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(54) EXHAUST DIFFUSER FOR AN AFTER TREATMENT SYSTEM OF AN INTERNAL COMBUSTION ENGINE AND AFTER TREATMENT SYSTEM COMPRISING SAID DIFFUSER

(57) Exhaust diffuser (D, D') for an After Treatment System (ATS) of an internal combustion engine comprising a first portion (FP) having a tubular frusto-pyramidal shape developing according to a first axis (Y), having an inlet (IN, IN'), for receiving exhaust gas from said ATS, proximal to a minor basis (MNB) of the truncated pyramid, and a second portion (SP), contiguous with and subsequent to said first one, according to an exhaust gas circulation, wherein said second portion comprises two or more separate paths (PTH) communicating with the outside, arranged side-by-side between each other according to said developing axis (Y), and wherein each path includes at least one ejector (EJ) arranged in such a way to suck fresh air from the outside of the diffuser.

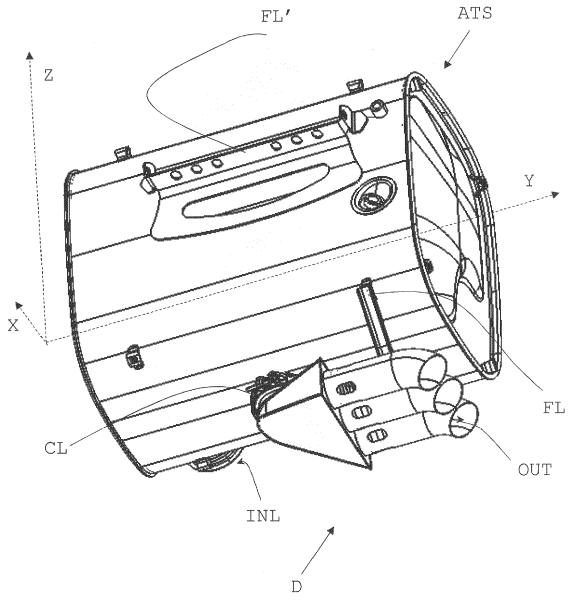

Fig. 3

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Description

Field of the invention

[0001] The present invention relates to the field of tail pipes of after treatment systems in particular comprising diffusers in order to lower the exhaust gas temperature.

State of the art known

[0002] The use of the gas diffusers as last component or tail pipe of the After Treatment Systems (ATS) of internal combustion engines is known.

[0003] Examples of such devices are in US2008110164.

[0004] The purpose of such devices is to lower the temperature of exhaust gas and mixing it with fresh air before being released into the environment.

[0005] Some layout of vehicles do not allow the installation of devices as the one shown in US2008110164.

[0006] Therefore, it may happen that the space available is particularly compact. With "compact" it is meant that the sizes of the ATS are similar to each other, that is within a ratio between 1 and 4, in absolute value. This implies that the installation of the device shown in US2008110164 is difficult or impossible when the space dedicated to the ATS is particularly compact.

Summary of the invention

[0007] The purpose of the present invention is to indicate a diffuser particularly suitable in those cases where the available space for ATS installation is limited and requires a compact ATS, in which a canning, housing the overall ATS, has a ratio, in absolute value, between two sizes within 1 and 4.

[0008] The basic idea of the present invention is to provide a diffuser suitable to be connected under the ATS. Such a diffuser, according to the invention, has a first portion having a tubular frusto-pyramidal shape, where the minor basis of the truncated pyramid is intended to be connected to the ATS, and a second portion, contiguous with and subsequent to the first one, according to an exhaust gas stream circulation, with two or more paths, arranged side-by-side, each including a hollow and a corresponding vane protruding toward the inside of the device, and oriented in such a way that a depression obtained due to the Venturi effect sucks fresh air from the outside of the device, though as said opening associated to said vane.

[0009] In other words, said vanes-hollows are defined as much ejectors. Each ejector is capable of creating a local depression, added to the one obtained by the frusto-pyramidal shape, in order to draw fresh air from the outside.

[0010] According to a first embodiment, the truncated pyramid develops along a first symmetry axis and it is squeezed according to a second axis perpendicular to said first axis, so as any cross-section perpendicular to said development axis is rectangular having major and minor segments corresponding to major and minor walls of the frusto-pyramidal shape, wherein the minor segments have almost constant size along said development. In addition, the second portion, inside to such truncated-pyramid volume, has some septum arranged in order to define separated paths with more or less equal widths.

[0011] According to a second embodiment of the invention the diffuser comprises also a second portion, external to the first one, consisting of two or more pipes arranged substantially parallel between each other and pneumatically connected to a major basis of the truncated pyramid.

[0012] Two or more pipes have, together, a cross section similar to the major basis of pyramid, so as the exhaust gas, slowed in the first portion of the diffuser due to Venturi effect, maintains a speed substantially constant. Preferably, the two or more tubular pipes, which defines the tail pipe of the ATS, are arranged such that their development axes are contained in a horizontal plane, namely parallel with the ground.

[0013] A first object of the present invention is an exhaust diffuser for an ATS of an internal combustion engine in accordance with claim 1.

[0014] A further object of the present invention is an After Treatment system comprising said diffuser.

[0015] The claims describe preferred embodiments of the invention, forming an integral part of the present description.

