

WO 2015/120618 A1



Published:

— *with international search report (Art. 21(3))*

EXHAUST TREATMENT SYSTEM WITH SOOT BLOWER FIELD

[0001] The present disclosure relates to an engine exhaust treatment system.

BACKGROUND

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

[0003] During operation of a diesel engine, particulate matter and/or soot can be produced and passed into the exhaust stream. To remove particulate matter and/or soot from the exhaust stream, exhaust treatment systems may include a diesel particulate filter (DPF). The DPF is designed to filter and remove particulate matter and/or soot from the exhaust stream. The use of a DPF, however, may not be required in various locations around the world and, therefore, the use of the DPF in an exhaust-treatment system in these locations may be omitted.

[0004] It should be appreciated that, even when a DPF is incorporated into an exhaust treatment system, the DPF does not necessarily remove all the particulate matter and /or soot from the exhaust stream. In such an instance, the remaining particulate matter and/or soot can flow downstream and possibly build-up on other exhaust treatment components. The deposited soot may reduce operational efficiency and, possibly, plug the exhaust treatment component. As such, it may be desirable to provide an exhaust treatment system that includes a soot blower that assists in preventing the build-up of particulate matter and/or soot on exhaust treatment components.

SUMMARY

[0005] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0006] An exhaust treatment system includes a soot blower located directly upstream from an exhaust treatment component. The soot blower includes a hollow first spray rod having a semi-circularly shaped portion terminating at a closed end as well as spray nozzles mounted on the semi-circularly shaped portion. The soot blower also includes a hollow second spray

rod having a semi-circularly shaped portion terminating at a closed end as well as spray nozzles mounted on its semi-circularly shaped portion. A source of compressed gas is provided to the soot blower to inject air through the nozzles toward the exhaust treatment component to disperse particulate matter and soot at the exhaust treatment component.

[0007] A soot blower for an exhaust treatment system includes an exhaust treatment component and a source of compressed gas. The soot blower includes a tubular housing having a downstream end adapted to be coupled in fluid communication with the exhaust treatment component. Hollow first and second spray rods extend through the housing diametrically opposed to one another. Each of the first and second spray rods include a first end adapted to be coupled to the source of compressed gas and a second closed end positioned within the housing. A first connection system interconnects the second end of the first spray rod to the second spray rod. A second connection system interconnects the second end of the second spray to the first spray rod. Spray nozzles are fixed to the first and second spray rods and are adapted to direct the compressed gas toward an upstream face of the exhaust treatment component.

[0008] 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.

DRAWINGS

[0009] 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.

[0010] Figure 1 is a schematic representation of an exhaust system according to a principle of the present disclosure;

[0011] Figure 2 is a schematic representation of an exhaust treatment system including a soot blower according to a principle of the present disclosure;

[0012] Figure 2a is a schematic representation of an alternate exhaust treatment system including two soot blowers;

[0013] Figure 2b is a schematic representation of another exhaust treatment system including soot blowers positioned at opposite ends of an exhaust treatment device;

[0014] Figure 3 is a perspective view of a soot blower according to a principle of the present disclosure;

[0015] Figure 4 is a cross-sectional view of an exhaust treatment component including a soot blower according to a principle of the present disclosure;

[0016] Figure 4a is a cross-sectional view of an exhaust treatment component including an alternate soot blower constructed in accordance with the teachings of the present disclosure;

[0017] Figure 5 is a cross-sectional view of the soot blower illustrated in Figure 3;

[0018] Figure 6 is a cross-sectional view of the soot blower illustrated in Figure 5;

[0019] Figure 7 is a cross-sectional view of the soot blower illustrated in Figure 3;

[0020] Figure 8 is a cross-sectional view of the soot blower illustrated in Figure 7; and

[0021] Figure 9 is a schematic representation of an alternative soot blower configuration according to a principle of the present disclosure.

[0022] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0023] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0024] Figure 1 schematically illustrates an exhaust system 10 according to the present disclosure. Exhaust system 10 may include an engine 12 in communication with a fuel source (not shown) that, once combusted, will produce exhaust gases that are discharged into an exhaust passage 14 associated with an exhaust treatment system 16. Downstream from engine 12 can be disposed an exhaust treatment component 18, which can be a diesel

oxidation catalyst (DOC), a diesel particulate filter (DPF) component, or, as illustrated, a selective catalytic reduction (SCR) device including a substrate 20. Although not required by the present disclosure, exhaust treatment system 16 may further include components such as a thermal enhancement device or burner 17 to increase a temperature of the exhaust gases passing through exhaust passage 14. Increasing the temperature of the exhaust gas is favorable to achieve light-off of the catalyst in the exhaust treatment component 18 in cold-weather conditions and upon start-up of engine 12, as well as initiate regeneration of the exhaust treatment component 18 when the exhaust treatment component 18 is a DPF.

[0025] To assist in reduction of the emissions produced by engine 12, exhaust treatment system 16 may include a dosing module 22 for periodically injecting an exhaust treatment fluid into the exhaust stream. As illustrated in Figure 1, dosing module 22 can be located upstream of exhaust treatment component 18, and is operable to inject an exhaust treatment fluid into the exhaust stream. In this regard, dosing module 22 is in fluid communication with a reagent tank 24 and a pump 26 by way of inlet line 28 to dose an exhaust treatment fluid such as diesel fuel or urea into the exhaust passage 14 upstream of exhaust treatment component 18. Dosing module 22 can also be in communication with reagent tank 24 via return line 30. Return line 30 allows for any exhaust treatment fluid not dosed into the exhaust stream to be returned to reagent tank 24. Flow of the exhaust treatment fluid through inlet line 28, dosing module 22, and return line 30 also assists in cooling dosing module 22 so that dosing module 22 does not overheat. Although not illustrated in the drawings, dosing module 22 can be configured to include a cooling jacket that passes a coolant around dosing module 22 to cool it.

[0026] The amount of exhaust treatment fluid required to effectively treat the exhaust stream may vary with load, engine speed, exhaust gas temperature, exhaust gas flow, engine fuel injection timing, desired NO_x reduction, barometric pressure, relative humidity, EGR rate and engine coolant temperature. A NO_x sensor or meter 32 may be positioned downstream from SCR 20. NO_x sensor 32 is operable to output a signal indicative of the exhaust NO_x content to a reagent dosing controller 36. All or some of the engine operating parameters may be

supplied from an engine control unit 34 via the engine/vehicle databus to reagent dosing controller 36. The reagent dosing controller 36 could also be included as part of the engine control unit 34. Exhaust gas temperature, exhaust gas flow and exhaust back pressure and other vehicle operating parameters may be measured by respective sensors, as indicated in Figure 1.

[0027] The amount of exhaust treatment fluid required to effectively treat the exhaust stream may be dependent on the size of the engine 12. In this regard, large-scale diesel engines used in locomotives, marine applications, and stationary applications can have exhaust flow rates that exceed the capacity of a single dosing module 22. Accordingly, although only a single dosing module 22 is illustrated for urea dosing, it should be understood that multiple dosing modules 22 for urea injection are contemplated by the present disclosure.

[0028] In exhaust treatment systems that do not include a DPF, the build-up of particulate matter or soot can affect the operation and efficiency of the exhaust treatment system. In particular, the build-up of soot can build-up and begin to plug exhaust treatment components such as a DOC or SCR. To assist in reducing the build-up of soot, the present disclosure provides a soot dispersion device 40 that is operable to assist in preventing build-up of soot deposits on the face of the catalyst-coated substrates 20 of either a DOC or SCR. Figure 2 schematically illustrates exhaust treatment system 16 including soot blower 40. Soot dispersion device (hereinafter "soot blower") 40 is in communication with a source of compressed air 42 that blows toward an upstream face 43 of exhaust treatment component 18 to disperse any particulate matter or soot that may be located at an inlet 44 of exhaust treatment device. In this manner, particulate matter and/or soot can be prevented, or least substantially minimized, from building up on the upstream face 43 of the exhaust treatment component 18.

