integral mounting system having sufficient thermal shielding.

SUMMARY

[0006] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0007] An exhaust treatment device includes an inlet tube having an end in communication with a cavity within a housing. An exhaust treatment component for treating engine exhaust is positioned within the housing. A metal mounting member includes a mounting provision. A retaining plate is engaged with the metal mounting member and fixed to the housing to retain the mounting member between the housing and the retaining plate.

[0008] An exhaust treatment device includes an insulation material positioned between an inner shell and an outer shell. An inlet tube has an end in communication with a cavity defined by the inner shell. A substrate for treating engine exhaust is positioned within the inner shell. A metal mounting ring is positioned between the inner and outer shells and includes a mounting provision for receipt of a fastener.

[0009] An exhaust treatment device includes an inner shell, an outer shell and an insulation material positioned therebetween. An inlet tube includes an end in communication with a cavity defined by the inner shell. A substrate for treating engine exhaust is positioned within the inner shell. A metal mounting member includes a mounting provision. A cover plate engages the mounting member and is fixed to the outer shell to retain the mounting member between the outer shell and the cover plate.

[0010] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

5

DRAWINGS

[0011] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0012] Figure 1 is a perspective view of an exemplary exhaust
10 treatment device with an integral mount;

[0013] Figure 2 is a cross-sectional view taken through the exhaust treatment device depicted in Figure 1;

[0014] Figure 3 is a perspective view of a cast mounting ring;

[0015] Figure 4 is a cross-sectional view taken through the cast
15 mounting ring depicted in Figure 3;

[0016] Figure 5 is a perspective view of an alternate exhaust treatment device;

[0017] Figure 6 is a cross-sectional view taken through the exhaust treatment device depicted in Figure 5;

[0018] Figure 7 is a cross-sectional view of an alternate exhaust
20 treatment device;

[0019] Figure 8 is a partial end view of another alternate exhaust treatment device;

[0020] Figure 9 is a fragmentary cross-sectional of another exhaust
25 treatment device;

[0021] Figure 10 is a fragmentary cross-sectional of another exhaust treatment device;

[0022] Figure 11 is a fragmentary cross-sectional of another exhaust treatment device; and

[0023] Figure 12 is a fragmentary cross-sectional of the exhaust
30 treatment device depicted in Figure 11.

[0024] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0025] Example embodiments will now be described more fully with
5 reference to the accompanying drawings.

[0026] Figures 1-4 depict an exemplary exhaust treatment device identified at reference numeral 10. Exhaust treatment device 10 includes a first substrate 12 positioned upstream of a second substrate 14 within a housing 15. First substrate 12 may be a diesel oxidation catalyst or a selective catalytic
10 reduction device, while second substrate 14 may be a diesel particulate filter or a slip catalyst. Other exhaust treatment elements may be used in lieu of first substrate 12 and second substrate 14. Furthermore, the present disclosure relates to an exhaust treatment device that includes one or more substrates within housing 15. The two substrate arrangements depicted in the Figures is
15 merely for illustration purposes.

[0027] Housing 15 includes an inner shell 16 and an outer shell 17 surrounding inner shell 16. Inner shell 16 includes several metal stampings coupled to one another. For example, inner shell 16 includes an inner tube 18 in receipt of first substrate 12 and second substrate 14. The substrates 12, 14 are
20 retained within inner tube 18 using a stuffing or sizing process for compressing a first mat 28 between first substrate 12 and inner tube 18, as well as compressing a second mat 30 between second substrate 14 and inner tube 18. Outer shell 17 also includes several interconnected stampings such as an outer tube 34 circumscribing inner tube 18. An insulation material 36 surrounds inner tube 18
25 and is positioned between outer tube 34 and inner tube 18.

[0028] An inlet assembly 37 is fixed to outer tube 34 and inner tube 18. Inlet assembly 37 includes a ring cover plate 38 having a flange 40 fixed to a first end cap 44. An inner inlet 41 includes a lip 43 fixed to inner tube 18. Inner inlet 41 forms a portion of inner shell 16 while end cap 44 forms a portion of outer
30 shell 17.

[0029] A mounting ring 54 is positioned between first end cap 44 and ring cover plate 38. Mounting ring 54 may be cast from a ductile iron having a

high content of silicon and molybdenum as a one-piece monolithic component. This material provides excellent structural physical properties and may withstand the high temperature environment of the exhaust treatment device. The mounting ring may alternatively be formed using processes such as forging, stamping, or machining. Metallic materials other than those listed are also contemplated.

[0030] Mounting ring 54 includes a generally cup-shaped hollow cross section defined by an inner wall 60 and an outer wall 62 interconnected by an end wall 64. A plurality of solid mounting bosses 66 are circumferentially spaced apart from one another. Each boss 66 includes a threaded aperture 68 for receipt of a fastener (not shown) to mount exhaust treatment device 10 to the vehicle. To define a robust structural mount for exhaust treatment device 10, an inner surface 70 of first end cap 44 is shaped as a pocket complementing an external surface 72 of mounting ring 54. A plurality of apertures 76 extend through first end cap 44 in alignment with threaded apertures 68. It should be appreciated that mounting ring 54 need not include the cup-shaped portions and may be shaped to have a more consistent solid cross-section.

[0031] To assemble exhaust treatment device 10, mounting ring 54 is placed into engagement with inner surface 70. Ring cover plate 38 is positioned to engage mounting ring 54. Flange 40 is welded to first end cap 44 to retain mounting ring 54 at a desired location and provide a structural interconnection between the casting and the remaining stamped steel components. First end cap 44 is also welded to mounting ring 54. An insulation material 77 is trapped between ring cover plate 38 and inner inlet 41. In an alternate arrangement, mounting ring 54 may be welded to one or more of the metal components it contacts.

[0032] Ring cover plate 38 includes at least one boss 48 engaging a like boss or plurality of bosses 50 formed on inner inlet 41. First end cap 44 also includes a boss or set of bosses 78 positioned in engagement with the boss or bosses 48 of ring cover plate 38. Each set of bosses are welded together to fix first end cap 44, ring cover plate 38 and inner inlet 41 to each other. Each weld joins three adjacent sheet steel portions. First end cap 44 includes a flange 46

that is fixed to outer tube 34 after the completion of inlet assembly 37. A thermal shield 80 may optionally be fixed to an exterior surface of first end cap 44 to cover bosses 78 because these areas are devoid of insulation 77.

5 **[0033]** An inlet pipe assembly 82 includes a pipe 84 fixed to a shield 86. An insulation material 88 is positioned between pipe 84 and shield 86. Pipe 84 includes a first end 90 extending through both outer tube 34 and inner tube 18 in communication with a cavity 92 formed upstream of first substrate 12. An inlet 94 is formed at the second opposite end of inlet pipe assembly 82 for receipt of exhaust from the internal combustion engine.

10 **[0034]** A flow distribution plate 96 is fixed to inner inlet 41 at a position downstream from first end 90 of pipe 84. Flow distribution plate 96 includes a plurality of spaced apart apertures 98 having different sizes to induce a substantially uniform exhaust gas flow through first substrate 12.

15 **[0035]** An outlet assembly 100 may be constructed using some of the same or at least very similar components used to manufacture inlet assembly 37. For example, outlet assembly 100 includes a second end cap 44a, a ring cover plate 38a, an insulation material 77a, an inner outlet 41a, a pipe 84a, a shield 86a, insulation 88a and an outlet 94a. Other features of outlet assembly 100 are substantially similar to the features of the components forming inlet assembly 37. As such, these elements will be identified with a lower "a" suffix.

