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(54) **Apparatus for treatment of exhaust gas**

Vorrichtung zur Behandlung von Abgas

Appareil de traitement de gaz d'échappement

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Description

[0001] The present invention relates to gas treatment apparatus for treating an exhaust gas stream from an internal combustion engine, particularly gas treatment apparatus for an internal combustion engine in a motor vehicle.

[0002] Internal combustion engines, particularly diesel engines produce an exhaust gas stream that contains a number of noxious gases, unburned hydrocarbons and particulates. It is desirable to treat the exhaust gas stream to render it less obnoxious.

[0003] It is common practice to pass the exhaust stream through a silencer assembly that contains one or more treatment compartments containing a treatment element, such as a catalytic converter or a filter to remove particulates. The treatment compartments within a silencer assembly are typically tubular and are a close fit with the treatment element that it contains. A treatment element is usually axially secured in a treatment compartment such that the treatment element cannot move during use. The silencer assembly may also serve to attenuate the noise emitted by the engine.

[0004] It is desirable to be able to remove one or more of the treatment elements from the silencer assembly for cleaning, servicing or replacement. For example, it is known that the life of a particulate filter in a silencer assembly may be extended if it is removed from the silencer assembly and replaced with its orientation reversed, thus reversing the direction of gas flow through the filter.

[0005] A treatment element typically comprises a cylindrical body member surrounded by a shock absorbing sleeve within a metal tubular case, usually stainless steel. The body member and sleeve are secured within the tubular case by internally directed ribs or flanges and gaskets at both ends of the body member. In use, a gas stream is treated by being passed through the body member of a treatment element. The body member may comprise a catalyst carried on a ceramic support, or it may comprise a ceramic filter which traps the particulates in the gas stream, or it may comprise any other type of gas treatment member.

[0006] It is known to permanently secure a particulate filter within a compartment by folding the ends of the compartment inwards. The compartment can then be removed and refitted as a whole during servicing. This is used particularly in modular systems. Such apparatus is shown in GB 2,357,048 or US 4,264,344.

[0007] To releasably secure a treatment element within the chamber it is known to weld a flanged part to the outside of the tubular case as shown in Figures 1 and 2. A flanged part is welded to the tubular case of a treatment element and the flange is secured to a corresponding flange on the chamber by a V-clamp. A second flanged part is also welded to the tubular case to ensure the symmetry of the treatment element for refitting in the reverse orientation. The flanged part increases the complexity of manufacture of the treatment element and increases the possibility of heat damage to the body member.

[0008] It is an object of the present invention to address some of the above issues.

[0009] According to the invention there is provided an apparatus for treating an exhaust gas stream from an internal combustion engine, said apparatus comprising a tubular compartment containing a treatment member through which a gas stream to be treated is to flow, the tubular compartment being substantially surrounded by an annular compartment through which gas may flow, the tubular compartment comprising a tubular canister and a retainer, the tubular canister including stopping means, the retainer being releasably attached to the canister by axial clamping means and the treatment member being secured within the tubular compartment by contact of a first end of the treatment member with the stopping means and contact of a second end of the treatment member with the retainer.

[0010] The invention also provides apparatus for housing a treatment member for treating a gas stream from an internal combustion engine, said apparatus comprising a tubular compartment for containing the treatment member through which a gas stream to be treated is to flow, the tubular compartment being substantially surrounded by an annular compartment through which gas may flow, the tubular compartment comprising a tubular canister and a tubular retainer, the tubular canister including stopping means and a substantially radially outwardly protruding flange, the tubular retainer including a substantially radially outwardly protruding flange and a substantially radially inwardly protruding flange, the tubular retainer being releasably attachable to the canister by axial clamping means acting on the substantially radially outwardly protruding flanges such that, in use, a treatment member may be secured within the compartment by contact of the treatment member with the stopping means and the substantially radially inwardly protruding flange.