[0029] As illustrated in Figures 2 and 3, soot blower 40 is located directly upstream from inlet 44 of exhaust treatment component 18, which in the illustrated embodiment is an SCR. It should be understood, however, that exhaust treatment component 18 can also be a DOC or catalyst-coated DPF without departing from the scope of the present disclosure. To provide compressed air to soot blower 40, exhaust treatment system includes a compressor 46 that is operable to draw in ambient air from the atmosphere, or

draw in air from an on-board source (not shown). Pressurized air supplied by compressor 46 may be stored in an accumulator 48 and fed, when needed, through an inlet line 50 through an air filter 52, an impulse valve 54, and an optional check valve 56, to soot blower 40. To disperse the compressed air across upstream face 43 of exhaust treatment component 18, soot blower includes nozzles 58. As best shown in Figure 3, soot blower 40 may include first and second spray rods 60, 62 each including several nozzles 58.

[0030] It should be understood that each spray rod 60, 62 may be independently supplied with compressed gas. In this regard, it should be understood that the use of multiple impulse valves 54 is contemplated. Each of first and second spray rods 60, 62 may be associated with an impulse valve 54 that can control flow of compressed gas thereto. Moreover, although not illustrated in the drawings, it should be understood that each individual nozzle 58 or groups of nozzles 58 may also be independently actuatable. That is, each nozzle 58 or group of nozzles 58 can also include a valve (not shown) that allows each nozzle group to be independently pressurized.

[0031] As previously discussed, soot blower 40 assists in preventing build-up of particulate matter and/or soot on exhaust treatment component 18. Regardless, it may be beneficial to monitor the pressure differential across the various components of exhaust treatment system 16. A first pressure sensor 64 may be located upstream of exhaust treatment component 18 and a second pressure sensor 66 may be located downstream of exhaust treatment component 18. Monitoring the pressure at locations upstream and downstream of exhaust treatment component 18 assists in determining whether soot blower 40 is properly functioning. In this regard, if soot blower 40 is not properly functioning, the build-up of particulate matter and/or soot on exhaust treatment component 18 can begin to plug the passages through exhaust treatment component 18, which can cause an increase of back-pressure in exhaust treatment system 16. If too much back-pressure develops in system 16, engine 12 performance can be negatively affected. A pressure drop greater than a predetermined magnitude may be an indication that soot blower 40 needs to be serviced. Based on a comparison of the pressures at various locations within exhaust treatment system 16, exhaust

treatment component 18 may require cleaning to remove particulate matter and/or soot from the passages therein.

[0032] Soot blower 40 includes a housing 68 and a pair of connection flanges 70 that couple to a connection flange 25 of a canister 23, as well as to a connection flange 72 of an exhaust treatment component inlet 74. Connection flanges 25, 70, and 72 allow each component 23, 40, and 74 to be bolted together in a hermetic manner that prevents exhaust gases from escaping exhaust treatment component 18 and reaching the atmosphere before being properly treated. Exhaust treatment component inlet 74 also includes an inlet flange 76 that allows exhaust treatment component inlet 74 to be coupled to exhaust passage 14. Soot blower 40, in the illustrated embodiment, is designed as a modular component for use with a singular cylindrically-shaped filter or substrate 20. Substrate 20 is mounted within canister 23 directly downstream from soot blower 40.

[0033] With reference to Figure 2a, an alternate exhaust treatment system 16a includes the elements of exhaust treatment system 16 as depicted in Figure 2 as well as another exhaust treatment component 18a positioned downstream from exhaust treatment component 18. A second soot blower assembly 40a is positioned between canister 23 and a canister 23a. Soot blower 40a is substantially the same as soot blower 40. Accordingly, a detailed description of soot blower 40a will not be provided. It should be appreciated that nozzles 58 of soot blower 40a are directed toward an upstream face of exhaust treatment component 18a.

[0034] Figure 2b provides a schematic representation of another alternate exhaust treatment system 16b. Exhaust treatment system 16b includes the elements of exhaust treatment system 16 depicted in Figure 2 as well as another soot blower assembly 40a positioned downstream from exhaust treatment component 18. Nozzles 58 of soot blower 40a are oriented to provide compressed air on a downstream face 45 of exhaust treatment component 18. In the arrangement depicted in Figure 2b, soot may be dislodged from upstream face 43 and downstream face 45 of exhaust treatment component 18. It should be appreciated that compressed air may be simultaneously or alternately supplied to soot blowers 40 and 40a of system 16a and 16b. Individual spray rods may also

be selectively and/or individually pressurized through the use of additional valves, as previously described.

[0035] It should also be appreciated that soot blower 40 or soot blower 40a may be positioned along another portion of exhaust passage 14 and spaced a greater distance from one of exhaust treatment components 18 than previously discussed. Nozzles 58 may be oriented to direct compressed air to an inner surface of exhaust passage 14 to dislodge soot that may accumulate on the walls of the exhaust conduit. In yet another application, soot blower 40 may be positioned along a portion of exhaust passage 14 where the velocity of the exhaust is reduced.

[0036] The reduction may be caused from any number of sources such as the location exhaust treatment components 18, turns or changes in the cross-sectional area of the conduit used to transport the exhaust gasses, or other disruptions to the flow of exhaust gas. The reduced velocity zones may be referred to as “dead zones” where soot would be more likely to be deposited on an inner surface of the exhaust conduit than continue to travel downstream. It may be beneficial to position soot blowers at or near these dead zones.

[0037] As best shown in Figures 3 and 4, soot blower 40 includes a first mounting structure 80 coupling first spray rod 60 to housing 68. A second mounting structure 82 couples second spray rod 62 to housing 68. First mounting structure 80 is substantially similar to second mounting structure 82. Accordingly, only one of the mounting structures will be described in detail. First mounting structure 80 includes a radially outwardly protruding stanchion 84 having opposing pairs of walls 86, 88 arranged in a hollow parallelepiped configuration. Walls 86, 88 define an elongated rectangularly-shaped passageway 90 extending through first stanchion 84. Passageway 90 is aligned with a similarly shaped aperture 92 extending through housing 68.

[0038] First mounting structure 80 also includes a cap 96 fixed to first stanchion 84 with a plurality of threaded fasteners 102. Cap 96 includes a plurality of apertures 98 extending therethrough for selective receipt of fasteners 102. It should be appreciated that cap 96 extends axially along the direction of exhaust gas flow a distance longer than the axial extent of first stanchion 84. Furthermore, the number of apertures extending through cap 96 is greater than

the number of fasteners used to couple cap 96 to first stanchion 84. The axially elongated shape of aperture 92 and passageway 90 allow adjustment of the distance between first spray rod 60 and upstream face 43 of SCR substrate 20.

[0039] A centrally located aperture 106 extends through cap 96 and is in receipt of a linearly extending portion 108 of first spray rod 60. Cap 96 is fixed to first spray rod 60 via a weld or other mechanical interconnection. Prior to installing threaded fasteners 102, a desired spacing between first spray rod 60 and upstream face 43 is determined. Cap 96 and spray rod 60 are axially translated to a position closest to the desired spacing as possible while aligning apertures 98 with associated apertures formed in first stanchion 84. At this time, cap 96 is secured to first stanchion 84 via threaded fasteners 102. Other fasteners such as pins, clips, clamps and the like are contemplated as being within the scope of this disclosure. A similar alignment and coupling procedure is performed using second mounting structure 82 and second spray rod 62.

[0040] First spray rod 60 includes a curved portion 110 integrally formed with linearly extending portion 108. Curved portion 110 extends approximately 180 degrees in the shape of a semi-circle. First spray rod 60 includes a closed end 114 and an open end 116. Open end 116 is coupled to the source of pressurized air provided by compressor 46 via inlet line 50 as depicted in Figure 2. Nozzles 58 are fixed to curved portion 110 in a variety of positions that are circumferentially spaced apart from one another. First and second spray rods 60, 62 may be formed of various metal materials including aluminum, steel, copper, or any other material known to one skilled in the art.

