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(72) Inventors:  
• **Morén, Mats**  
**417 19 Göteborg (SE)**  
• **Fyhr, Christian**  
**428 35 Kallered (SE)**

(71) Applicant: **Ford Global Technologies, Inc.**  
**Dearborn, Michigan 48126 (US)**

(74) Representative: **Hellbom, Lars Olof et al**  
**Albihns Stockholm AB,**  
**P O Box 5581**  
**114 85 Stockholm (SE)**

(54) **A catalytic converter device**

(57) A catalytic converter device is presented, comprising a first (3) and a second catalytic converter (4), and flow control means (6), to control the flow of exhaust gases in a first flow alternative where essentially all of the exhaust gases are guided to the first catalytic converter (3), or in a second flow alternative where at least some of the exhaust gases are guided past the latter. The flow control means (6) comprises a movable part

(7), adapted to assume a first position for the first flow alternative, and a second position for the second flow alternative. The flow control means comprises a fixed part (11), arranged to intersect the flow of exhaust gases, whereby the movable part (7) and the fixed part (11) are facing each other and thereby defining an interface between each other. The movable part (7) is adapted to move along said interface.

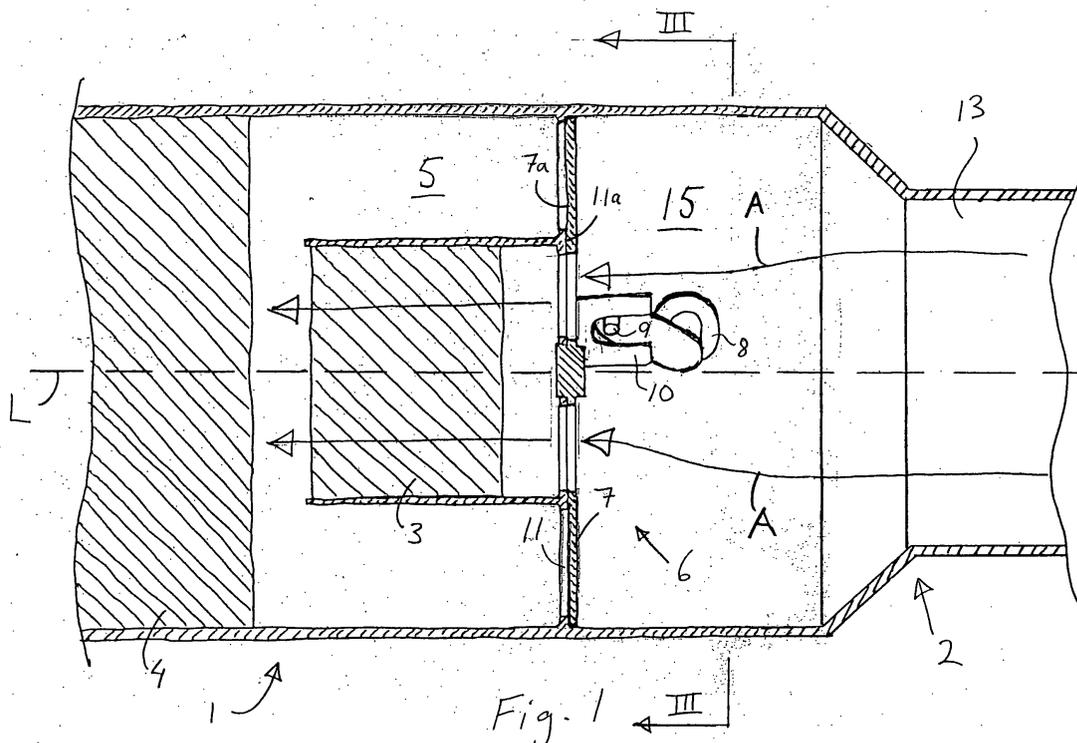


Fig. 1

## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a catalytic converter device adapted to receive a flow of exhaust gases from an internal combustion engine.

### BACKGROUND

**[0002]** In the vehicle industry a lot of effort is made to bring emissions in exhaust gases down, by introducing various designs for catalytic converters.

**[0003]** A number of catalytic converter designs have been suggested for a SULEV (Super Ultra Low Emission Vehicle). A problem with many of these designs is that they introduce a high pressure decrease from the upstream side to the downstream side of the converter. This in turn results in a lower output torque at high rotational speeds of the engine. For turbo charged engines the result will also be a lower output torque at low rotational speeds.

**[0004]** In many traditional catalysts, the converters present a very high density. A high density of a converter will make it warm up fast when exhaust gas is infiltrated in it. Usually, a converter does not reach a desired activity until it has reached a certain temperature. Thus, the reason for choosing a high density converter is that moments after an engine is started, the converter has to warm up fast to reach a temperature in which its activity has reached a desired level. However, a problem with a high density catalytic converter is that it creates a high pressure drop in the exhaust system, which in turn decreases the performance of the engine.

**[0005]** DE2851675 presents two catalytic converters, one located upstream of the other one, whereby the upstream converter has a passage through its center region, through which gases can pass directly to the downstream converter. The passage can be blocked by a butterfly valve, located therein, to force the flow through the upstream converter. A problem with this design is that the upstream converter is not very effective as a start converter, since it is located in the periphery of a cross-section of the exhaust system, while the flow in the middle is blocked. This results in the exhaust gases being cooled when guided through it. This in turn is a disadvantage to the conversions of nitrogen oxides (NO<sub>x</sub>), hydrocarbons (HC), and carbon monoxide (CO), since a high temperature is desired for these conversions. Another disadvantage with the design in DE2851675 is that the upstream catalyst is not protected against the exhaust gases, when the passage is open for guiding gases directly to the downstream converter. This can result in phosphoric deposits occurring at a surface of the upstream converter, oriented in the upstream direction of the exhaust flow. These deposits can result in an upstream part of the converter not being active during operation.

**[0006]** EP0580931A1 discloses a start catalyst design that has a valve arrangement comprising a slideable, tube-formed device with side apertures, located inside an exhaust conduit, upstream of two catalytic converters. The device can take two positions, at which it selectively guides exhaust gases to a start catalyst or into bypass conduits to a main catalyst located downstream of the start catalyst. A problem with this design is that the arrangement for controlling the gas flow is complicated, which in turn means that it is difficult to adapt it to the environment of the exhaust, including high temperatures. The complexity also means that a small disturbance can easily cause a malfunction. The design also requires low permissible variations in the geometry of included parts, and the risk of a leakage at the valve arrangement is high. The high tolerance requirements and the tough environment also increase the risk of parts seizing, especially after at the end of the life-cycle of the converter. In addition, the complexity and high tolerance requirements increase manufacturing costs of the converter.