20 **[0036]** The interconnection of components to form outer assembly 100 is substantially the same as inlet assembly 37 with the exception that mounting ring 54 is not present within outlet assembly 100 depicted in the Figures. It should be appreciated, however, that should mounting flexibility be required, outlet assembly 100 may include a mounting ring substantially similar to mounting ring 54. In yet another arrangement, inlet assembly 37 may be constructed without mounting ring 54 and outlet assembly 100 may include a mounting ring sandwiched between second end cap 44a and ring cover plate 38a.

30 **[0037]** Figure 5 depicts an alternate exhaust treatment device identified at reference numeral 110. Exhaust treatment device 110 is substantially the same as exhaust treatment device 10 with the exception that

outlet assembly 100 has been replaced with an outlet assembly 114. Outlet assembly 114 includes an inner cone 116 fixed to inner tube 18 and an outer cone 118 fixed to outer tube 34. An insulation material 120 is positioned between inner cone 116 and outer cone 118. A tube 124 extends through apertures formed in both outer cone 118 and inner cone 116 to place a first end 126 of tube 124 in communication with a cavity 128. Tube 124 includes an outlet 130 to allow treated exhaust to escape exhaust treatment device 110.

[0038] Exhaust treatment device 110 provides an alternate plumbing arrangement from device 10. Pipe 84 transversely intersects an axis aligned with a direction of exhaust flow through substrates 12, 14. Tube 124 provides an outlet coaxially aligned with this flow axis. This contrasts with the plumbing arrangement defined by exhaust treatment device 10 where both the inlet 94 and the outlet 94a extend at right angles to a direction of exhaust flow through substrates 12, 14. One skilled in the art will appreciate that other geometrical arrangements of the inlet, outlet and exhaust flow path are contemplated as being within the scope of the present disclosure.

[0039] Figure 7 depicts an alternate exhaust treatment device identified at reference numeral 200. Exhaust treatment device 200 is substantially the same as exhaust treatment device 110 with the exception that inlet assembly 37 is replaced with an inlet assembly 202. Inlet assembly 202 includes an inner inlet 204 fixed to inner tube 18 to form a portion of inner shell 16. An end cap 206 is a cup-shaped stamping surrounding inner inlet 204 and includes an end 207 fixed to outer tube 34 to form a portion of outer shell 17. Insulation 208 is positioned between inner inlet 204 and end cap 206. A mounting member 210 is sandwiched between an inner surface 212 of end cap 206 and a retaining plate 214. Retaining plate 214 is fixed to end cap 206. An inlet pipe assembly 220 includes a pipe 222 fixed to a shield 224. An insulation material 226 is positioned between pipe 222 and shield 224. Pipe 222 includes a first end 228 extending through end cap 206, retaining plate 214, and inner inlet 204 to be in communication with cavity 94 upstream of first substrate 12. Shield 224, retaining plate 214 and inner inlet 204 are fixed to pipe 222. Pipe 222 extends through mounting member 210.

[0040] Another alternate exhaust treatment device is identified at reference numeral 250 and depicted in Figure 8. Exhaust treatment device 250 is substantially similar to each of the embodiments previously described with at least one exception that the cross-sectional shape of the device is not necessarily a circle or some other regular polygon. Exhaust treatment device 250 also includes a first mounting member 252 spaced apart from a second mounting member 254 in lieu of the one-piece mounting member previously described. It should be appreciated that any number of spaced apart mounting members may be incorporated without departing from the scope of the present disclosure. The individual mounting members are contemplated as being coupled to the exhaust treatment device as previously described. For example, first mounting member 252 and second mounting member 254 may be positioned within an end cap not depicted in Figure 8. The mounting members 252, 254 may be subsequently trapped between a retaining plate and the end cap. It is also within the scope of the present disclosure to use multiple spaced apart mounting members in the exhaust treatment devices subsequently introduced in this document.

[0041] Figure 9 depicts a portion of another alternate exhaust treatment device identified at reference numeral 300. Exhaust treatment device 300 is substantially similar to the exhaust treatment devices previously described with at least one exception that a retaining plate 302 and a mounting member 316 may be fixed to a previously assembled exhaust treatment device. Retaining plate 302 may be fixed directly to a flange 304 of an outer end plate 306 instead of being directly coupled to outer tube 34. An inner end plate 308 may be fixed to inner tube 18. Inner end plate 308 may be shaped as shown in Figure 9 or may be elongated and conically shaped as previously described and identified as an inner inlet or an inner outlet. An insulation material 310 is positioned between inner end plate 308 and outer end plate 306. In the arrangement shown in Figure 9, flange 304 of outer end plate 306 is fixed to an outer surface 312 of outer tube 34. A portion of retaining plate 302 overlaps flange 304 and is fixed thereto.

[0042] Mounting member 316 is trapped between retaining plate 302 and outer end plate 306. It should be appreciated that in another configuration not shown in Figure 9, flange 304 may engage an inner surface 318 of outer tube 34 while retaining plate 302 directly engages outer surface 312 of outer tube 34.

[0043] By arranging the components as depicted in Figure 9, a simplified method of manufacture may result. More particularly, insulation 310 may be accurately compressed a desired amount by engaging outer end plate 306 with inner end plate 308 prior to fixing flange 304 to outer tube 34. The assembly exhaust treatment device 300 may be substantially complete before handling and coupling mounting member 316 to device 300. Device 300 may be more economically constructed as each of the stampings are relatively shallow when compared to the deep draw versions previously described.

[0044] Once inner end plate 308 and outer end plate 306 have been fixed to inner tube 18 and outer tube 34, mounting member 316 is positioned within a pocket formed in retaining plate 302. Retaining plate 302 is positioned to overlap flange 304 and engage outer end plate 306 at or near its center. At this location, each of the three stamped metal components, retaining plate 302, outer end plate 306 and inner end plate 308 may be simultaneously welded together. Mounting member 316 may engage an outer surface 322 of outer end plate 306. An outer perimeter of retaining plate 302 may also be welded to flange 304.

[0045] Figure 10 shows another alternate exhaust treatment device identified by reference numeral 350. Only a portion of the exhaust treatment device is shown in Figure 10 to illustrate the differences from the previously described devices. Exhaust treatment device 350 includes an inner shell 352 including an inner tube 354 and an inner end plate 356. An outer shell 360 includes an outer tube 362 surrounding inner tube 354 and an outer end plate 364. An insulation 366 is positioned between inner tube 354 and outer tube 362, as well as between inner end plate 356 and outer end plate 364.

[0046] A mounting member 368 is positioned between inner end plate 356 and outer end plate 364. In one arrangement, a pocket 370 is formed in

outer end plate 364 for receipt of mounting member 368. As previously described, mounting member 368 may be constructed as a one-piece monolithic member or, alternatively, may include more than one spaced apart mounting member. In the configuration depicted in Figure 10, an inner surface 374 of mounting member 368 is positioned in engagement with an outer surface 380 of insulation 366. It should be appreciated that insulation 366 is compressible and a biasing load may be applied on mounting member 368 based on the position of outer end plate 364 and mounting member 368 prior to fixing outer end plate 364 to outer tube 362. A stud 384 is fixed to mounting member 368 and extends through an aperture 386 of outer end plate 364. Stud 384 includes an external thread useful for mounting exhaust treatment device 350 to a support structure. Externally threaded stud 384 is merely an example of a mounting provision that can be provided by mounting member 368. It is also contemplated that mounting member 368 may include an internally extending blind threaded bore. Other mounting provisions including differently shaped fasteners are contemplated as being within the scope of the present disclosure. These fasteners may extend outwardly beyond an outer surface of outer end plate 364 or may be internally located within mounting member 368 and accessible via aperture 386. The alternate mounting provisions may be part of any of the mounting members or mounting rings described in this paper.

