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OSADA

(54) **POST-PROCESSING SYSTEM**

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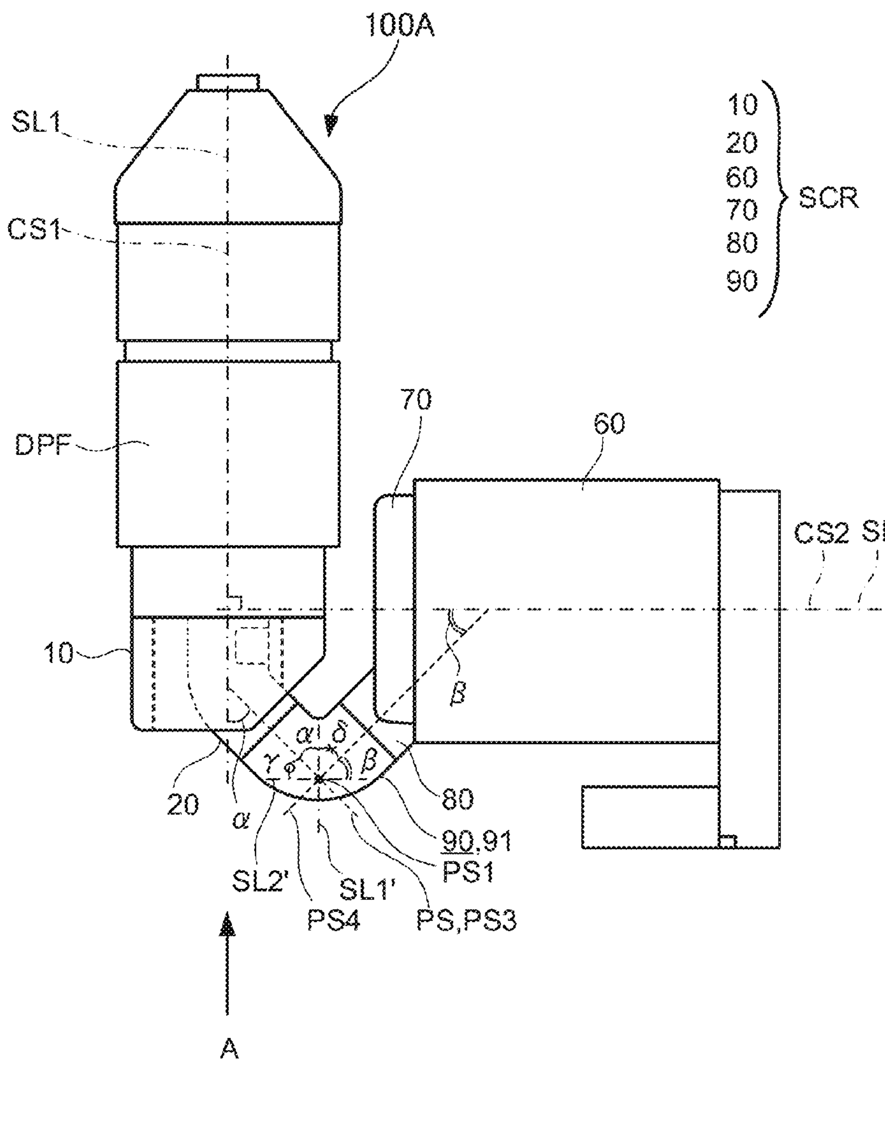
(57) **ABSTRACT**

A post-processing system includes: a cylindrical first processing section extending in a first cylinder axis direction and processing exhaust discharged from an internal combustion engine; a cylindrical second processing section disposed on an exhaust downstream side compared to the first processing section, extending in a second cylinder axis direction, and processing the exhaust; a first pipe extending in a direction at a first angle to the first cylinder axis direction, rotatably disposed around a first cylinder axis, and guiding out the exhaust processed by the first processing section; a second pipe extending in a direction at a second angle to the second cylinder axis direction, rotatably disposed around a second cylinder axis, and introducing the exhaust processed by the second processing section; and a third pipe formed to form an angle obtained of the first angle and the second angle, and coupling the first pipe with the second pipe.



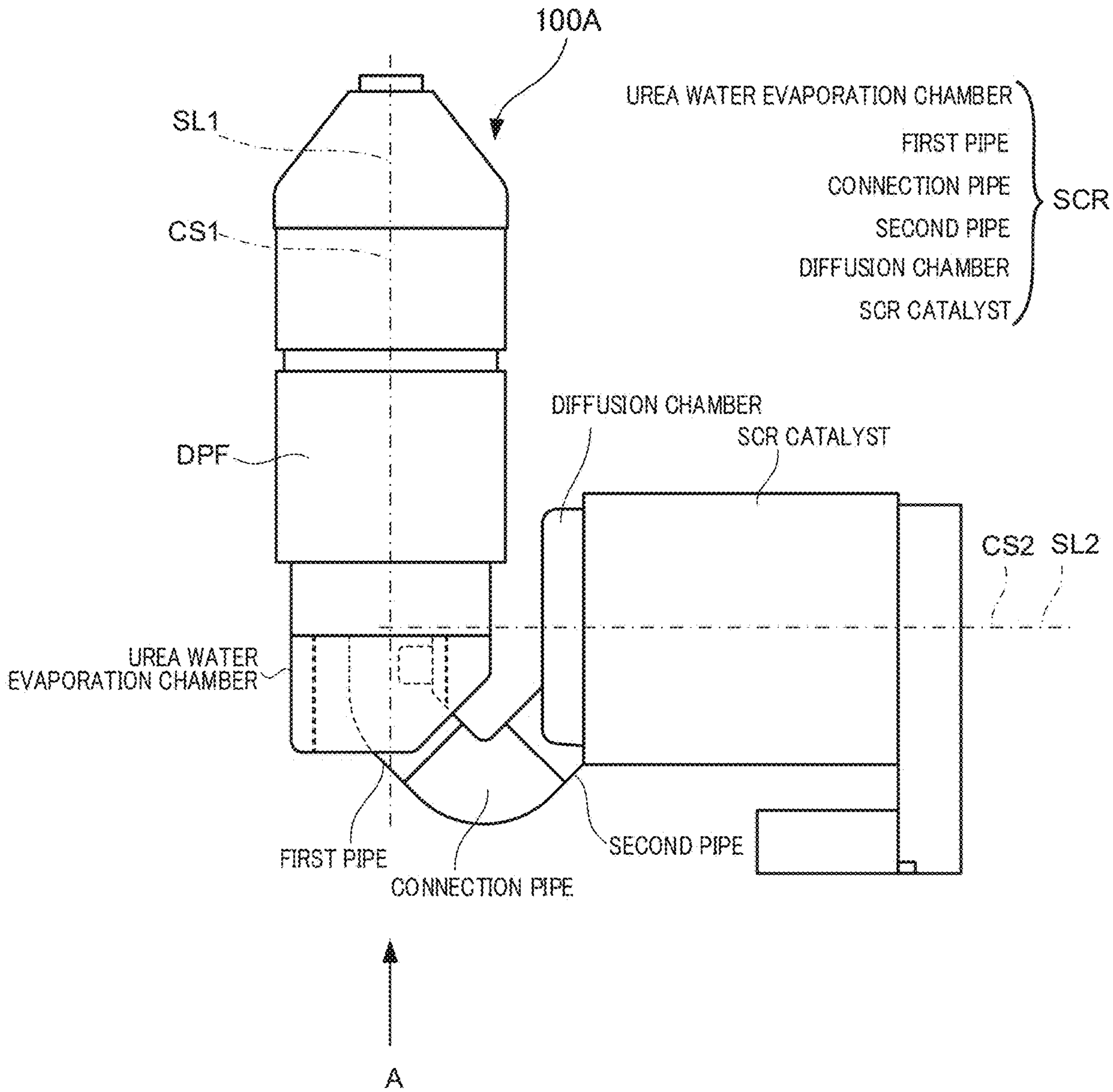

100A
SL1
CS1
DPF
UREA WATER EVAPORATION CHAMBER
FIRST PIPE
CONNECTION PIPE
SECOND PIPE
DIFFUSION CHAMBER
SCR CATALYST
SCR
DIFFUSION CHAMBER
SCR CATALYST
CS2
SL2
UREA WATER
EVAPORATION CHAMBER
FIRST PIPE
CONNECTION PIPE
SECOND PIPE
A