[0011] The treatment member may be a single treatment element, or may be a combination of two or more treatment elements or a combination of one or more treatment elements and other elements such as a flame trap, inlet or outlet module or noise attenuation module. Preferably the elements are combined in series. For convenience, the present invention will be described hereafter with reference to an embodiment in which the treatment member is a single treatment element.

[0012] Providing a retainer that is not attached to the treatment element, but secures the treatment element within the compartment removes the need to attach additional parts to the treatment element at locations dependent upon the relative lengths of the canister and treatment element. The manufacture of the treatment element is therefore greatly simplified and the risk of damaging the body member of the treatment element during a welding process is removed. A gas treatment appara-

tus is therefore provided that may be used in several different designs and/or for different duties by including different retainers for the same canister.

[0013] The tubular canister can have any cross-section, but it is preferably substantially circular or substantially elliptical, as these shapes can be manufactured using rolling techniques.

[0014] Axial clamping means secure the retainer to the canister by applying an axial force across the joint between the canister and the retainer. The use of an axial clamping means, such as an adjustable axial strap, V-clamp, a plurality of clamps or clips or other means may allow an axial force to be applied to the treatment element towards the stopping means, thereby securing the treatment element within the compartment. The axial clamping means may be attached to either the compartment or to the retainer, but is preferably separate.

[0015] The canister and retainer may comprise one or more substantially radially outwardly projecting flanges, but preferably each comprise a circumferential flange around their periphery upon which the axial clamping means may act to attach the canister and retainer together. The attachment is preferably by clamping the outwardly projecting flanges together using a V-clamp. The joint may further comprise a gasket or other seal that may prevent gas flow through the joint, or between the canister and treatment element.

[0016] A V-clamp is typically formed from a strap with a V-shaped cross section that is formed into a hoop such that the opening of the 'V' is directed substantially radially inwards. The ends of the length of material are secured together by an adjustable fastening such that the length of the perimeter of the hoop can be altered by adjusting the fastening. A V-clamp may be used to secure tubular parts together if each part has a radially outwardly projecting flange. The two parts are brought together such that the flanges are adjacent one another and the V-clamp is then arranged such that the flanges are within the opening of the 'V' shape. The perimeter of the strap is then shortened so that the flanges are forced together axially as the flanges enter the 'V' and the parts are secured together. It should be understood that the invention is not limited to this construction of V-clamp.

[0017] The stopping means prevent the treatment element from moving further into the canister. The stopping means may be a substantially radially inwardly directed shoulder or flange that makes contact with an end of the treatment element and prevents axial movement into the canister. It should be understood that other stopping means could also be used, for instance an additional retainer.

[0018] Preferably the retainer comprises a tubular portion with substantially the same cross section as the tubular canister. This allows the retainer to fit over an end of a treatment element protruding from the canister. The retainer can therefore be attached to the canister and still make contact with an end of the treatment element if the element is longer than the canister. This allows different lengths of treatment elements to be accommodated within a canister by changing the retainer. If the cross section of the retainer is slightly smaller than the cross section of the canister, it may be possible for the retainer to slide into the canister and retain a treatment element that is shorter than the canister. These variations in the retainer allow a single size of canister to be used for many different duties by changing the length of the treatment element and retainer. This can simplify manufacture, as fewer canister sizes are needed for a range of duties. The retainer may also include an inlet or outlet pipe and serve as the inlet or outlet to the compartment through which gas enters or leaves the compartment.

[0019] The retainer and stopping means preferably make contact with the ends of the treatment element at or adjacent the periphery of the treatment element so that the gas flow through the treatment element is not substantially hindered.

[0020] The currently preferred retainer comprises a tubular portion, with a substantially radially outwardly projecting circumferential flange at or adjacent one end of the tubular portion and a substantially radially inwardly directed circumferential flange at the opposing end of the tubular portion. The tubular portion preferably has a cross section that is substantially identical with the cross section of the canister.

[0021] The canister is preferably shorter than the treatment element to be located within it such that the element protrudes from the canister when it is located against the stopping means as this allows for easier extraction of the filter element. Preferably the treatment element is less than about 50% longer than the canister and preferably less than about 25%.

