(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 617 070 A1

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.01.2006 Bulletin 2006/03

(51) Int Cl.:
F02M 25/08 *(2006.01)*

(21) Application number: **04254256.3**

(22) Date of filing: **15.07.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK

(71) Applicant: **Delphi Technologies, Inc.**
Troy, MI 48007-5052 (US)

(72) Inventors:
- **De Biaso, Ennio**
4926 Bascharage (LU)
- **Gabriel, Pierron**
57650 Fontoy (FR)

(74) Representative: **Jones, Keith William et al**
Murgitroyd & Company
Scotland House
165-169 Scotland Street
Glasgow G5 8PL (GB)

(54) **Vapour canister**

(57) This invention relates to a vapour canister (100, 500) that has a volume compensator (10, 200, 300, 400) adapted with compression holding means (22, 50, 70, 72, 80, 90) to retain the volume compensator (10, 200, 300, 400) in a compressed or locked position, such that it can be sandwiched between two adsorbent chambers (112, 114) during assembly of the vapour canister (100, 500), and is operatively released or unlocked by release means, when required. Sandwiching the volume compensator (10, 200, 300, 400) between the chambers (112, 114) allows for a substantially even distribution of force to be applied thereto.

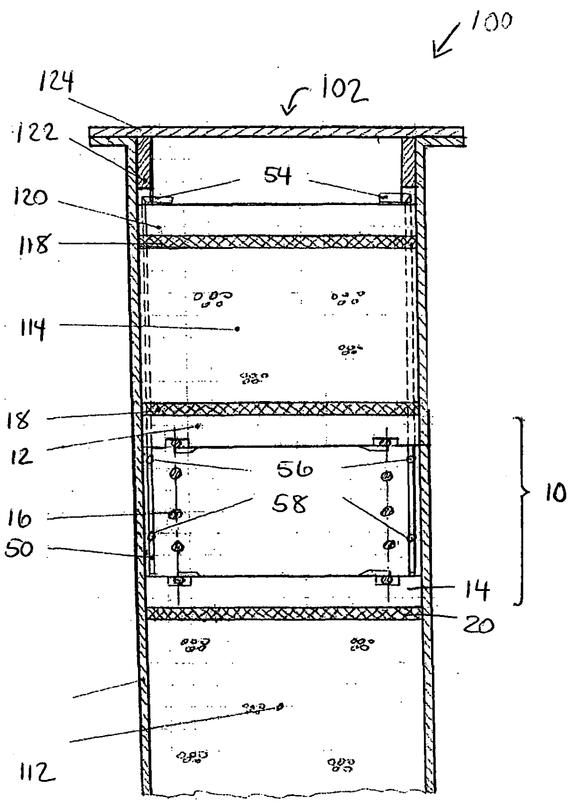


FIG 4.

EP 1 617 070 A1

Description

[0001] This invention relates to a vehicle fuel system, and in particular, but not exclusively, to a vapour canister as used in an evaporative emission system to reduce the amount of potentially harmful emissions released into the environment.

[0002] Fuel vapour from a vehicle's tank and delivery system cause evaporative emissions that can potentially harm the environment. These harmful evaporative emissions occur whilst the vehicle is in motion (running losses), when a hot engine is turned off (hot soak losses), and even when the vehicle is stationary (diurnal losses).

[0003] Vehicles, such as automobiles, are equipped with an evaporative emission system to reduce the amount of harmful emissions. Such emission systems comprise a vapour canister which is typically filled with activated carbon that acts to adsorb the harmful emissions, such as hydrocarbons, thus preventing them from being released into the environment.

[0004] Carbon particles of the activated carbon should be tightly packed to efficiently adsorb the emissions. If the carbon particles are not tightly packed, they may erode against one another, forming flow paths for the harmful emissions to escape without being adsorbed. Moreover, should the carbon particles erode against one another, they may form a dust which can block the vapour canister.

[0005] The carbon particles may become loose when the vapour canister is subjected to harsh vibrations and impacts. These may cause the particles to migrate, resulting in regions that have a low density of carbon particles, such that the particles erode against one another forming flow paths and perhaps dust.

[0006] The carbon particles may also become loose since the canister itself, which is typically made of a plastics material or metal, is subjected to wide temperature variations, causing the canister to expand and contract, resulting in carbon particles not being adequately compact.

[0007] To account for the volume changes of the vapour canister, and to ensure that the carbon particles remain adequately packed, a volume compensator is typically inserted within the body of the canister.

[0008] Known volume compensators comprise a spring-loaded tray or plate that urges against the activated carbon to keep it tightly packed. Typically, during assembly, the spring is compressed at the final stages, prior to attachment of a bottom cover. This happens at the final stages because adding a precompressed volume compensator (as known in the art and without a locking means) may become released during assembly.

[0009] It is therefore advantageous to provide a vapour canister that has a volume compensator that remains compressed or locked; can be added in the assembly of the vapour canister at almost any stage as desired; and can be operatively released or unlocked when required.

[0010] Known volume compensators are located at the bottom of the vapour canister. This is because the compression of the spring is the penultimate stage in assembly of the vapour canister, the final stage being the attachment of a bottom cover.

[0011] With long vapour canisters, it is difficult for the volume compensator to exert an appropriate force over the length of the canister such that the activated carbon is adequately packed. If the activated carbon is not adequately packed, carbon particles will move around and rub against one another and turn into a dust, which could block the canister and lead to flow paths for the harmful emissions to propagate without being adsorbed. If the force applied is not great enough, the activated carbon at the far end may not be adequately packed, and thus will lead to the formation of a dust and flow paths. If the force applied is too strong, the activated carbon at the end where the force is being applied may be compressed to form a dust, which can block the canister.

[0012] It is therefore also advantageous to provide a volume compensator which may be located or sandwiched within a vapour canister such that a substantially even distribution of force is exerted on the activated carbon.

[0013] According to a first aspect of the present invention there is provided a vapour canister comprising:

- a first and second chamber filled with an adsorbent;
- a volume compensator comprising:
  - a first and second compression plate, each plate engagable with the adsorbent of the vapour canister, and biasing means arranged between the first and second plates to urge them apart;

characterised in that the volume compensator is sandwiched between the first and second chambers.

[0014] Preferably the volume compensator is sandwiched between the chambers substantially at a longitudinal mid-point of the vapour canister, such that a substantially even distribution of force is applied to the chambers.

[0015] Preferably the volume compensator includes compression holding means to retain the biasing means in compression or a locked position, until operatively released.

[0016] Preferably screens are located between the compression plates and the chambers such that, the screens prevent the adsorbent from entering into the volume compensator.

[0017] According to a first embodiment of the present invention, preferably the compression holding means is of the form of at least one guide rod assembly.

[0018] Preferably the guide rod assembly includes a guide rod.

[0019] Preferably the guide rod assembly includes a holding member that protrudes from the guide rod, the holding member being engagable with the biasing means to retain said biasing means in a compressed or locked position.

[0020] Preferably the guide rod assembly includes releasing means, such as a handle, that protrudes from the guide rod such that operation of said releasing means causes the holding member to release or unlock the biasing means.

[0021] Preferably the guide rod assembly includes a stop member that protrudes from the guide rod to limit the travel of the guide rod assembly.

[0022] Preferably two guide rod assemblies are provided diametrically opposite one another.

[0023] According to a second embodiment of the present invention, the compression holding means alternatively comprises two magnetic portions which releasably engage with one another to retain the biasing means in the locked position.

[0024] Preferably the magnetic portions are releasable or unlocked in response to releasing means.

[0025] Preferably the releasing means applies a magnetic field proximate to said magnetic portions.

[0026] Preferably one of the ends of one of the magnetic portions is connected to a pivot member, the pivot member being attached to a biasing means engaging surface of one of the plates.

[0027] According to a third embodiment of the present invention, the compression holding means alternatively comprises a low temperature melting rod connected between the first and second compression plates, the melting rod retaining the biasing means in the locked position.

[0028] Preferably the biasing means is releasable or unlocked in response to releasing means.

[0029] Preferably the releasing means applies a thermal field proximate to said melting rod.

[0030] Preferably at least one end of the melting rod is connected to a pivot member, the pivot member being attached to a biasing means engaging surface of one of the plates.

[0031] According to a fourth embodiment of the present invention, the compression holding means alternatively comprises a lever.

[0032] Preferably the lever has a first lever end which has an angled portion to grip one of the compression plates.

[0033] Preferably the lever has a second lever end which has an angled pivot portion to grip the other compression plate and pivot from a locked to an unlocked or released position.

[0034] Preferably the second lever end also has an extended lever portion such that in response to a force being applied to the extended lever portion, the second lever end is caused to pivot, which in turn causes the first lever end to release its grip on the respective compression plate, releasing the biasing means.

[0035] Preferably two levers are provided diametrically opposite one another.

[0036] According to a second aspect of the present invention there is provided a method of assembling a vapour canister comprising the steps of:

partially filling the vapour canister with an adsorbent to define a first chamber;
adding a volume compensator comprising:

> a first and second compression plate, each plate engagable with the adsorbent of the vapour canister, biasing means arranged between the first and second plates to urge them apart;

adding more adsorbent to the vapour canister to define a second chamber;
characterised in that the method includes sandwiching the volume compensator between the first and second chambers.

[0037] Preferably the method includes sandwiching the volume compensator between the chambers substantially at a longitudinal mid-point of the vapour canister, such that a substantially even distribution of force is applied to the chambers.

[0038] Preferably the volume compensator includes compression holding means to retain the biasing means in compression, until operatively released.

[0039] Preferably screens are located between the compression plates and the chambers such that, the screens prevent the adsorbent from entering into the volume compensator.

[0040] Preferably the biasing means is releasable or unlocked in response to releasing means. The releasing means is of the form of a guide rod assembly (first embodiment), means that provides a suitable magnetic field (second embodiment), means that provides a suitable thermal field (third embodiment) and a lever (fourth embodiment).

[0041] According to a third aspect of the present invention there is provided a volume compensator comprising:

a first and second compression plate, each plate engagable with an adsorbent of a vapour canister;
biasing means arranged between the first and second plates to urge them apart;
characterised in that the volume compensator includes compression holding means to retain the biasing means in compression, until operatively released.