**[0007]** JP6346724A19941220 discloses a catalyst design, whereby one catalytic converter is located upstream of another catalytic converter. A damper like device is located between the converters and can be turned in a direction out of its plane to block flow coming out of the upstream converter, so as for the flow to be directed through a bypass passage beside the upstream converter. If the damper like device is turned in a opposite direction, the bypass passage is blocked, so as for the flow to be directed through the upstream converter. A problem with this solution is that the device to control the flow requires a large space for its movements, which in turn results in the catalyst presenting large dimensions. This is undesirable since modern vehicles present space limitations to apparatuses included in them. Also the design requires a large movement of the device for controlling the flow, which present difficulties in the design of an actuation arrangement for this device.

### SUMMARY

**[0008]** An object of the present invention is to decrease emissions from internal combustion engine vehicles.

**[0009]** Another object of the present invention is to decrease emissions from an internal combustion engine vehicle, without decreasing the performance level of the engine.

**[0010]** Another object of the present invention is to provide a catalytic converter device that is easy to manufacture.

**[0011]** Another object of the invention is to provide a catalytic converter device that has a long life cycle.

**[0012]** Another object of the invention is to provide a catalytic converter device that presents a compact design.

**[0013]** These objects are reached by a catalytic converter device adapted to receive a flow of exhaust gases from an internal combustion engine, the catalytic converter device comprising a first catalytic converter and a second catalytic converter, the first catalytic converter being located upstream of the second catalytic converter, the catalytic converter device comprising flow control means, adapted to control the flow of exhaust gases in either one of at least two flow alternatives, whereby in a first flow alternative essentially all of the exhaust gases are guided to the first catalytic converter, and in a second flow alternative at least some of the exhaust gases are guided past the first catalytic converter, the flow control means comprising a movable part, adapted to assume a first position, whereby the flow is controlled according to the first flow alternative, and a second position, whereby the flow is controlled according to the second flow alternative. The flow control means comprises a fixed part, arranged to intersect the flow of exhaust gases, whereby the movable part and the fixed part are facing each other and thereby defining an interface between each other. The movable part is adapted to move along said interface.

**[0014]** The catalytic converter device is suited to be used so that the first flow alternative is active during a period of time following a start of the engine, herein referred to as a start phase. The second flow alternative can be active during an engine operation time period following the start phase, herein referred to as a warm phase. Since the fixed part is arranged to intersect the gas flow, it follows that it is oriented in an angle to the flow, and since the movement of the movable part is restricted along the interface to the fixed part, the flow control means can be designed to have only a small extension in a direction of the gas flow, which means that space can be saved in this direction.

**[0015]** Preferably, the movable part presents a principal plane, parallel to which a major part of it extends, the movable part being adapted to move in its principal plane. This further secures the space saving effect of the invention, since movement in the flow control means is essentially restricted to a direction of the extension of one of its major components.

**[0016]** Preferably, the movable part is adapted to move in a plane essentially perpendicular to a longitudinal direction of the catalytic converter device. Since the movable part is restricted to move in the lateral direction of the catalytic converter device, the flow control means can be designed to have only a small extension in the longitudinal direction of the catalyst. This means that a very space economical design can be accomplished.

**[0017]** Preferably, the flow control means is located upstream and in the vicinity of the first catalytic converter. Also, preferably, the movable part is adapted to, in the second position, block gas flow to the first catalytic converter. This provides an effective control of the flow, and will, in the second flow alternative protect the first

catalytic converter from harmful exposure to oil contamination, the exhaust gases and the high temperatures thereof. In particular, it will prevent phosphoric deposit buildup on the first catalytic converter. This will provide for a long life cycle of the catalytic converter device, so that it will have a desired performance also at a high mileage of a vehicle in which it is operating.

**[0018]** Preferably, the first flow alternative comprises guiding essentially all of the exhaust gases are guided to the second catalytic converter after passing through the first catalytic converter. This will warm up the second catalytic converter during the start phase, so that it will reach a light off temperature faster, i.e. reach a desired capacity faster. When the second flow alternative is initiated, the second catalytic converter can already be warm, which means that a relatively low density can be used for it. This will result in a low pressure drop over the catalyst, which in turn improves the performance of the engine. At the same time the density of the first catalytic converter can be kept very high for it to reach a light off temperature fast in the start phase of the engine. Since it the first catalytic converter is operative only during a short period of time, approximately 20 seconds, the decrease in performance of the engine due to a high pressure drop over the first catalytic converter will be compensated by the increased performance in the warm phase of the engine. Also, the flow rate during a cold start is relatively low, wherefore the increase in the pressure drop is almost negligible.

**[0019]** Preferably, the movable part presents a plurality of apertures distributed in the direction of movement of the movable part, and the fixed part presents a plurality of apertures, whereby the apertures are located so that the fixed and the movable part are adapted to interact to control the flow of exhaust gases. The plurality of apertures in the fixed and movable part, and the interaction between them, will result in the movable part having to be moved only a small distance from the first to the second position. In turn, this will result in smaller demands on an actuation mechanism for the movable part, and will be space economic. It also allows for a design which, due to small movements and a relatively low number of parts, presents a small sensitivity to disturbances.

**[0020]** Preferably, the first converter is located essentially centrally in a lateral direction of the catalytic converter device. This will secure a symmetric distribution of exhaust gases to both catalytic converters.

**[0021]** Preferably, the cross-section area of the first catalytic converter is smaller than that of a passage upstream of the catalytic converter device from which the latter is adapted to receive the flow of exhaust gases. This results in the first catalytic converter reaching fast a light off temperature, normally occurring at 250-350°C. In the first flow alternative, the difference in cross-section area will enhance the mixing of the exhaust gases before entering the first catalytic converter, which in turn provides an even distribution in the con-

verter of substances in the gases, which improves the catalytic processes. This will be described closer below.

**[0022]** Preferably, the catalytic converter device comprises a bypass region, through which at least some of the exhaust gases are guided in the second flow alternative, whereby, laterally, the bypass region is at least partly located at a greater distance from a center of the catalytic converter device than a passage, located upstream of the catalytic converter device. In the second flow alternative, this will provide for the exhaust gases being guided partly outwards laterally in the device resulting in a mixing of the exhaust gases before entering the second catalytic converter, which in turn provides an even distribution in the second catalytic converter of substances in the gases. Thus, in the warm phase, a good mixture of exhaust gases will improve the catalytic processes and improve the performance of the catalytic converter device. This will be described closer below.