Brief description of the drawings

[0016] The invention will become fully clear from the following detailed description, given by way of a mere exemplifying and non limiting example, to be read with reference to the attached drawing figures, wherein:

Figure 1 shows a low perspective view of a first embodiment of the gas diffuser subject of the present invention;

Figure 2 shows an up perspective view of the same diffuser of Figure 1;

Figure 3 shows a low perspective view of a compact After treatment system (ATS) comprising the diffuser of the figures 1 and 2;

Figure 4 shows a lateral perspective view of the ATS of figure 3;

Figure 5 shows an up perspective view of a second embodiment of the gas diffuser subject of the present invention;

Figure 6 shows a low perspective view of the same diffuser of Figure 5;

Figure 7 shows a low perspective view of the ATS of figure 3 where the diffuser of figures 5 and 6 is implemented;

Figure 8 shows a scheme of the ATS of figure 3, 4

and 7 according to a longitudinal development of the ATS.

[0017] The same reference numerals and letters in the figures designate the same or functionally equivalent parts.

[0018] According to the present invention, the term "second element" does not imply the presence of a "first element", first, second, etc.. are used only for improving the clarity of the description and they should not be interpreted in a limiting way.

Detailed description of the preferred embodiments

[0019] The present invention relates to an exhaust diffuser D, D' for an After Treatment System (ATS) of an internal combustion engine.

[0020] The diffuser comprises a first portion FP having a tubular frusto-pyramidal shape developing according to a first axis Y and has an inlet IN, IN', for receiving exhaust gas from said ATS, proximal to a minor basis MNB of the truncated pyramid and a second portion SP, contiguous with and subsequent to said first one, according to an exhaust gas circulation, wherein said second portion comprises two or more separate paths PTH communicating with the outside, arranged side-by-side between each other according to said developing axis Y.

[0021] Each path includes at least one ejector EJ arranged in such a way to suck fresh air from the outside of the diffuser.

[0022] According to a preferred embodiment of the invention, a vane is cut by the casing itself of the second portion of the diffuser and is bent towards the inside of the second part so as it is superimposed to a corresponding hollow. Each vane lefts open its hollow and defines a sort of ramp for the circulating gas. Therefore, the gas meets the ramp, and thus a local section reduction, thus, for the Venturi's effect, accelerates. A low pressure is defined just after the ramp sucking fresh air from the outside of the device that is mixed with the exhaust gas in order to refresh the latter.

[0023] According to both the embodiments of the invention at least the first portion FP has a frusto-pydamidal shape with rectangular bases.

[0024] The second embodiment of the invention according to the figures 5 - 7 has the first FP and second portion SP in one piece defining as a whole a frusto-pyramid. Thus, said second portion is defined inside the truncated-pyramid casing defining the diffuser.

[0025] In particular such frusto-pyramid is squeezed according to a second axis Z, perpendicular to said first axis Y, so as any cross-section perpendicular to said development axis is rectangular having two major and two minor segments corresponding to the two major UW, LW and the two minor MW walls of the frusto-pyramidal shape, wherein the minor segments have almost constant size along said development. The second portion SP preferably comprises septum(s) SPT perpendicular to said major walls UW, LW of the frusto-pyramid, arranged in order to define said two or more separated paths PTH.

[0026] According to the first embodiment according to the figures 1 - 4, the first portion is (also) squeezed according to the second axis Z, perpendicular to said first axis and the second portion SP comprises two or more separate tubular pipes TM, each defining a path PTH, arranged substantially parallel between each other and pneumatically connected to a major basis MJB of the frusto-pyramid, opposite to the minor one MNB.

[0027] Preferably, any cross-section perpendicular to said development axis Y of said first portion FP is rectangular having major and minor segments corresponding to the two major UW, LW and the two minor MW walls of the frusto-pyramidal shape and wherein said two major walls diverge reciprocally and said two minor walls diverge reciprocally toward said major basis MJB.

[0028] For both the embodiments the inlet IN, IN' is arranged on one UW of said major walls close to said minor basis MNB and the minor basis is rounded and smoothly joined with the other wall LW of said two major walls in order to reduce turbulence.

[0029] Both the diffusers of the embodiments are provided with collars for a simple mounting on the outlet of the ATS disclosed according to the figures 3, 4 and 7.

[0030] In order to assure that the diffuser is fixedly connected to the ATS a V shaped flange FL has the opposite ends affixed to the ATS and the vertex affixed to the second portion of the diffuser.

[0031] The ATS, according to the invention, has substantially a parallelepiped shape having a predominant development, parallel, within +/- 30°, with said first axis Y. The parallelepiped shape can be rectangular.

[0032] In operation, the diffuser is arranged under the ATS, according to a vertical direction parallel to said second axis Z.

[0033] According to both the embodiments of diffusers, the end CT of said second portion SP, corresponding to the outlet OUT of the diffuser D, D' is slightly bent downwardly in order to direct exhaust gas towards the ground.

[0034] Figure 8 discloses a compact ATS. The ATS is defined "compact" because its sizes along the coordinate axes Z, Y, X are substantially comparable to each other, being in the mutual ratio of no more than 4.

[0035] Also the ATS is provided with flanges FL' to affix the ATS to the vehicle chassis. They are preferably parallel to the development axis Y of the ATS.

[0036] Said ATS schematizes the ones of the figures 3,4 and 7 sectioned according to the plane X-Z.

[0037] An inlet opening INL, preferably oriented along the Y axis, receives the combustion engine exhaust gas, represented by arrows FLW, which enters into a first chamber CH1, operatively communicating with a second chamber CH2 in which is housed the catalytic material on a carrier structure, which communicates with a third chamber CH3 turning the gas flow and orientating the flow lines for an accurate Lambda measurement, which

communicates with a fourth CH4 chamber, made in a low part of the ATS, so as to be connected and communicating with the diffuser D, D' via the duct, schematized with the collar CL. An ejector permits a flow of fresh air FAI to inter in the diffuser to lower the exhaust gas.

[0038] From the scheme, it is clear that the upper wall UW of the two major walls of the frusto-pyramid coincides with a lower wall of the canning itself of the ATS.