[0041] As depicted in Figures 5-8, each nozzle 58 includes a single aperture 120 extending therethrough from an inlet end 124 to an outlet end 126. Aperture 120 includes an enlarged substantially cylindrical opening at inlet end 124 that tapers radially inwardly to a reduced diameter portion 128. Aperture 120 enlarges and radially outwardly expands from reduced diameter portion 128 to outlet end 126. The shape of aperture 120 is useful for accelerating the pressurized fluid provided by compressor 46. Figure 5 depicts one nozzle 58a fixed to curved portion 110. A nozzle axis 132 extends at an angle A relative to a horizontal datum plane 134 extending through the center of aperture 120 at inlet end 124. Similarly, axis 132 extends at an angle B relative to a vertical datum

plane 136 extending through the center of aperture 120 at inlet end 124. It is contemplated that Angle A ranges between 18 and 20 degrees. Angle B may range between 2 and 4 degrees. Several nozzles may be similarly positioned at other circumferential locations. Figures 7 and 8 depict a nozzle 58b oriented at different angles C and D. Angle C may range between 30 and 35 degrees while angle D may range between 7 and 10 degrees. The spacing and orientation of nozzles 58 (58a and 58b) assures that pressurized air contacts a large percentage of the area of upstream face 43. The depicted arrangement covers over 80 percent of the face area.

[0042] In order to add structural stability to soot blower 40 and account for the relatively wide temperature range across which the soot blower operates, a connecting system 140 (Figure 4) is provided. Connecting system 140 includes a first link 144 including a first end 146 pivotably coupled to the closed end of first spray rod 60. An opposite second end 148 of first link 144 is pivotably coupled to second spray rod 62. Link 144 may be joined to the first and second spray rods 60, 62, by any number of elements including pins, rivets, threaded fasteners or the like. In similar fashion, a second link 154 includes a first end 156 coupled to the closed end of second spray rod 62. An opposite second end 158 of link 154 is pivotably coupled to first spray rod 60. First link 144 and second link 154 restrict relative movement of the cantilevered closed end of each spray rod relative to housing 68. Concurrently, first link 144 and second link 154 allow for a change in size of each spray rod due to the coefficient of thermal expansion and changes in the temperature within soot blower 40.

[0043] Figure 4a represents a soot blower 40 having an alternate connecting system 140a interconnecting first spray rod 60 and second spray rod 62. Instead of the pivotable links previously described, connecting system 140a includes a first bracket 162 fixed to closed end 114 of first spray rod 60. First bracket 162 includes an elongated slot 164 extending therethrough. A first plate 170 is fixed to second spray rod 62. First plate 170 is sized and shaped to be received within slot 164 with a predetermined amount of clearance. The clearance between first plate 170 and slot 164 provides a restricted amount of freedom between first spray rod 60 and second spray rod 62 to account for the thermal coefficient of expansion of the materials. First plate 170 may also be

referred to as a blade, a finger or a pin positioned within slot 164. Slot 164 may be alternately described as a receptacle, recess, pocket, or the like.

[0044] Connecting system 140a also includes a second bracket 166 fixed to the closed end of second spray rod 62. Second bracket 166 is substantially similar to first bracket 162 and includes an elongated slot 168. A second plate 172 is fixed to first spray rod 60. Second plate 172 is substantially similar to first plate 170. Second plate 172 extends through slot 168 of second bracket 166 with a predetermined amount of clearance to allow a limited amount of relative movement between first spray rod 60 and second spray rod 62.

[0045] Figure 9 depicts an alternate soot blower 40' intended for a large engine application such as a marine, stationary, or locomotive engine application where relatively high mass air flow rates of exhaust are produced during operation of engine 12. In this regard, instead of using a single SCR substrate to treat the engine exhaust, the exhaust treatment component 18' includes a plurality of SCR substrates 20 arranged in a single canister 23' that houses each of the SCR substrates 20. Soot blower 40' includes three substantially similar subsets of the components used to treat single SCR substrate 20. The three different sets of components will be identified with suffixes "a", "b" and "c". Each of the three substrates 20 are circumferentially spaced apart from one another at 120 degree intervals. Each substrate 20 is associated with one of the soot blower subsets a, b, or c. The components depicted in Figure 9 are substantially similar to those previously described with the exception that second spray rods 62a, 62b, 62c include a longer linearly shaped portion than its counterpart first spray rod 60a, 60b, 60c. In addition, second spray rods 62a, 62b, 62c may include a bend to clear a portion of a crossing pipe. Flexibility of control continues to exist in that the nozzle of any one spray rod may be individually provided with pressurized air or sets of spray rods may be simultaneously provided with pressurized air. The location of additional valves 54 will be determined on the function desired by the end user.

[0046] Each set of first and second spray rods 60, 62 may be located at positions 120 degrees apart from one another within housing 68 of soot blower 40. Specifically, each set of spray rods can be located to correspond to a particularly designated SCR substrate 20 to ensure that particulate matter and/or soot is

satisfactorily dispersed at each SCR substrate 20. In the illustrated embodiment, each SCR substrate 20 is spaced apart at 120 degrees within canister 23'. Spray rod sets 60a, 62a; 60b, 62b; and 60c, 62c are correspondingly located at positions 120 degrees apart within housing 68. It should be understood, however, that spray rod sets 60, 62 may be disposed in any manner desired to maximize dispersion of particulate matter and/or soot at SCR substrate 20.

[0047] 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. The same 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 system, comprising:
an exhaust treatment component;
a soot blower located directly upstream from the exhaust treatment component, the soot blower including a hollow first spray rod having a semi-circularly shaped portion terminating at a closed end as well as spray nozzles mounted on the semi-circularly shaped portion, the soot blower including a hollow second spray rod having a semi-circularly shaped portion terminating at a closed end as well as spray nozzles mounted on its semi-circularly shaped portion; and
a source of compressed gas in communication with the soot blower, wherein the compressed gas provided to the soot blower is injected by each of the nozzles toward the exhaust treatment component to disperse particulate matter and soot at the exhaust treatment component.
2. The system of claim 1, wherein the semi-circularly shaped portions of the first and second spray rods are positioned relative to one another to form a circular shape.
3. The system of claim 1, wherein the compressed gas is alternately provided to the first spray rod and the second spray rod.
4. The system of claim 1, wherein the soot blower includes an adjustment mechanism to vary an axial position of the first and second spray rods.
5. The system of claim 4, wherein the soot blower includes a housing through which the first and second spray rods extend, the adjustment mechanism including a stanchion fixed to the housing and a cap fixed to the first spray rod, the cap being attachable to the stanchion at different axial positions to position the nozzles at different axial positions relative to the exhaust treatment component.

6. The system of claim 5, wherein the stanchion and the housing each include an elongated aperture in receipt of the first spray rod.

7. The system of claim 1, wherein the soot blower includes a pivotable link interconnecting the first and second spray rods.

8. The system of claim 7, wherein the link includes a first end rotatably coupled to the closed end of the first spray rod and a second end pivotally coupled to the second spray rod.

9. The system of claim 8, wherein the soot blower includes another pivotable link including a first end pivotably coupled to the closed end of the second spray rod and a second end pivotably coupled to the first spray rod.

10. The system of claim 1, wherein at least one of the spray nozzles includes only a single aperture communicating with the source of compressed gas.

11. The system of claim 10, wherein the aperture includes a reduced diameter portion between first and second ends of the nozzle to increase the velocity of the compressed gas as it travels through the nozzle.

12. The system of claim 1, wherein adjacent nozzles are aimed along different axes and both axes intersect an upstream face of the exhaust treatment component.

13. The system of claim 1, wherein the soot blower includes an adjustment mechanism to vary an axial position of the first and second spray rods.

14. The system of claim 4, wherein the soot blower includes a housing through which the first and second spray rods extend, the adjustment mechanism including a stanchion fixed to the housing and a cap fixed to the first spray rod, the cap being attachable to the stanchion at different axial positions to position the nozzles at different axial positions relative to the exhaust treatment component.

15. The system of claim 1, wherein adjacent nozzles are aimed along different axes and both axes intersect an upstream face of the exhaust treatment component upstream of the soot blower.

16. The system of claim 1, further including a first connection system coupling the closed end of the first spray rod to the second spray rod.

17. The system of claim 1, further including a second connection system coupling the closed end of the second spray rod to the first spray rod.

18. The system of claim 17, wherein the first connection system includes a bracket with a slot fixed to one of the first and second spray rods and a plate positioned within the slot and fixed to the other of the first and second spray rods.