[0042] Preferably the volume compensator includes compression holding means according to any embodiment of the previous aspects of the present invention to retain the biasing means in compression.

[0043] Preferably the volume compensator includes releasing means according to any embodiment of the previous aspects of the present invention.

[0044] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Fig. 1 is a side part sectional view of a volume compensator according to a first embodiment of the present invention held in a compressed or locked position;

Fig. 2 is an exploded schematic view of part of the apparatus of Fig. 1;

Fig. 3 is a side part sectional view of a vapour canister including the volume compensator of Fig. 1 in a locked position;

Fig. 4 is a side part sectional view of the apparatus of Fig. 3 showing the volume compensator in a released or unlocked position, including an end cap;

Fig. 5 is a plan view of a stop ring of the apparatus of Figs. 3 and 4;

Fig. 5A is a side part sectional view of the stop ring of Fig. 5;

Fig. 6 is a side part sectional view of a modified guide rod assembly in a compressed or locked position;

Fig. 7 is a side part sectional view of the guide rod assembly of Fig. 6 in a released or unlocked position;

Fig. 8 is a side part sectional view of an alternative end cap;

Fig. 9 is a side part sectional view of a volume compensator according to a second embodiment in a locked position;

Fig. 10 is the volume compensator of Fig. 9 in a released or unlocked position;

Fig. 11 is a side part sectional view of a volume compensator according to a third embodiment in a locked position;

Fig. 12 is the volume compensator of Fig. 11 in a released or unlocked position;

Fig. 13 is a side part sectional view of part of a vapour canister including a volume compensator according to a fourth embodiment;

Fig. 14 is a side part sectional view of part of a volume compensator according to an alternative to the apparatus of Fig. 13;

Fig. 15 is a side part sectional view of a vapour canister including the volume compensator of Fig. 14 in a locked position;

Fig. 16 is the vapour canister of Fig. 15 showing the volume compensator in a released or unlocked position, including an end cap;

Fig. 17 is a side part sectional view of part of the vapour canister of Fig. 3 showing the volume compensator in a compressed or locked position, including an inner tube; and

Fig. 18 is part of the apparatus of Fig. 17 showing the volume compensator in a released position.

[0045] With reference to Fig. 1, there is shown a volume compensator 10 comprising a first and second compression plate 12, 14, biasing means in the form of a spring 16 arranged between the plates 12, 14 to urge them apart, the volume compensator 10 also including compression holding means 22 to retain the spring 16 in compression or in a locked position, until operatively released.

[0046] Fig. 2 shows the plates 12, 14 in more detail, which are substantially planar, cylindrical and slideably fit within a vapour canister 100 (Figs. 3 and 4).

[0047] Whilst the plates 12, 14 are shown as planar and cylindrical, it is to be appreciated that they may be of any suitable shape or form, such as rectangular. It is also to be appreciated that the plates 12, 14 may be made of any suitable material such as a plastics material or metal.

[0048] Referring back to Fig. 2, the plates 12, 14 have optional central apertures 26, 28 to receive an inner tube, which will be described in more detail later herein.

[0049] Spaced apart concentric apertures 30, 32, 34, 36 are located around the periphery of the outer and inner diameters of each plate 12, 14, on either side of an annulus 38, 40.

[0050] The apertures 30, 32, 34, 36 serve to allow ingress of air to flow from an air inlet (not shown) through the vapour canister 100 and volume compensator 10 with minimal flow restriction.

[0051] Referring back to Fig. 1, a pair of recesses 42a, 42b, 44a, 44b at the spring engaging surfaces of each annulus 38, 40 serve to receive respective ends of the spring 16, which are retained there by two respective pairs of retaining portions 46a, 46b, 48a, 48b that protrude partly over the recesses 42a, 42b, 44a, 44b.

[0052] The spring 16 is a typical spring as known in the art, such as a coil spring.

[0053] Two screens 18, 20 are located at each outwardly facing end of the plates 12, 14 furthest away from the spring 16 to prevent any adsorbent entering into the volume compensator 10. The screens 18, 20 are made of a suitable material, for example, a foam or needled polyester, such that there is minimal flow restriction through the volume compensator 10.

[0054] The screens 18, 20 are located at either outwardly facing surface of the plates 12, 14 such that the plates and the spring 16 are sandwiched between them. The screens 18, 20 are substantially planar and cylindrical, and have a diameter that is slightly larger than the plates 12, 14 to snugly fit within the vapour canister 100, as shown in Figs. 2 to 4.

[0055] The screens 18, 20 may equally well be of other shapes and forms, for example, rectangular, or as required for the specific application of the vapour canister 100 and volume compensator 10.

[0056] In a first embodiment of the present invention the compression holding means 22 is of the form of a guide rod assembly 50, as shown in Figs. 1, 3 and 4.

[0057] There are two substantially similar guide rod assemblies 50 located diametrically opposite one another. Only one guide rod assembly shall now be described.

[0058] The guide rod assembly 50 includes a guide rod 52 which extends from plate 14 to near a capped end 102 of the vapour canister 100. The guide rod 52 is made of any suitable material such as a plastics material or metal.

[0059] The guide rod 52 is located through a first guide slot 53 in plate 12, where one end of the guide rod 52 comes to rest near the base of plate 14 in a second guide slot 55.

[0060] The guide rod assembly 50 also includes releasing means of the form of a substantially perpendicular protrusion or handle 54 located on the guide rod 52 nearest the capped end 102 of the vapour canister 100, and a second substantially perpendicular protrusion or first holding member 56 located at the other end of the guide rod 52.

[0061] The holding member 56 is engagable with the spring 16 to retain it in a compressed or locked position.

[0062] The handle 54 and fist holding member 56 are perpendicular to one another such that rotation of the handle 54 causes the first holding member 56 to rotate from a compressed or locked position to a released or unlocked position. It will be appreciated that the handle 54 and first holding member 56 need not be perpendicular to one another and may be of other orientations.

[0063] A second holding member 58, which is substantially the same as the first holding member 56 and similarly orientated, is located adjacent the holding member 56 on the guide rod 52 to provide added support to retain the spring 16 in a compressed position.

[0064] Likewise, the second holding member 58 is also rotatable from the compressed or locked position to the released or unlocked position upon rotation of the handle 54.

[0065] When engaging the spring 16, the first and second holding members 56, 58 compress that portion of the spring therebetween.

[0066] The plates 12, 14 and screens 18, 20 (and 118 of Figs. 3 and 4) have an aperture 59, which align with one another to allow the guide rod 52 to be threaded therethrough. It should be appreciated that there will be substantially similar apertures diametrically opposite to allow a second, diametrically opposite guide rod assembly to be threaded therethrough.

[0067] The volume compensator 10 is assembled as follows:

> with the guide rod assembly 50 pre-assembled, the base of the rod 52 is then inserted in slot 55 of the plate 14. The other plate 12 and screen 18 are then threaded onto the rod 52 via slot 53 and respective apertures 59. Respective ends of the spring 16 are then inserted in recesses 42a, 42b and 44a, 44b and retained there by retaining portions 46a, 46b, 48a, 48b. Finally, the spring 16 is compressed and the holding members 56, 58 are rotated by the handle 54 to engage and retain the spring 16 in a compressed or locked position.

[0068] In assembly of a vapour canister 100, activated carbon, or some other suitable adsorbent, is located at a sealed end of the vapour canister 100 to form a first carbon chamber 112 (Figs. 3 and 4). A screen (not shown) may be located at the sealed end of the vapour canister 100 before the carbon is added. The carbon chamber 112 is then, if required, shaken to remove any air pockets.

[0069] Screen 20 is then located on the surface of the carbon chamber 112.

[0070] The volume compensator 10, held in a compressed or locked position by the compression holding means 22, i.e. guide rod assembly 50, is then sandwiched into the vapour canister 100 with plate 14 in contact with screen 20.

[0071] Importantly, the volume compensator 10 is added to the vapour canister 100 such that it is located substantially at a longitudinal mid-point of the canister 100. This serves to allow the volume compensator 10, when operatively released, to exert an approximately equal force on both chambers 112, 114. Although it is preferably that the volume compensator 10 be located substantially at a longitudinal mid-point of the canister 100, it may be located elsewhere within the canister 100, or as required for a specific application.

[0072] Screen 18 is then located on plate 12 of the volume compensator 10 and more activated carbon is then added to the vapour canister 100 to form a second carbon chamber 114.

[0073] A screen 118 and retainer plate 120 are then pressed down onto the second carbon chamber 114.

[0074] A press fit stop ring 122, as shown in Figs. 5 and 5A, is then pressed into the end of the vapour canister 100, until it is adjacent the handle 54 of the guide rod assembly 50.

[0075] When desired, the compressed volume compensator is released by rotating the handle 54 of the guide rod assembly 50, which in turn rotates the holding members 56, 58 which disengage from the spring 16, thus releasing it.

[0076] Once the spring 16 has been released, the volume compensator 10 exerts a force on both carbon chambers 112, 114, causing the handle 54 and retainer plate 120 to move towards, and abut, the stop ring 122.

The abutment causes the stop ring 122 to urge against the guide rod assemblies 50, the retainer plate 120, and consequently, the carbon chambers 112, 114 and volume compensator 10.

[0077] Limiting the travel of the retainer plate 120 in this way allows the volume compensator 10 to compress the carbon chambers 112, 114 and compensate for any volume changes within the vapour canister 100.

[0078] An end cap 124 is then attached, by welding or other suitable means, to the end of the vapour canister 100.

[0079] In a modification, the stop ring 122 and cap end 124 may be combined to form an integral cap end 125, as shown in Fig. 8.

[0080] It is to be appreciated that an air inlet (not shown) is connected to one of the chambers 112, 114, "air inlet chamber", and a fuel vapour inlet (not shown) and a purge inlet (not shown) are connected to the other chamber 114, 112, "fuel vapour inlet chamber".

[0081] In use, hydrocarbons from the fuel tank enter the vapour canister 100 through the fuel vapour inlet and are adsorbed by the activated carbon of the chambers 112, 114 and thus are prevented from emitting into the environment.