[0022] Although the canister and retainer can be fabricated from any suitable material, it is preferred that they are fabricated from stainless steel, as it is highly corrosion resistant.

[0023] A method for securing a treatment within the compartment according to a preferred embodiment of the invention is for the treatment element to be inserted into the tubular canister until it reaches the stopping means, an end of the treatment element remaining protruding from the canister. The retainer is then fitted over the protruding end of the treatment element such that the inwardly protruding flange of the retainer is in contact with the end of the treatment element. The outwardly protruding circumferential flange of the retainer is then adjacent to the corresponding outwardly protruding circumferential flange of the tubular canister and a V-clamp is then used to secure the retainer to the canister and hence secure the treatment element within the compartment.

[0024] This invention is of particular use because the compartment forms a central compartment and has an annular compartment that substantially surrounds it. The invention is of particular use because of the in-

creased difficulty in obtaining access to the treatment element within the central compartment. In such a gas treatment apparatus it is common practice to have a removable endcap which allows access to an end of the central compartment. It is desirable that the axial clamping means is easily accessible once the endcap has been removed. It is therefore preferred that the retainer is located at the end of the canister closest to the removable endcap.

[0025] Such an embodiment according to the present invention also provides the advantage over known embodiments that the canister can be permanently supported at both ends, thereby supporting the treatment element. In known designs it is often necessary to provide a cruciform type support attached to the removable endcap to support one end of the treatment element. Such a support requires careful manufacture and fitting to ensure that it supports the treatment element when the removable endcap is fitted.

[0026] The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a known gas treatment apparatus in which the treatment element has flanged parts welded to the tubular case of a treatment element;

Figure 2 shows a close-up of the attachment of the treatment element to the chamber shown in Figure 1;

Figure 3 shows a preferred embodiment of a gas treatment apparatus according to the invention; and

Figure 4 shows a close-up of the attachment of the retainer to the chamber shown in Figure 3.

[0027] Figure 1 shows a known gas treatment apparatus 1 having a central tubular compartment 2 and an annular compartment 4 substantially surrounding the central compartment 2. A gas stream enters the apparatus 1 through an inlet 6 and passes into a catalytic treatment element 8 in the central compartment 2. The gas stream then passes into a filter element 10. The direction of the gas flow is then reversed by a contact with an endwall 12 and the gas flows through the annular compartment 4 to an outlet 14. The direction of gas flow is indicated by arrows 15.

[0028] The catalytic treatment element 8 is for catalytic oxidation of at least some of the chemicals in the gas stream and is a Platinum based catalyst on a ceramic frit support. The filter 10 is a ceramic wall flow filter for removing particulates from the gas stream.

[0029] Each treatment element 8,10 comprises a respective body member 16,18 surrounded by a shock absorbing sleeve 20 within a tubular case 22.

[0030] The catalytic treatment element 8 is permanently secured within the central compartment 2, but the filter element 10 is releasably attached to the central compartment 2 by a V-clamp 24. The nature of the attachment is best shown in Figure 2.

[0031] The outside of the tubular case 22 surrounding the filter element 10 has two circumferential flanged parts 26,28 welded it. The flanged parts 26,28 include substantially radially outwardly protruding flanges 30,32. The central compartment 2 includes a substantially radially outwardly directed circumferential flange 34. When the filter element 10 is fully inserted into the central compartment 2 in a first orientation, the flange 34 on the central compartment 2 is adjacent a flange 30 of the flanged part 26. The V-clamp 24 can be used to secure the flanges 34,30 together to hold the treatment element 10 in the central compartment in a first orientation. When the filter element 10 is secured in a second, reversed, orientation, the flange 34 on the central compartment 2 is adjacent a flange 32 of the flanged part 28. The V-clamp 24 can then be used to secure the flanges 34,30 together to hold the treatment element 10 in the central compartment in a second orientation.