[0047] Figures 11 and 12 depict an exhaust treatment device 400 equipped with an alternate or supplementary mount 402. Mount 402 includes a mounting member 404 positioned in contact with an outer surface 406 of outer tube 34. A retaining plate 410 includes an inner surface 412 shaped as a pocket complementing an outer profile of mounting member 404. Retaining plate 410 is fixed to outer tube 34 at flanges 416, 418. Mounting member 404 or retaining plate 410 need only extend along a portion of the circumference of outer tube 34 as depicted in Figure 12. To save cost and weight, mounting member 404 and retaining plate 410 circumferentially extend less than 180 degrees. An aperture 422 extends through retaining plate 410 to allow access to a threaded blind bore 424. Alternatively, a stud or other fastener may be fixed to mounting member 404 and extend through aperture 422.

[0048] The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. For example, the mounting member and retaining plate interactions previously described could be utilized on an exhaust treatment device having a single wall in lieu of the inner and outer shell construction previously described. Another set of exhaust treatment devices are contemplated as having all of the features previously mentioned except the mounting ring. These devices may be mounted using more traditional means such as bands or straps. An economical advantage is provided through the use of common components. Other features may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

CLAIMS

What is claimed is:

1. An exhaust treatment device, comprising:
a housing;
5 an inlet tube having an end in communication with a cavity within the housing;
an exhaust treatment component for treating engine exhaust, the exhaust treatment component positioned within the housing;
a metal mounting member including a mounting provision; and
10 a retaining plate engaged with the mounting member and fixed to the housing to retain the mounting member between the housing and the retaining plate.
2. The exhaust treatment device of claim 1, wherein the retaining
15 plate and the mounting member are positioned within the housing, the housing including an aperture aligned with the mounting provision.
3. The exhaust treatment device of claim 2, wherein the mounting
provision includes a stud fixed to the mounting member and extending through
20 the aperture in the housing.
4. The exhaust treatment device of claim 2, wherein the mounting
provision includes a receptacle in the mounting member, the aperture being
aligned with the receptacle.
25
5. The exhaust treatment device of claim 1, wherein the retaining
plate and the mounting member are positioned outside of the housing, the
retaining plate including an aperture aligned with the mounting provision.
6. The exhaust treatment device of claim 5, wherein the mounting
30 provision includes a stud fixed to the mounting member and extending through the aperture in the retaining plate.

7. The exhaust treatment device of claim 5, wherein the mounting provision includes a receptacle in the mounting member, the aperture being aligned with the receptacle.

5 8. The exhaust treatment device of claim 5, wherein the housing includes a tube and an end plate closing one end of the tube, the mounting member contacting the end plate and the retaining plate.

10 9. The exhaust treatment device of claim 1, wherein the housing includes a curved outer surface, the mounting member including a mating surface shaped to complement the curved outer surface, the mating surface engaging the curved outer surface, the retaining plate being fixed to the housing and coupling the mounting member to the housing.

15 10. The exhaust treatment device of claim 9, wherein the retaining plate contacts the mounting member.

20 11. The exhaust treatment device of claim 9, wherein the curved outer surface together with the retaining plate encapsulate the mounting member.

12. The exhaust treatment device of claim 9, wherein the retaining plate and the mounting member circumferentially extend around the housing less than 180 degrees.

25 13. The exhaust treatment device of claim 1, wherein the housing includes a sheet metal inner shell, a sheet metal outer shell and an insulation therebetween.

14. An exhaust treatment device, comprising:
an inner shell;
an outer shell;
an insulation material positioned between the inner shell and the outer
5 shell;
an inlet tube having an end in communication with a cavity defined by the
inner shell;
an exhaust treatment component for treating engine exhaust positioned
within the inner shell;
10 a metal mounting member including one of a receptacle and a stud; and
a retaining plate engaging the mounting member and being fixed to the
outer shell to trap the mounting member between the outer shell and the
retaining plate, the retaining plate including an aperture aligned with the
receptacle or the stud.

15

15. The exhaust treatment device of claim 14, wherein the inner shell
includes a metal inner tube and an inner end plate closing one end of the inner
tube, the outer shell including a metal outer tube surrounding the inner tube and
an outer end plate closing one end of the outer tube, the mounting member
20 contacting the outer end plate.

16. The exhaust treatment device of claim 15, wherein the insulation
material is positioned between the inner end plate and the outer end plate.

- 25 17. The exhaust treatment device of claim 16, wherein the retaining
plate is fixed to the outer end plate.

18. The exhaust treatment device of claim 16, wherein the retaining
plate is fixed to the outer tube.

19. The exhaust treatment device of claim 14, wherein the retaining plate includes a substantially planar surface and a circumferentially extending flange, the planar surface and the flange contacting the mounting member.

5 20. The exhaust treatment device of claim 14, wherein the retaining plate and the outer shell encompass the mounting member.

21. The exhaust treatment device of claim 14, further including another metal mounting member spaced apart from the mounting member and trapped
10 between the outer shell and the retaining plate.

22. The exhaust treatment device of claim 14, wherein the mounting member includes an uninterrupted ring.

15 23. The exhaust treatment device of claim 14, wherein the mounting member includes a "U" shape.

24. The exhaust treatment device of claim 14, wherein the inner shell, the outer shell, and the retaining plate are fixed to each other at a common
20 location.

25. The exhaust treatment device of claim 14, wherein the metal mounting member engages an outer surface of the outer shell.

25 26. An exhaust treatment device, comprising:
an inner shell;
an outer shell;
an insulation material positioned between the inner shell and the outer
shell;
30 a tube having an end in communication with a cavity defined by the inner
shell;

an exhaust treatment component for treating engine exhaust positioned within the inner shell;

a metal mounting member including a mounting provision; and

5 a retaining plate engaged with the mounting member and fixed to the outer shell to retain the mounting member between the outer shell and the retaining plate, wherein the metal mounting member at least partially surrounds the tube.

27. The exhaust treatment device of claim 26, wherein the mounting
10 provision includes a stud fixed to the mounting member and extending through the retaining plate.

28. The exhaust treatment device of claim 26, wherein the mounting
15 provision includes a threaded bore and the retaining plate includes an aperture aligned with the threaded bore.

29. The exhaust treatment device of claim 26, wherein the mounting
member is shaped as an uninterrupted ring and the tube extends through the
20 ring.

30. The exhaust treatment device of claim 26, wherein the insulation
material is sandwiched between the inner shell and the retaining plate.

31. The exhaust treatment device of claim 26, further including another
metal mounting member spaced apart from the mounting member and trapped
25 between the outer shell and the retaining plate.

32. The exhaust treatment device of claim 26, wherein the inner shell,
the outer shell, and the retaining plate are fixed to each other at a common
location.