[0039] Many changes, modifications, variations and other uses and applications of the subject invention will become apparent to those skilled in the art after considering the specification and the accompanying drawings which disclose preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the scope of the invention are deemed to be covered by this invention.

[0040] It should be understood that all the single features and/or embodiments can be combined between each other. In addition, the features disclosed in the prior art background are introduced only in order to better understand the invention and not as a declaration about the existence of known prior art.

[0041] Further implementation details will not be described, as the man skilled in the art is able to carry out the invention starting from the teaching of the above description.

Claims

1. Exhaust diffuser (D, D') for an After Treatment System (ATS) of an internal combustion engine comprising a first portion (FP) having a tubular frusto-pyramidal shape developing according to a first axis (Y), having an inlet (IN, IN'), for receiving exhaust gas from said ATS, proximal to a minor basis (MNB) of the truncated pyramid, and a second portion (SP), contiguous with and subsequent to said first one, according to an exhaust gas circulation, wherein said second portion comprises two or more separate paths (PTH) communicating with the outside, arranged side-by-side between each other according to said developing axis (Y), and wherein each path includes at least one ejector (EJ) arranged in such a way to suck fresh air from the outside of the diffuser.

2. Diffuser according to claim 1, wherein said ejector comprises a hollow and a vane folded inside its respective path, defining a ramp superimposed to said hollow.

3. Diffuser according to claims 1 or 2, wherein said first portion (FP) is squeezed according to a second axis (Z), perpendicular to said first axis, so as any cross-section perpendicular to said development axis is rectangular having two major and two minor segments corresponding to the two major (UW, LW) and the two minor (MW) walls of the frusto-pyramidal shape, wherein the minor segments have almost constant size along said development.

4. Diffuser according to claim 3, wherein said second portion is defined inside said truncated-pyramid shape so as the overall shape of the diffuser is frusto-pyramidal, and wherein said second portion comprises septum(s) (SPT) perpendicular to said major walls (UW, LW) arranged in order to define said two or more separated paths (PTH).

5. Diffuser according claims 1 or 2, wherein said first portion is squeezed according to a second axis (Z), perpendicular to said first axis of said second portion (SP), and wherein said second portion comprises two or more separate tubular pipes (TM) arranged substantially parallel between each other and pneumatically connected to a major basis (MJB) of the truncated pyramid, opposite to the smaller one.

6. Diffuser according to claim 5, wherein any cross-section perpendicular to said development axis (Y) of said first portion is rectangular having major and minor segments corresponding to the two major (UW, LW) and the two minor (MW) walls of the frusto-pyramidal shape and wherein said two major walls diverge reciprocally and said two minor walls diverge reciprocally toward said major basis (MJB).

7. Diffuser according to claims 3 or 6, wherein said inlet (IN, IN') is arranged on one (UW) of said major walls close to said minor basis (MNB) and wherein said minor basis is rounded and smoothly joined with the other wall (LW) of said two major walls.

8. After treatment system (ATS) having a diffuser according to any of previous claims 1 - 7.

9. ATS according to claim 8, having substantially a parallelepiped shape having a predominant development according to said first axis (Y) and wherein said diffuser is arranged under the ATS, according to a vertical direction parallel to said second axis (Z), when the latter is in operation.

10. ATS according to claims 8 or 9, wherein the end (CT) of said second portion (SP) of the diffuser (D, D') is slightly bent downwardly in order to direct exhaust gas towards the ground.