[0082] Air from the air inlet enters the air inlet chamber and flushes the carbon chambers 112, 114.

[0083] Over time the adsorbed hydrocarbons migrate from the fuel vapour inlet chamber to the air inlet chamber.

[0084] It is to be appreciated that the volume compensator 10 will fulfil the function of a "partition" as known in the art i.e. as the hydrocarbons migrate from the fuel vapour inlet chamber towards the air inlet chamber, the volume compensator 10 presents a redistribution path for the hydrocarbons to travel. This in turn reduces the amount of migrating hydrocarbons to the air inlet chamber which will therefore remain cleaner longer, improving the efficiency of the vapour canister 100.

[0085] It is also to be appreciated that the vapour canister 100 will also be purged in the same way as known in the art, i.e. the carbon chambers 112, 114 are regenerated by drawing combustion air through the vapour canister 100.

[0086] In a modification of the first embodiment, as shown in Figs. 6 and 7, the stop ring 122 may be replaced by the guide rod assembly 50 including an extended guide rod 60 that has a protruding stop member 62 located at the base of the guide rod 60 which is substantially the same as the handle 54.

[0087] The stop member 62 performs the same function as the stop ring 122 and will limit the travel of the spring 16, for example, when the handle member 54 is rotated, the holding members 56, 58 disengage from the spring 16 and in so doing, release it. In turn, this causes the plate 12 to exert a force on the carbon chamber 114, which in turn causes the retainer plate 120, the handle 54, which now engages the retainer plate 120, the guide rod 60, and the stop member 62 to urge in the direction towards the capped end 102 of the vapour canister 100. Hence, the stop member 62 will engage the screen 20 preventing the retainer plate 120 from moving any further towards the capped end 102.

[0088] It is important that the orientation of the handle 54 and stop member 62 are such that they are engagable with the retainer plate 120 and plate 12 respectively.

[0089] As shown, the guide slot 55 in plate 14 will extend the entire thickness of the plate 14. Furthermore, the screen 20 will require an aperture 59 so that the rod 60 can pass therethrough.

[0090] With the first embodiment and the modifications of the present invention, the following advantages are to be appreciated: the volume compensator 10 can be sandwiched between the screens 18, 20 and chambers 112, 114 at a substantially longitudinal mid-point of the vapour canister, which allows for an approximately equal force to be exerted on both chambers 112, 114, thus mitigating the disadvantages as set out above of applying too great or too little a force on the activated carbon, and maintaining the chambers 112, 114 adequately packed, such that the carbon particles do not rub against one another to form a dust; the present invention also makes it possible to add a volume compensator in assembly of a vapour canister at any stage of the assembly process; known vapour canisters typically have two side by side chambers, each requiring a separate volume compensator whereas only one compensator is required for the present invention; each volume compensator required for the aforementioned prior art chambers may have slightly different properties which means that one chamber may be more compact than the other whereas with the present invention, both chambers 112, 114 will be similarly compact; the present invention is also easier to manufacture and assemble as the volume compensator 10 can be maintained in a locked position.

[0091] In a second embodiment of the present invention, as shown in Figs. 9 and 10, a volume compensator 200 is substantially the same as the fist embodiment, except for the compression holding means 22 which is of the form of magnetic engaging portions 70, 72 that are releasably engagable with one another.

[0092] One of the magnetic portions 70 is attached to a spring engaging surface of plate 12 and extends towards plate 14. Although shown as L-shaped, the magnetic portion 70 may be of other shapes or form to releasably engage with one end of the other magnetic portion 72.

[0093] The other end of the magnetic portion 72 is pivotally connected to a pivot member 74, which is attached to a spring engaging surface of plate 14.

[0094] The magnetic portion 72, although shown as L-shaped, may be of other shapes or form to releasably engage with one end of the other magnetic portion 70.

[0095] In assembly of the volume compensator 200, the spring 16 is connected to the plates 12, 14 as previously described, and compressed until the magnetic portion 72 can be pivoted and engaged with magnetic portion

70 such that the portions 70, 72 are magnetised together and hold the spring 16 in a compressed or locked position.

[0096] In assembly of a vapour canister (not shown), activated carbon, or some other suitable adsorbent, is located at a sealed end of the vapour canister to form a first carbon chamber (not shown). The carbon chamber is then, if required, shaken to remove any air pockets.

[0097] Screen 20 is then located on the surface of the carbon chamber.

[0098] The volume compensator 200, held in a compressed or locked position, is then located in the vapour canister with plate 14 in contact with screen 20.

[0099] Importantly, the volume compensator 200 is added such that it is located substantially at a longitudinal mid-point of the vapour canister. This serves to allow the volume compensator 200, when operatively released, to exert an approximately equal force on both chambers 112, 114. Although it is preferably that the volume compensator 10 be located substantially at the longitudinal mid-point of the canister 100, it may be located elsewhere within the canister 100, or as required for a specific application.

[0100] Screen 18 is then located on plate 12 of the volume compensator 200 and more activated carbon is then added to the vapour canister to form a second carbon chamber (not shown).

[0101] A screen 118 and retainer plate 120 are then pressed down onto the second carbon chamber.

[0102] A press fit stop ring 122 is then pressed into the end of the vapour canister until it is adjacent the retainer plate 120.

[0103] An end cap 124 is then attached, by welding or other suitable means, to the end of the vapour canister.

[0104] Similarly, the integral cap end 125 may be used.

[0105] This second embodiment operates in substantially the same way as the first embodiment with the exception that releasing means (not shown) applies a suitable magnetic field, remotely, proximate to the magnetic portions 70, 72, causing portion 72 to pivot and release the spring 16. In so doing, the volume compensator 200 exerts a force on both chambers.

[0106] It is to be appreciated that the volume compensator 200 will fulfil the function of a "partition" as known in the art, and as previously described.

[0107] It is also to be appreciated that the vapour canister 10 will be purged in the same way as known in the art.

[0108] The same advantages with the first embodiment should also be realised with this embodiment, with a further advantage that the vapour canister can be retained in a compressed position whilst the stop ring 122 and end cap 124, or integral end cap 125, are attached to the end of the vapour canister with ease by virtue of the retainer plate 120 not urging towards the stop ring. The spring 16 can then be operatively released, remotely, by the releasing means as and when required.

[0109] In a third embodiment of the present invention, as shown in Figs. 11 and 12, a volume compensator 300 is substantially the same as the previous embodiments, except for the compression holding means 22 being of the form of a low temperature melting rod 80.

[0110] Each end of the melting rod 80 is pivotally connected to respective pivot members 82, 84 which are attached to spring engaging surfaces of the plates 12, 14. This allows the remaining rod portions (as shown in Fig. 12) not to interfere with the spring 16 by pivoting away.

[0111] It is to be appreciated that this is a preferred embodiment and that either end of the melting rod 80 need not be pivotable.

[0112] This third embodiment is assembled in substantially the same way as the second embodiment, so too is a vapour canister utilising this embodiment, where the spring 16 is released by releasing means (not shown) applying a suitable thermal field, remotely, proximate to said melting rod 80.

[0113] This third embodiment is assembled and used in substantially the same way as described in the previous embodiments.

[0114] The same advantages with the previous embodiments should also be realised with this embodiment.

[0115] In a fourth embodiment of the present invention, as shown in Figs. 13 to 16, a volume compensator 400 is substantially the same as the previous embodiments, except for the compression holding means 22 being of the form of a lever 90. Whilst only one lever 90 is shown, there may be two substantially similar levers located diametrically opposite one another.

[0116] Fig. 13 shows a lever 90 which has a substantially planar portion 92, angled ends 94, 96 to grip adapted compression plates 98, 99 and hold the spring 16 in a compressed or locked position. The lever 90 also includes a further angled lever portion 101, which extends from angled end 96.

[0117] The planar portion 92 is substantially the same length as the distance between the non-spring engaging surfaces of the plates 98, 99 when the spring 16 is compressed.

[0118] Angled end 96 also has a fulcrum 104 such that when a suitable force F2 is applied to the lever portion 101, the planar portion 92 pivots away from the plate 99 (as shown by the dotted lines in Fig. 13), and causes the angled end 94 to release its grip on said plate 99, in turn, releasing the spring 16.

[0119] The adapted plates 98, 99 are substantially the same as plates 12, 14, except for apertures 106, 108 located near the outer circumferences of the plates 98, 99.

[0120] It should be appreciated that there may be similar apertures located diametrically opposite to house a second lever.

[0121] The apertures 106, 108 serve to allow the angled ends 94 of the lever 90 to grippingly engage and pivot away from the plate 99.

[0122] Fig. 14 shows an alternative to the fourth embodiment where the angle end 94 instead of gripping a top portion of the plate 12, grips a ledge 401 within the plate 99 such that the angled end 94 is pivotable within an aperture 408 of the plate 99, and such that the angled end 94 does not protrude onto the screen 18. It is to be appreciated that the plate 99 will be adapted with hollow portions to house the ledges 401 and receive the angled ends 94 of the levers 90.

[0123] Figs. 15 and 16 show a vapour canister 500 having a volume compensator 400 in a compressed position, and released position, respectively, employing the alternative embodiment described in the above paragraph.

[0124] The fourth embodiment and alternative are assembled in substantially the same way as described with the second and third embodiments, with the exception that the lever ends 94, 96 grip the plates 99, 98 to retain the spring 16 in a compressed or locked position.

[0125] A vapour canister 500, as shown in Figs. 13 to 16, is assembled in substantially the same way as described with the previous embodiments.

[0126] Referring back to Fig. 13, as activated carbon is added to the chamber 114 of the vapour canister 500, a downwardly force **F** is exerted on the volume compensator 400, which acts as the releasing means, pressing down on the chamber 112, in turn resulting in an upwardly, reactive force **F2** being exerted on the angled lever portion 101, causing the planar portion 92 to pivot away from the plates 98, 99 and causing the angled end 94 to release its grip on plate 99 and pivot away from said plate 99, which in turn, releases the spring 16.

[0127] The fourth embodiment and alternative are then used in substantially the same way as described in the previous embodiments.

[0128] The same advantages with the previous embodiments should also be realised with the fourth embodiment and alternative, with the further advantage that no release means is required per se.