33. An exhaust treatment device, comprising:

an inner shell including a metal inner tube and an inner end plate closing one end of the inner tube;

an outer shell including a metal outer tube surrounding the inner tube and an outer end plate closing one end of the outer tube;

5 an insulation material positioned between the inner shell and the outer shell;

a flow tube having an end in communication with a cavity defined by the inner shell;

10 an exhaust treatment component for treating engine exhaust positioned within the inner shell; and

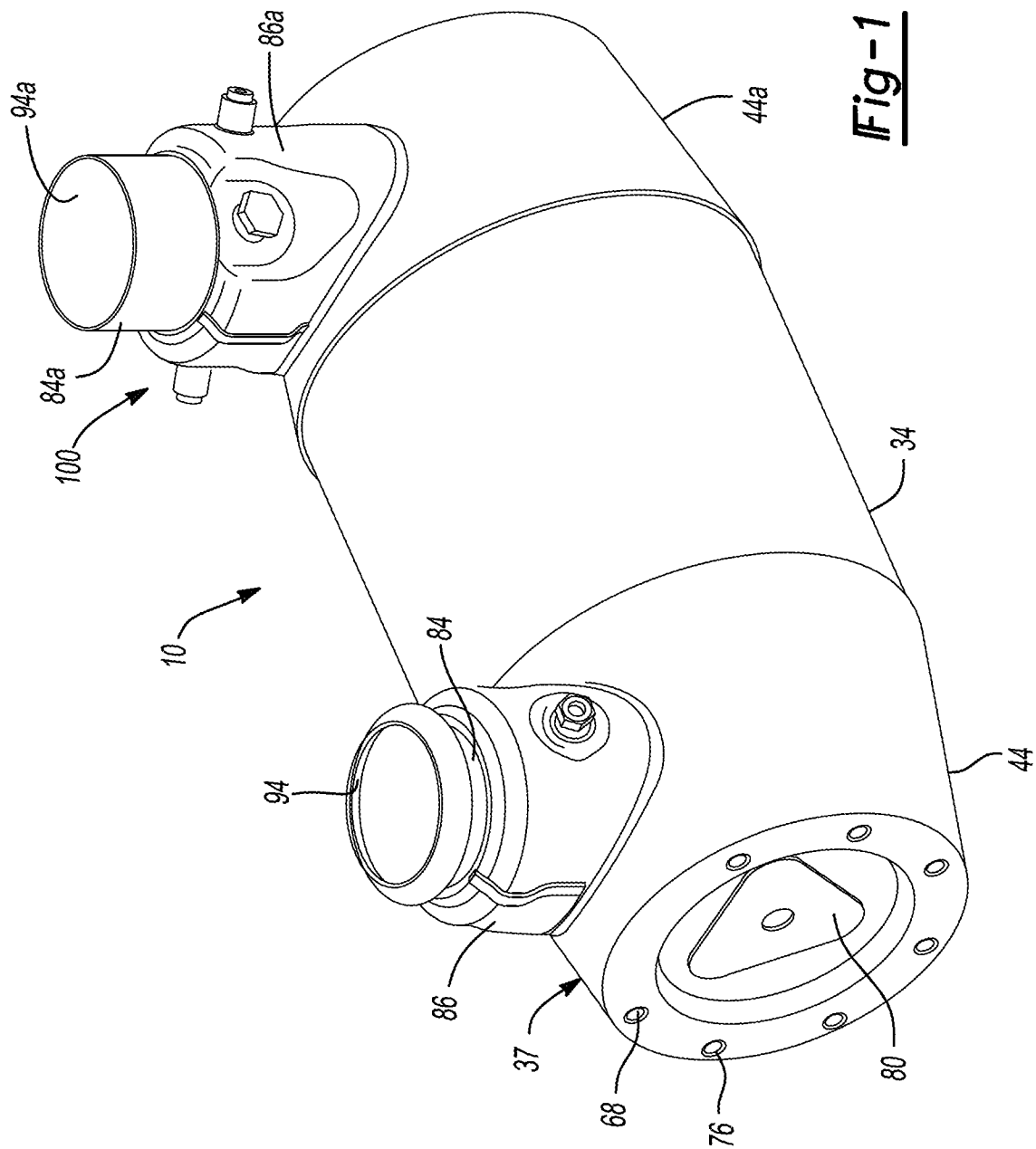
a metal mounting member including a mounting provision, the mounting member being positioned between the inner shell and the outer shell, and engaging the outer shell and the insulation.

15 34. The exhaust treatment device of claim 33, wherein the insulation material is compressed to bias the mounting member into engagement with the outer shell.

20 35. The exhaust treatment device of claim 34, wherein a portion of the insulation is compressed between the mounting member and the inner end plate.

36. The exhaust treatment device of claim 33, wherein the insulation is positioned between the inner tube and the outer tube.

25 37. The exhaust treatment device of claim 33, wherein the mounting provision includes a stud fixed to the mounting member and extending through an aperture in the outer shell.