**[0023]** Further advantages with the present invention are given in the following presentation.

#### BRIEF DESCRIPTION OF DRAWINGS

**[0024]** Below the invention will be described in detail with reference to the drawings, in which

- fig. 1 and 2 show sectioned views of a part of a catalytic converter device 1 according to a preferred embodiment of the invention, sectioned along a longitudinal axis of the device,
- fig. 3 and 4 each shows a perspective view of a section of the catalytic converter device in fig 1 and 2, the catalytic converter device being sectioned along the line III-III, and IV-IV, respectively, in fig. 1 and 2, respectively,
- fig. 5 and 6 show sectioned views of a part of a catalytic converter device 1 according to an alternative embodiment of the invention, sectioned along a longitudinal axis of the device, and
- fig. 7 and 8 each shows a perspective view of a section of the catalytic converter device in fig 5 and 6, the catalytic converter device being sectioned along the line VII-VII, and VIII-VIII, respectively, in fig. 7 and 8, respectively.

#### DETAILED DESCRIPTION OF EMBODIMENTS

**[0025]** Fig. 1 shows a sectioned view of a part of a catalytic converter device 1 according to a preferred embodiment of the invention, sectioned along a longitudinal axis of the device, indicated with a broken line L.

**[0026]** The catalytic converter device is adapted to receive, at an inlet 2 a flow of exhaust gases from an internal combustion engine. The device is adapted to deliver at least partly converted exhaust gases at an outlet, also not shown in fig. 1 and located to the left of the part shown in fig. 1. Thus, in this example, the longitudinal axis, or longitudinal direction of the catalytic converter

device can be said to be essentially parallel to a straight line between a center of the inlet and a center of the outlet of the catalytic converter device.

**[0027]** The catalytic converter device 1 comprises a first catalytic converter 3 and a second catalytic converter 4, the first catalytic converter being located upstream of the second catalytic converter. In this example, the longitudinal direction of the catalytic converter device 1 can also be said to be essentially parallel to a straight line from a center position of the first catalytic converter 3 to a center position of the second catalytic converter 4. The longitudinal direction of the catalytic converter device 1 can also be defined as parallel to a vector sum of local exhaust gas flow directions in a region of the first catalytic converter 3. Alternatively, the longitudinal direction can be defined as being parallel to the direction of the gas flow through the first catalytic converter 3.

**[0028]** The first catalytic converter 3 presents a cross-section area that is smaller than the catalytic converter device 1 in the region of the first catalytic converter 3. Preferably, the first catalytic converter 3 is located essentially centrally in a lateral direction of the catalytic converter device 1. Thereby, a bypass region 5 is presented surrounding the first catalytic converter 3, so that a bypass flow can take place, described closer below. The catalytic converter device 1 in this example has an essentially circular cross-section, and the first catalytic converter has also an essentially circular cross-section, and is located centered in the middle in the lateral direction of the catalytic converter device. Alternatively, the catalytic converter device 1 can present any other cross-sectional shape, e.g. elliptic or rectangular. In such cases the first catalytic converter 3 can present a cross-section being either similar or dissimilar to the catalytic converter device 1 in the region of the first catalytic converter 3, and be located centrally in lateral direction of the latter.

**[0029]** The catalytic converter device 1 comprises flow control means 6, located upstream and in the vicinity of the first catalytic converter 3 and adapted to control the flow of exhaust gases in either one of at least two flow alternatives. A first flow alternative comprises controlling the flow so that essentially all of the exhaust gases are guided to the first catalytic converter 3, as indicated in fig 1 by the arrows A. Thereby, the flow control means 6, herein also referred to as a flow control device, blocks the flow into the bypass region 5. After passing through the first catalytic converter 3, the gases enter the second catalytic converter 4.

**[0030]** A second flow alternative is shown in fig. 2. Here, the flow control means 6 blocks the flow to the first catalytic converter 3 and directs essentially all flow to the bypass region 5, so that it bypasses the first catalytic converter 3 before reaching the second catalytic converter 4, as indicated by the arrows B. As an alternative, some of the gases could be allowed to pass through the first catalytic converter 3 before entering the second catalytic converter 4.

**[0031]** The first flow alternative is used during a start phase of the engine, taking place during a time period from the start of the engine to a later point in time. The first catalytic converter 3 presents a high density for it to quickly reach a light off temperature at which it has reached a desired level of converting activity. Since the gases are guided to the second catalytic converter 4 after passing through the first converter 3, the former is heated during the first flow alternative.

**[0032]** Approximately at a time at which the second catalytic converter has reached a light off temperature, the flow control means 6, or the flow control device 6, is used to implement the second flow alternative, which initiated a warm phase of the catalytic converter device 1. Since the second catalytic converter 4 is heated during the start phase, the density thereof does not have to be high to accelerate a reaching of the light off temperature. Therefore it can present a low density, which has the advantage of resulting in a low pressure drop over the catalytic converter device 1, which in turn improves the performance of the engine.

**[0033]** The flow control means 6 is located upstream of the first catalytic converter 3 and, preferably, it blocks the gas to from the first catalytic converter 3 in the second flow alternative. As a result, the first catalytic converter is protected from very high temperatures of the exhaust gas. This means that materials, usually excluded for their high temperature sensitivity, can be considered for the first catalytic converter 3. As an example, Zeolite can be included in the first converter. Zeolite can be used to bind hydrocarbons (HC) at the beginning of the engine operation. When the catalyst is warm, the hydrocarbons can be released and converted and converted in the second catalyst 4 into harmless gases. The device according to the preferred embodiment of the invention allows for the temperature sensitive material Zeolite to be used and at the same time allow high temperatures of the exhaust gases, since the material is protected by the flow control means 6.

**[0034]** Fig. 3 and 4 each shows a perspective view of a section of the catalytic converter device 1, the catalytic converter device being sectioned along the line III-III, and IV-IV, respectively, in fig. 1 and 2, respectively.