FIG. 1

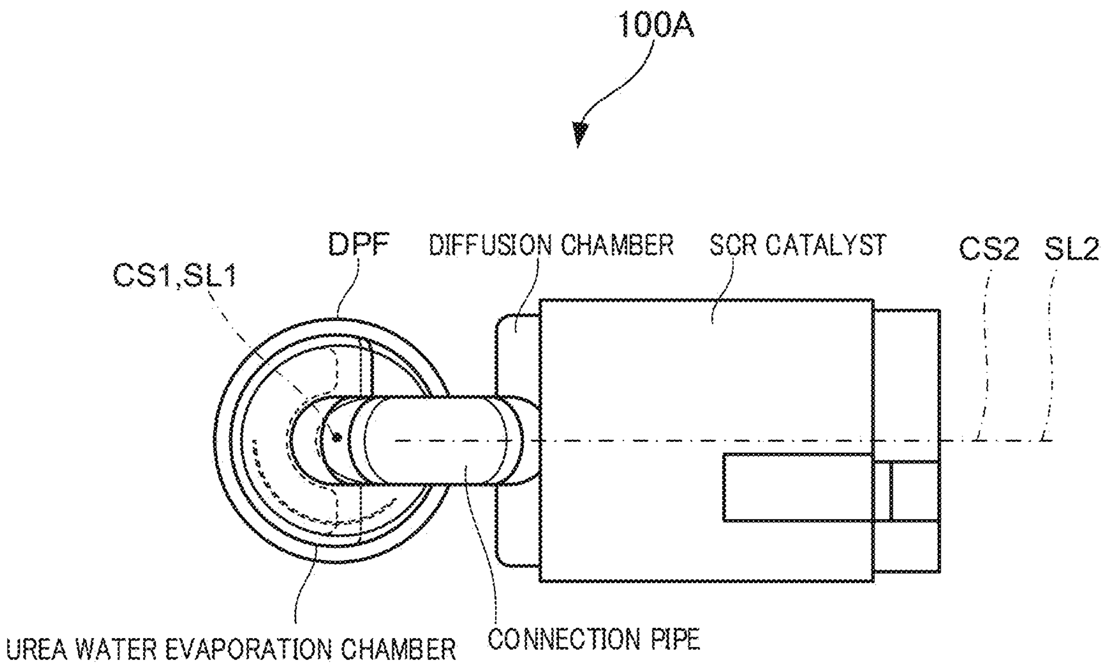

100A
CS1,SL1
DPF
DIFFUSION CHAMBER
SCR CATALYST
CS2
SL2
UREA WATER EVAPORATION CHAMBER
CONNECTION PIPE

FIG. 2

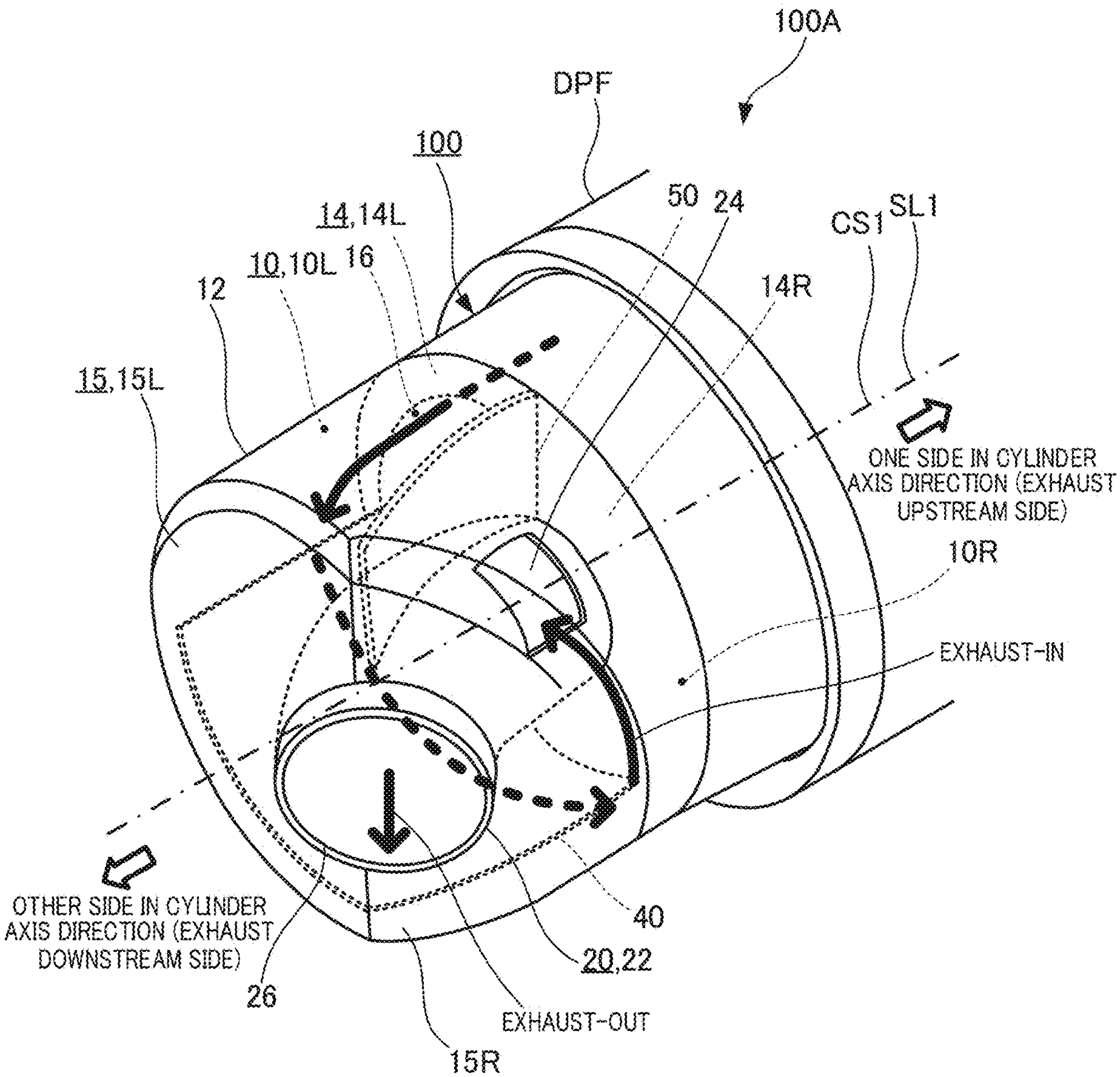

100A
DPF
100
50
24
14,14L
CS1
SL1
10,10L
16
14R
12
15,15L
ONE SIDE IN CYLINDER AXIS DIRECTION (EXHAUST UPSTREAM SIDE)
10R
EXHAUST-IN
40
OTHER SIDE IN CYLINDER AXIS DIRECTION (EXHAUST DOWNSTREAM SIDE)
20,22
26
EXHAUST-OUT
15R