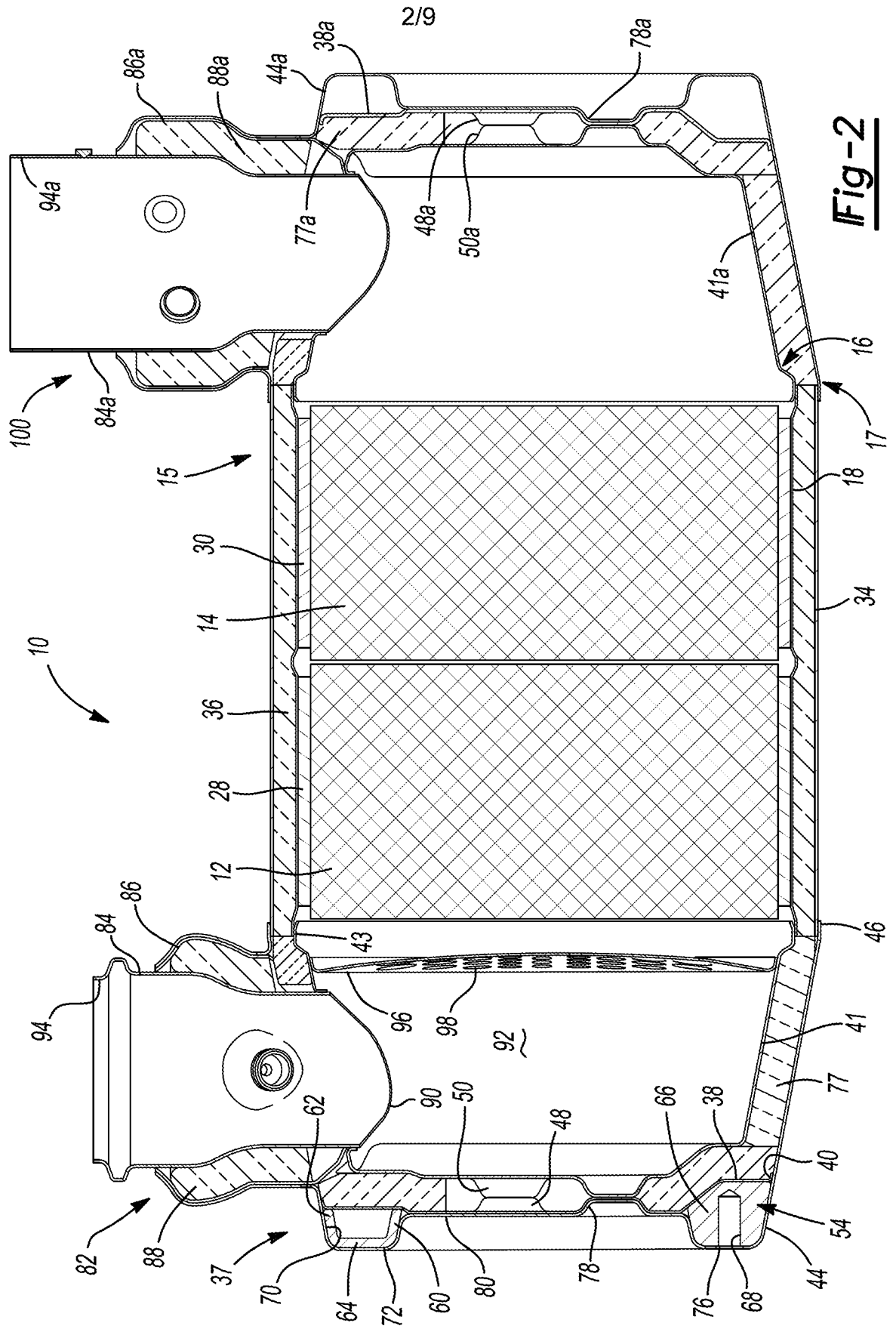


Fig-2

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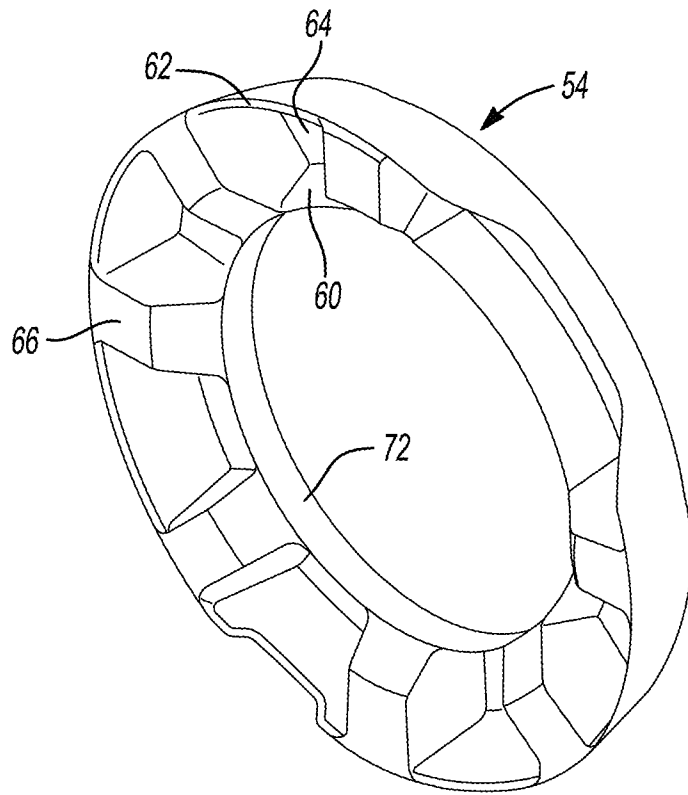