**[0035]** The flow control means 6 comprises a movable part 7, presenting an essentially flat and substantially circular shape and is movably connected to the rest of the catalytic converter device 1 at a center position. More generally, the movable part 7 has a shape so that it presents a principal plane, parallel to which a major part of it extends. It should be noted that the movable part 7 can present one or more stiffeners or other protruding parts extending in a direction other than that of the principal plane. Preferably, the movable part extends mostly parallel to a plane being perpendicular to the longitudinal axis L, and is adapted to rotate around its connection to the rest of the device 1, and around an axis being essentially parallel to the longitudinal axis L.

**[0036]** An actuation arrangement 8 comprises a mov-

able pin 9, which by engagement with a fork 10, fixed to the movable part 7, can cause the latter to rotate around its rotation axis. Other types of actuation arrangements are possible as well, e.g. a push-pull cable.

**[0037]** As can be seen in fig. 1 and 2, the flow control means 6 also comprises a fixed part 11, located adjacent to the movable part 7, and downstream of the latter. Alternatively, it can be located upstream of the movable part 7. The movable part 7 and the fixed part 11 each present an essentially planar, essentially parallel first surface 7a and a second surface 11a, respectively, which are adjacent each other and faced towards each other, whereby an interface between the movable part 7 and the fixed part is defined 11. Thereby, the movable part 7 is movable essentially parallel to a plane defined by the first surface 7a. More generally, the movable part 7 is adapted to move in its principal plane, which is essentially parallel to the first surface 7a.

**[0038]** The movable part 7 presents a plurality of apertures 12a, 12b distributed in the direction of movement of the movable part, i.e. spaced around the center of rotation thereof. Thereby an inner set of apertures 12a is located at a radial distance being less than the radius of the first catalytic converter 3, and adapted to guide gases in the first flow alternative. An outer set of apertures 12b is located at a radial distance outside the first catalytic converter, and is adapted to guide gases in the second flow alternative.

**[0039]** The fixed part 11 also presents a plurality of apertures, whereby the apertures are located so that the fixed and the movable part are adapted to interact to control the flow of exhaust gases. Thereby, in the first flow alternative the movable part 7 is controlled by the actuation arrangement 8 so that it assumes a first position indicated in fig. 3. Thereby the inner set of apertures 12a of the movable part 7 is lined up with apertures in an inner region of the fixed part 11 so as to allow a flow of gas into the first catalytic converter. At the outer region of the movable part 7, the apertures 12b in the outer set are out of line with corresponding apertures in the fixed part 11, so as to block gases from flowing into the bypass region 5 (fig. 1).

**[0040]** In the second flow alternative the movable part 7 is controlled by the actuation arrangement 8 so that it assumes a second position indicated in fig. 4. Thereby the outer set of apertures 12b of the movable part 7 is lined up with the apertures in the outer region of the fixed part 11 so as to allow gas to bypass the first catalytic converter 3 (fig. 2). At the inner region of the movable part 7, the apertures 12a in the inner set are out of line with the corresponding apertures in the fixed part 11, so as to block gases from flowing into the first catalytic converter 3.

**[0041]** It can be seen in the figures that the fixed and movable part are arranged and oriented so as to intersect the flow of exhaust gases, and to direct it according to any of the flow alternatives.

**[0042]** As an alternative to having planar surfaces, the

fixed and the movable part could present surfaces facing each other that are shaped as parts of a sphere, or part of a cylinder, or other shapes, the interface also assuming such a shape, whereby the parts are still arranged to intersect the flow of exhaust gases.

**[0043]** The solution with a movable and a fixed part presenting a plurality of interacting apertures results in the movement from the first to the second position being small. Increasing the number of apertures can provide for an even smaller, but other aspects has to be taken into account, such as flow efficiency, which limits the amount of apertures used. In the embodiment shown in fig. 1-4, the movement of the movable part 7, from the first to the second position is approximately 15 degrees of rotation. This small movement provides for a using an actuation arrangement, which has an un-complex design, and presents a low risk of malfunctioning. Also, the space required for the motion of parts of the actuation arrangement and the flow control means is small.

**[0044]** Also, the movable part 7 being restricted to a lateral movement in the catalytic converter device provides for space being saved in the longitudinal direction of the latter. Thereby, a relatively short catalyst can be provided, which is a large advantage in vehicles, where space requirements are demanding.

**[0045]** Referring to fig. 1, the cross-section area of the first catalytic converter 3 is smaller than that of a passage 13, located directly upstream of the catalytic converter device 1 from which the latter is adapted to receive the flow of exhaust gases. Due to the change of the cross-section area, in the first flow alternative the exhaust gases will undergo a mixing which enhances an even distribution of particles and substances in the catalyst, in turn improving the performance of the latter. The apertures 12a of the flow control means 6 will also contribute to an area decrease that further improves the mixing of the exhaust gases.

**[0046]** Referring to fig. 1, in an entry region 15 located between the first catalytic converter 3 and the passage 13, upstream of the device 1, the cross-section area is larger than in the passage 13. This means that there is an increase in the cross-sectional area from the passage 13 to the entry region 15. As a result, in the first flow alternative, in the entry region 15, there will be high gas velocities close to the center and low velocities closer to the periphery. This will allow for some exhaust gases to recirculate close to the periphery of the entry region 15, which will further improve the mixing of the gases. This process will include pulses from the engine being partly dampened through the re-circulation in the entry region 15 and interacting with subsequent pulses, to further enhance the mixing of the gases.

**[0047]** In the first flow alternative, three area changes contribute to the mixing of the gases, i.e. when it passes from the passage 13 to the entry region 15, from the entry region 15 to the apertures 12a in the flow control means 6 and from the apertures 12a to the first catalytic converter 3. This three stage area change will provide

for very effective mixing of the exhaust gases.

**[0048]** Computations performed by one of the inventors show that the mixing of the exhaust gases in a catalytic converter device according to this embodiment of the invention, in the first flow alternative, is improved approximately four times compared to a conventional catalyst located close to the engine. The mixing is comparable to that provided in a system with a turbo charger. However, it should be kept in mind that the invention is also applicable in a vehicle with a turbo charged engine.

**[0049]** Preferably, laterally the bypass region 5 is at least partly located at a greater distance from the center of the catalytic converter device 1 than the passage 13, located immediately upstream of the catalytic converter device 1. In the second flow alternative, the gases will be moved outwards laterally when passing from the passage 13 to the bypass region 5, and this will provide for a mixing of the exhaust gases before entering the second catalytic converter 4, and improve the performance of the latter.