19. A soot blower for an exhaust treatment system including an exhaust treatment component and a source of compressed gas, comprising:

- a tubular housing having a downstream end adapted to be coupled in fluid communication with the exhaust treatment component;

- hollow first and second spray rods extending through the housing diametrically opposed to one another, each of the first and second spray rods including a first end adapted to be coupled to the source of compressed gas and a second closed end positioned within the housing;

- a first connection system interconnecting the second end of the first spray rod to the second spray rod;

- a second connection system interconnecting the second end of the second spray to the first spray rod; and

- spray nozzles fixed to the first and second spray rods, the nozzles being adapted to direct the compressed gas toward an upstream face of the exhaust treatment component.

20. The soot blower of claim 19, further including an adjustment mechanism to vary an axial position of the first and second spray rods.

21. The soot blower of claim 20, wherein the adjustment mechanism includes a stanchion fixed to the housing and a cap fixed to the first spray rod, the cap being attachable to the stanchion at different axial positions to position the nozzles at different axial positions relative to the exhaust treatment component.

22. The soot blower of claim 21, wherein the stanchion and the housing each include an elongated aperture in receipt of the first spray rod.

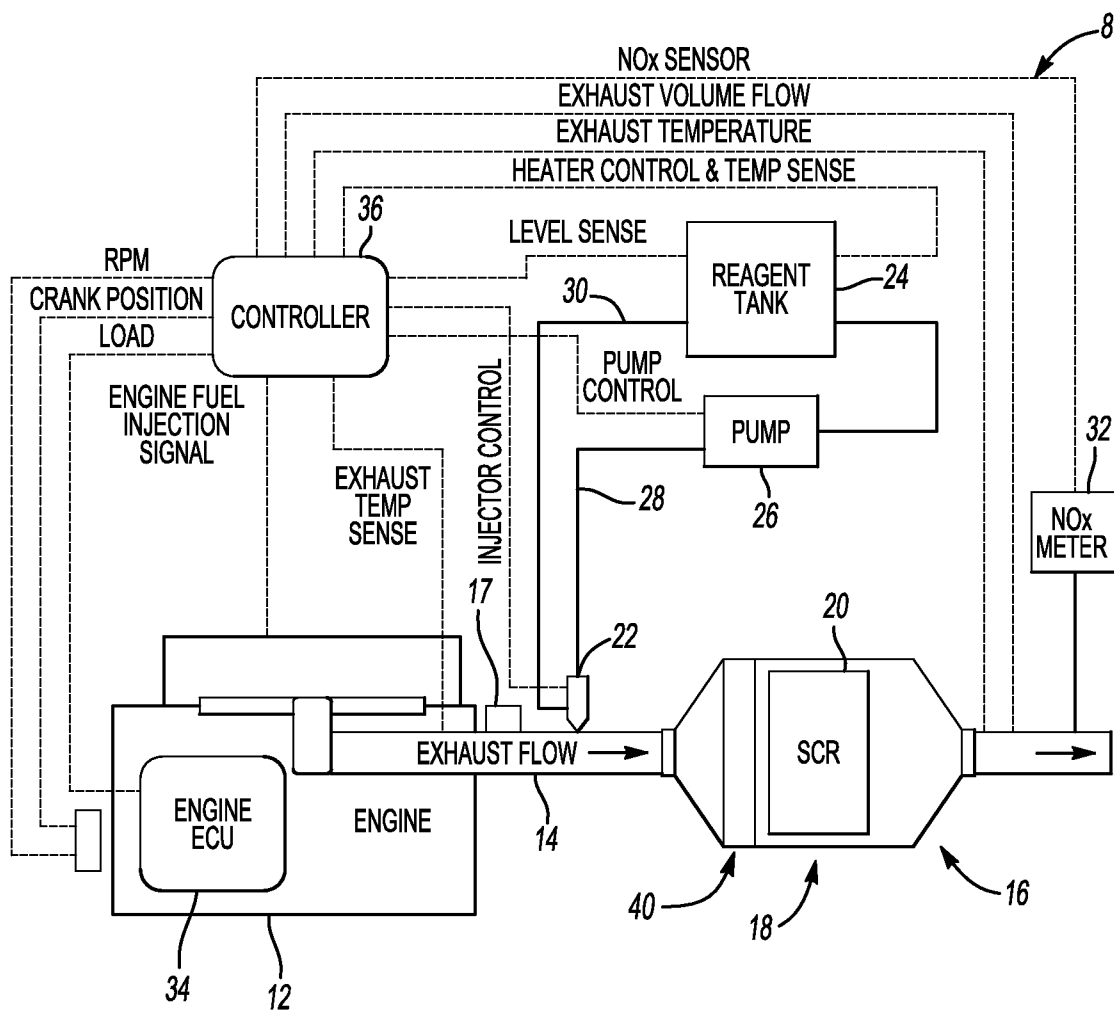
23. The soot blower of claim 19, wherein the first and second spray rods each include curved portions aligned with one another along a circle.

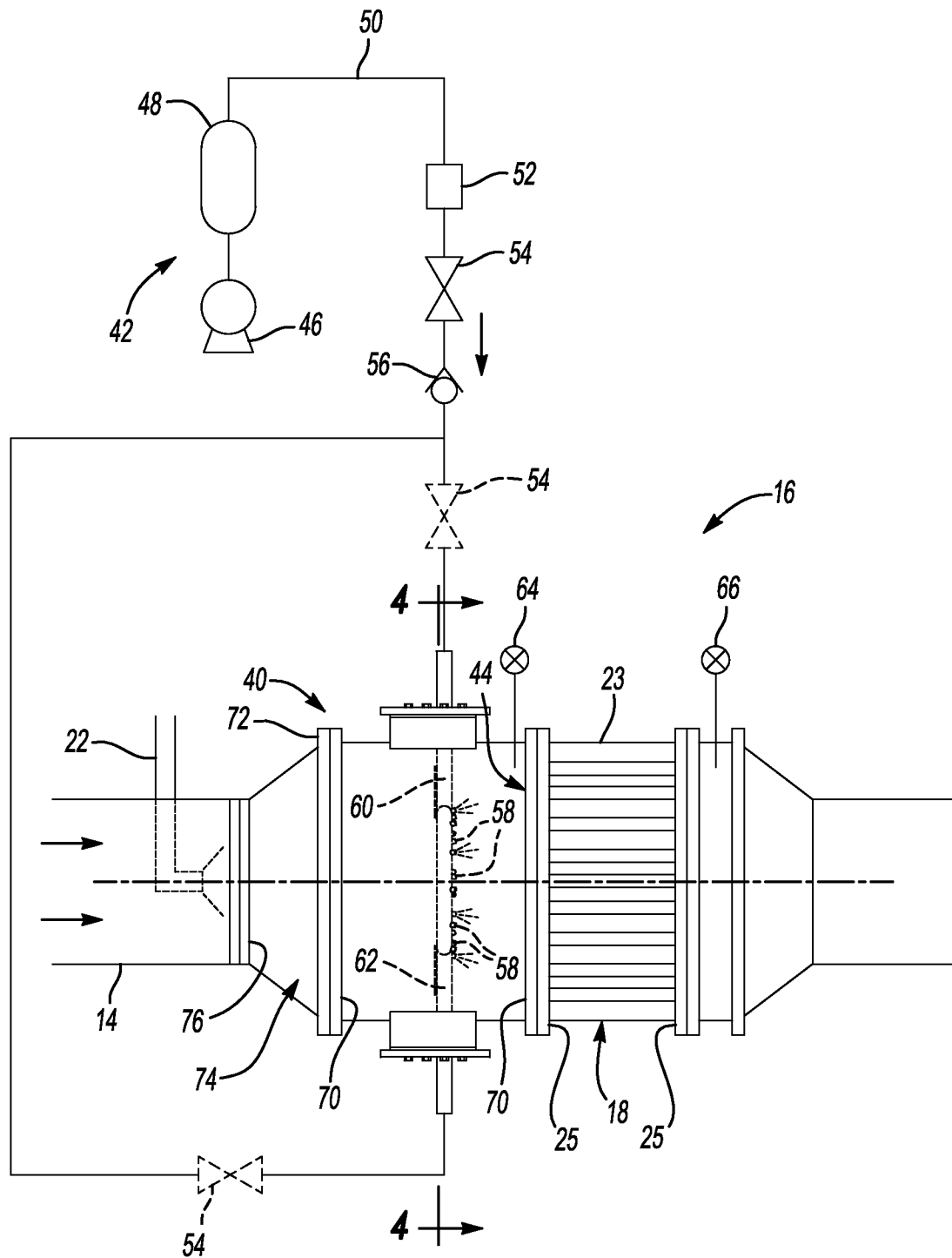
24. The soot blower of claim 19, wherein at least one of the spray nozzles includes only a single aperture communicating with the source of compressed gas.