Fig-3

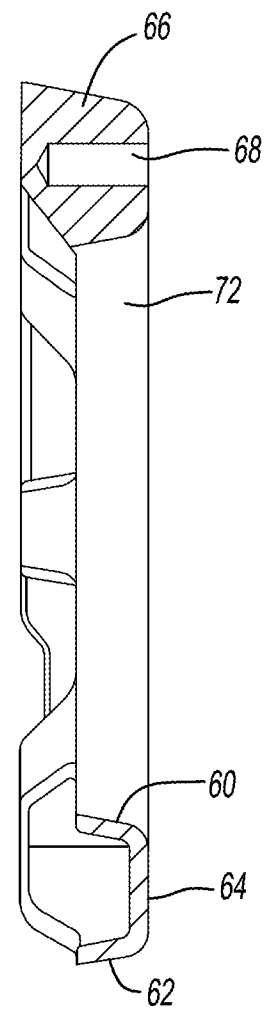


Fig-4

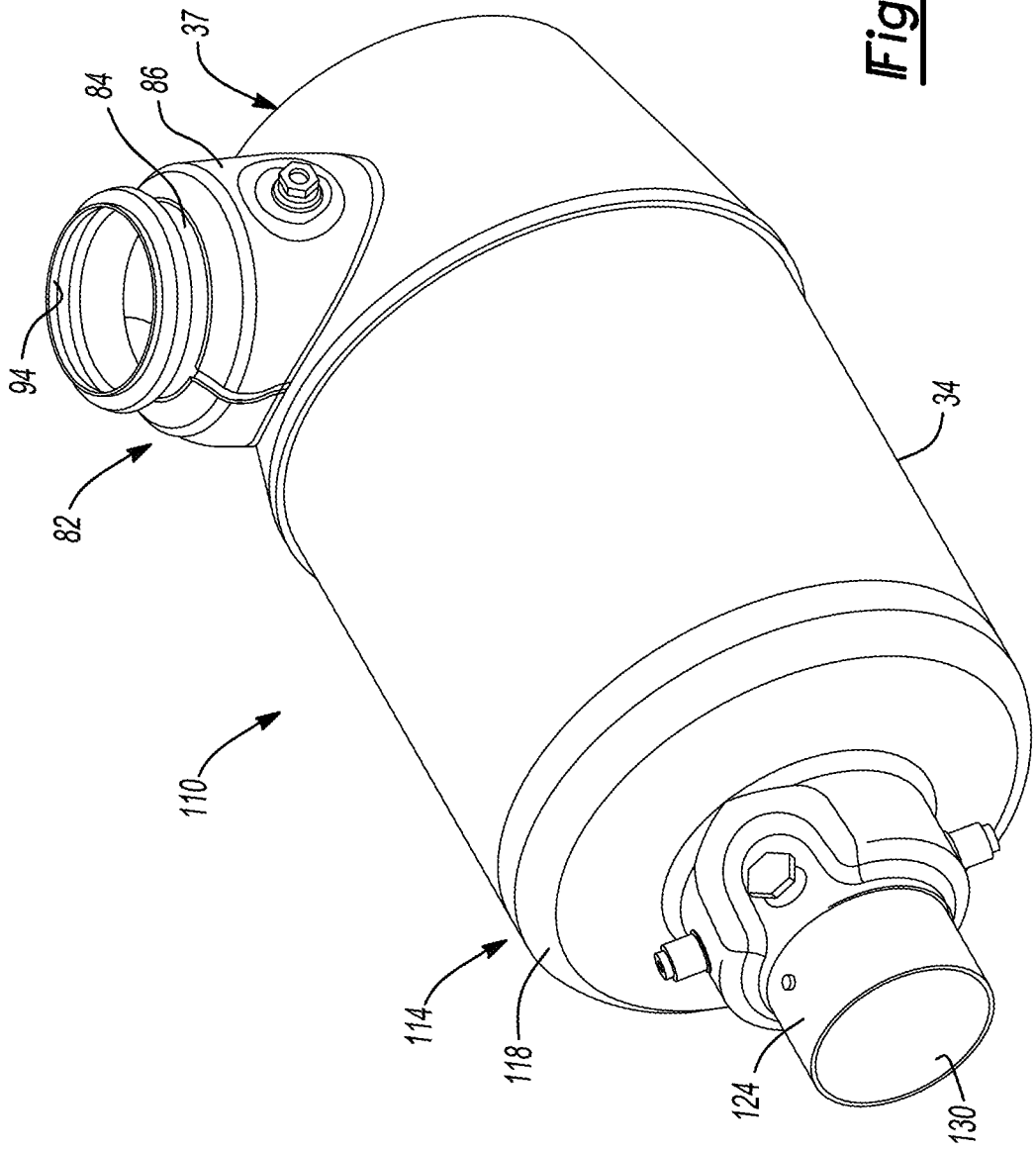


Fig-5