FIG. 3

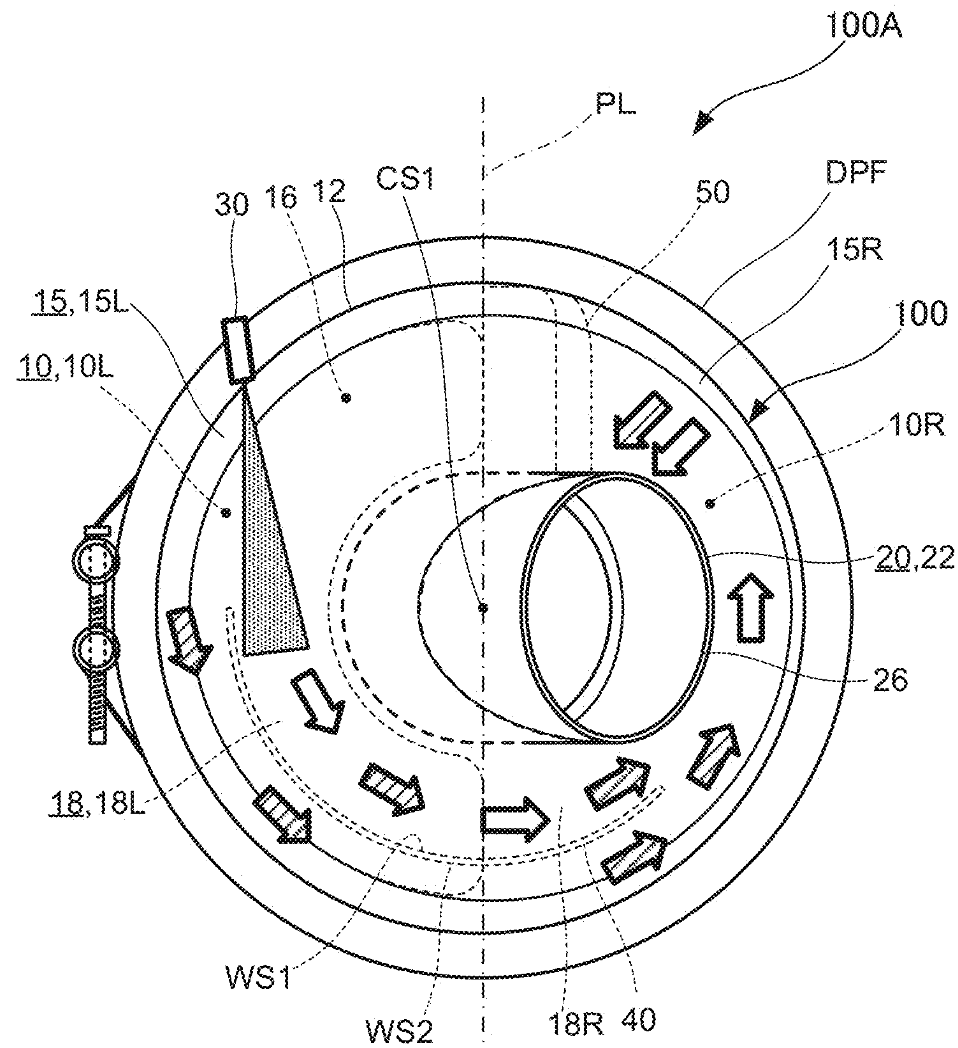

100A
PL
CS1
30
16
12
50
DPF
15R
15,15L
100
10,10L
10R
20,22
26
18,18L
WS1
WS2
18R
40

FIG. 4

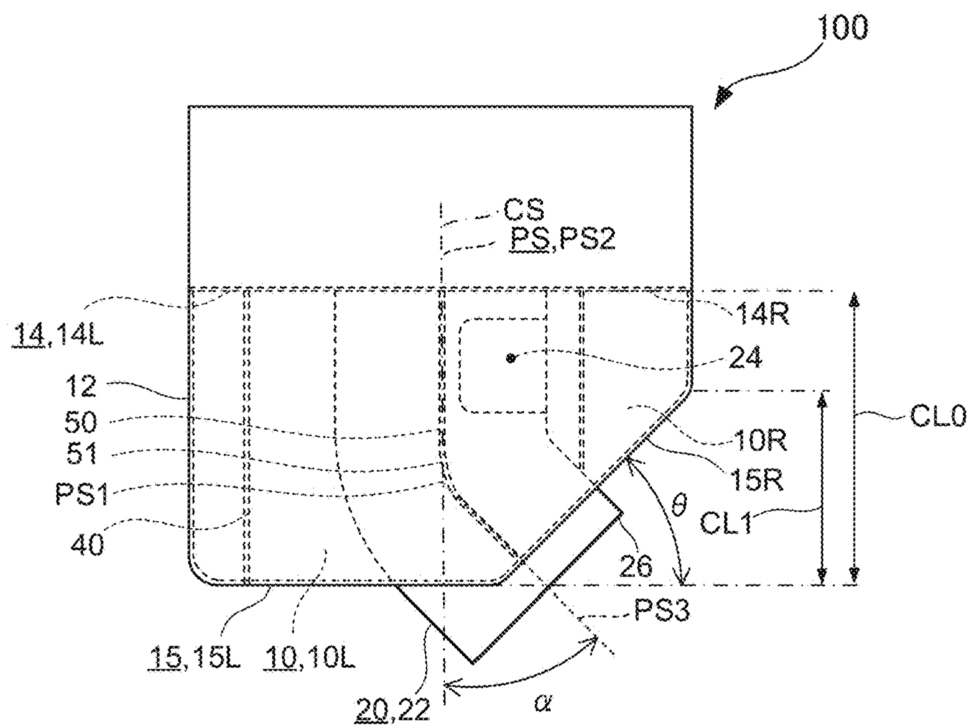

100
CS
PS,PS2
14,14L
14R
24
12
50
51
PS1
40
10R
15R
CL0
θ
CL1
26
PS3
15,15L
10,10L
20,22
α

FIG. 5

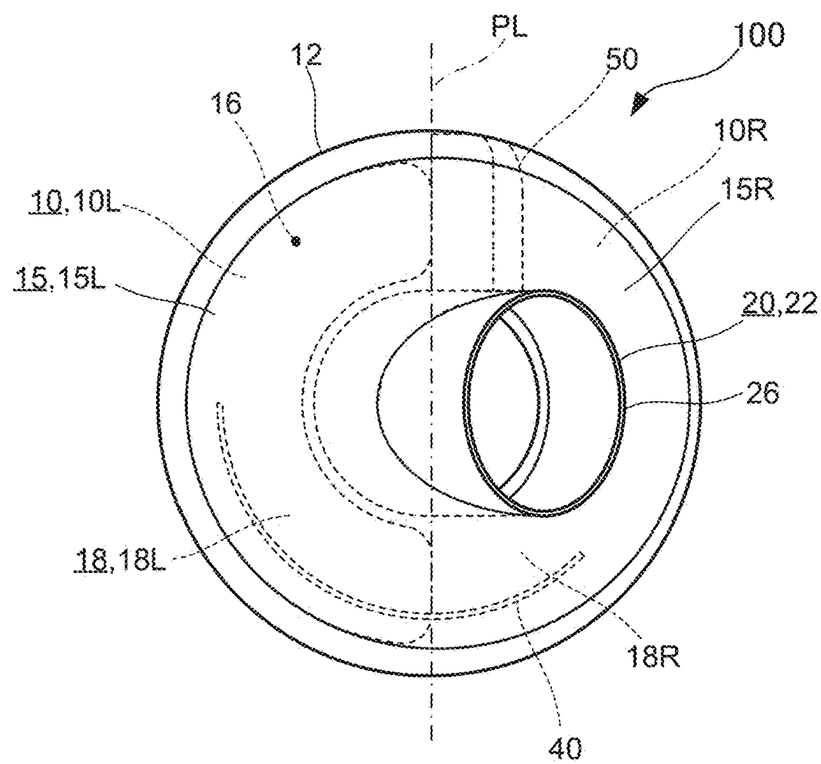

PL
12
50
100
16
10R
10,10L
15R
15,15L
20,22
26
18,18L
18R
40

FIG. 6

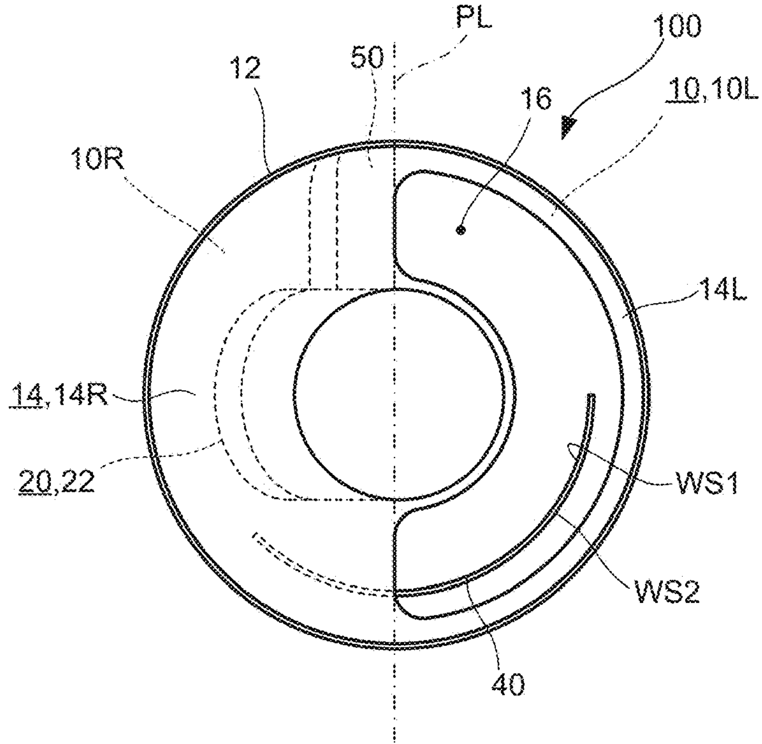

PL
100
50
12
16
10,10L
10R
14L
14,14R
WS1
20,22
WS2
40

FIG. 7

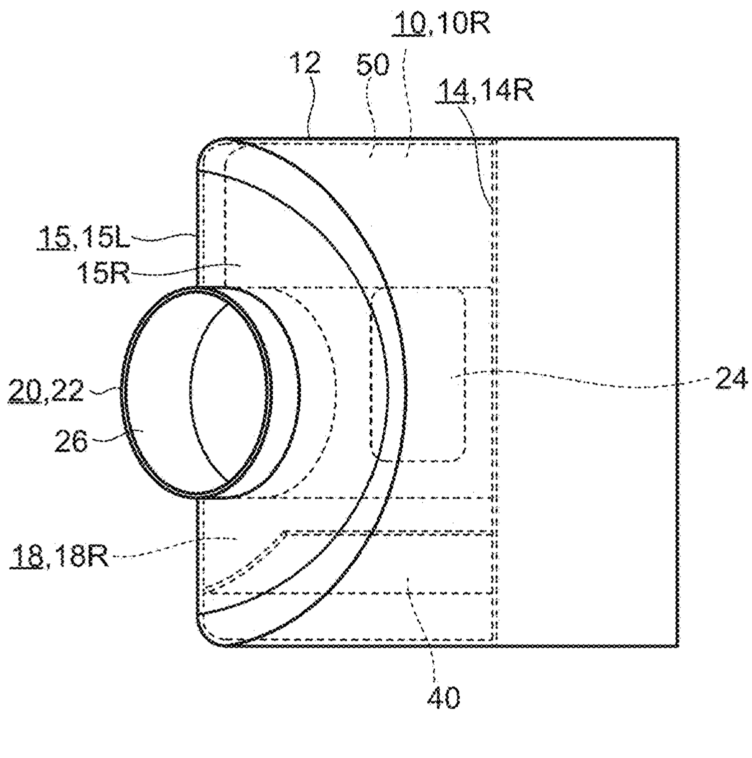

10,10R
12
50
14,14R
15,15L
15R
24
20,22
26
18,18R
40

FIG. 8

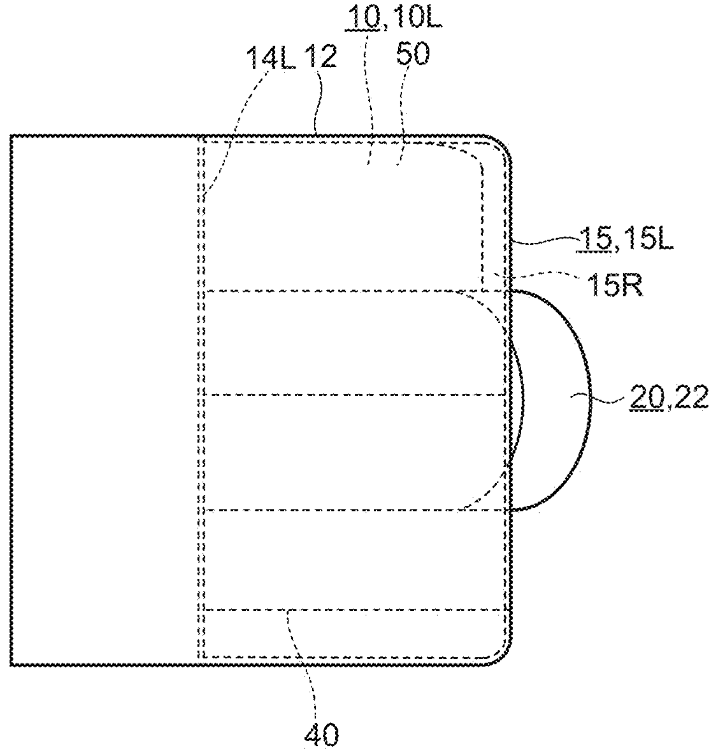

10,10L
14L 12
50
15,15L
15R
20,22
40

FIG. 9

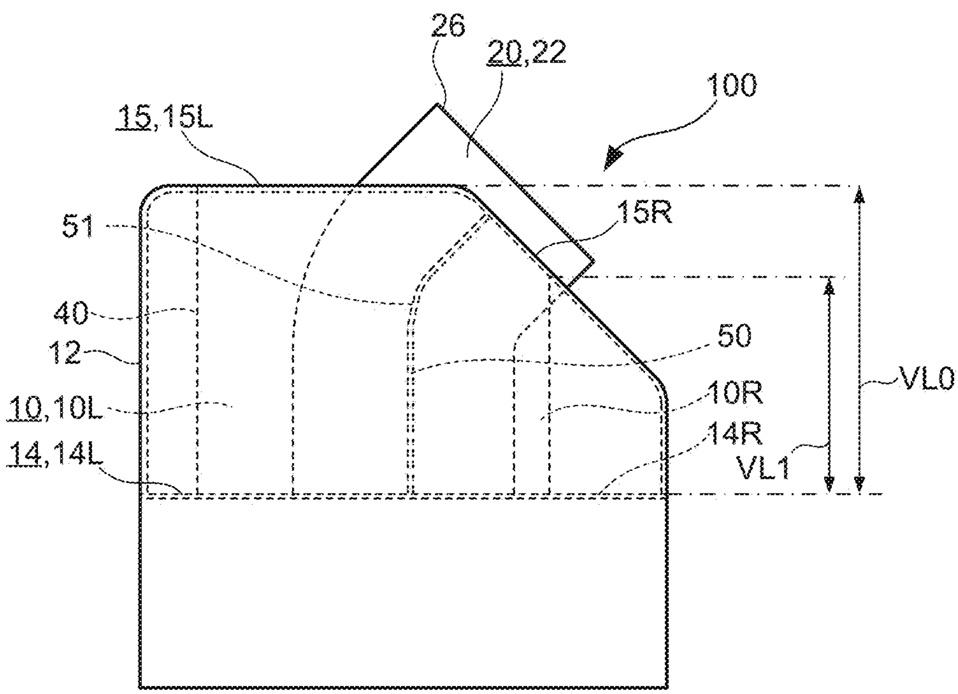

26
20,22
100
15,15L
51
15R
40
12
50
10,10L
10R
14R
VL0
14,14L
VL1

FIG. 10

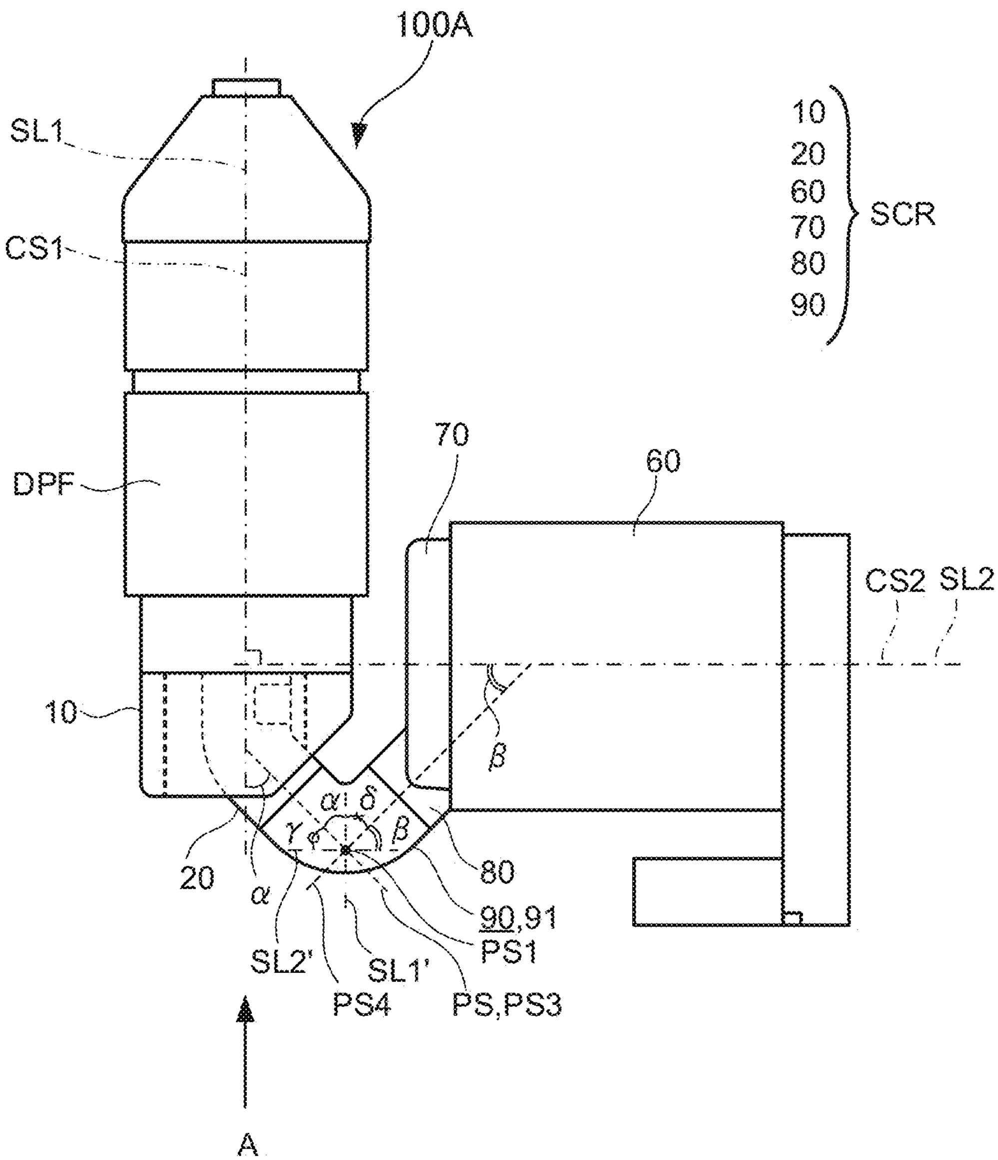

100A
SL1
CS1
DPF
10
20
60
70
80
90
SCR
CS2 SL2
β
α
δ
γ
20
α
80
90,91
PS1
SL2'
SL1'
PS4
PS,PS3
A

FIG. 11

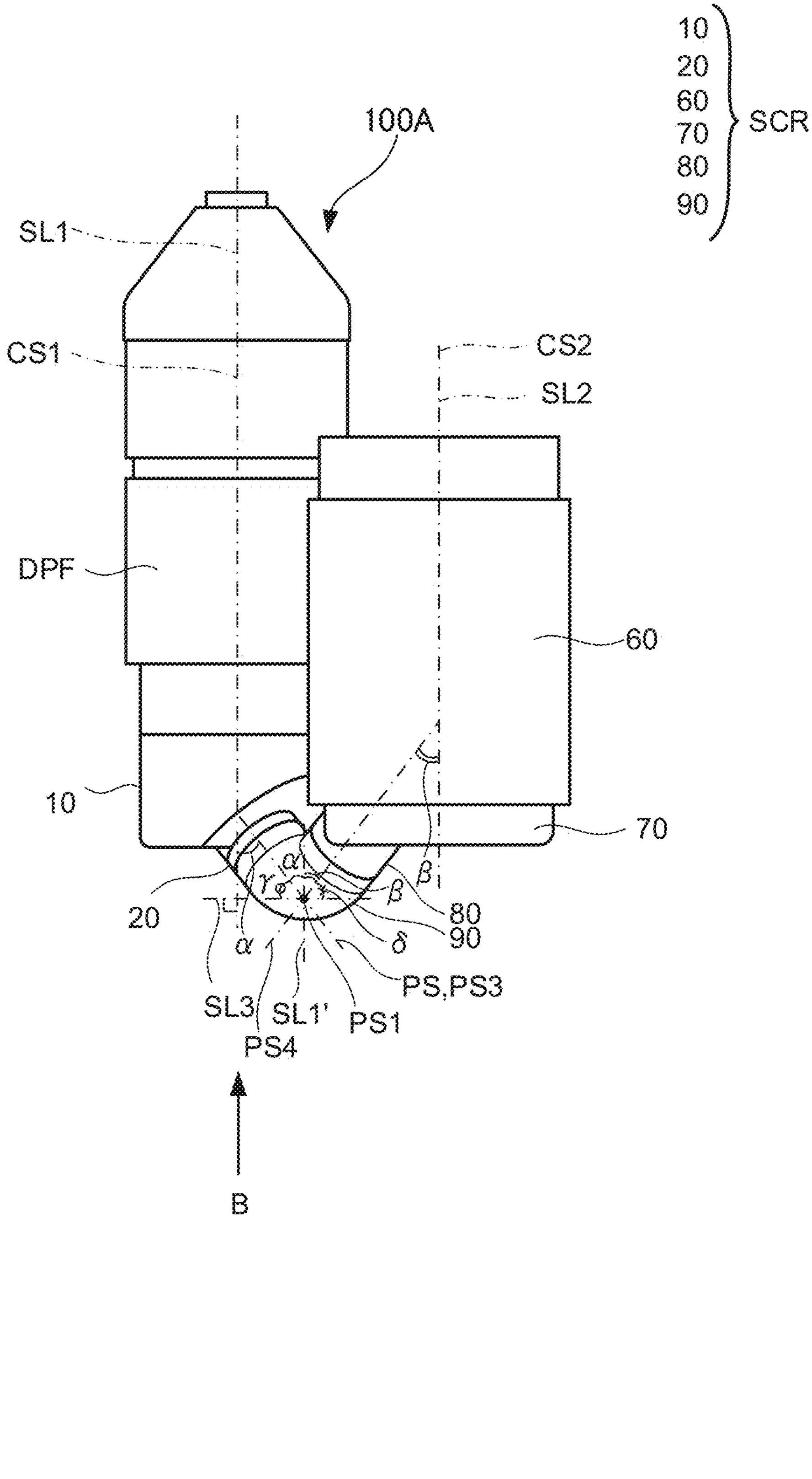

10
20
60
70
80
90
SCR
100A
SL1
CS1
CS2
SL2
DPF
60
10
70
20
α
γ
φ
β
80
90
δ
PS,PS3
SL3
SL1'
PS1
PS4
B

FIG. 12

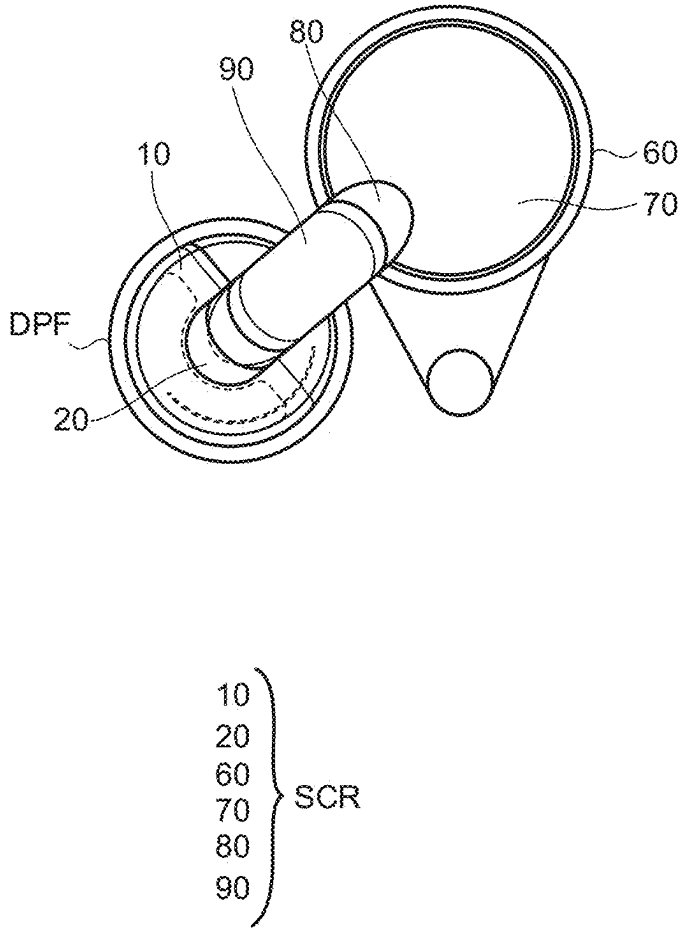


FIG. 13

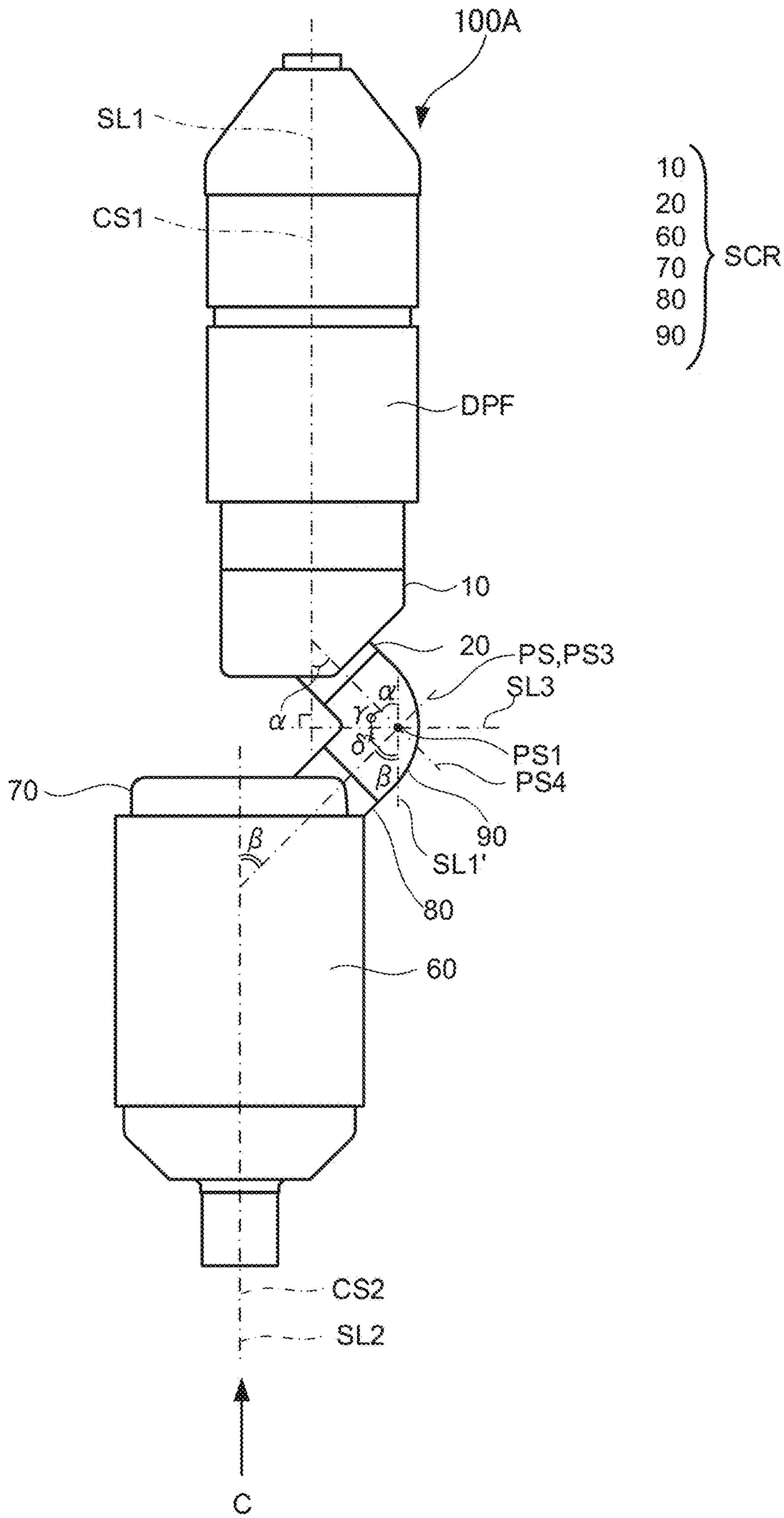

100A
SL1
CS1
10
20
60
70
80
90
SCR
DPF
10
20
PS,PS3
SL3
α
α
γ
δ
PS1
PS4
β
70
90
β
SL1'
80
60
CS2
SL2
C

FIG. 14

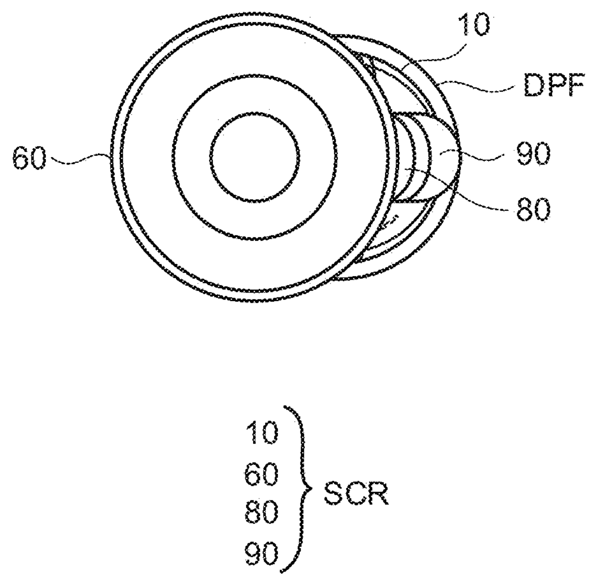


FIG. 15

POST-PROCESSING SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority of Japanese Patent Application No. 2024-022172, filed on Feb. 16, 2024. The contents of the above application is all incorporated by reference as if fully set forth herein in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a post-processing system.

BACKGROUND ART