[0129] As shown in Figs. 17 and 18, the vapour canister 100 (of Figs. 3 and 4) may include an inner tube 600 which has several functions. Firstly, the inner tube 600 can be inserted through the respective central apertures of the volume compensator, as best shown in Fig. 2, to provide added support to the vapour volume compensator. Moreover, the inner tube 600 can be inserted to positively affect the flow characteristics such that, as an air/vapour mixture egresses into the chambers, it flows up through the inner tube 600 in a U-shape fashion to an air vent to be flushed.

[0130] Vapour canisters utilising any of the aforementioned volume compensators may include an inner tube 600.

[0131] Various modifications and improvements may be made to the above without departing from the scope of the present invention.

Claims

1. A vapour canister (100, 500) comprising:

   a first and second chamber (112, 114) filled with an adsorbent;
   a volume compensator (10, 200, 300, 400) comprising:

      a first and second compression plate (12, 14), each plate (12, 14) engagable with the adsorbent of the vapour canister (100, 500), and biasing means (16) arranged between the first and second plates (12, 14) to urge them apart;
      characterised in that the volume compensator (10, 200, 300, 400) is sandwiched between the first and second chambers (112, 114).

2. A vapour canister (100, 500) as claimed in claim 1, wherein the volume compensator (10, 200, 300, 400) is sandwiched between the chambers (112, 114) substantially at a longitudinal mid-point of the vapour canister (100, 500), such that a substantially even distribution of force is applied to the chambers (112, 114).

3. A vapour canister (100, 500) as claimed in any preceding claim, wherein the volume compensator (10, 200, 300, 400) includes compression holding means (22, 50, 70, 72, 80, 90) to retain the biasing means (16) in compression or a locked position, until operatively released.

4. A vapour canister (100, 500) as claimed in claim 3, wherein the compression holding means (22) is of the form of at least one guide rod assembly (50).

5. A vapour canister (100, 500) as claimed in claim 4, wherein two guide rod assemblies (50) are provided diametrically opposite one another.

6. A vapour canister (100, 500) as claimed in claim 4 or 5, wherein each guide rod assembly (50) includes a guide rod (52, 60).

7. A vapour canister (100, 500) as claimed in claim 6, wherein each guide rod assembly (50) includes a holding member (56, 58) that protrudes from the guide rod (52, 60), the holding member (56, 58) being engagable with the biasing means (16) to retain said biasing means (16) in a compressed or locked position, until operatively released.

8. A vapour canister (100, 500) as claimed in claims 6 or 7, wherein each guide rod assembly (50) includes releasing means (54) which protrudes from the guide

rod (52, 60) such that operation of said releasing means (54) causes the holding member (56, 58) to release or unlock the biasing means (16).

9. A vapour canister (100, 500) as claimed in any of claims 6 to 8, wherein the guide rod assembly (50) includes a stop member (62) that protrudes from the guide rod (52, 60) to limit the travel of the guide rod assembly (50).

10. A vapour canister (100, 500) as claimed in claim 3, wherein the compression holding means (22) is of the form of two magnetic portions (70, 72) connected between the first and second compression plates (12, 14) which releasably engage with one another to retain the biasing means (16) in the locked position, until operatively released.

11. A vapour canister (100, 500) as claimed in claim 10, wherein the magnetic portions (70, 72) are releasable or unlocked in response to releasing means (not shown).

12. A vapour canister (100, 500) as claimed in claim 11, wherein the releasing means applies a magnetic field proximate to said magnetic portions (70, 72).

13. A vapour canister (100, 500) as claimed in any of claims 10 to 12, wherein at least one of the ends of one of the magnetic portions (70, 72) is connected to a pivot member (74), the pivot member (74) being attached to one of the plates (12, 14).

14. A vapour canister (100, 500) as claimed in claim 3, wherein the compression holding means (22) is of the form of a low temperature melting rod (80) connected between the first and second compression plates (12, 14), the melting rod (80) retaining the biasing means (16) in compression or a locked position, until operatively released.

15. A vapour canister (100, 500) as claimed in claim 14, wherein the biasing means (16) is releasable or unlocked in response to releasing means (not shown).

16. A vapour canister (100, 500) as claimed in claim 15, wherein the releasing means applies a thermal field proximate to said melting rod (80).

17. A vapour canister (100, 500) as claimed in any of claims 14 to 16, wherein at least one end of the melting rod (80) is connected to a pivot member (82, 84), the pivot member (82, 84) being attached to one of the plates (12, 14).

18. A vapour canister (100, 500) as claimed in claim 3, wherein the compression holding means (22) is of the form of a lever (90) releasably engagable with the compression plates (12, 14).

19. A vapour canister (100, 500) as claimed in claim 18, wherein the lever (90) has a first lever end (94) which has an angled portion to releasably grip one of the compression plates (12, 99).

20. A vapour canister (100, 500) as claimed in claim 18 or 19, wherein the lever (90) has a second lever end (96) which has an angled pivot portion to grip the other compression plate (14, 98) and pivot from a locked position to an unlocked position.

21. A vapour canister (100, 500) as claimed in claim 20, wherein the second lever end (96) also has an extended lever portion (101) such that in response to a force (F2) being applied to the extended lever portion (101), the second lever end (96) is caused to pivot, which in turn causes the first lever end (94) to release its grip on the respective compression plate (12, 99), releasing the biasing means (16).

22. A vapour canister (100, 500) as claimed in any of claims 18 to 21, wherein two levers (90) are provided diametrically opposite one another.

23. A method of assembling a vapour canister (100, 500) comprising the steps of:

partially filling the vapour canister (100, 500) with an adsorbent to define a first chamber (112);
adding a volume compensator (10, 200, 300, 400) comprising:

a first and second compression plate (12, 14, 98, 99), each plate (12, 14, 98, 99) engagable with the adsorbent of the vapour canister (100, 500), biasing means (16) arranged between the first and second plates (12, 14, 98, 99) to urge them apart;

adding more adsorbent to the vapour canister (100, 500) to define a second chamber (114);
characterised in that the method includes sandwiching the volume compensator (10, 200, 300, 400) between the first and second chambers (112, 114).

24. A method as claimed in claim 23, wherein the method includes sandwiching the volume compensator (10, 200, 300, 400) between the chambers (112, 114) substantially at a longitudinal mid-point within the vapour canister (100, 500), such that a substantially even distribution of force is applied to the chambers (112, 114).

25. A method as claimed in claim 23 or 24, wherein the volume compensator (10, 200, 300, 400) includes compression holding means (22, 50, 70, 72, 80, 90) to retain the biasing means (16) in compression, until operatively released.

26. A vapour canister (100, 500) as claimed in any of claims 23 to 25, wherein the biasing means (16) is releasable or unlocked in response to releasing means (50, 90).

27. A vapour canister (100, 500) as claimed in claim 26, wherein the releasing means is the guide rod assembly (50) of claim 8 or the lever (90) of claim 18.

28. A vapour canister (100, 500) as claimed in claim 26, wherein the releasing means is remotely applied to the volume compensator as described in claims 12 or 16.

29. A volume compensator (10, 200, 300, 400) comprising:

a first and second compression plate (12 14, 98, 99), each plate (12, 14, 98, 99) engagable with an adsorbent of a vapour canister (100, 500);
biasing means (16) arranged between the first and second plates (12, 14, 98, 99) to urge them apart;
characterised in that the volume compensator (10, 200, 300, 400) includes compression holding means (22, 50, 70, 72, 80, 90) to retain the biasing means (16) in compression, until operatively released.

30. A volume compensator (10, 200, 300, 400) as claimed in claim 29 or 30, wherein the volume compensator has the features of any of claims 4 to 22.

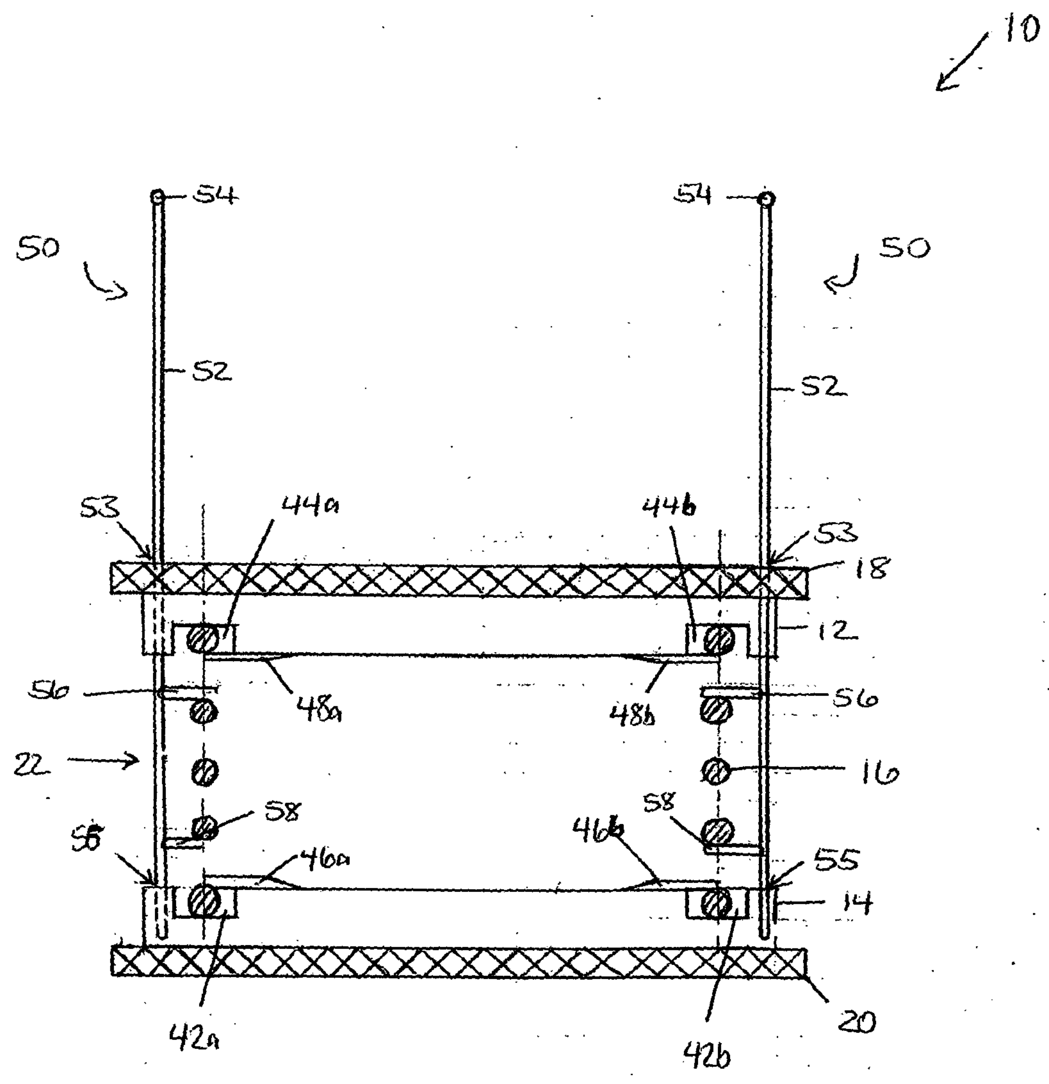

10
54
54
50
50
52
52
53
44a
44b
53
18
12
56
48a
48b
56
22
16
58
58
55
46a
46b
55
14
20
42a
42b

FIG 1.