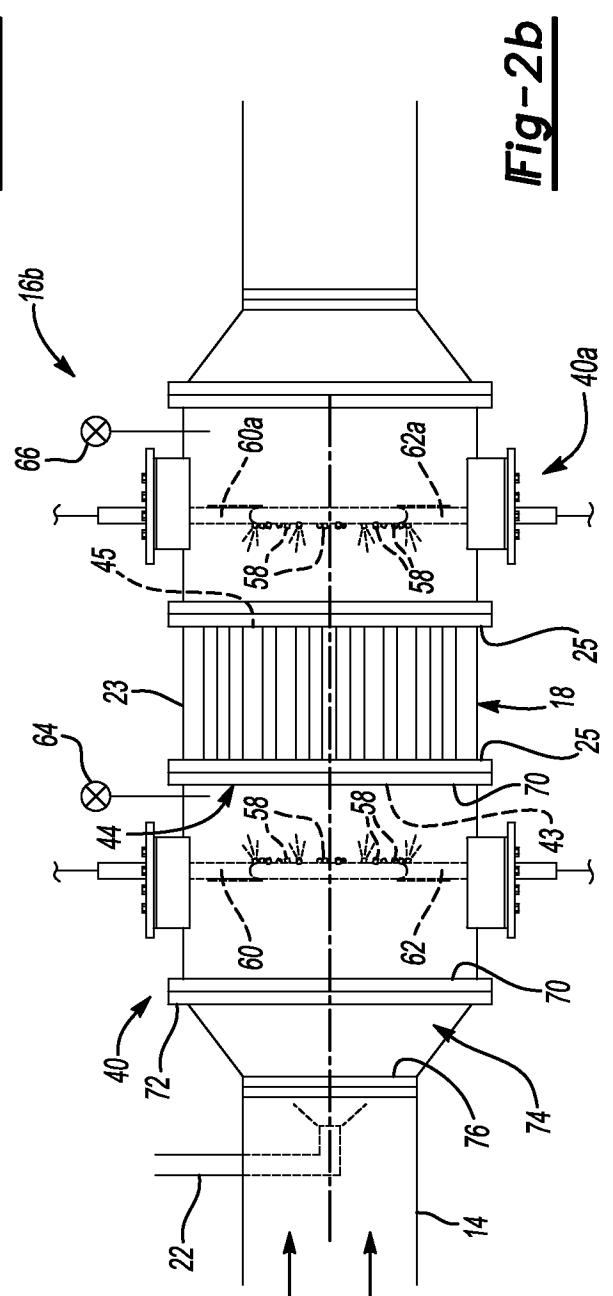
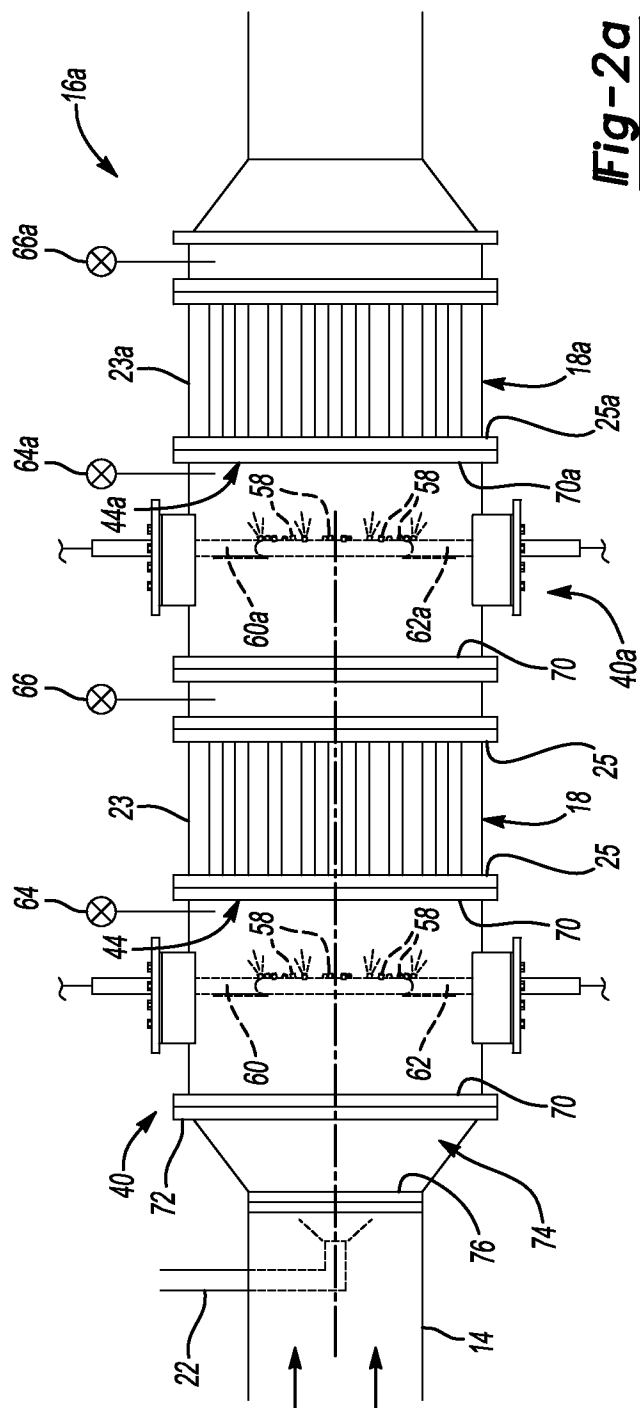
25. The soot blower of claim 24, wherein the aperture includes a reduced diameter portion between first and second ends of the nozzle to increase the velocity of the compressed gas as it travels through the nozzle.