[0003] Conventionally, exhaust gas discharged from an internal combustion engine contains a particulate matter (PM). PM is generated by unburned fuel in a rich situation where the air-fuel ratio exceeds 1.5 times the theoretical air-fuel ratio. On the other hand, PM decreases in a lean situation where the air-fuel ratio is 1.5 times or less than the theoretical air-fuel ratio. Further, in the case of a diesel engine, there is a trade-off relationship such that in a rich situation where the air-fuel ratio exceeds 2 times the theoretical air-fuel ratio, oxygen becomes insufficient and PM is generated, and in a lean situation where air-fuel ratio approaches the theoretical air-fuel ratio or becomes less than the theoretical air-fuel ratio, the combustion temperature becomes high and nitrogen oxides (NOx) are generated.

[0004] A vehicle is equipped with a post-processing system that processes PM and NOx in exhaust gas. As an exhaust gas processing apparatus that processes PM, a diesel particulate filter (DPF) that collects and removes PM is known. Further, a diesel oxidation catalyst (DOC) is known, which increases the temperature of exhaust gas by oxidizing fuel (HC) injected after a combustion step, thereby promoting combustion in the DPF. Further, as an exhaust gas processing apparatus that processes NOx, a selective catalytic reduction apparatus (SCR) is known, which mixes a reducing agent such as ammonia with exhaust gas containing NOx and decomposes NOx into nitrogen and water.

[0005] The layout of the post-processing system, which is composed of a DPF, a DOC, an SCR, and the like, is set according to the vehicle type.

[0006] For example, Patent Literature (hereinafter, referred to as PTL) 1 discloses a post-processing system that is provided on the downstream side of a post-processing apparatus that purifies exhaust gas discharged from an internal combustion engine mounted on a vehicle. The post-processing system includes a tubular main body including therein a flow path of the exhaust gas purified by the post-processing apparatus, and the tubular main body includes a curved portion formed to be curved such that the curved portion is convex upward in a height direction of the vehicle.