[0032] Figure 3 shows a gas treatment apparatus 101 according to the present invention. Features that have the same function as described for the embodiment 1 of Figure 1 will be referenced by the same numerals.

[0033] The compartment 102 comprises a tubular canister 42 and a retainer 36. The retainer comprises a tubular portion 44 with a substantially radially outwardly projecting circumferential flange 40 at one end and a substantially inwardly projecting flange 38. The canister includes a substantially radially outwardly projecting circumferential flange 34. The treatment member, in this case a treatment element 110, is located within the canister 42 and rests against stopping means 46, in this case an inwardly directed shoulder. An end of the treatment element 110 protrudes from the canister 42. The retainer is fitted over the protruding end until the radially inwardly protruding circumferential flange 38 makes contact with the end of the treatment element 110. The radially outwardly projecting flanges 34,40 are adjacent one another and a V-clamp 24 acts on the flanges 34,40 to axially clamp the retainer 36 to the canister 42. The axial clamping by the V-clamp applies a force on the treatment element 110 towards the stopping means 46 to secure the treatment element within the compartment 2.

[0034] The filter element 110 is of standard construction and does not have any additional parts attached to the outside. Although the treatment member is shown as a single treatment element 110 for simplicity, it should be understood that the treatment member could also include a flame trap, noise attenuation module or other element.

[0035] Figure 4 shows a close up of the attachment between the retainer 36 and the canister 42. This figure shows the position of two different retainers 36,36'. The retainer 36 is longer than the retainer 36' and can therefore be used to secure longer filter elements 110 within

the compartment 102.

[0036] It can be seen from the diagrams that the retainer 36 is of simple construction and can be easily fabricated. If the endcap 12 is removed from the apparatus 101 it allows access to remove the V-clamp 24 and retainer 36 and hence allows the removal of the treatment element 110 from the compartment 102. The treatment element 110 can then be serviced and replaced, or substituted for a different treatment element of substantially the same diameter which need not have been specially adapted for use in the compartment 102.

[0037] The present invention has been described above purely by way of example. It should be noted that modifications in detail may be made within the scope of the invention as defined in the claims.

Claims

1. Apparatus (101) for treating an exhaust gas stream from an internal combustion engine, said apparatus (101) comprising a tubular compartment (102) containing a treatment member (110) through which a gas stream to be treated is to flow, the tubular compartment (102) being substantially surrounded by an annular compartment (4) through which gas may flow, **characterised in that** the tubular compartment (102) comprises a tubular canister (42) and a retainer (36), the tubular canister (42) including stopping means (46), the retainer (36) being releasably attached to the canister (42) by axial clamping means (24) and the treatment member (110) being secured within the tubular compartment (102) by contact of a first end of the treatment member (110) with the stopping means (46) and contact of a second end of the treatment member (110) with the retainer (36).

2. Apparatus (110) as claimed in claim 1, in which both the retainer (36) and the canister (42) include substantially radially outwardly projecting flanges (34,40) upon which the axial clamping means (24) may act to attach the retainer (36) to the canister (42).

3. Apparatus as claimed in claim 2, in which the substantially radially outwardly projecting flange (34) of the canister is at or adjacent an open end of the canister (42).

4. Apparatus as claimed in claim 2 or claim 3, in which at least one of the substantially radially outwardly projecting flanges (34,40) is a circumferential flange.

5. Apparatus as claimed in any of claims 2 to 4, in which the retainer (36) includes a substantially radially inwardly projecting flange (38) that makes contact with the second end of a treatment member (110) within the canister (102).

6. Apparatus as claimed in claim 5, in which the substantially radially inwardly projecting flange (38) is a circumferential flange.

7. Apparatus as claimed in claim 5 or claim 6, in which the radially inwardly projecting flange (38) of the retainer is connected to the radially outwardly projecting flange (40) of the retainer by a tubular portion (44).

8. Apparatus as claimed in claim 7, in which the tubular portion (44) of the retainer (36) has substantially the same cross section as the tubular canister (102).