**[0050]** Also, the cross-section area of the bypass region 5 can be larger than that of the passage 13. Due to the change of the cross-section area, the mixing of the exhaust gases in the second flow alternative will be further enhanced. Further, in the second flow alternative, a further mixing of the exhaust gases is provided by the area increase from the bypass region 5 to a space located between the first 3 and the second catalytic converter 4.

**[0051]** As has been described above, the catalytic converter device according to the invention provides for a more efficient conversion in both a start mode and a warm operation mode of it.

**[0052]** The mixing of the exhaust gases described above will also be favorable because pulses from the engine originating from different cylinders can have different lambda values. The catalytic converter device described here will improve the mixing of gases from different cylinders and thereby provide for gases with a more even lambda value to enter the converters, which improves the conversion processes.

**[0053]** Fig. 5-8 show a catalytic converter device 1 according to an alternative embodiment of the invention. Fig. 5 shows a sectioned view of a part of the catalytic converter device 1, sectioned along a longitudinal axis of the device, indicated with a broken line L.

**[0054]** The embodiment shown in fig. 5-8 corresponds to the one described above with reference to fig. 1-4, except for the arrangement of the flow control means 6. The flow control means 6 is located upstream and in the vicinity of the first catalytic converter 3 and adapted to control the flow of exhaust gases in either one of at least two flow alternatives. A first flow alternative comprises controlling the flow so that essentially all of the exhaust gases are guided to the first catalytic converter 3, as indicated in fig 5 by the arrows A. Thereby, the flow control means 6 blocks the flow into a bypass region 5, forming a bypass to the first catalytic converter.

**[0055]** A second flow alternative is shown in fig. 6. Here, the flow control means 6 blocks the flow to the first catalytic converter 3 and directs essentially all flow to the bypass region 5, so that it bypasses the first catalytic converter 3 before reaching the second catalytic converter 4, as indicated by the arrows B.

**[0056]** Fig. 7 and 8 each shows a perspective view of a section of the catalytic converter device 1, the catalytic converter device being sectioned along the line VII-VII, and VIII-VIII, respectively, in fig. 5 and 6, respectively.

**[0057]** The flow control means 6 comprises a movable part 7, presenting an essentially flat shape and is slidably connected to the rest of the catalytic converter device 1 at two guide rails 14, one at the top and the other at the bottom of the movable part 7. The movable part 7 extends mostly parallel to a plane being perpendicular to the longitudinal axis L, and is adapted to be moved in a lateral direction, parallel to the guide rails 14.

**[0058]** An actuation arrangement 8 comprises a movable pin 9, which by engagement with a fork 10, fixed to the movable part 7, can cause the latter to slide in the guide rails 14, laterally in the catalyst. Other types of actuation arrangements are possible as well, e.g. a push-pull cable connected to the movable part 7.

**[0059]** As can be seen in fig. 5 and 6, the flow control means 6 also comprises a fixed part 11, located adjacent to the movable part 7, and downstream of the latter. The movable part 7 presents a plurality of apertures 12a, 12b distributed in the direction of movement of the movable part, i.e. spaced in the lateral direction of movement. Thereby an inner set of apertures 12a is located at a radial distance being less than corresponding to the radius of the first catalytic converter 3, and adapted to guide gases in the first flow alternative. An outer set of apertures 12b is located at a radial distance outside the first catalytic converter, and is adapted to guide gases in the second flow alternative.

**[0060]** The fixed part 11 also presents a plurality of apertures, whereby the apertures are located so that the fixed and the movable part are adapted to interact to control the flow of exhaust gases. Thereby, in the first flow alternative the movable part 7 is controlled by the actuation arrangement 8 so that it assumes a first position indicated in fig. 7. Thereby the inner set of apertures 12a of the movable part 7 is lined up with apertures in an inner region of the fixed part 11 so as to allow a flow of gas into the first catalytic converter, as can also be seen in fig. 5. At the outer region of the movable part 7, the apertures 12b in the outer set are out of line with corresponding apertures in the fixed part 11, so as to block gases from flowing into the bypass region 5 (fig. 5).

**[0061]** In the second flow alternative the movable part 7 is controlled by the actuation arrangement 8 so that it assumes a second position indicated in fig. 8. Thereby the outer set of apertures 12b of the movable part 7 is lined up with the apertures in the outer region of the fixed part 11 so as to allow gas to bypass the first catalytic converter 3 (fig. 6). At the inner region of the movable

part 7, the apertures in the inner set are out of line with the corresponding apertures in the fixed part 11, so as to block gases from flowing into the first catalytic converter 3.

**[0062]** As an alternative to what has been described above, the first catalytic converter could be located asymmetrically in the latitudinal direction of the catalytic converter device, for example off-center, adjacent a part of the inner surface of the latter, whereby apertures in the flow control means are arranged to selectively block a bypass flow or allow a bypass flow, correspondingly to what has been described above.

**[0063]** In the embodiments described above, the first and second catalytic converters 3, 4 are located close to each other in a common "housing". As an alternative, the catalytic converter device 1 is arranged so that a first and a second catalytic converter 3, 4 are separated by a relatively long distance. In such a case, the first catalytic converter 3 and flow control means 6 can be located close to the engine, and the second catalytic converter 4 can be located in a separate housing, under the floor of the vehicle. This is an advantage where there are space limitations in the vicinity of the engine. It also allows for a very high exhaust temperature, without increasing the risk of damaging the catalysts.

**[0064]** A large merit of the invention is that it provides for the design of a catalytic converter device, which, due to the arrangement of the flow control device, has a short extension in a longitudinal direction. This, apart from being space saving, provides for large cross-section area differences along a relatively short distance in the direction of the flow of exhaust gases, at least in a region of the flow control device. In turn, this provides for an effective mixing of the exhaust gases, which improves the performance of the catalytic converter device.

**[0065]** Above, the movable part has been described as being oriented perpendicular to the longitudinal direction of the catalytic converter device. Alternatively, the movable part as well as the fixed part of the flow control means can be arranged so that the movable part can move in an angle to the longitudinal direction, which is other than perpendicular.