[0007] Further, for example, PTL 2 discloses an exhaust purification system that includes a post-processing apparatus that allows exhaust gas to pass therethrough and purifies the exhaust gas, and adopts a layout in which the exhaust gas is reversed and introduced into the post-processing apparatus. In the exhaust purification system, the post-processing system includes a gas dispersion chamber that covers an inlet-side end surface of the post-processing apparatus and guides the exhaust gas into the post-processing apparatus through an exhaust gas introduction port from a direction substantially orthogonal to an axial center direction of the post-processing apparatus. An exhaust pipe line that guides the exhaust gas to the exhaust gas introduction port of the gas dispersion chamber is extended in the axial center direction of the post-processing apparatus, is bent in a direction away from the exhaust gas introduction port at a position immediately before the exhaust gas introduction port, is bent back in a hook shape, and is connected to the exhaust gas introduction port. In the post-processing system, a wind guiding structure is provided in the gas dispersion chamber to cooperate with a hook-shaped exhaust guide portion of the exhaust pipe line to allow a flow of the exhaust gas to be folded back in an arc shape toward the axial center of the post-processing apparatus.

[0008] Further, for example, PTL 3 discloses a post-processing system including a post-processing apparatus that includes the following: an exhaust pipe through which exhaust gas discharged from an internal combustion engine mounted on a vehicle flows; and a terminal section disposed on a lower side of the vehicle and on a downstream side of the exhaust pipe, and configured to discharge the exhaust gas from a right side or a left side of the vehicle to the left side or the right side of the vehicle. The post-processing apparatus is disposed, for example, on a downstream side of the exhaust pipe and on an upstream side of the terminal section, and is configured to purify the exhaust gas.