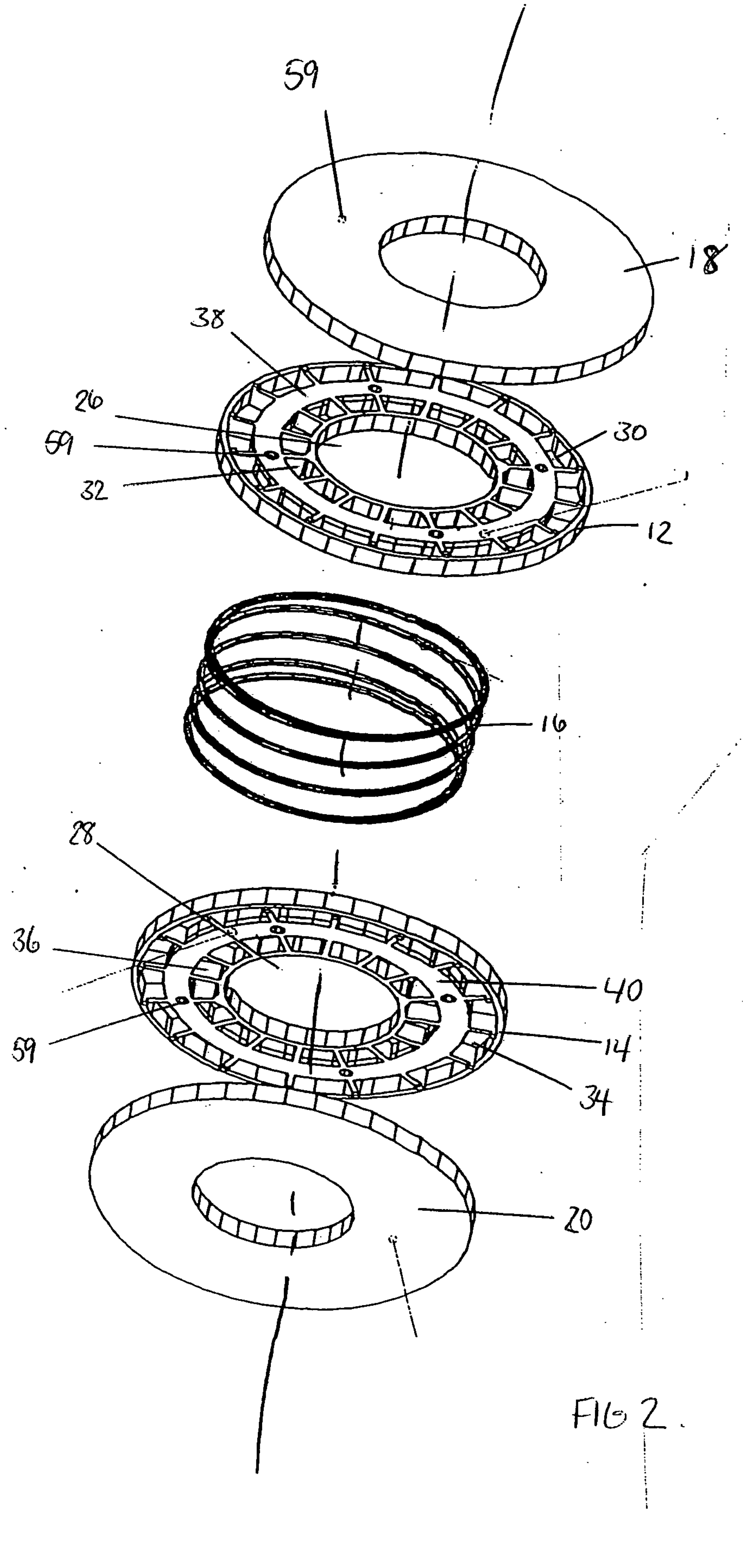


FIG 2.

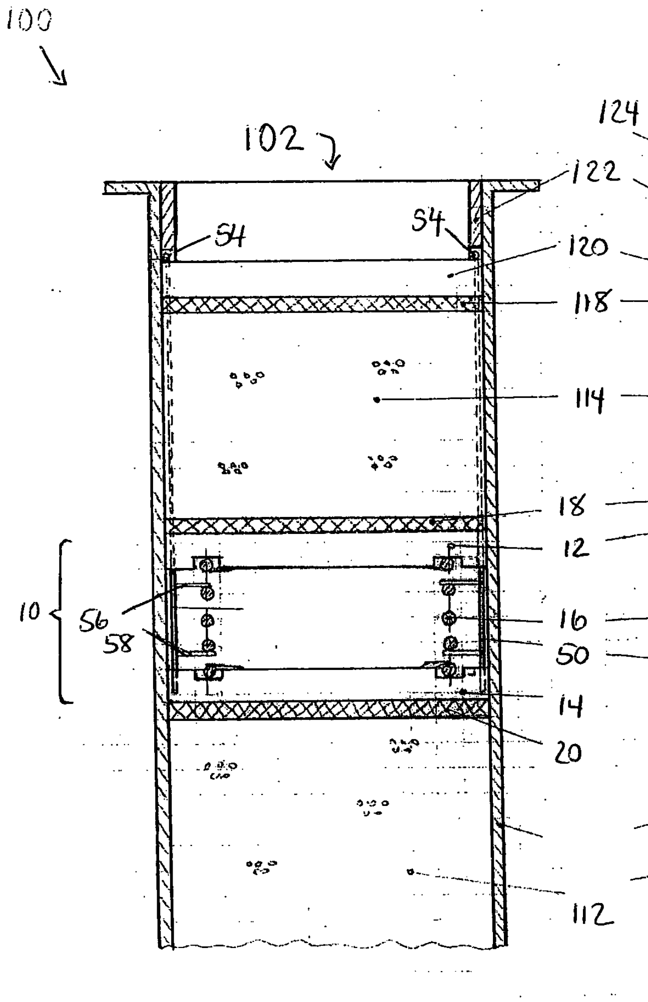

100
102
54
54
122
120
118
114
18
12
10
56
58
16
50
14
20
112

FIG3.

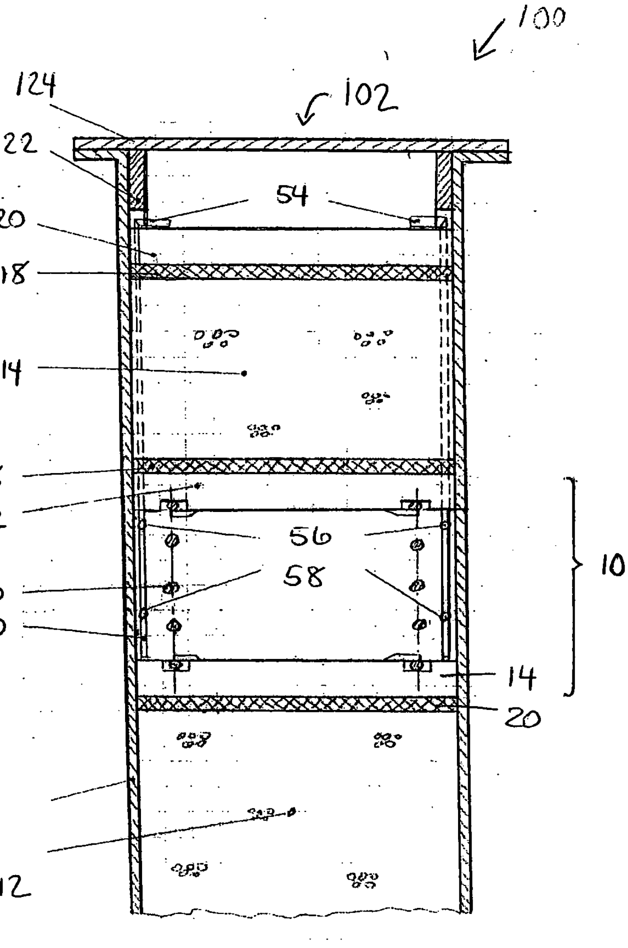
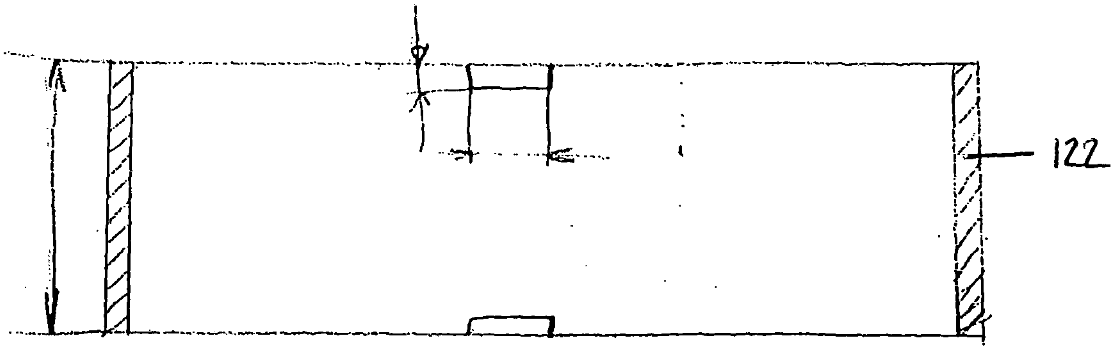

100
124
102
122
54
120
118
114
18
12
56
58
16
50
10
14
20
112

FIG 4.