## 45 Claims

1. A catalytic converter device adapted to receive a flow of exhaust gases from an internal combustion engine, the catalytic converter device comprising a first catalytic converter (3) and a second catalytic converter (4), the first catalytic converter (3) being located upstream of the second catalytic converter (4), the catalytic converter device comprising flow control means (6), adapted to control the flow of exhaust gases in either one of at least two flow alternatives, whereby in a first flow alternative essentially all of the exhaust gases are guided to the first catalytic converter (3), and in a second flow alter-

- native at least some of the exhaust gases are guided past the first catalytic converter (3), the flow control means (6) comprising a movable part (7), adapted to assume a first position, whereby the flow is controlled according to the first flow alternative, and a second position, whereby the flow is controlled according to the second flow alternative, **characterized in that** the flow control means comprises a fixed part (11), arranged to intersect the flow of exhaust gases, whereby the movable part (7) and the fixed part (11) are facing each other and thereby defining an interface between each other, and **in that** the movable part (7) is adapted to move along said interface.
2. A catalytic converter device according to claim 1, whereby the movable part (7) presents a principal plane, parallel to which a major part of it extends, the movable part (7) being adapted to move in its principal plane.
  3. A catalytic converter device according to any of the preceding claims, whereby the movable part (7) is adapted to move in a plane essentially perpendicular to a longitudinal direction (L) of the catalytic converter device.
  4. A catalytic converter device according to any of the preceding claims, whereby the flow control means (6) is located upstream and in the vicinity of the first catalytic converter (3).
  5. A catalytic converter device according to any of the preceding claims, whereby the movable part (7) is adapted to, in the second position, block gas flow to the first catalytic converter (3).
  6. A catalytic converter device according to any of the preceding claims, whereby, in the first flow alternative, essentially all of the exhaust gases are guided to the second catalytic converter (4) after passing through the first catalytic converter (3).
  7. A catalytic converter device according to any of the preceding claims, whereby the movable part (7) presents a plurality of apertures (12a, 12b) distributed in the direction of movement of the movable part (7), and the fixed part (11) presents a plurality of apertures, whereby the apertures are located so that the fixed and the movable part (7) are adapted to interact to control the flow of exhaust gases.
  8. A catalytic converter device according to any of the preceding claims, whereby the movable part (7) is adapted to rotate around an axis being essentially parallel to a longitudinal direction (L) of the catalytic converter device.
  9. A catalytic converter device according to any of the preceding claims, whereby the first catalytic converter (3) is located essentially centrally in a lateral direction of the catalytic converter device.
  10. A catalytic converter device according to any of the preceding claims, whereby the cross-section area of the first catalytic converter (3) is smaller than that of a passage (13) upstream of the catalytic converter device from which the latter is adapted to receive the flow of exhaust gases.
  11. A catalytic converter device according to any of the preceding claims, whereby an entry region (15) is located between the first catalytic converter 3 and a passage (13) upstream of the catalytic converter device, the cross-section area is generally larger in the entry region (15) than in the passage (13).
  12. A catalytic converter device according to any of the preceding claims, comprising a bypass region (5), through which at least some of the exhaust gases are guided in the second flow alternative, whereby, laterally in the catalytic converter device, the bypass region (5) is at least partly located at a greater distance from a center of the catalytic converter device (1) than a passage (13), located upstream of the catalytic converter device (1).