CITATION LIST

Patent Literature

PTL 1

[0009] Japanese Patent Application Laid-Open No. 2020-148146

PTL 2

[0010] Japanese Patent Application Laid-Open No. 2013-104393 PTL 3

[0011] Japanese Patent Application Laid-Open No. 2020-51408

SUMMARY OF INVENTION

Technical Problem

[0012] The layout of a plurality of components forming a post-processing system is set according to the vehicle type. In general, the shape, size, and the like of each of the plurality of components are changed in accordance with the layout variation.

[0013] Even in the post-processing systems described in PTLs 1 to 3, there is a problem in that it is necessary to change components in accordance with layout variations, making it difficult to achieve component sharing.

[0014] An object of the present disclosure is to provide a post-processing system capable of sharing components.

Solution to Problem

[0015] In order to achieve the above object, a post-processing system of the present disclosure includes:

[0016] a first processing section that extends in a direction of a first cylinder axis and processes exhaust discharged from an internal combustion engine, the first processing section having a cylindrical shape; and a second processing section that is disposed on an exhaust downstream side compared to the first processing section, extends in a direction of a second cylinder axis, and processes the exhaust, the second processing section having a cylindrical shape, in which

[0017] the post-processing system further includes:

[0018] a first pipe that extends in a direction at a first angle with respect to the direction of the first cylinder axis, is disposed to be rotatable around the first cylinder axis, and guides out the exhaust processed by the first processing section,

[0019] a second pipe that extends in a direction at a second angle with respect to the direction of the second cylinder axis, is disposed to be rotatable around the second cylinder axis, and introduces the exhaust processed by the second processing section, and

[0020] a third pipe that is formed to have an angle obtained by adding the first angle and the second angle and couples the first pipe with the second pipe.

Advantageous Effects of Invention

[0021] The present disclosure can achieve component sharing.

BRIEF DESCRIPTION OF DRAWINGS

[0022] FIG. **1** illustrates an example of a layout of a post-processing system in an embodiment of the present disclosure;

[0023] FIG. **2** is a view along arrow A in FIG. **1**;

[0024] FIG. **3** is a perspective view illustrating a state in which an exhaust gas processing apparatus according to the embodiment of the present disclosure is assembled with a diesel particulate filter;

[0025] FIG. **4** is a front view illustrating the state in which the exhaust gas processing apparatus according to the embodiment of the present disclosure is assembled with the diesel particulate filter;

[0026] FIG. **5** is a plan view of the exhaust gas processing apparatus in the embodiment of the present disclosure;

[0027] FIG. **6** is a front view of the exhaust gas processing apparatus in the embodiment of the present disclosure as viewed from the exhaust downstream side;

[0028] FIG. **7** is a rear view of the exhaust gas processing apparatus in the embodiment of the present disclosure as viewed from the exhaust upstream side;

[0029] FIG. **8** is a right side view of the exhaust gas processing apparatus in the embodiment of the present disclosure;

[0030] FIG. **9** is a left side view of the exhaust gas processing apparatus in the embodiment of the present disclosure;

[0031] FIG. **10** is a bottom view of the exhaust gas processing apparatus in the embodiment of the present disclosure;

[0032] FIG. **11** illustrates an example of a layout of a post-processing system in an embodiment of the present disclosure;

[0033] FIG. **12** illustrates another example of the layout of the post-processing system in the embodiment of the present disclosure;

[0034] FIG. **13** is a view along arrow B in FIG. **12**;

[0035] FIG. **14** illustrates another example of the layout of the post-processing system in the embodiment of the present disclosure; and

[0036] FIG. **15** is a view along arrow C in FIG. **14**.

DESCRIPTION OF EMBODIMENTS

[0037] Hereinafter, an embodiment of the present disclosure will be described with reference to the drawings. FIG. **1** illustrates an example of a layout of a post-processing system in an embodiment of the present disclosure. FIG. **2** is a view along arrow A in FIG. **1**. Post-processing system **100**A illustrated in FIGS. **1** and **2** includes a diesel particulate filter (DPF) and a urea selective catalytic reduction apparatus (SCR). The layout of the DPF and the SCR is set according to the vehicle type. The DPF collects and removes a particulate matter (PM) from the exhaust gas emitted from an internal combustion engine. Post-processing system **100**A may include a diesel oxidation catalyst (DOC) disposed on the exhaust upstream side of the DPF, which oxidizes fuel (HC) injected after a combustion step to increase the temperature of the exhaust gas and promote combustion within the DPF.

[0038] The DPF includes a cylindrical wall that extends in the cylinder axis direction. The cylinder axis direction is a direction that extends along straight line SL**1**.

[0039] The SCR is disposed on the exhaust downstream side of the DPF, and reduces nitrogen oxides (NOx) contained in the exhaust by mixing the exhaust, from which PM has been collected and removed by the DPF, with a reducing agent. Urea water ($(NH_2)_2CO$) is used as a reducing agent to be mixed with the exhaust. Urea water is decomposed into ammonia (NH_3) by the heat of the exhaust. Ammonia generated by the decomposition of the urea water reacts with nitrogen oxides (NOx). Through the above reaction process, nitrogen oxides are reduced to nitrogen (N_2) and water (H_2O).

[0040] Exhaust gas processing apparatus **100** (SCR) in the present embodiment includes a urea water evaporation chamber, a diffusion chamber, and an SCR catalyst. The layout of the urea water evaporation chamber, the diffusion chamber, and the SCR catalyst is set according to the vehicle type. Each of the urea water evaporation chamber, the diffusion chamber, and the SCR catalyst has a cylindrical wall and a cylinder axis.

[0041] The urea water evaporation chamber is disposed such that cylinder axis CS**1** is along straight line SL**1**. Each of the diffusion chamber and the SCR catalyst is disposed such that cylinder axis CS**2** is aligned on straight line SL**2**, which is orthogonal to straight line SL**1**. The first pipe disposed on the urea water evaporation chamber side and the second pipe disposed on the diffusion chamber side are coupled with each other by a third pipe (connection pipe **90**). The urea water evaporation chamber promotes the decomposition of urea water. The diffusion chamber diffuses ammonia and nitrogen oxides in the exhaust. The SCR catalyst uses a hydrocarbon (HC) as a reducing agent. Thus, ammonia selectively reacts with nitrogen oxides in the exhaust to produce nitrogen and water.

[0042] In the present embodiment, three types of layout LYT**1**, layout LYT**2**, and layout LYT**3** will be described. Layout LYT**1** is a layout in which cylinder axis CS**2** (straight line SL**2**) of the SCR catalyst is orthogonal to cylinder axis CS**1** (straight line SL**1**) of the DPF. Layout LYT**2** is a layout in which the DPF and the SCR catalyst are arranged in parallel. Layout LYT**3** is a layout in which the DPF and the SCR catalyst are arranged in series.

(Layout LYT**1**)

[0043] Hereinafter, layout LYT**1** will be described. In the following, layout LYT**2** will be described, followed by a description of layout LYT**3**.

[0044] In the present embodiment, exhaust gas processing apparatus **100** will be described using a urea water evaporation chamber as an example. FIG. **3** is a perspective view illustrating a state in which the exhaust gas processing apparatus is assembled with a DPF in the present embodiment. FIG. **4** is a front view illustrating the state in which the exhaust gas processing apparatus is assembled with the DPF in the present embodiment. FIG. **5** is a plan view of the exhaust gas processing apparatus according to the present embodiment. FIG. **6** is a front view of the exhaust gas processing apparatus in the present embodiment as viewed from the exhaust downstream side. FIG. **7** is a rear view of the exhaust gas processing apparatus in the present embodiment.

[0045] As illustrated in FIGS. **3** to **7**, exhaust gas processing apparatus **100** includes urea water evaporation chamber **10** (hereinafter, simply referred to as "chamber"), pipe **20**, injector **30** (see FIG. **4**), reducing agent evaporation plate **40**, and guidance plate **50**. Chamber **10** corresponds to the "first processing section" of the present disclosure. Further, pipe **20** corresponds to the "first pipe" of the present disclosure.

(Chamber **10**)

[0046] Chamber **10** includes, for example, cylindrical wall **12** formed of a stainless steel pipe. Partition line PL extending in the up-down direction in FIGS. **4** and **7** is indicated by a two-dot chain line. In the following description, the cylinder axis direction may be referred to as the "exhaust direction." Further, one side in the cylinder axis direction may be referred to as the "exhaust upstream side," and the other side in the cylinder axis direction may be referred to as the "exhaust downstream side." Further, a direction orthogonal to the cylinder axis direction may be referred to as a "radial direction." Further, a direction radially away from cylinder axis CS**1** may be referred to as "one side in the radial direction" or "centrifugal direction," and a direction radially approaching cylinder axis CS**1** may be referred to as "the other side in the radial direction" or "centripetal direction." Further, in FIG. **4** illustrating the front of exhaust gas processing apparatus **100**, the right direction may be referred to as the "right side," and the left direction may be referred to as the "left side."

[0047] Chamber **10** includes one-side end wall **14** disposed at the end of the chamber on one side in the cylinder axis direction (exhaust upstream side) and the other-side end wall **15** disposed at the end of the chamber on the other side in the cylinder axis direction (exhaust downstream side).

[0048] As illustrated in FIGS. **3**, **5**, and **7**, one-side end wall **14** is divided into two regions, namely left-side wall **14**L that is located on the left side of partition line PL, and right-side wall **14**R that is located on the right side of partition line PL. In FIG. **7**, which is a rear view of exhaust gas processing apparatus **100**, left-side wall **14**L is illustrated at a position on the right side of partition line PL, and right-side wall **14**R is illustrated at a position on the left side of partition line PL. One-side end wall **14** is a circular wall that extends in the radial direction with cylinder axis CS**1** as the center. Introduction port **16** for introducing exhaust from the DPF (not illustrated) side is opened in one-side end wall **14**. Introduction port **16** is an arc-shaped opening that has a predetermined width in the radial direction and extends in a counterclockwise direction from the 12 o'clock position to the 6 o'clock position of one-side end wall **14**, which is a circular wall.