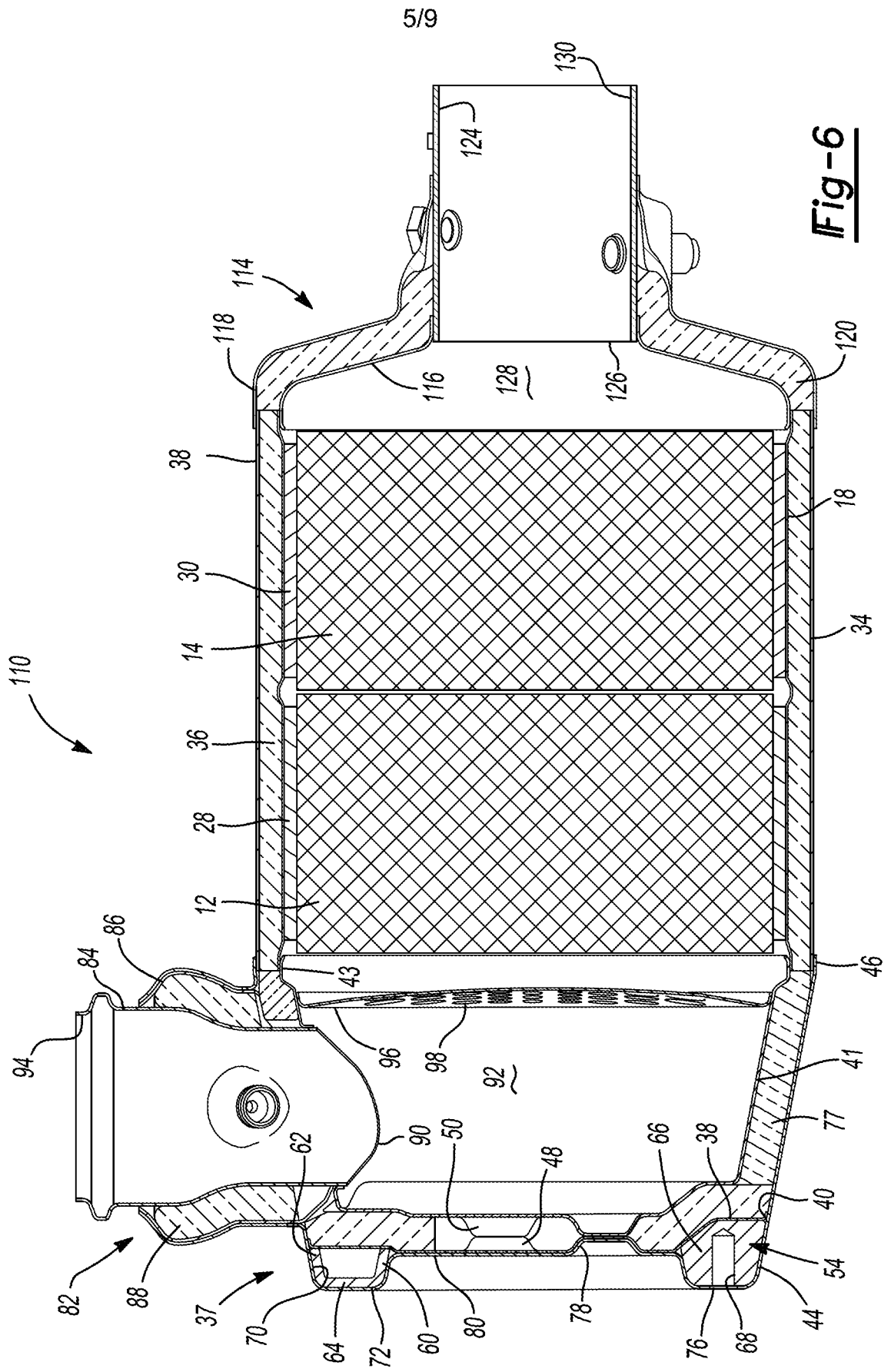


Fig-6

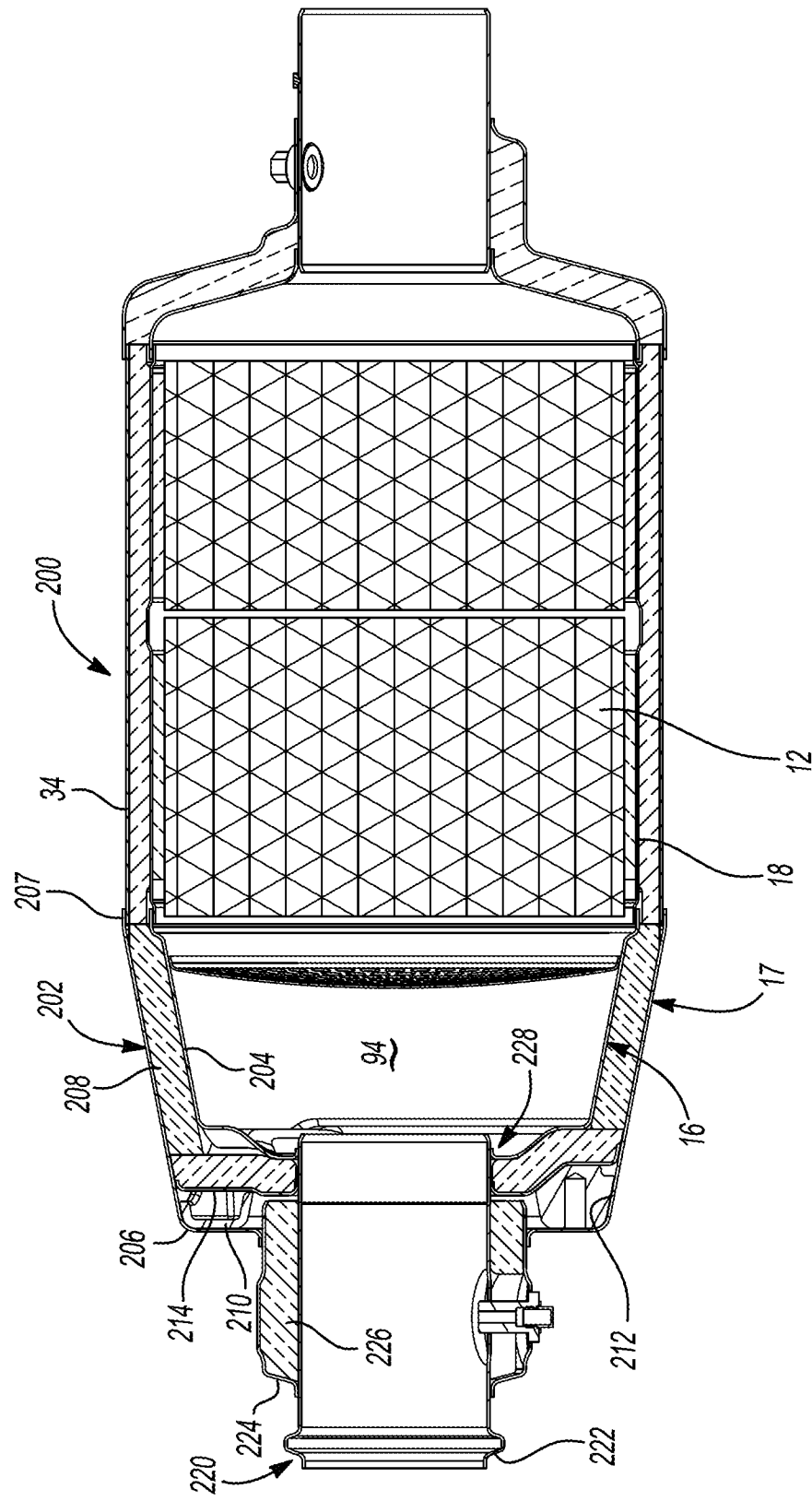
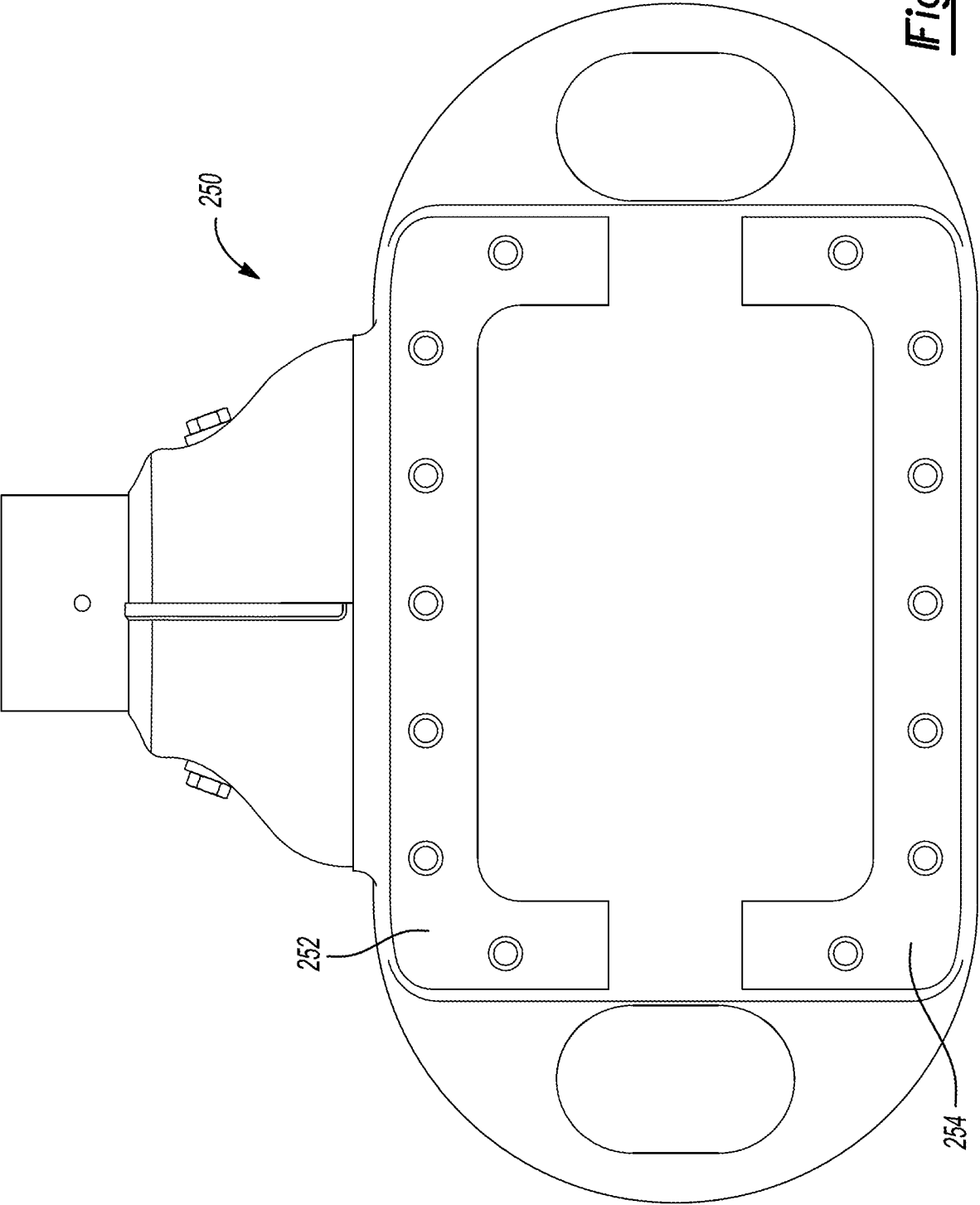