9. Apparatus as claimed in any preceding claim, in which the axial clamping means (24) is a V-clamp.

10. Apparatus as claimed in any preceding claim, in which the apparatus includes a removable endcap (12) releasably attached to the apparatus (101).

Patentansprüche

1. Vorrichtung (101) zur Behandlung eines Abgasstroms von einem Verbrennungsmotor, wobei die Vorrichtung (101) eine röhrenförmige Kammer (102) umfasst, die ein Behandlungsglied (110) enthält, durch das ein zu behandelnder Gasstrom strömen soll, wobei die röhrenförmige Kammer (102) von einer ringförmigen Kammer (4), durch die Gas strömen kann, im Wesentlichen umgeben wird, **dadurch gekennzeichnet, dass** die röhrenförmige Kammer (102) einen röhrenförmiger Behälter (42) und einen Halter (36) umfasst, wobei der röhrenförmige Behälter (42) Sperrmittel (46) enthält, der Halter (36) durch ein axiales Klemmmittel (24) lösbar am Behälter (42) befestigt ist und das Behandlungsglied (110) durch Kontakt eines ersten Endes des Behandlungsglieds (110) mit dem Sperrmittel (46) und Kontakt eines zweiten Endes des Behandlungsglieds (110) mit dem Halter (36) in der röhrenförmigen Kammer (102) befestigt ist.

2. Vorrichtung (110) nach Anspruch 1, bei der sowohl der Halter (36) als auch der Behälter (42) im Wesentlichen radial nach außen ragende Flansche (34, 40) enthalten, auf die das axiale Klemmmittel (24) zur Befestigung des Halters (36) am Behälter (42) einwirken kann.

3. Vorrichtung nach Anspruch 2, bei der sich der im Wesentlichen radial nach außen ragende Flansch (34) des Behälters an oder neben einem offenen

Endes des Behälters (42) befindet.

4. Vorrichtung nach Anspruch 2 oder 3, bei der mindestens einer der im Wesentlichen radial nach außen ragenden Flansche (34, 40) ein Umfangsflansch ist.

5. Vorrichtung nach einem der Ansprüche 2 bis 4, bei der der Halter (36) einen im Wesentlichen radial nach innen ragenden Flansch (38) enthält, der das zweite Ende eines Behandlungsglieds (110) im Behälter (102) berührt.

6. Vorrichtung nach Anspruch 5, bei der der im Wesentlichen radial nach innen ragende Flansch (38) ein Umfangsflansch ist.

7. Vorrichtung nach Anspruch 5 oder 6, bei der der radial nach innen ragende Flansch (38) des Halters durch einen röhrenförmigen Teil (44) mit dem radial nach außen ragenden Flansch (40) des Halters verbunden ist.

8. Vorrichtung nach Anspruch 7, bei der der röhrenförmige Teil (44) des Halters (36) im Wesentlichen den gleichen Querschnitt aufweist, wie der röhrenförmige Behälter (102).

9. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der es sich bei dem axialen Klemmmittel (24) um eine V-Klemme handelt.

10. Vorrichtung nach einem der vorhergehenden Ansprüche, die eine abnehmbare Endkappe (12) enthält, die lösbar an der Vorrichtung (101) befestigt ist.

Revendications

1. Dispositif (101) pour traiter un flux de gaz d'échappement issu d'un moteur à combustion interne, ledit dispositif (101) comprenant un compartiment tubulaire (102) contenant un élément de traitement (110) par lequel est destiné à passer un flux de gaz à traiter, le compartiment tubulaire (102) étant sensiblement entouré par un compartiment annulaire (4) par lequel peut s'écouler un gaz, **caractérisé en ce que** le compartiment tubulaire (102) comporte une cartouche tubulaire (42) et un moyen de retenue (36), la cartouche tubulaire (42) comportant un moyen d'arrêt (46), le moyen de retenue (36) étant fixé de manière amovible à la cartouche (42) par un moyen de serrage axial (24) et l'élément de traitement (110) étant fixé à l'intérieur du compartiment tubulaire (102) par contact d'une première extrémité de l'élément de traitement (110) avec le moyen d'arrêt (46) et par contact d'une deuxième extrémité de l'élément de traitement (110) avec le moyen de retenue (36).