FIG 5A.



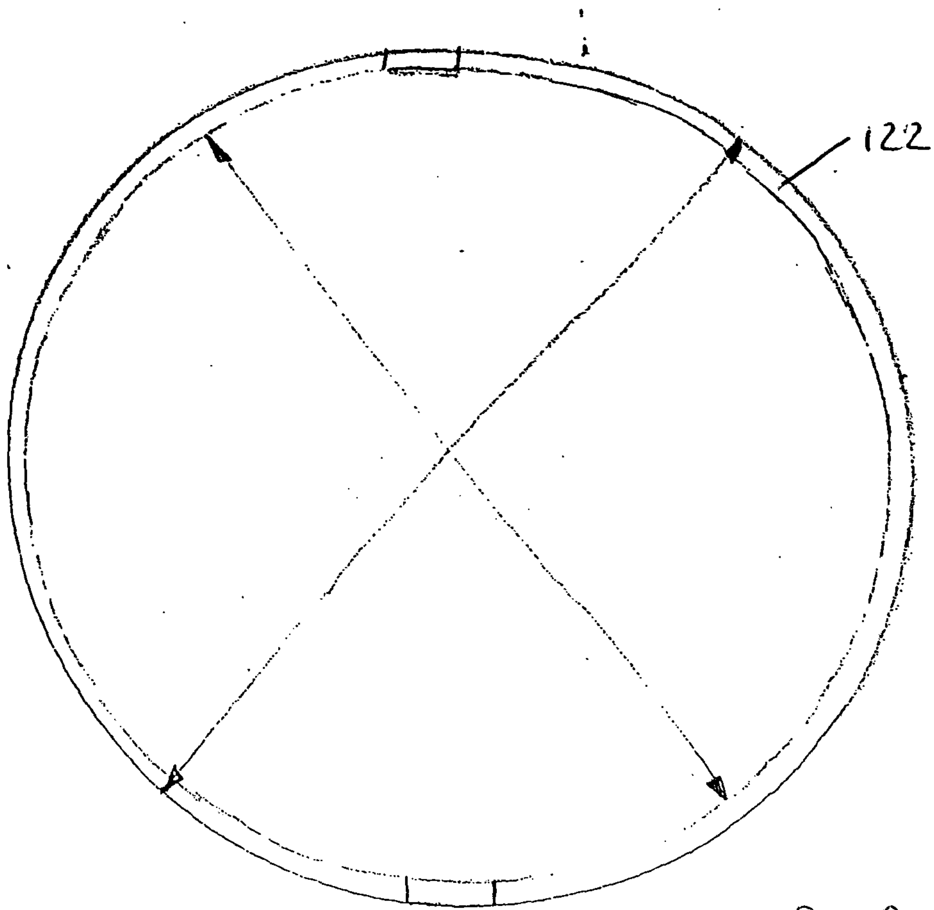


FIG. 5.

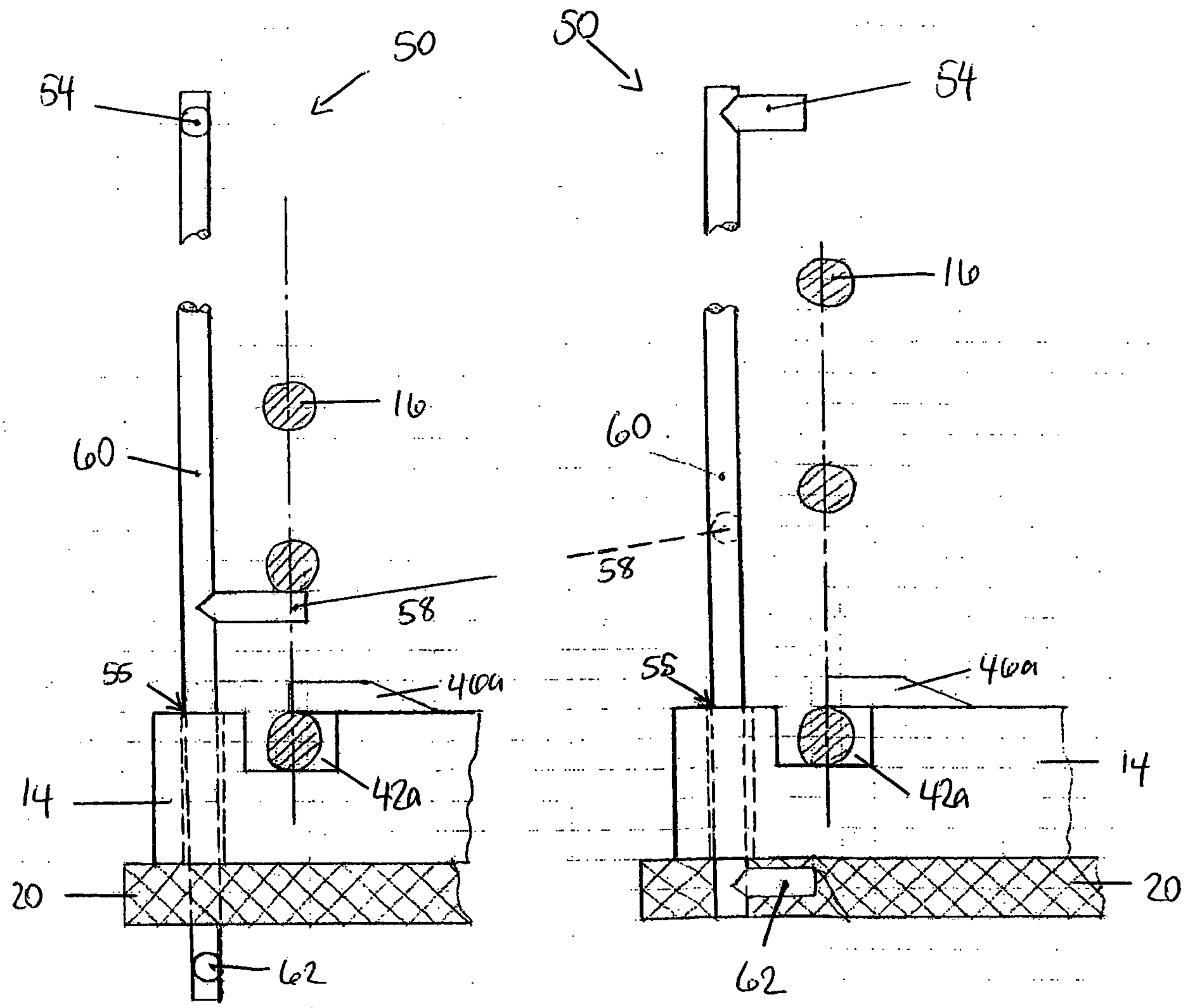


FIG 6.

FIG 7.

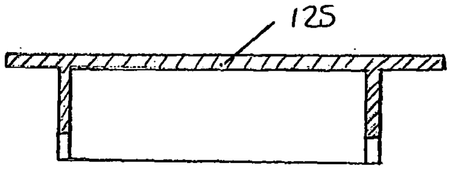


FIG 8.

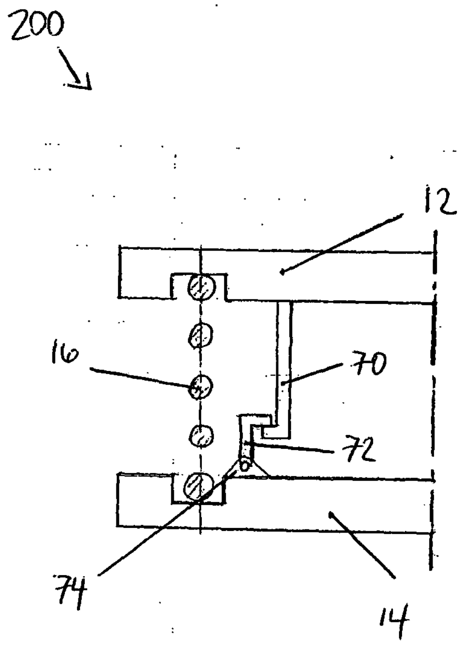


FIG 9.

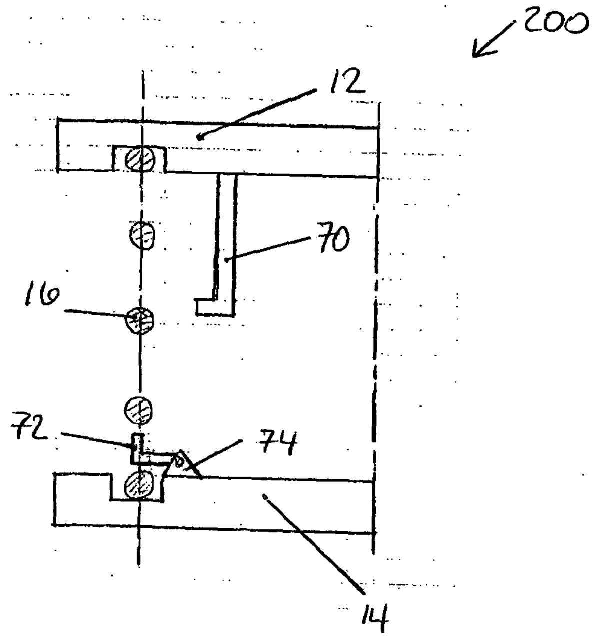


FIG 10.