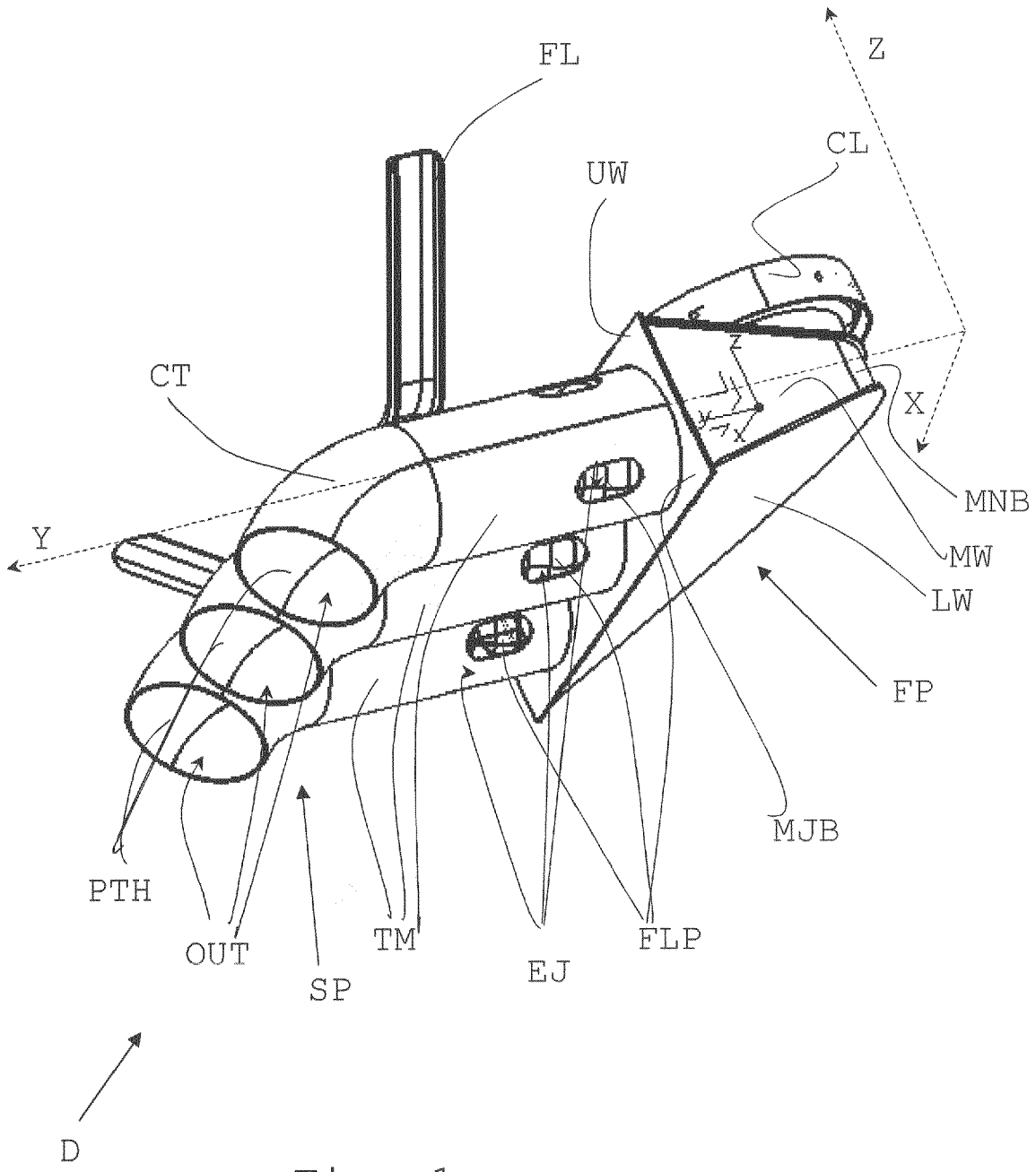

Fig. 1

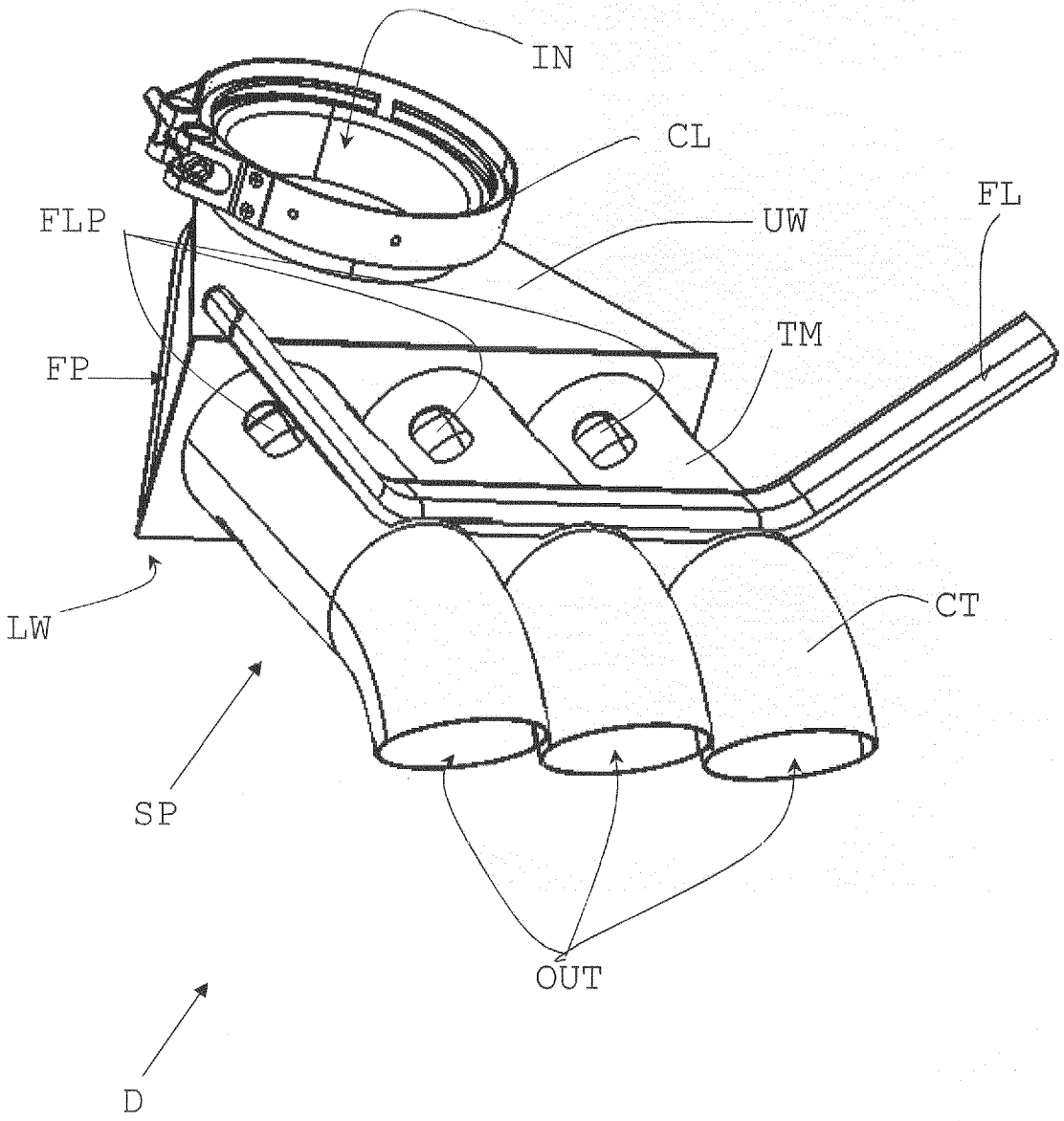

Fig. 2

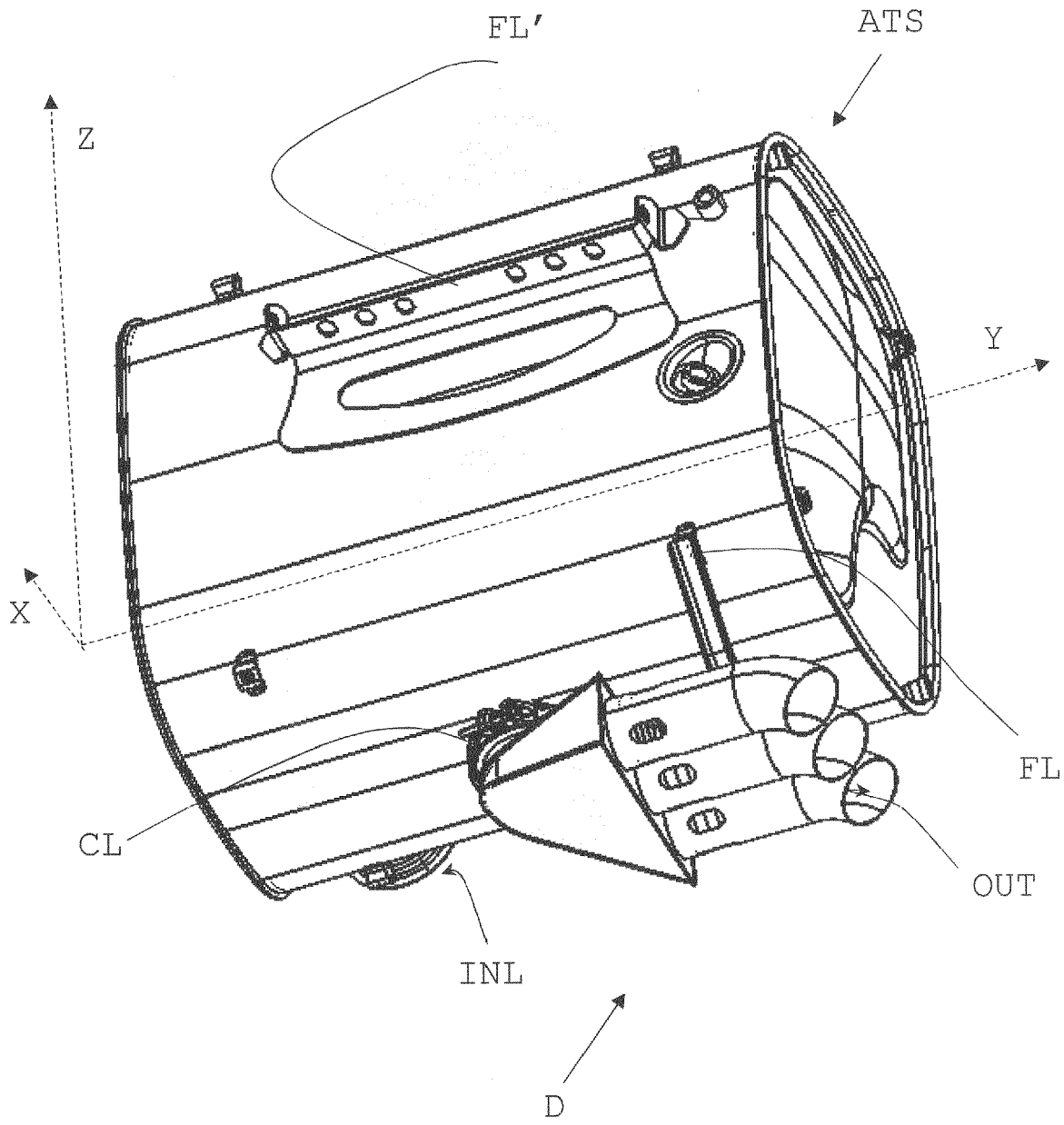

Fig. 3