2. Dispositif (110) selon la revendication 1, dans lequel le moyen de retenue (36) et la cartouche (42) comportent des rebords (34, 40) faisant saillie sensiblement de manière radiale vers l'extérieur, sur lesquels le moyen de serrage axial (24) peut agir pour fixer le moyen de retenue (36) à la cartouche (42).

3. Dispositif selon la revendication 2, dans lequel le rebord (34) de la cartouche, qui fait saillie de manière sensiblement radiale vers l'extérieur, se trouve à ou au voisinage immédiat d'une extrémité ouverte de la cartouche (42).

4. Dispositif selon la revendication 2 ou la revendication 3, dans lequel au moins l'un des rebords (34, 40) faisant saillie de manière sensiblement radiale vers l'extérieur est un rebord périphérique.

5. Dispositif selon l'une quelconque des revendications 2 à 4, dans lequel le moyen de retenue (36) comporte un rebord (38) faisant saillie de manière sensiblement radiale vers l'intérieur, qui vient au contact de la deuxième extrémité d'un élément de traitement (110) à l'intérieur de la cartouche (102).

6. Dispositif selon la revendication 5, dans lequel le rebord (38) qui fait saillie de manière sensiblement radiale vers l'intérieur est un rebord périphérique.

7. Dispositif selon la revendication 5 ou la revendication 6, dans lequel le rebord (38) du moyen de retenue, qui fait saillie de manière radiale vers l'intérieur, est relié par une partie tubulaire (44) au rebord (40), faisant saillie de manière radiale vers l'extérieur, du moyen de retenue.

8. Dispositif selon la revendication 7, dans lequel la partie tubulaire (44) du moyen de retenue (36) a sensiblement la même section transversale que la cartouche tubulaire (102).

9. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le moyen de serrage axial (24) est une attache en V.

10. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le dispositif comporte un embout amovible (12) fixé de manière amovible au dispositif (101).