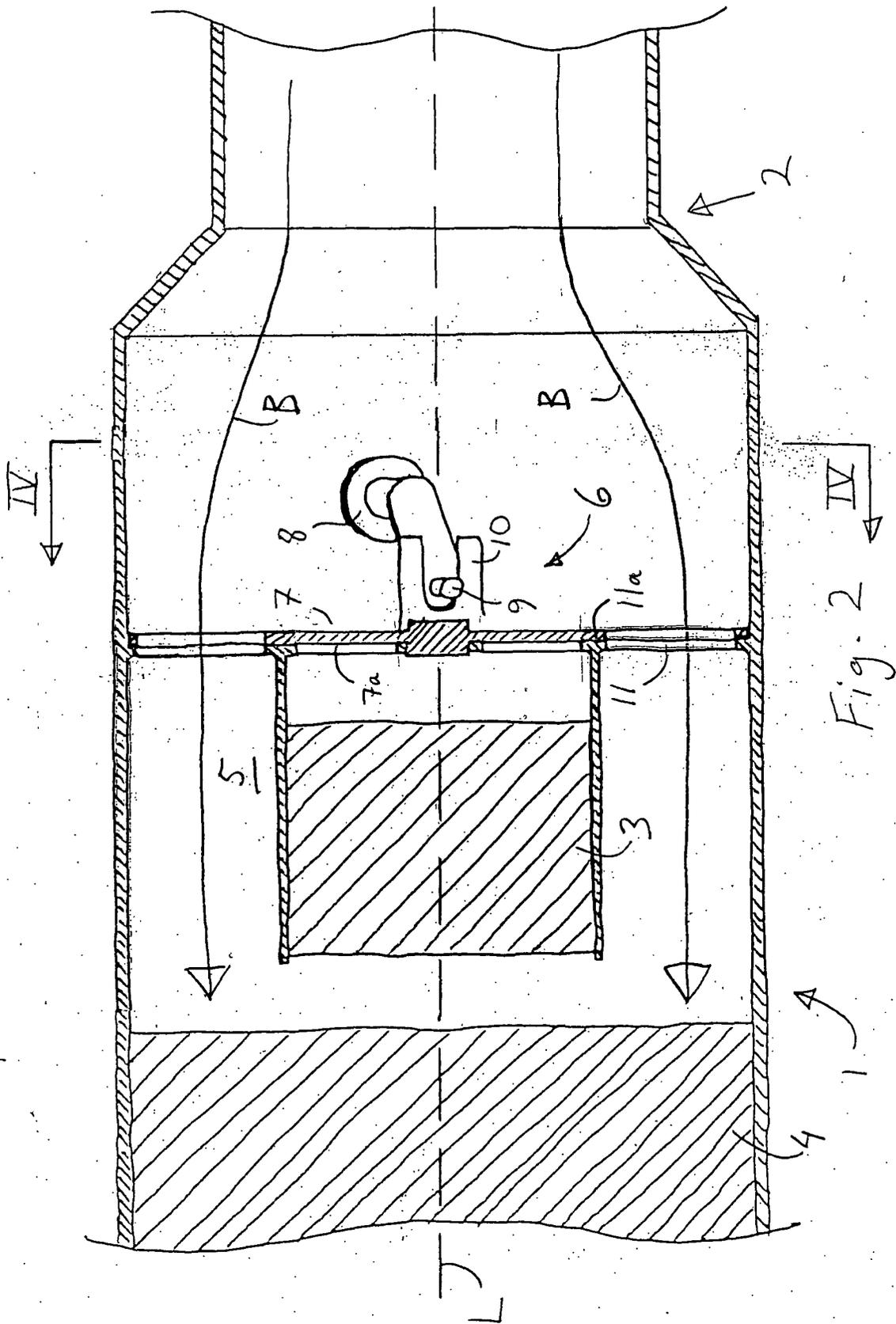


Fig. 2

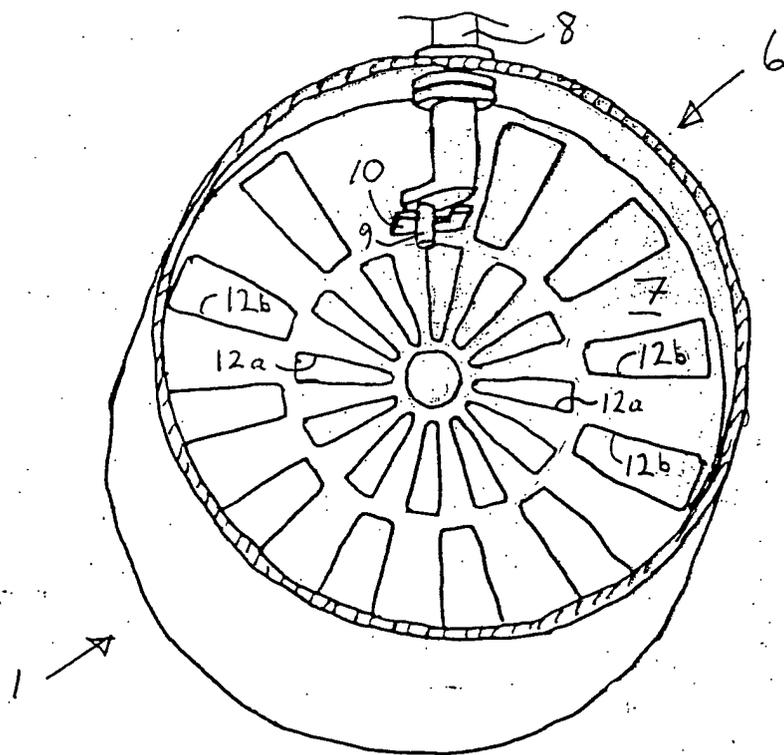


Fig. 3

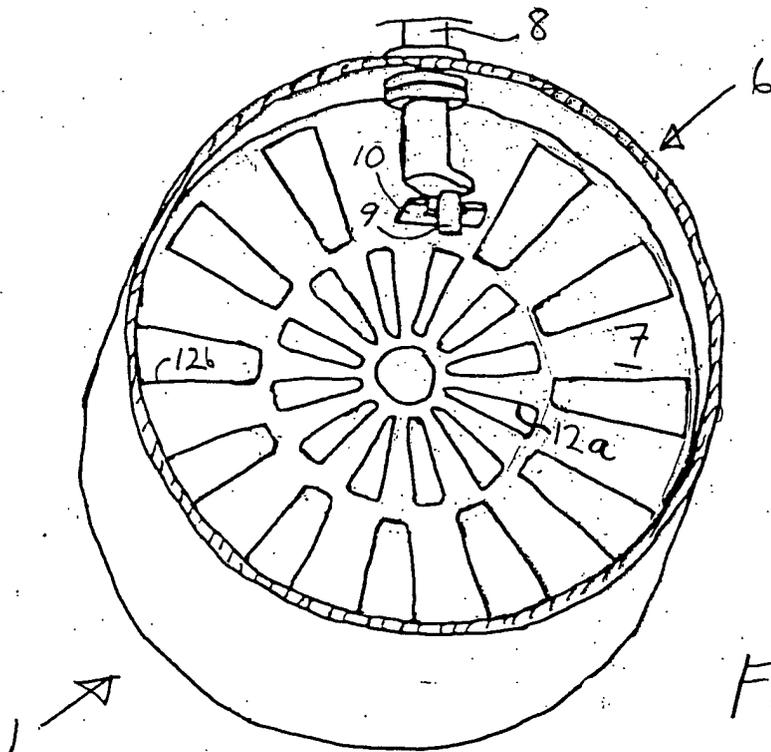
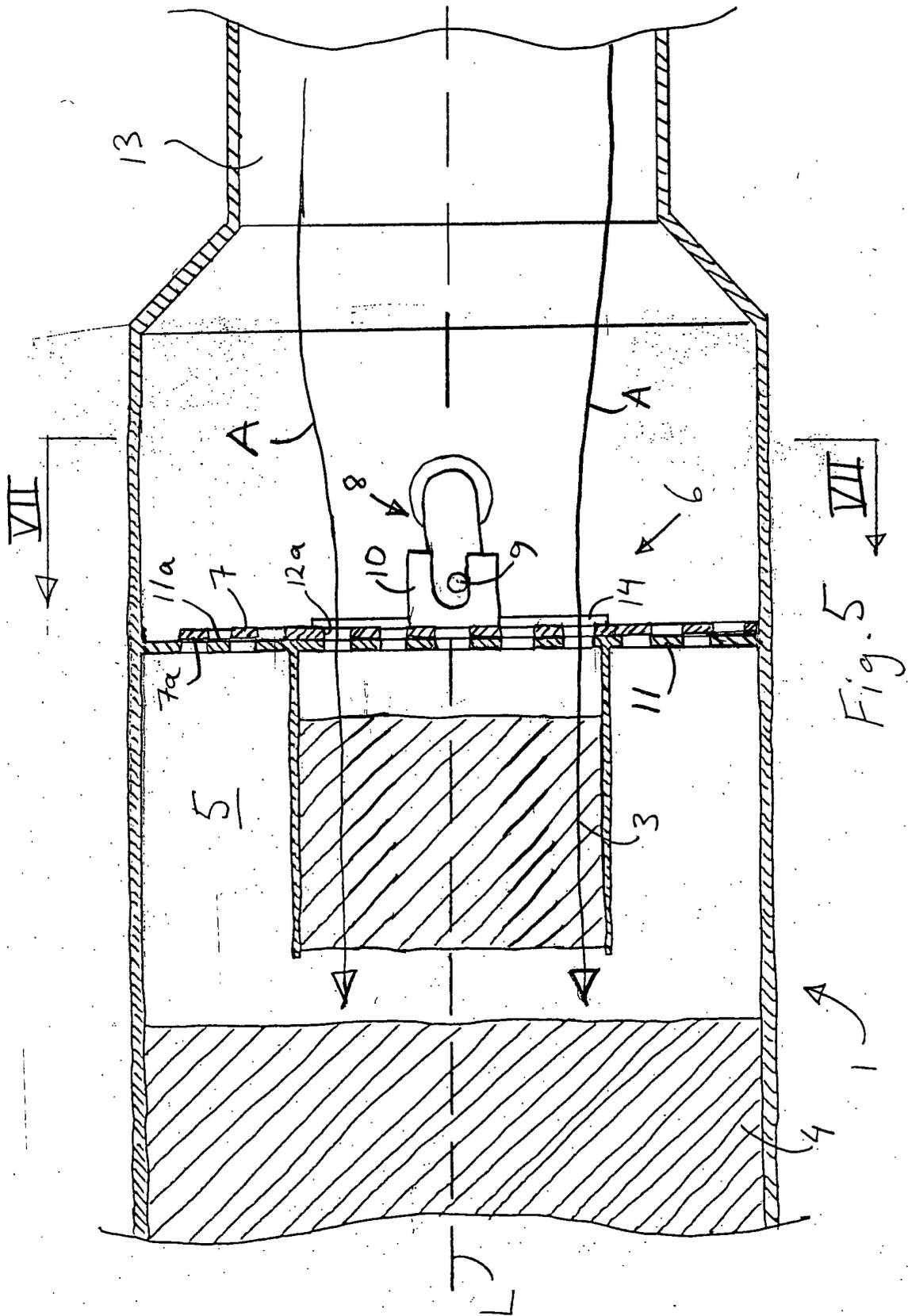
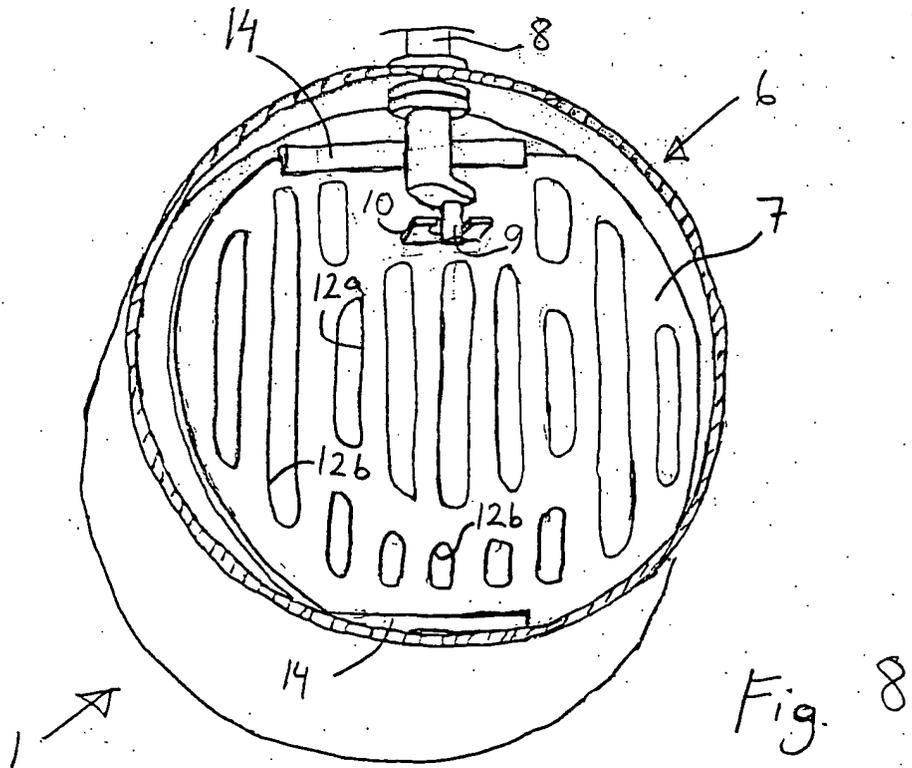