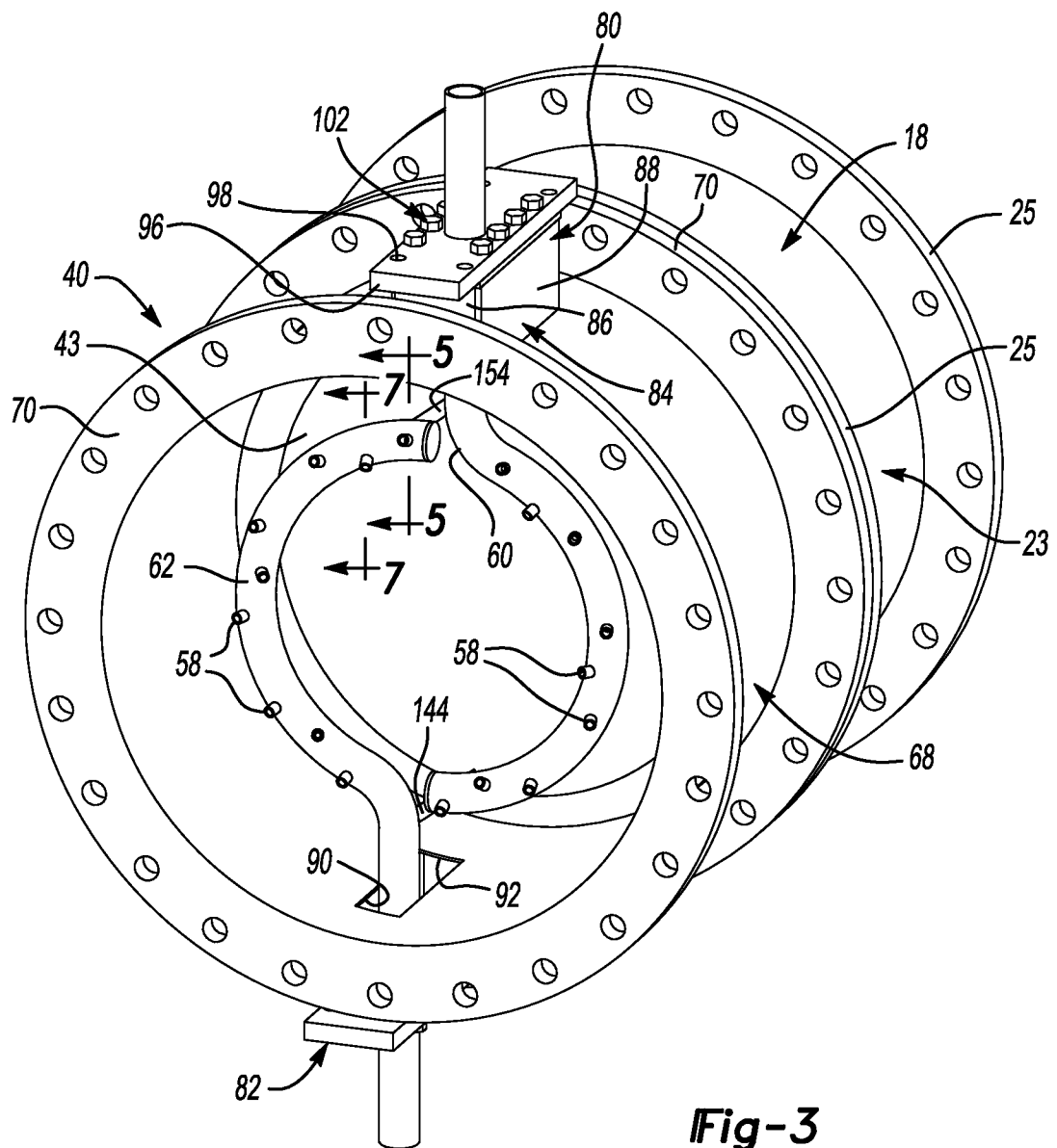
26. The soot blower of claim 19, wherein the first connection system includes a first pivotable link and the second connection system includes a second pivotable link.

27. The soot blower of claim 19, wherein the first connection system includes a bracket with a slot fixed to one of the first and second spray rods and a plate positioned within the slot and fixed to the other of the first and second spray rods.