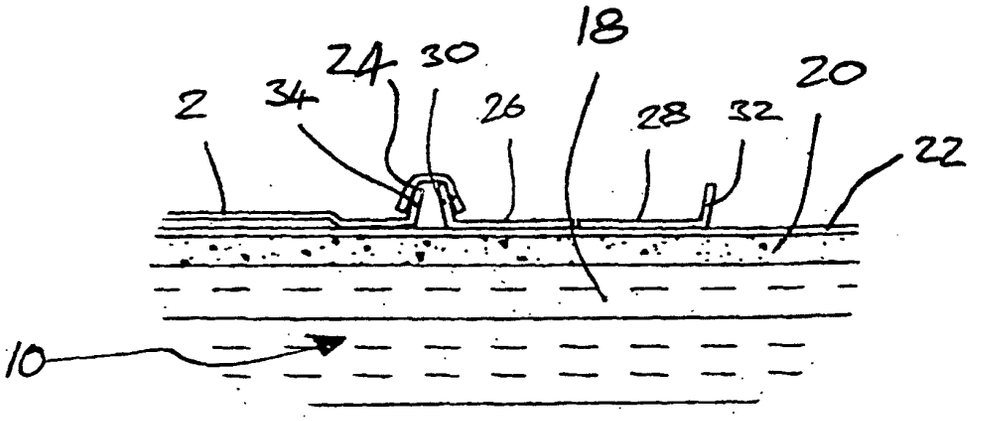

Fig. 2

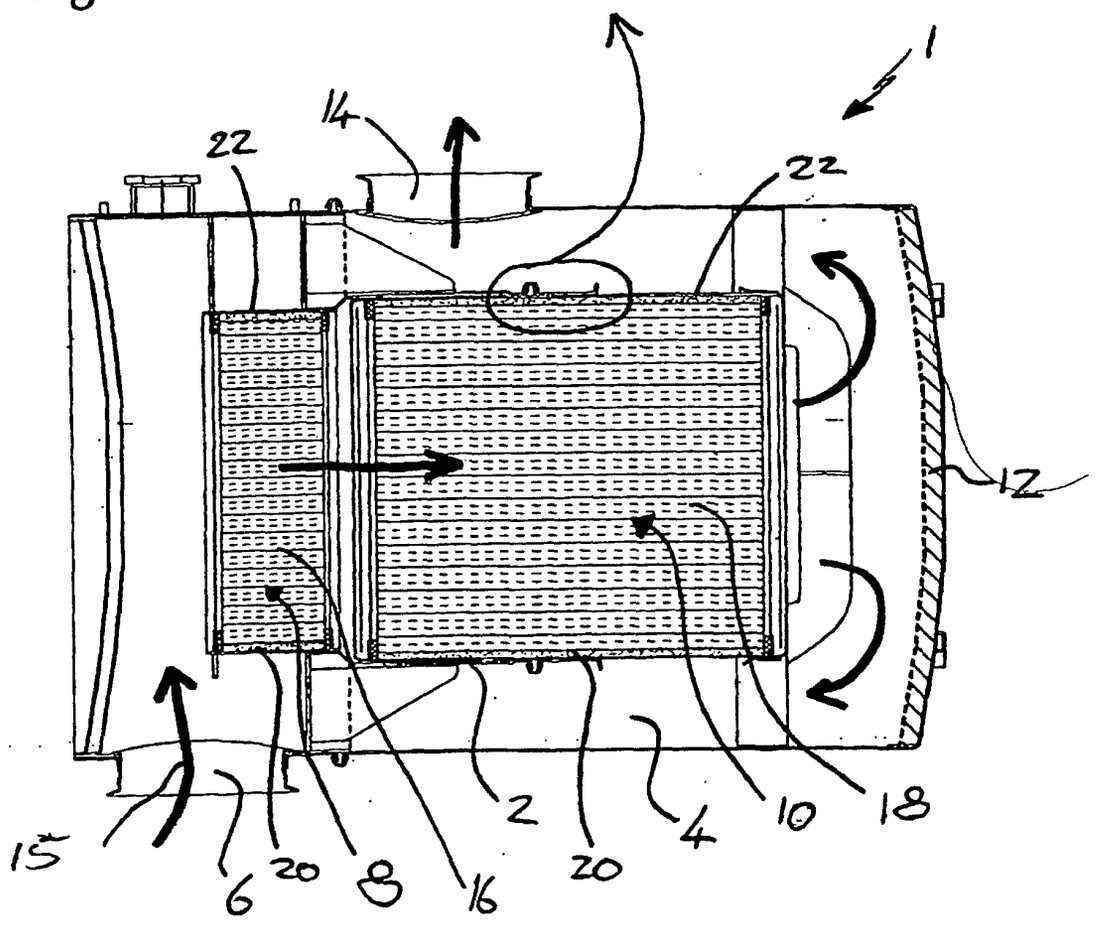

Fig. 1