[0049] As illustrated in FIGS. **3** to **6**, the other-side end wall **15** is divided into two regions, namely left-side wall **15**L that is located on the left side of partition line PL and right-side wall **15**R that is located on the right side of the partition line. The other-side end wall **15** closes the end of chamber **10** on the other side in the cylinder axis direction (exhaust downstream side). Left-side wall **15**L has a wall surface that extends in a substantially semicircular shape in the radial direction from cylinder axis CS**1**. In other words, the wall surface of left-side wall **15**L is a wall surface that extends in a counterclockwise direction from the 12 o'clock position to the 6 o'clock position. Right-side wall **15**R has a wall surface that extends in a substantially semicircular shape in the radial direction from cylinder axis CS**1**. In other words, the wall surface of right-side wall **15**R is a wall surface that extends in a counterclockwise direction from the 6 o'clock position to the 12 o'clock position. Further, the wall surface of right-side wall **15**R is inclined at a predetermined angle θ with respect to the wall surface of left-side wall **15**L toward the one side in the cylinder axis direction (exhaust upstream side) (see FIG. **5**).

[0050] Chamber **10** is divided into two spaces, namely left-side chamber portion **10**L that is located on the left side of partition line PL, and right-side chamber portion **10**R that is located on the right side of partition line PL. The total length of left-side chamber portion **10**L in the cylinder axis direction has a certain length CL**0** (see FIG. **5**). In contrast, the total length of right-side chamber portion **10**R in the cylinder axis direction is gradually shortened from the 6 o'clock position to the 3 o'clock position in the counterclockwise direction, because the wall surface of right-side wall **15**R is inclined to the one side in the cylinder axis direction (exhaust upstream side) with respect to cylinder axis CS**1**. Specifically, the total length of right-side chamber portion **10**R in the cylinder axis direction is shortened from length CL**0** to length CL**1** (see FIG. **5**). Thus, the cross-sectional area of right-side chamber portion **10**R (the cross-sectional area on a plane orthogonal to the cylinder axis direction of right-side chamber portion **10**R) is reduced from the other side in the cylinder axis direction toward the one side in the cylinder axis direction.

(Pipe **20**)

[0051] FIG. **8** is a right side view of the exhaust processing apparatus in the present embodiment. FIG. **9** is a left side view of the exhaust gas processing apparatus in the present embodiment. As illustrated in FIGS. **3** to **6**, **8**, and **9**, pipe **20** includes pipe axis PS and pipe peripheral wall **22**, and is formed of, for example, a stainless steel pipe. FIG. **5** illustrates pipe axis PS with a broken line. Pipe **20** includes bent portion PS**1** bent at a central portion in the pipe axis direction. Portion PS**2** located closer to the one side than bent portion PS**1** is in the pipe axis direction (herein also referred to as "one-side portion in the pipe axis direction PS**2**") extends along cylinder axis CS**1**. Portion PS**3** located closer to the other side than bent portion PS**1** is in the pipe axis direction (herein also referred to as "the other-side portion in the pipe axis direction PS3") extends in a direction inclined with respect to cylinder axis CS1 at a predetermined angle α (see FIG. 5). Inclination angle α of the other-side portion in the pipe axis direction PS3 with respect to cylinder axis CS1 coincides with inclination angle θ of the wall surface of right-side wall 15R with respect to the wall surface of left-side wall 15L ($\alpha=\theta$).

[0052] One end of pipe **20** in the pipe axis direction is a closed end that is closed by one-side end wall **14**. The other end of pipe **20** in the pipe axis direction is an open end. In pipe peripheral wall **22** in one-side portion in the pipe axis direction PS**2**, inlet **24** is opened. Outlet **26** as an open end is provided in the other-side portion in the pipe axis direction PS**3**. Outlet **26** is disposed outside chamber **10**.

[0053] Pipe peripheral wall **22** is disposed to be surrounded from the outside by cylindrical wall **12**. Thus, circumferential space **18** that circumferentially extends is formed between pipe peripheral wall **22** and cylindrical wall **12**. Circumferential space **18** is divided into two spaces, namely left-side circumferential space **18**L (see FIG. **6**) located on the left side of partition line PL and right-side circumferential space **18**R (see FIG. **6**) located on the right side of partition line PL, in the same manner as chamber **10**, which is divided into two spaces by partition line PL. Further, similarly to the cross-sectional area of right-side chamber portion **10**R, the cross-sectional area of right-side circumferential space **18**R is reduced from the other side in the cylinder axis direction toward the one side in the cylinder axis direction. One side (exhaust upstream side) of left-side circumferential space **18**L is in communication with introduction port **16**. Thus, the exhaust from the DPF is introduced into left-side circumferential space **18**L through introduction port **16**, and the introduced exhaust is movable from left-side circumferential space **18**L to right-side circumferential space **18**R. Further, the exhaust that has moved to right-side circumferential space **18**R is movable from the other side in the cylinder axis direction to one side in the cylinder axis direction. That is, the exhaust from the DPF is movable from left-side circumferential space **18**L toward the one side of right-side circumferential space **18**R in the cylinder axis direction. FIG. **3** illustrates the flow direction of the exhaust with a thick arrow.

(Injector **30**)

[0054] Injector **30** is disposed in cylindrical wall **12** in left-side chamber portion **10**L (see FIG. **4**). The injection port of injector **30** is directed from cylindrical wall **12** side toward left-side circumferential space **18**L. Thus, injector **30** can inject a reducing agent (urea water) toward the exhaust introduced from introduction port **16** into left-side circumferential space **18**L. FIG. **4** illustrates the flow direction of the exhaust with hatched arrows and the flow direction of the reducing agent with white arrows.

(Reducing Agent Evaporation Plate **40**)

[0055] FIG. **10** is a bottom view of the exhaust gas processing apparatus in the present embodiment. As illustrated in FIGS. **3** to **10**, reducing agent evaporation plate **40** is a flat plate member disposed in circumferential space **18** along cylindrical wall **12**. Specifically, reducing agent evaporation plate **40** is disposed between cylindrical wall **12** and pipe peripheral wall **22**, and circumferentially extends in a counterclockwise direction from the 9 o'clock position to the 4 o'clock position. That is, reducing agent evaporation plate **40** circumferentially extends from left-side circumferential space **18**L to right-side circumferential space **18**R. Further, reducing agent evaporation plate **40** includes inner wall surface WS**1** facing pipe peripheral wall **22** and outer wall surface WS**2** facing cylindrical wall **12**. Inner wall surface WS**1** is disposed such that the reducing agent injected from injector **30** hits inner wall surface WS**1**. Exhaust and a reducing agent (urea water) flow through the gap between pipe peripheral wall **22** and inner wall surface WS**1**. Exhaust flows through the gap between cylindrical wall **12** and outer wall surface WS**2**. Thus, the reducing agent that flows into the gap between pipe peripheral wall **22** and inner wall surface WS**1** is decomposed into ammonia by the heat of the exhaust that flows into the gap between cylindrical wall **12** and outer wall surface WS**2**. Chamber **10** is called a "urea water evaporation chamber" because it decomposes the reducing agent (urea water) into ammonia using the heat of the exhaust.

[0056] The total length of reducing agent evaporation plate **40** in the cylinder axis direction in left-side circumferential space **18**L has a certain length VL**0** (see FIG. **10**). The total length of reducing agent evaporation plate **40** in the cylinder axis direction in right-side circumferential space **18**R is gradually shortened from the 6 o'clock position to the 4 o'clock position in the counterclockwise direction, similarly to the total length of right-side chamber portion **10**R in the cylinder axis direction, because the wall surface of right-side wall **15**R is inclined to the one side in the cylinder axis direction (exhaust upstream side) with respect to cylinder axis CS**1**. Specifically, the total length of reducing agent evaporation plate **40** in the cylinder axis direction in right-side circumferential space **18**R is shortened from length VL**0** to length VL**1** (see FIG. **10**).

(Guidance Plate **50**)

[0057] Guidance plate **50** is bent at central portion **51** in the cylinder axis direction, similarly to pipe **20** bent at central portion (bent portion PS**1**) in the pipe axis direction. Guidance plate **50** extends in the radial direction from the 12 o'clock position of pipe peripheral wall **22** to cylindrical wall **12**, with one side of the guidance plate in the radial direction connected to cylindrical wall **12** and the other side of the guidance plate in the radial direction connected to pipe peripheral wall **22**. Thus, guidance plate **50** blocks the movement of the exhaust and ammonia that have moved from left-side circumferential space **18**L (see FIG. **6**) to right-side circumferential space **18**R (see FIG. **6**) from returning from right-side circumferential space **18**R to left-side circumferential space **18**L. The exhaust and ammonia move in right-side circumferential space **18**R from the other side in the cylinder axis direction to the one side in the cylinder axis direction.

[0058] While guidance plate **50** blocks the movement of the exhaust and ammonia from right-side circumferential space **18**R to left-side circumferential space **18**L, guidance plate **50** guides the exhaust and ammonia, which have moved within right-side circumferential space **18**R toward the one side in the cylinder axis direction, from right-side circumferential space **18**R to inlet **24** side. The exhaust and ammonia guided to inlet **24** enter pipe **20** at a position on the one side of the pipe axis, move from that position to a position on the other side of the pipe axis, and are discharged to the outside of chamber **10** through outlet **26**.

(SCR Catalyst **60**, Diffusion Chamber **70**, Second Pipe **80**, and Connection Pipe **90**)

[0059] In the following, layout LYT**1** of post-processing system **100**A in the present embodiment will be described with reference to FIG. **11**. The DPF, the urea water evaporation chamber, the first pipe, the SCR catalyst, the diffusion chamber, the second pipe, and the third pipe (connection pipe **90**) illustrated in FIG. **1** respectively correspond to the DPF, chamber **10**, pipe **20**, SCR catalyst **60**, diffusion chamber **70**, second pipe **80**, and connection pipe **90** illustrated in FIG. **11**. Further, chamber **10** and diffusion chamber **70** illustrated in FIG. **11** correspond to the "first chamber" and the "second chamber" in the present disclosure. FIG. **11** illustrates straight line SL**1**' parallel to straight line SL**1** and straight line SL**2**' parallel to straight line SL**2**. As described above, cylinder axis CS**2** (straight line SL**2**) is a straight line that is orthogonal to cylinder axis CS**1** (straight line SL**1**). Accordingly, straight line SL**2**' is orthogonal to straight line SL**1**'.