Fig-7

Fig-8



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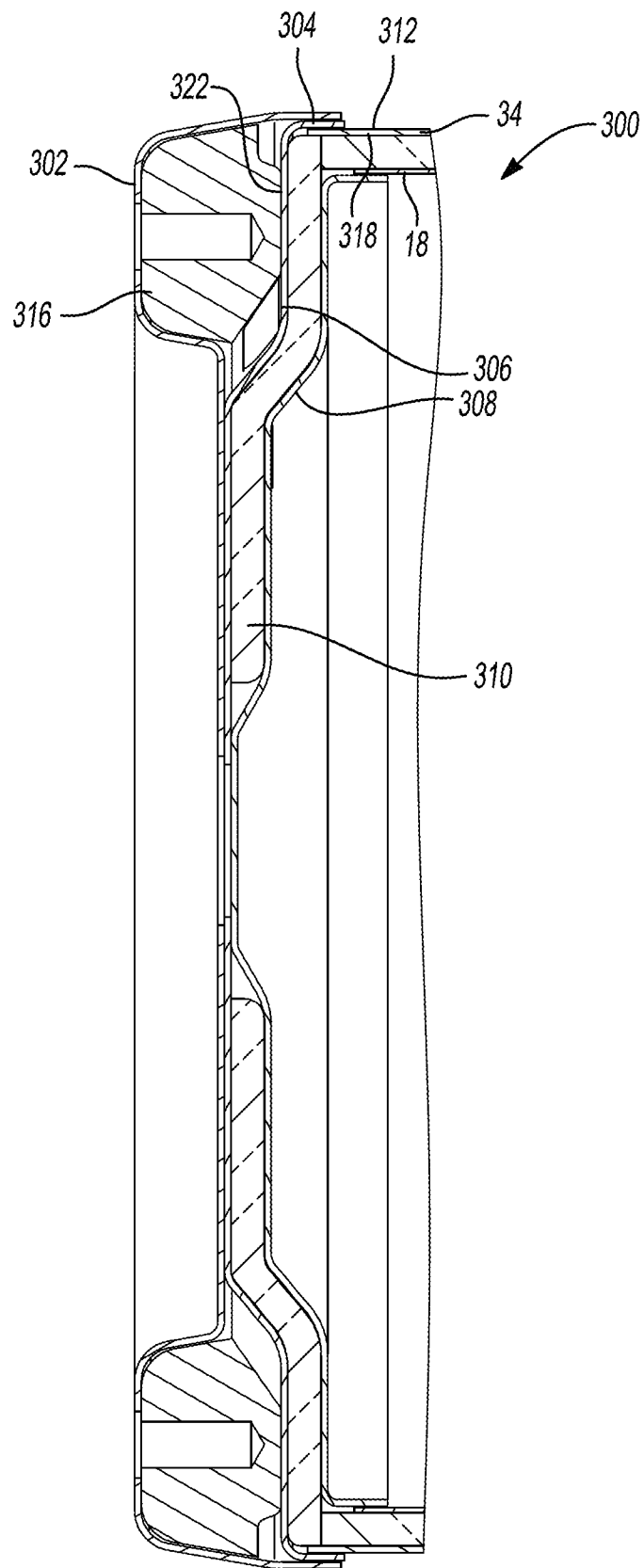
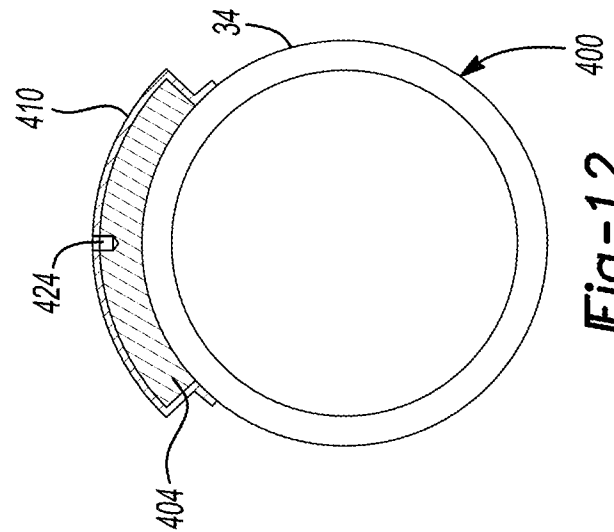
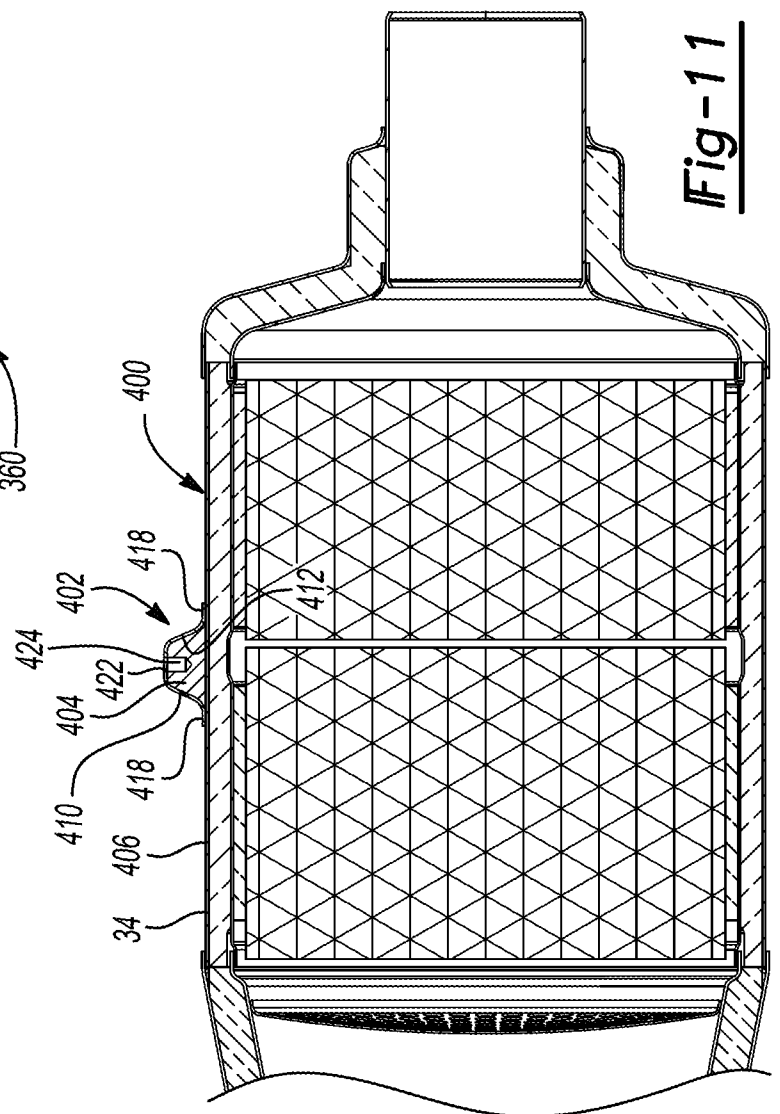
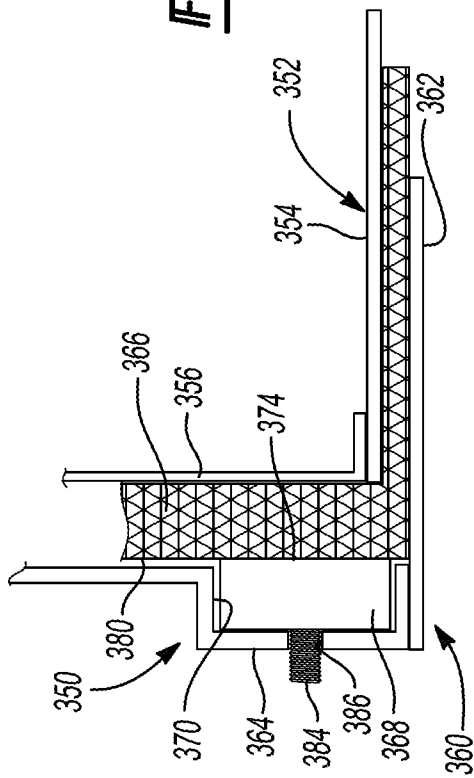


Fig-9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/027908**A. CLASSIFICATION OF SUBJECT MATTER****F01N 3/28(2006.01)i, F01N 3/20(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F01N 3/28; F16L 13/04; F16L 25/14; F01N 3/00; B01D 53/94; F01N 1/00; F01N 3/02; F01N 3/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: exhaust, integral, mount, plate, engage, aperture, treatment, align, shell, insulation and assembly,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013-0086894 A1 (WIKARYASZ et al.) 11 April 2013 See abstract; paragraphs [0007]-[0009], [0020]-[0023]; claim 1; and figures 2-6.	1-37
A	US 2009-0232592 A1 (GUDORF et al.) 17 September 2009 See abstract; paragraphs [0008]-[0014]; and figure 1.	1-37
A	US 6555070 B1 (KRUGER, KLAUS GERHARD) 29 April 2003 See abstract; column 2, line 52 - column 5, line 16; and figure 2.	1-37
A	US 8281581 B2 (OLIVER et al.) 09 October 2012 See abstract and column 1, line 53 - column 2, line 11.	1-37
A	JP 08-144740 A (ISUZU CERAMICS KENKYUSHO K.K.) 04 June 1996 See paragraphs [0005]-[0010] and claim 1.	1-37

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

24 July 2015 (24.07.2015)

Date of mailing of the international search report

28 July 2015 (28.07.2015)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/027908

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 6555070 B1	29/04/2003	AR 020716 A1 BR 9904425 A DE 59914322 D1 EP 0992659 A2 EP 0992659 A3 EP 0992659 B1 JP 2000-110557 A JP 4596581 B2 KR 10-2000-0028835 A	22/05/2002 15/08/2000 14/06/2007 12/04/2000 10/12/2003 02/05/2007 18/04/2000 08/12/2010 25/05/2000
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JP 08-144740 A	04/06/1996	None	