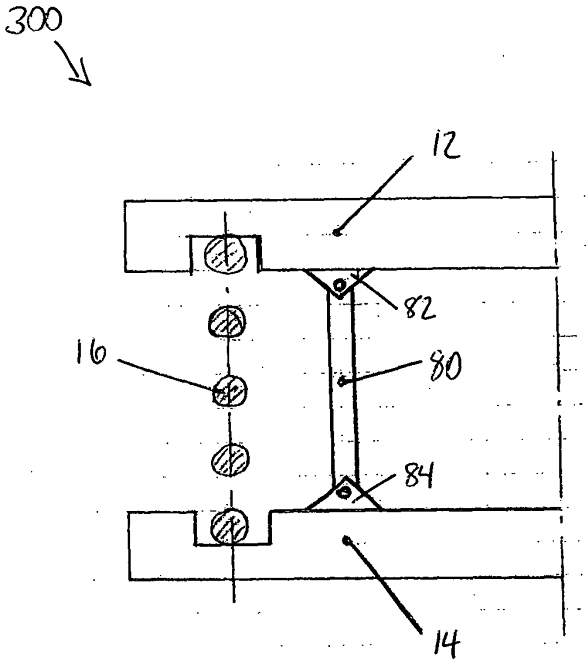


FIG 11.

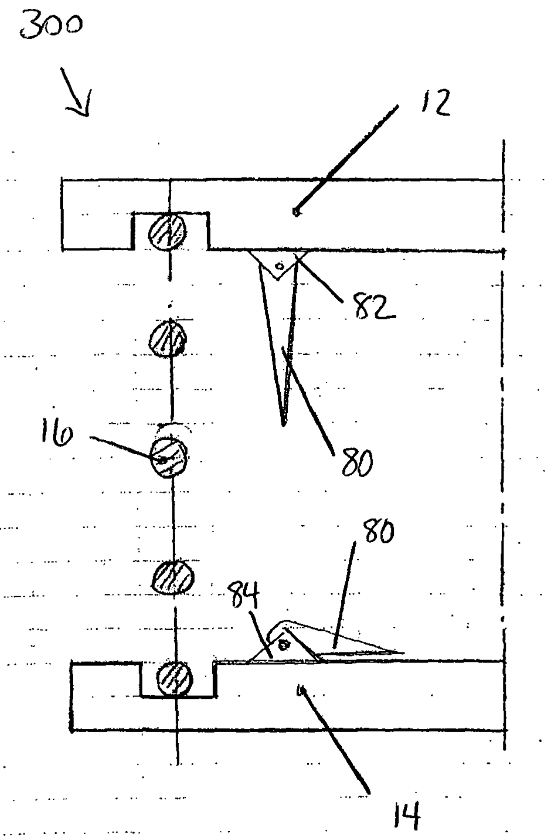


FIG 12.

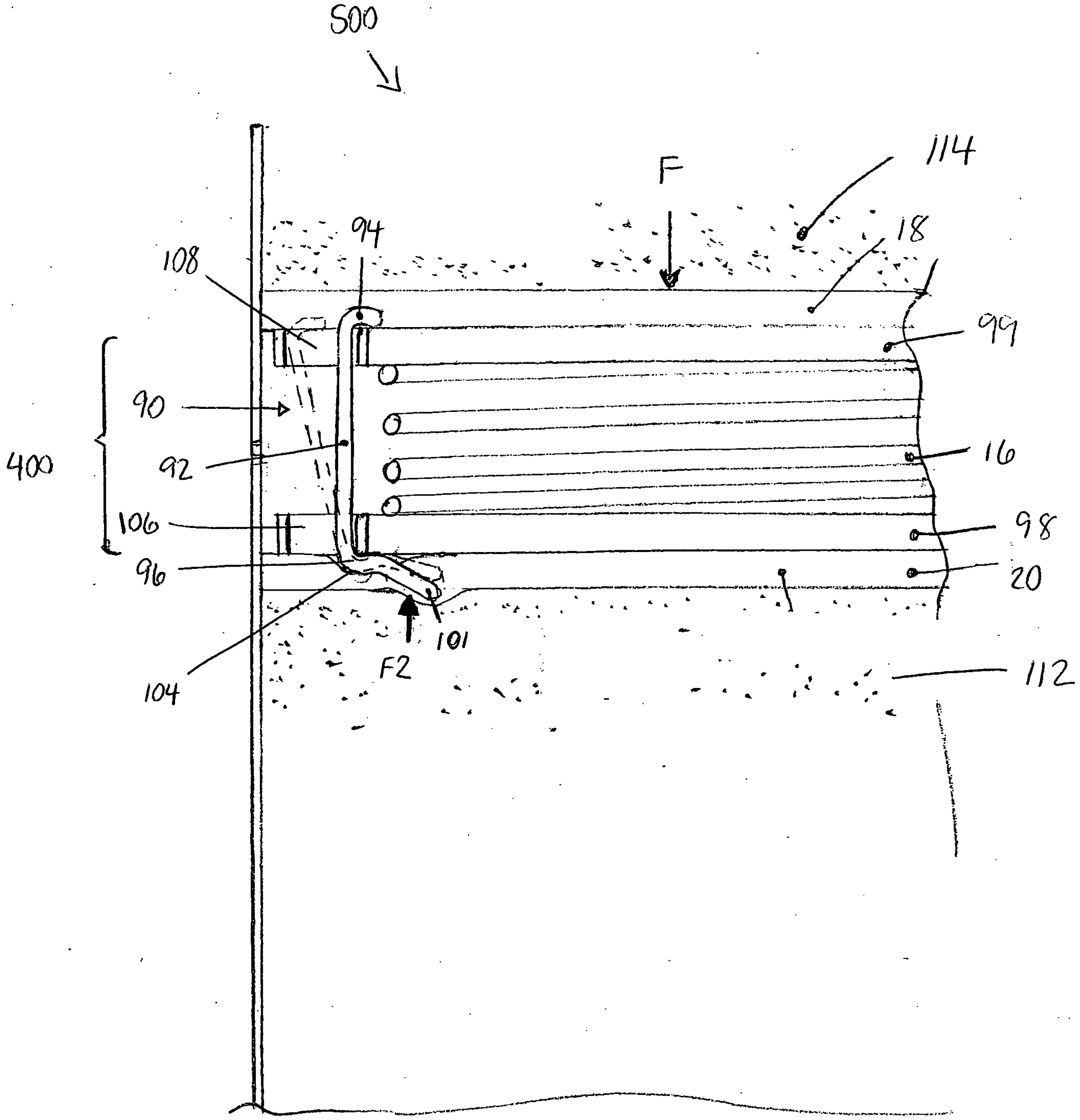


FIG. 13

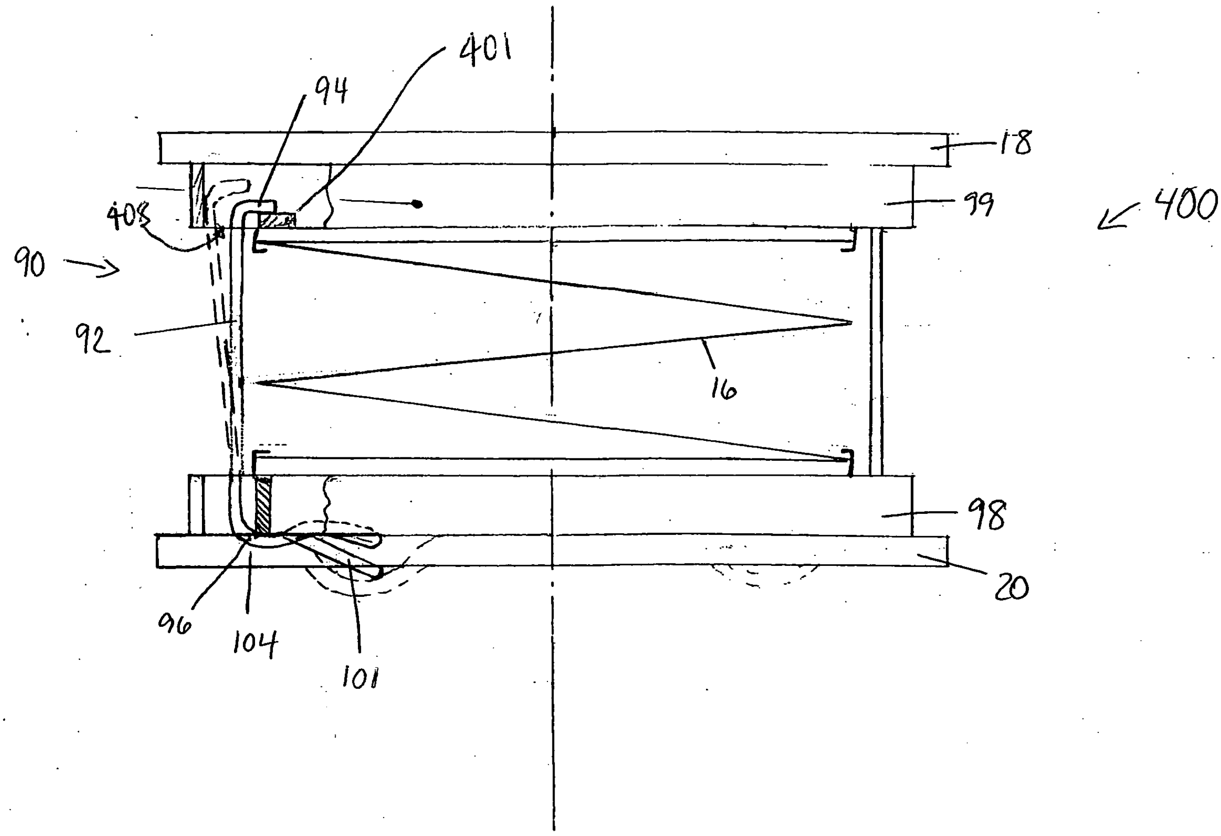


FIG 14.