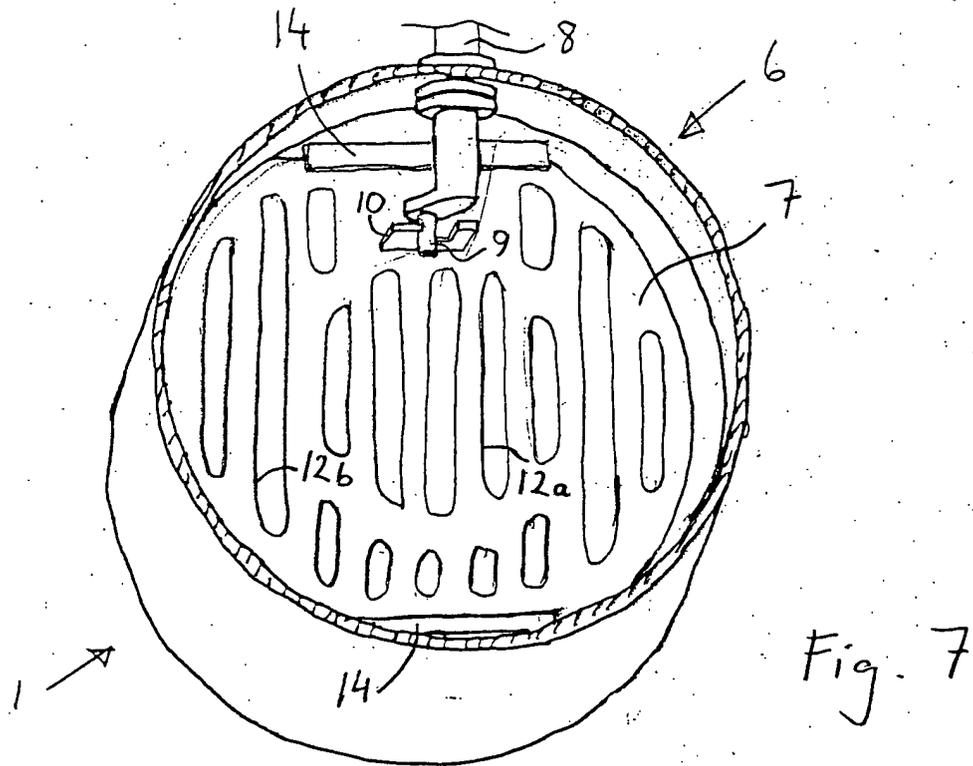


Fig. 4









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Application Number  
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