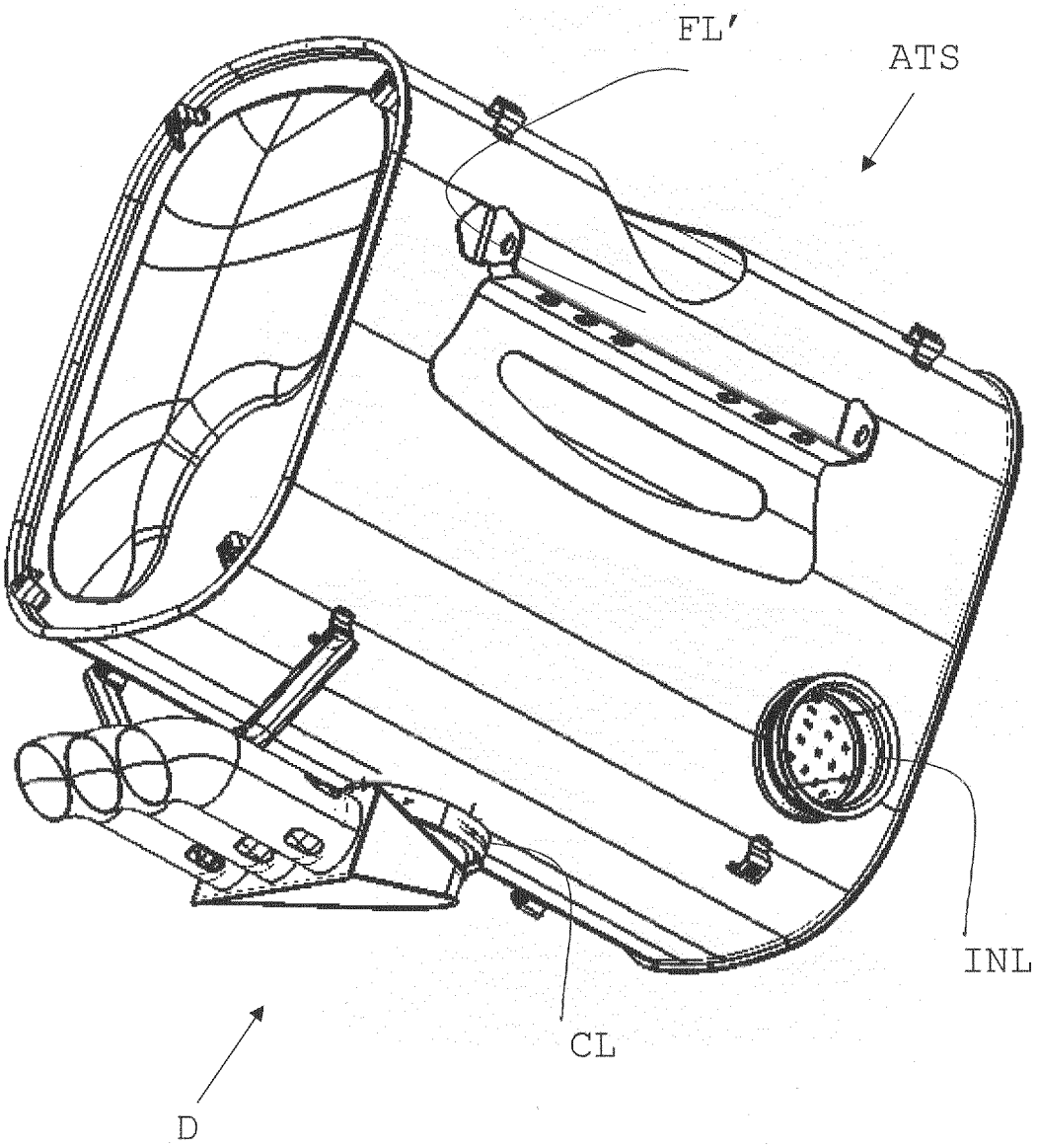

Fig. 4

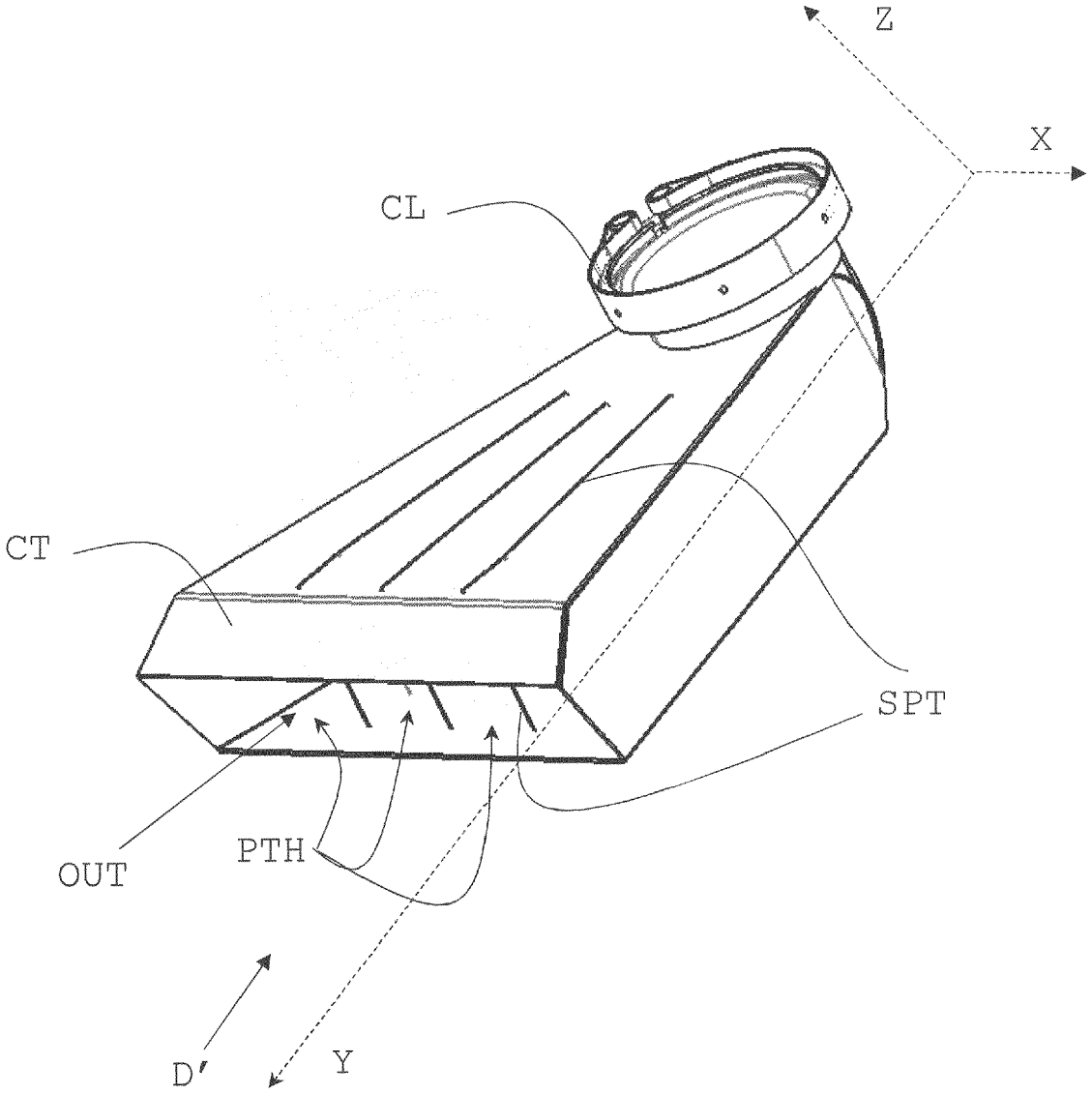

Fig. 5

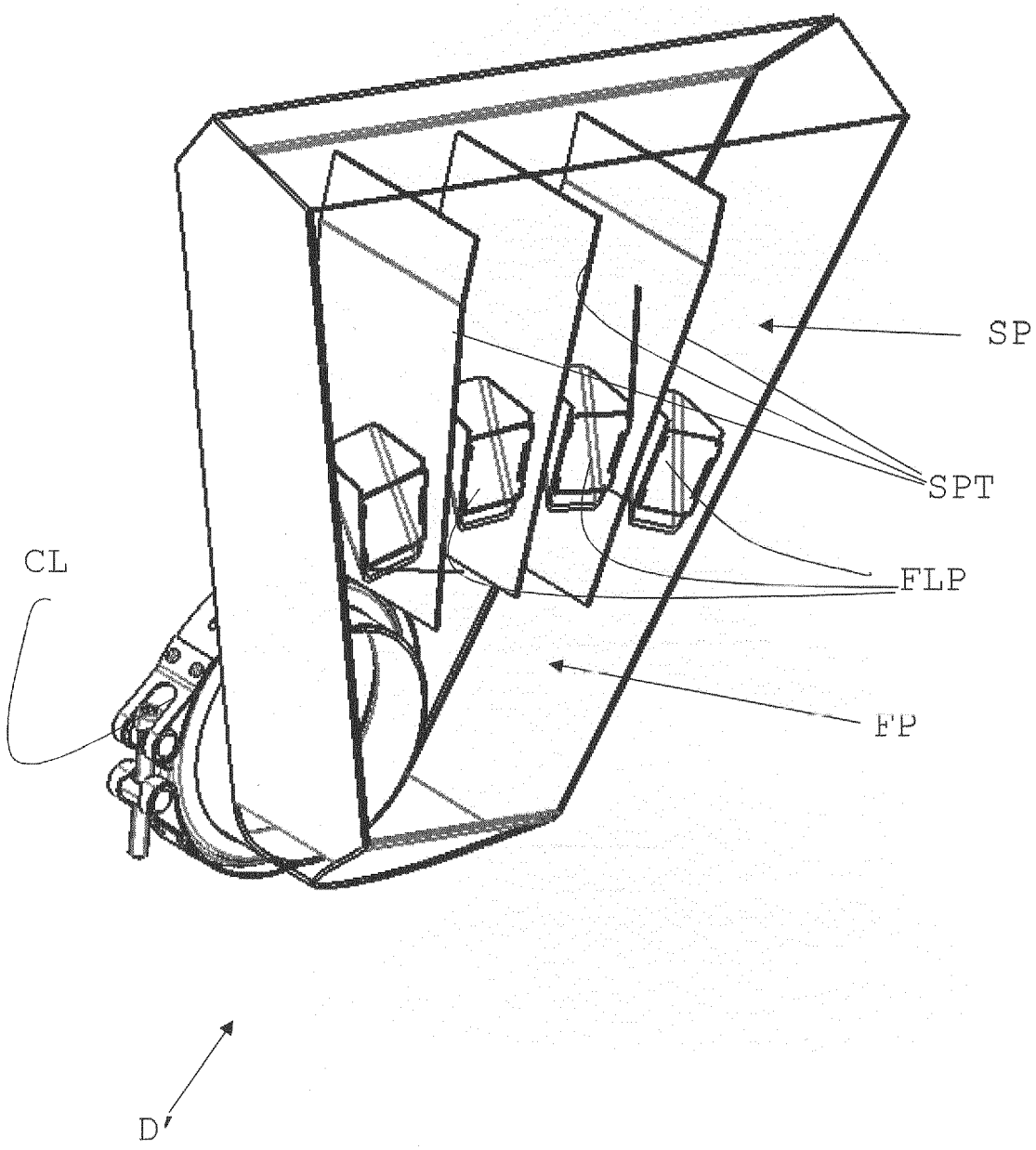