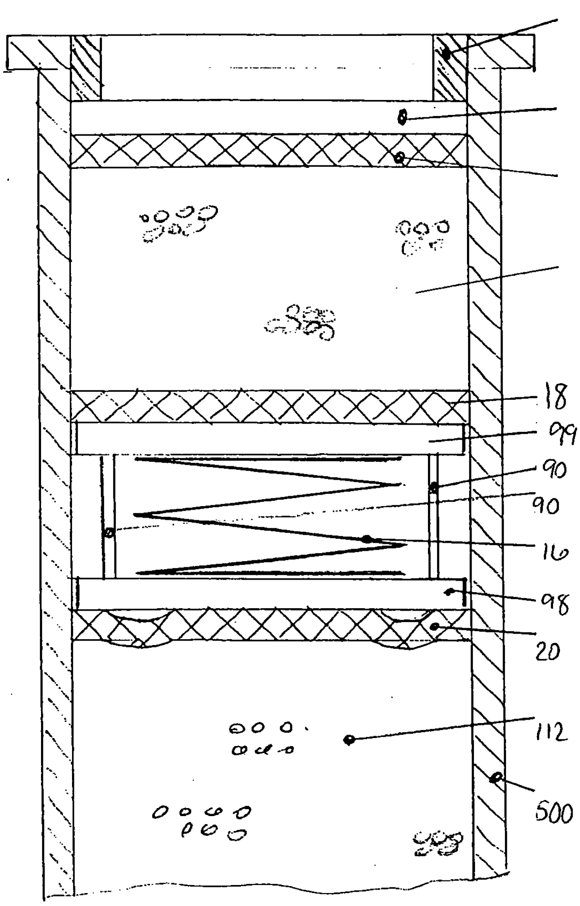

122
120
118
114
18
99
90
90
16
98
20
112
500

FIG 15

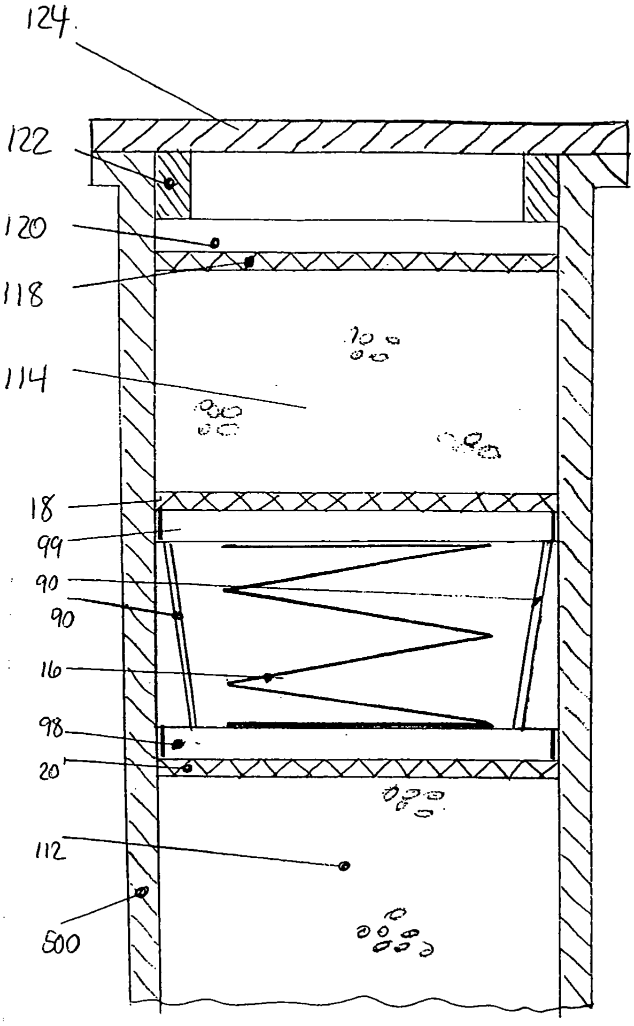

124
18
99
90
90
16
98
20'
112
500

FIG 16.

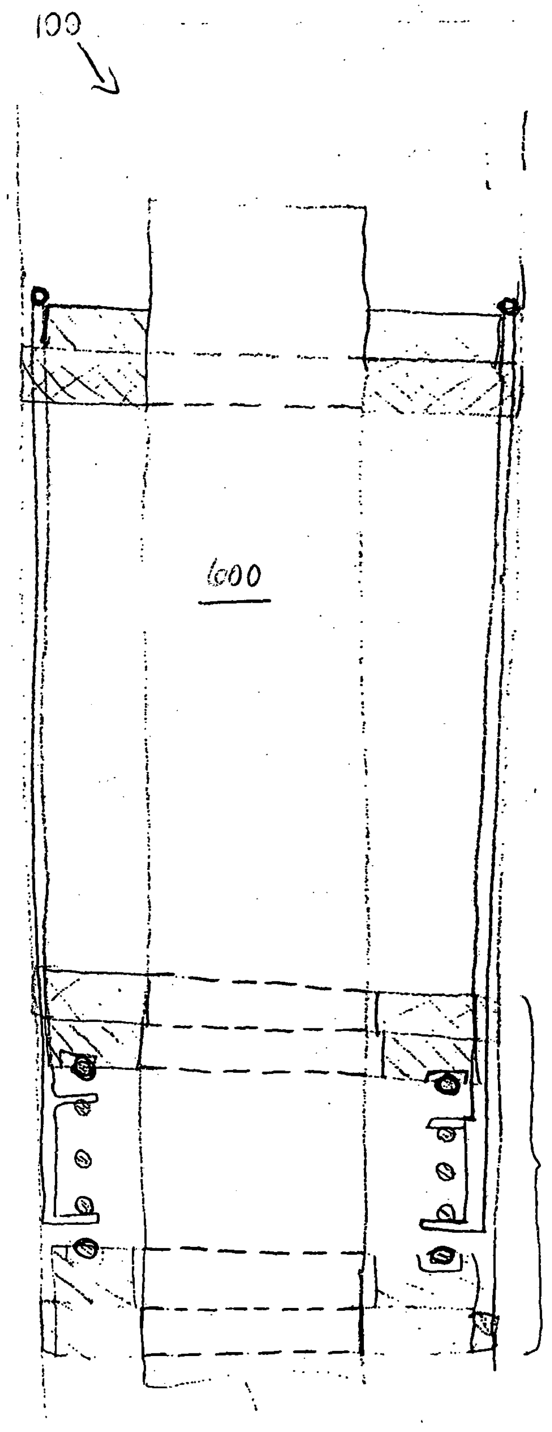


FIG. 17

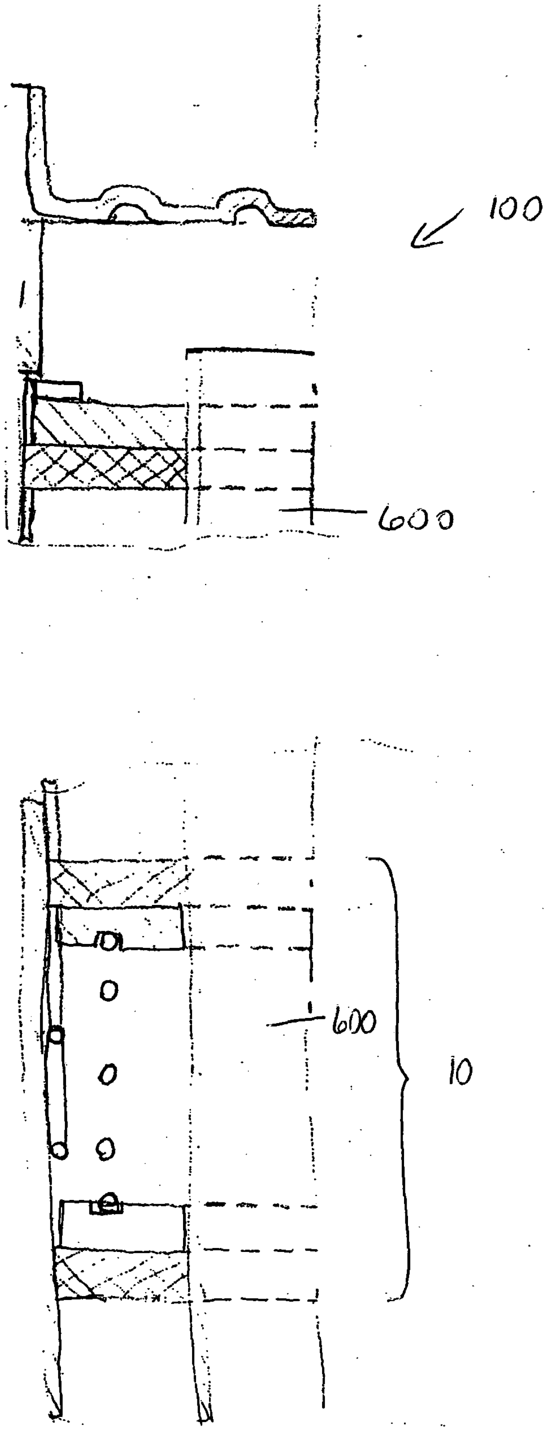


FIG. 18

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 4256

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	THOMAS LEONARD: "Fuel vapour absorption canisters" RESEARCH DISCLOSURE, KENNETH MASON PUBLICATIONS, HAMPSHIRE, GB, vol. 474, no. 21, October 2003 (2003-10), XP007132901 ISSN: 0374-4353 * the whole document * -----	1-30	F02M25/08
X	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2004 068715 A (TOYOTA MOTOR CORP), 4 March 2004 (2004-03-04)	1	
A	* abstract * -----	23,29	
A	EP 0 512 597 A (GENERAL MOTORS CORP) 11 November 1992 (1992-11-11) * the whole document * -----	1,23,29	
A	US 4 758 255 A (YAMADA ET AL) 19 July 1988 (1988-07-19) * the whole document * -----	1,23,29	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F02M
A	US 5 538 542 A (WATANABE ET AL) 23 July 1996 (1996-07-23) * the whole document * -----	1,23	

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	13 December 2004	Van Zoest, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
....
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 25 4256

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-12-2004

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
JP 2004068715	A	04-03-2004	NONE			
EP 0512597	A	11-11-1992	US	5098453	A	24-03-1992
			CA	2056944	A1	03-11-1992
			DE	69203284	D1	10-08-1995
			DE	69203284	T2	02-11-1995
			EP	0512597	A1	11-11-1992
			JP	2008858	C	11-01-1996
			JP	5125998	A	21-05-1993
			JP	7042899	B	15-05-1995
US 4758255	A	19-07-1988	JP	63080057	A	11-04-1988
US 5538542	A	23-07-1996	JP	3265094	B2	11-03-2002
			JP	7139441	A	30-05-1995