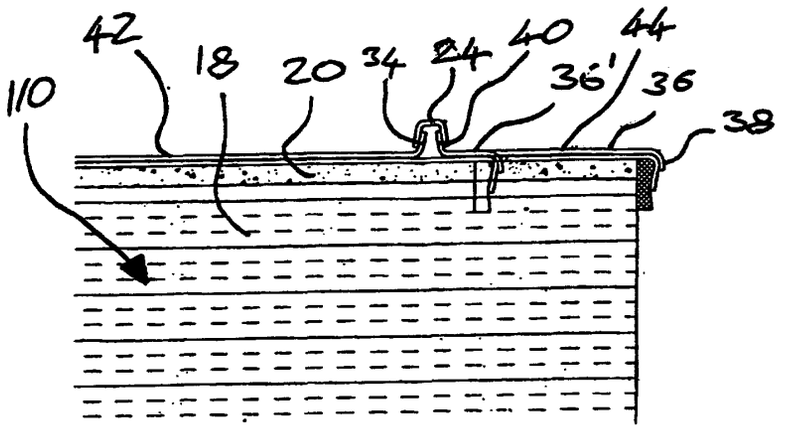

Fig. 4

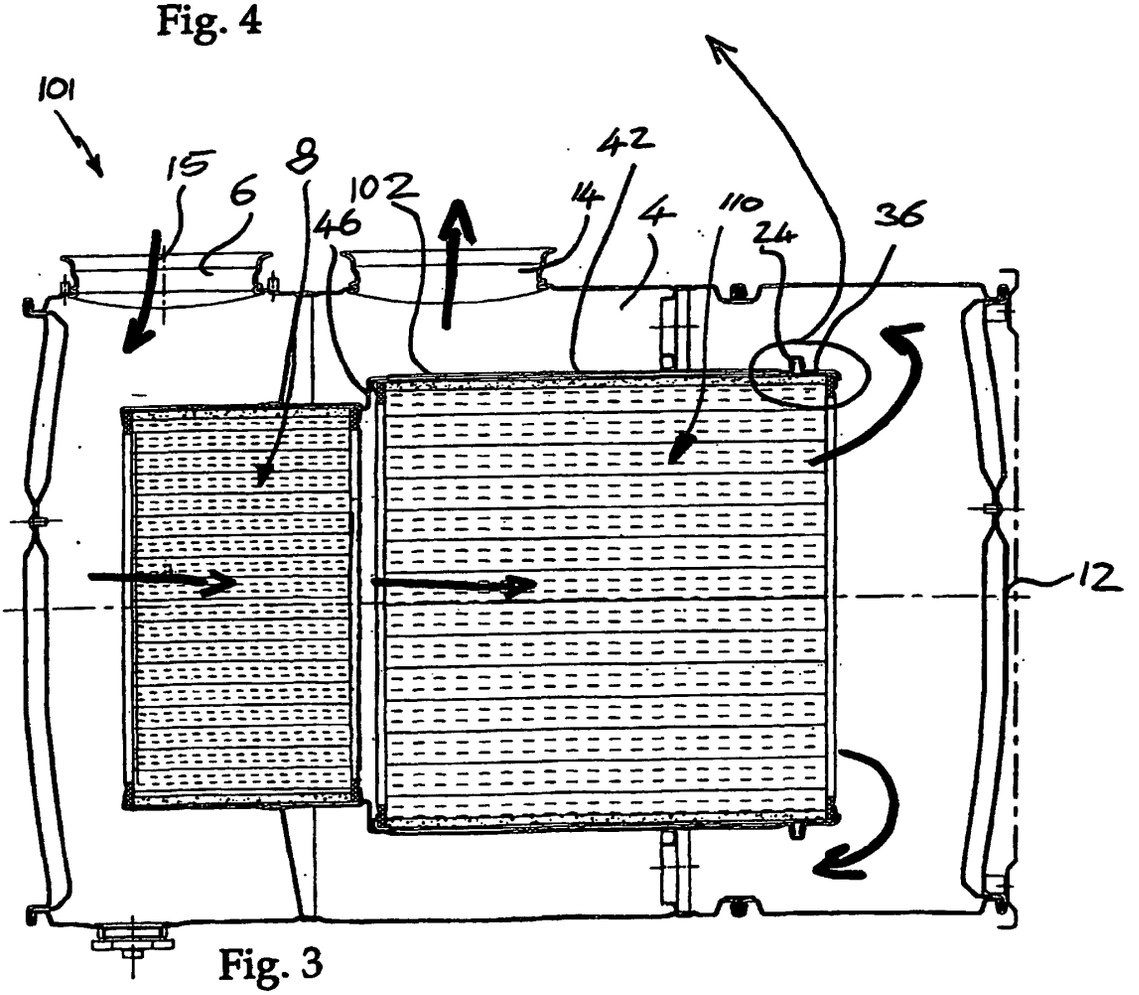

Fig. 3