Fig. 6

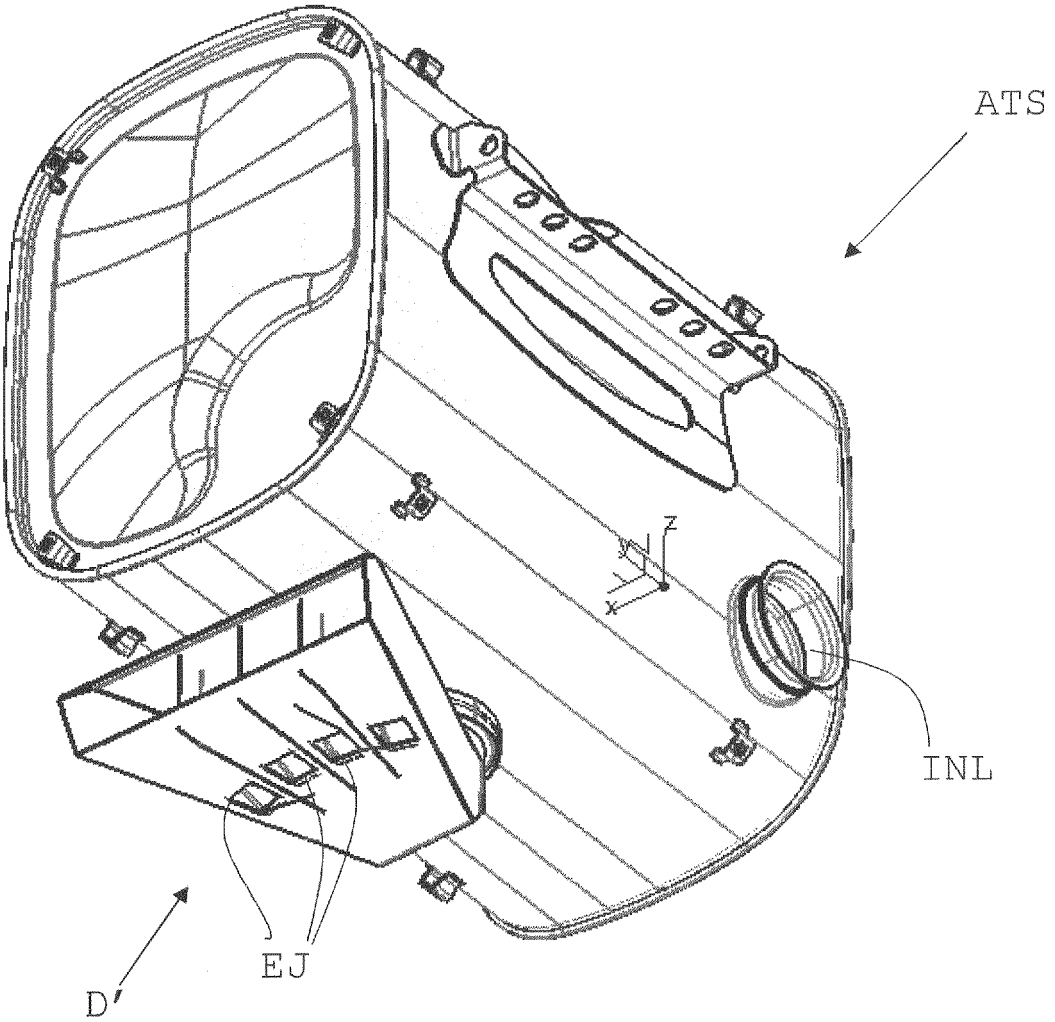

Fig. 7

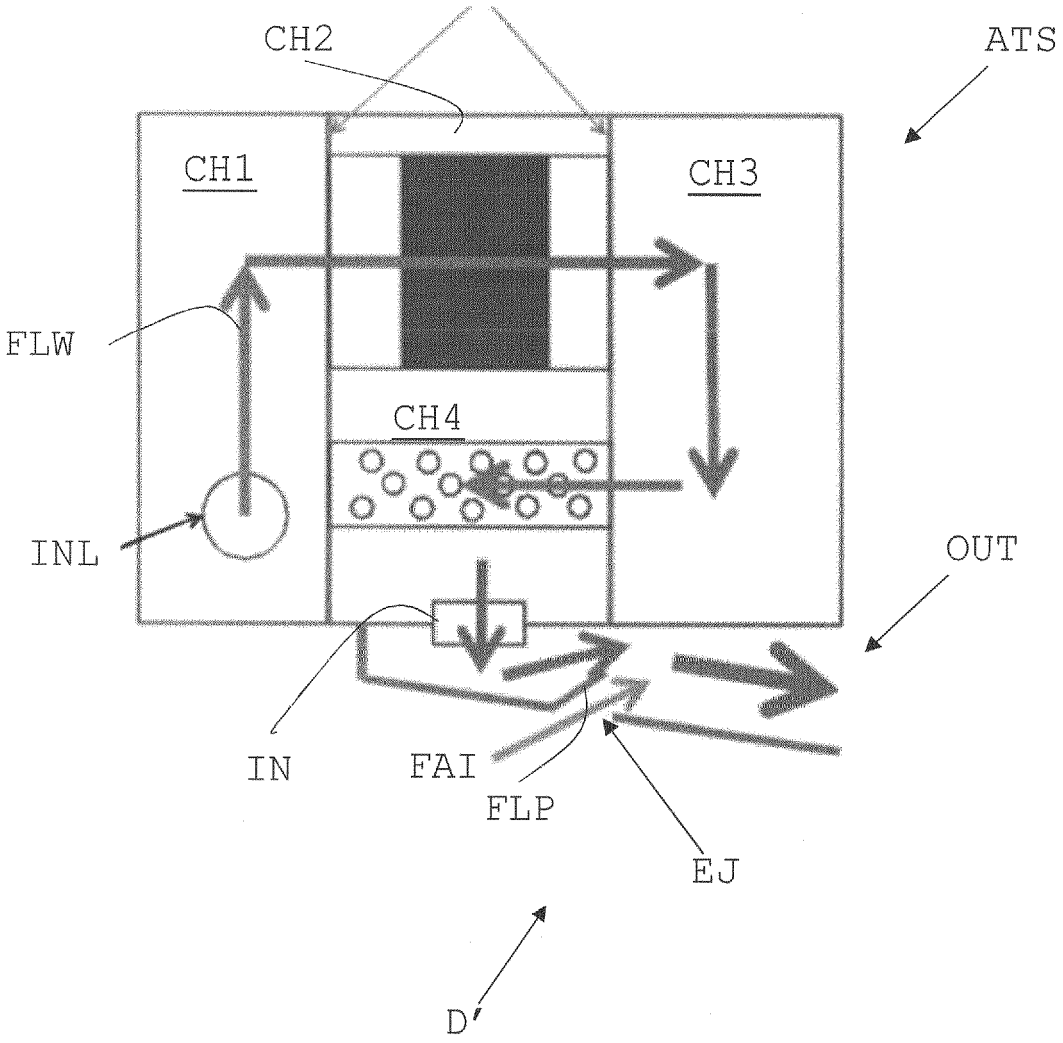

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 1403

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			TECHNICAL FIELDS SEARCHED (IPC) F01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 January 2018	Kolland, Ulrich

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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