***Fig-1***

**Fig-2**





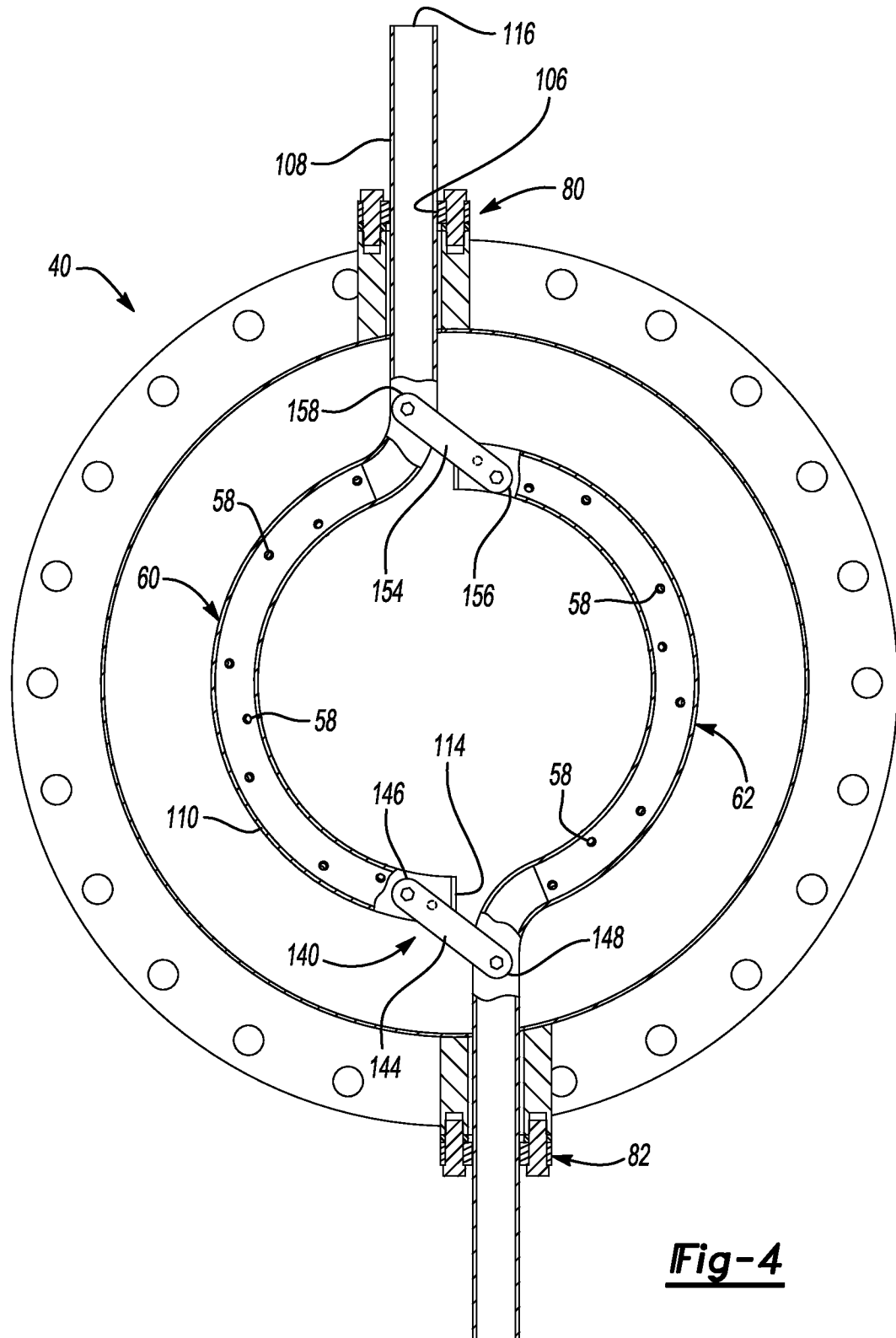
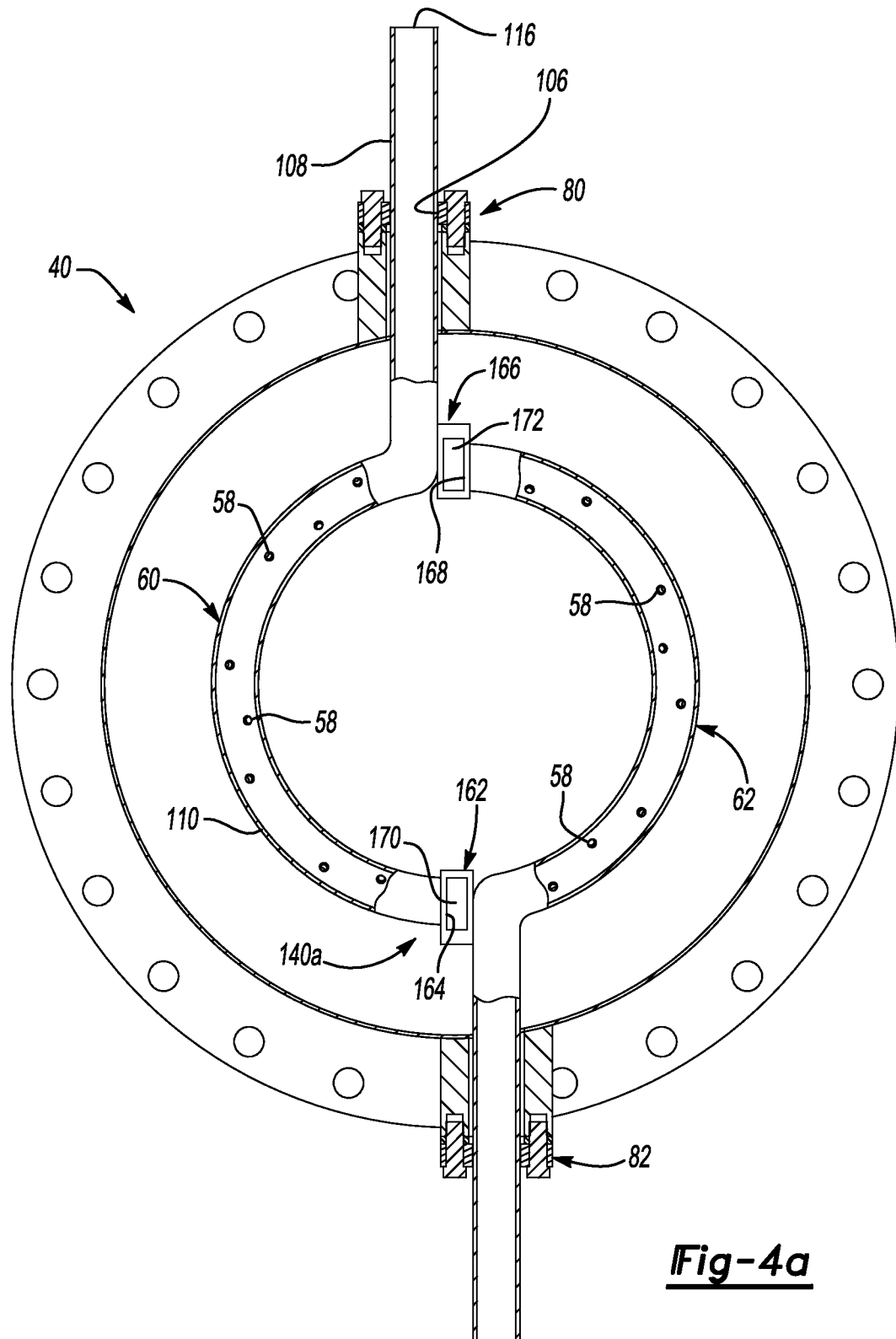
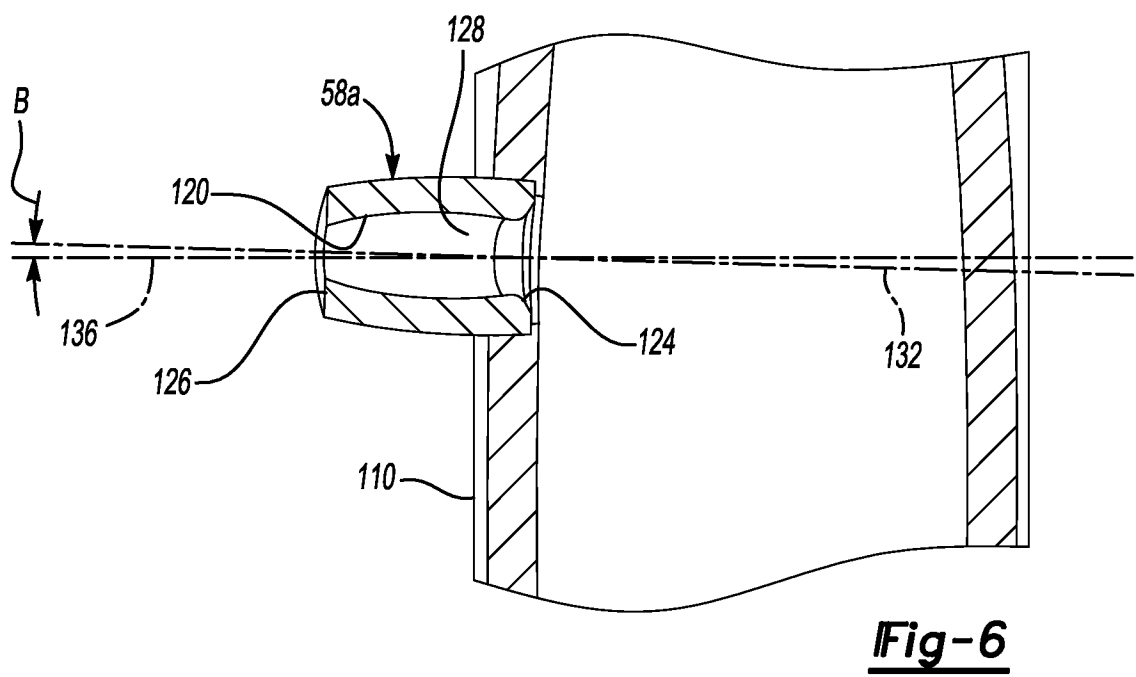
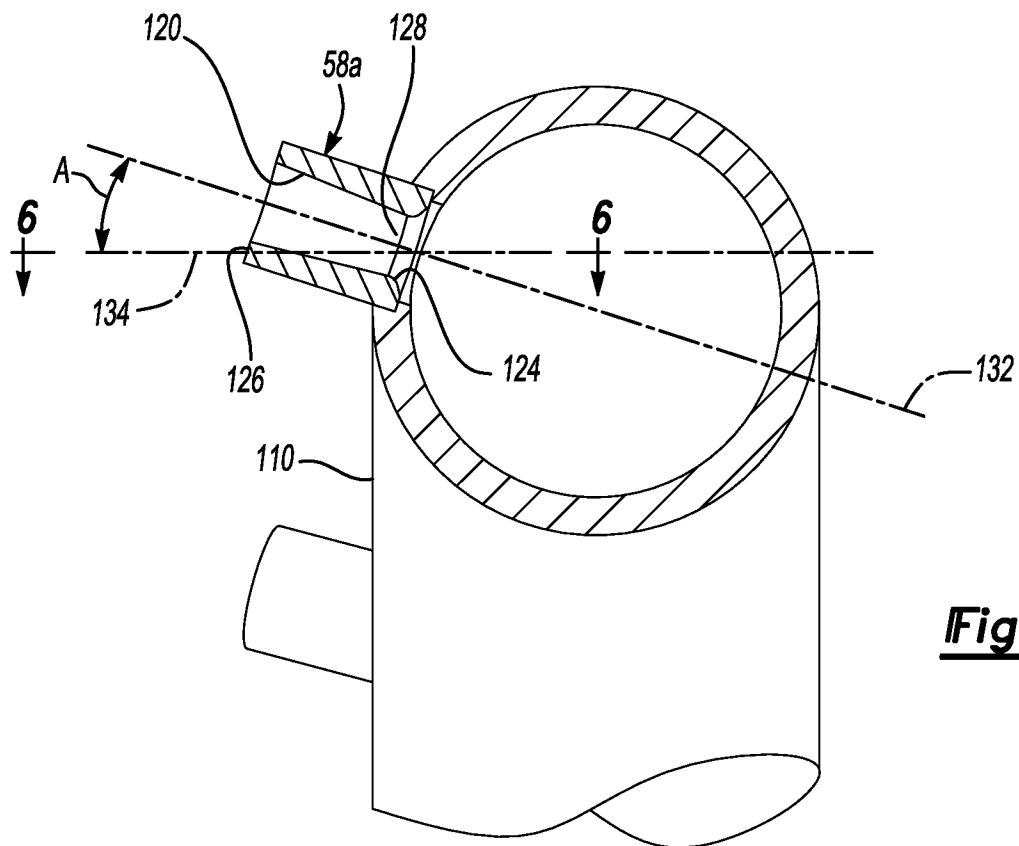