[0060] As illustrated in FIG. **11**, diffusion chamber **70** for diffusing the exhaust and ammonia is connected to chamber **10**. Specifically, second pipe **80** is disposed at diffusion chamber **70**. Second pipe **80** is coupled with pipe **20** (first pipe) through connection pipe **90** (third pipe). Thus, ammonia reacts with nitrogen oxides in the exhaust, and in the reaction process, the nitrogen oxides are reduced to nitrogen and water.

[0061] The other-side portion in the pipe axis direction PS3 of pipe **20** extends in a direction inclined at a predetermined angle α with respect to cylinder axis CS**1**, as described above. Further, pipe **20** is disposed to be rotatable around cylinder axis CS**1** with respect to chamber **10**. Then, pipe **20** is fixed to chamber **10** at a predetermined rotation angle.

[0062] Second pipe **80** includes pipe axis PS4 and a pipe peripheral wall, and is formed of, for example, a stainless steel pipe. Pipe axis PS**4** is illustrated in FIG. **11** with a broken line. Pipe axis PS4 extends in a direction inclined at a predetermined angle β with respect to straight line SL2. The inlet of second pipe **80** is disposed outside diffusion chamber **70**. The outlet of second pipe **80** communicates with the inside of diffusion chamber **70**. Second pipe **80** is disposed to be rotatable around cylinder axis SC**2** with respect to diffusion chamber **70**. Then, second pipe **80** is fixed to diffusion chamber **70** at a predetermined rotation angle.

[0063] Connection pipe **90** includes an exhaust upstream side end portion connected to outlet **26** of pipe **20** and an exhaust downstream side end portion connected to the inlet of second pipe **80**. A central portion between the end portion on the exhaust upstream side and the end portion on the exhaust downstream side of connection pipe **90** includes bent portion **91** that is bent at a predetermined angle (a+8). As described above, straight line SL2' is orthogonal to straight line SL**1**'. Thus, angle δ is π/2-β. Further, angle γ shown in FIG. **11** is π/2-α.

[0064] In the following, it is assumed that the following relationships of equations (1) and (2) are satisfied between angles α, β, γ, and δ.

$$\alpha+\delta=\gamma+\delta=\alpha+\delta \tag{1}$$

$$\alpha+\beta+\gamma+\delta=\pi \tag{2}$$

[0065] From equations (1) and (2), the following equation is satisfied.

$$\alpha=\beta=\gamma=\delta=\pi/4 \tag{3}$$

[0066] That is, connection pipe **90** includes bent portion **91** that is bent at a predetermined angle (α+δ=π/2). In the present embodiment, connection pipe **90** may be in any form as long as the connection pipe forms a predetermined angle (α+β).

(Layout LYT**2**)

[0067] In the following, layout LYT**2** will be described with reference to FIGS. **12** and **13**. FIG. **12** illustrates another example of the layout of the post-processing system in the embodiment of the present disclosure. FIG. **13** is a view along arrow B in FIG. **12**. In the description of layout LYT**2**, mainly the configuration different from that of layout LYT**1** will be described, and the description of the same configuration will be omitted by attaching the same reference numerals.

[0068] As described above, layout LYT**2** is a layout in which the DPF and the SCR catalyst are arranged in parallel.

[0069] In layout LYT**2**, equation (3) described above is satisfied in the same manner as in layout LYT**1**. Thus, even in a case where the layout of post-processing system **100**A is set to layout LYT**2** according to the vehicle type, the same components as chamber **10**, pipe **20**, SCR catalyst **60**, diffusion chamber **70**, second pipe **80**, and connection pipe **90** forming exhaust gas processing apparatus **100** (SCR) in the above-described embodiment can be used.

(Layout LYT**3**)

[0070] In the following, layout LYT**3** will be described with reference to FIGS. **14** and **15**. FIG. **14** illustrates another example of the layout of the post-processing system in the embodiment of the present disclosure. FIG. **15** is a view along arrow C in FIG. **14**. In the description of layout LYT**3**, mainly the configuration different from that of layout LYT**1** will be described, and the description of the same configuration will be omitted by attaching the same reference numerals.

[0071] As described above, layout LYT**3** is a layout in which the DPF and the SCR catalyst are arranged in series.

[0072] In layout LYT**3**, equation (3) described above is satisfied in the same manner as in layout LYT**1**. Thus, even in a case where the layout of post-processing system **100**A is set to layout LYT**3** according to the vehicle type, the same components as chamber **10**, pipe **20**, SCR catalyst **60**, diffusion chamber **70**, second pipe **80**, and connection pipe **90** forming exhaust gas processing apparatus **100** (SCR) in the above-described embodiment can be used.

[0073] Post-processing system **100**A in the above embodiment includes the following: cylindrical chamber **10** (urea water evaporation chamber) that extends in cylinder axis CS**1** direction and processes exhaust discharged from an internal combustion engine; and cylindrical diffusion chamber **70** that is disposed on the exhaust downstream side compared to chamber **10**, extends in cylinder axis CS**2** direction, and processes exhaust. Post-processing system **100**A further includes the following: pipe **20** (first pipe) that extends in a direction at a first acute angle with respect to cylinder axis CS**1** direction, is disposed to be rotatable around cylinder axis CS**1**, and guides out exhaust processed by chamber **10**; second pipe **80** that extends in a direction at a second acute angle with respect to cylinder axis CS**2** direction, disposed to be rotatable around cylinder axis CS**2**, and introduces exhaust processed by diffusion chamber **70**; and connection pipe **90** that is formed to form the first angle and the second angle and couples pipe **20** with second pipe **80**.

[0074] With the above configuration, it is possible to dispose chamber **10** (urea water evaporation chamber) and diffusion chamber **70** in such a way that cylinder axis CS**1** and cylinder axis CS**2** are orthogonal to each other, or to dispose the chamber and the diffusion chamber in parallel with each other or in series with each other. Therefore, it is possible to set the layout of post-processing system **100**A according to the vehicle type without changing the components forming the post-processing system. Thus, it is possible to achieve the sharing of components in post-processing system **100**A.

[0075] In the post-processing system in the above embodiment, pipe **20** (first pipe), second pipe **80**, and connection pipe **90** (third pipe) have the same diameter. Thus, it is possible to suppress a change in the flow velocity of the exhaust flowing through pipe **20**, second pipe **80**, and connection pipe **90**. Further, it is possible to manufacture the pipes using the same material.

[0076] The post-processing system in the above embodiment includes the following: chamber **10** disposed at the end of a first processing section, the end being on the exhaust downstream side; and a mixer apparatus that mixes a reducing agent with the exhaust and is disposed in chamber **10**. The post-processing system further includes the following: diffusion chamber **70** disposed at the end of a second processing section, the end being on the exhaust upstream side; and a diffusion apparatus that diffuses the mixed exhaust and reducing agent and is disposed in diffusion chamber **70**. Thus, it is possible to share each component of chamber **10**, diffusion chamber **70**, the mixer apparatus, and the diffusion apparatus.

[0077] In the post-processing system in the above embodiment, the first acute angle is the same angle as the second acute angle, which is $\pi/4$. Thus, the bending angle of bent portion **91** of connection pipe **90**, which is bent at an angle obtained by adding the first acute angle and the second acute angle, becomes $\pi/2$.

[0078] In the post-processing system in the above embodiment, the first angle of pipe **20** with respect to cylinder axis CS**1** direction is described as the first acute angle, but may be a right angle or an obtuse angle. Further, the second angle with respect to cylinder axis CS**2** of second pipe **80** is described as a second acute angle, but may be a right angle or an obtuse angle. For example, the first angle may be a right angle or an obtuse angle, and the second angle may be an acute angle, or conversely, the first angle may be an acute angle, and the second angle may be a right angle or an obtuse angle. Further, for example, the first angle may be an obtuse angle, and the second angle may also be an obtuse angle. Even in this case, connection pipe **90** is formed to have an angle obtained by adding the first angle and the second angle. For example, in a case where the first angle is a right angle and the second angle is a right angle, connection pipe **90** is formed to have two right angles. In other words, connection pipe **90** is a pipe that is not bent and extends straight.

[0079] Each of the above-described embodiment merely shows an example of specific implementation of the present disclosure, and the technical scope of the present disclosure should not be construed to be limited thereto. That is, the present disclosure can be implemented in a variety of ways without departing from the spirit or essential features thereof.

INDUSTRIAL APPLICABILITY

[0080] The present disclosure is suitably utilized in a vehicle including a post-processing system in which sharing of components is required.

1. A post-processing system comprising:

a first processing section that extends in a direction of a first cylinder axis and processes exhaust discharged from an internal combustion engine, the first processing section having a cylindrical shape; and

a second processing section that is disposed on an exhaust downstream side compared to the first processing section, extends in a direction of a second cylinder axis, and processes the exhaust, the second processing section having a cylindrical shape,

wherein the post-processing system further comprises:

a first pipe that extends in a direction at a first angle with respect to the direction of the first cylinder axis, is disposed to be rotatable around the first cylinder axis, and guides out the exhaust processed by the first processing section,

a second pipe that extends in a direction at a second angle with respect to the direction of the second cylinder axis, is disposed to be rotatable around the second cylinder axis, and introduces the exhaust processed by the second processing section, and

a third pipe that is formed to have an angle obtained by adding the first angle and the second angle and couples the first pipe with the second pipe.

2. The post-processing system according to claim **1**, wherein

the first pipe, the second pipe, and the third pipe have identical diameters.

3. The post-processing system according to claim **1**, further comprising:

a first chamber disposed at an end of the first processing section, the end being on the exhaust downstream side;

a mixer apparatus that mixes a reducing agent with the exhaust and is disposed in the first chamber;

a second chamber disposed at an end of the second processing section, the end being on an exhaust upstream side; and

a diffusion apparatus that diffuses the mixed exhaust and the reducing agent and is disposed in the second chamber.

4. The post-processing system according to claim **1**, wherein

the first angle is a first acute angle, and the second angle is a second acute angle.

5. The post-processing system according to claim **4**, wherein

the first acute angle and the second acute angle are identical to each other and are $\pi/4$.

* * * * *