Fig-4





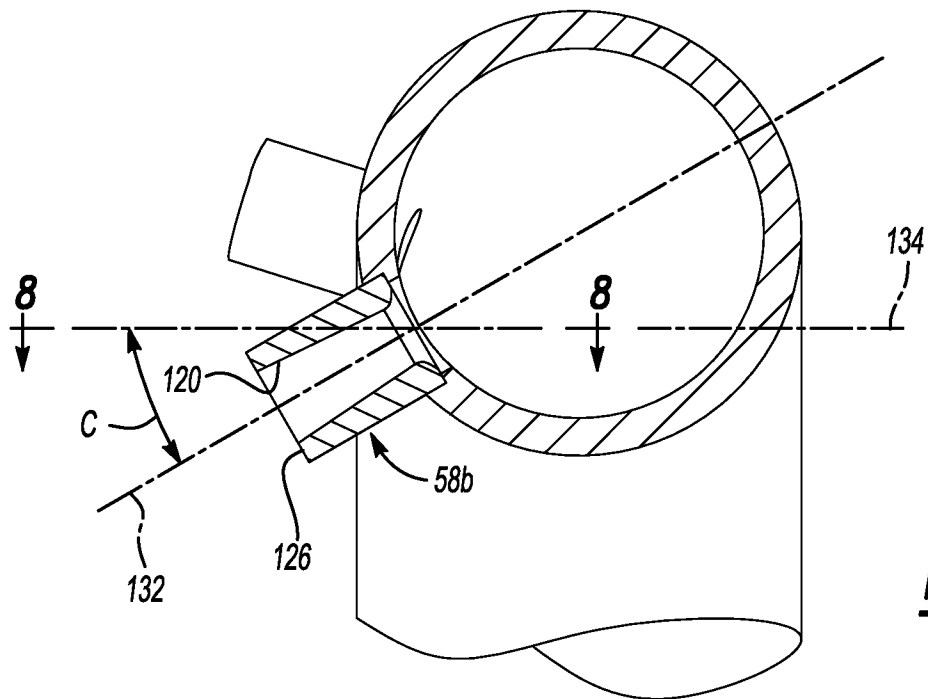


Fig-7

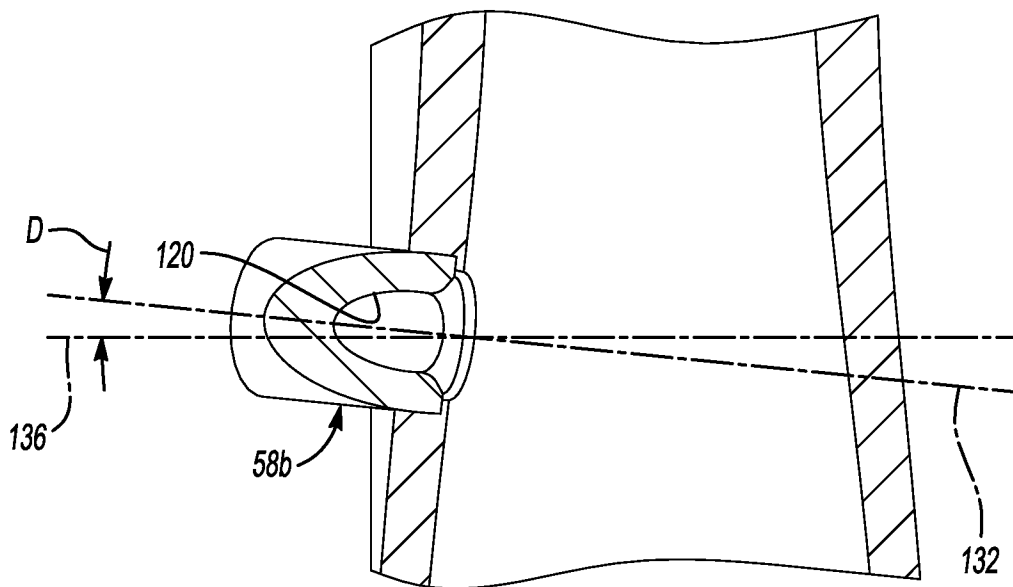


Fig-8

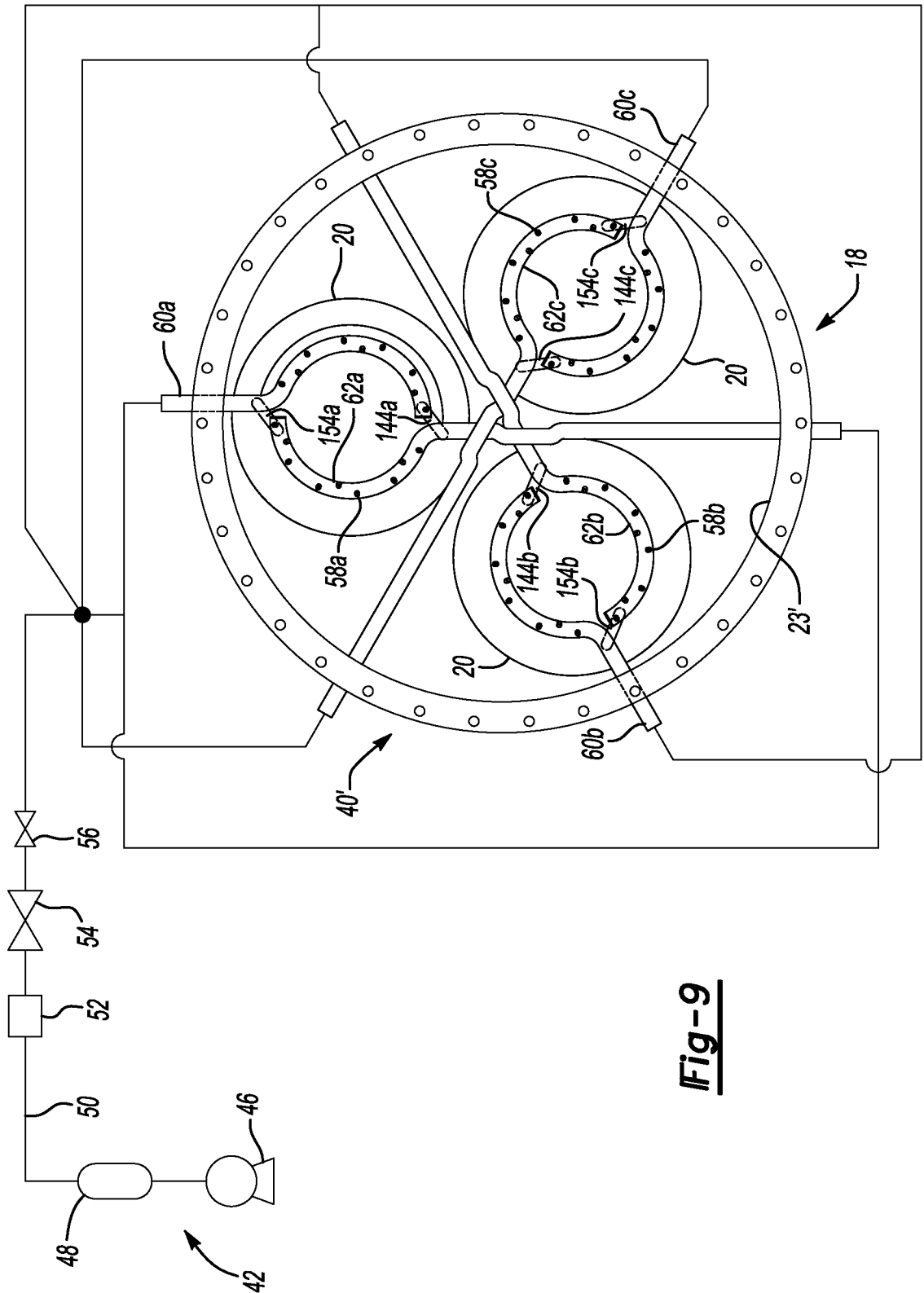


Fig-9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/072101

A. CLASSIFICATION OF SUBJECT MATTER

F01N 3/22(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; B01J

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

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

WPI;EPODOC;CNPAT;CNKI;IEEE;CNTXT;TWTXT;USTXT;WOTXT;EPTXT;CATXT:exhaust, treatment, soot, particulate, blower, dispers+, rod, tube, nozzle?, circularly, compressed gas, adjust+, housing, link+, connect+, stanchion, engine

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1597100 A (KOCAT INC.) 23 March 2005 (2005-03-23) description, page 6, line 8 to page 8, line 13, and figure 2	1-3
A	CN 102465738 A (GM GLOBAL TECH. OPERATIONS INC.) 23 May 2012 (2012-05-23) the whole document	1-27
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

15 October 2014

Date of mailing of the international search report

18 November 2014

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
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PCT/CN2014/072101

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