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(71) Applicant: **Caterpillar Inc.**
Peoria, IL 61626-9510 (US)

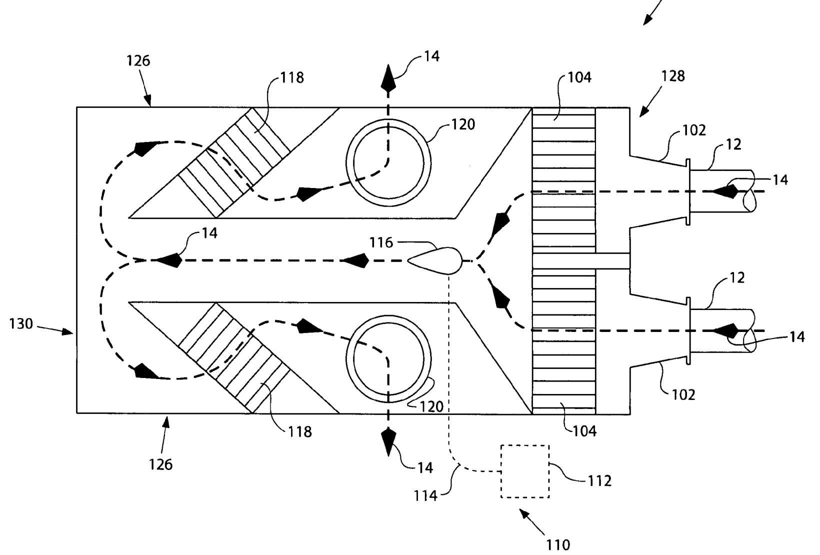
(72) Inventors:
- **Tan, Dongming**
  Peoria
  Illinois 61629-9510 (US)
- **Baig, Mirza P.**
  Peoria
  Illinois 61629-9510 (US)
- **Jeffs, Rick E.**
  Peoria
  Illinois 61629-9510 (US)
- **Velasquez, Tetsu O.**
  Peoria
  Illinois 61629-9510 (US)
- **Sakaray, Umakanth**
  Peoria
  Illinois 61629-9510 (US)
- **Gandhi, Ramanlal M.**
  Peoria, Illinois 61629-9510 (US)
- **Stephens, Brandon J.**
  Peoria, Illinois 61629-9510 (US)
- **Storm, Steven R.**
  Peoria, Illinois 61629-9510 (US)

(74) Representative: **Wagner & Geyer**
Patent- und Rechtsanwälte
Gewürzmühlstrasse 5
80538 München (DE)

(54) Aftertreatment mounting system

(57) An exhaust aftertreatment module (100) comprising a plurality of mounts (202) for connecting the module (100) to a surface (5). The mounts (202) are arranged in a radial pattern around a central location (204) of the module (100). The mounts (202) also have a direction of travel (208) aligned with a radial direction of expansion (210) that passes through the central location (204).

FIG. 3



EP 2 444 619 A1

Description

Technical Field

[0001] The present disclosure relates to the mounting of an aftertreatment module.

Background

[0002] Many power systems require an aftertreatment module to control emissions. The aftertreatment module may become hot during operation and expand but are often mounted on a surface that does not become as hot or expand as much. This difference in thermal expansion creates stress.

[0003] United States Patent No. 6,209,844 discloses an arrangement for supporting an exhaust system that is pivotable in a longitudinal direction of the exhaust system so as to permit expansion of the exhaust system.

Summary

[0004] In one aspect, an exhaust aftertreatment module is provided comprising a plurality of mounts for connecting the module to a surface. The mounts are arranged around a central location of the module. The mounts also have a direction of travel aligned with a radial direction of expansion that passes through the central location. In another aspect, an exhaust aftertreatment module is provided comprising a plurality of mounts for connecting the module to a surface, wherein the mounts are arranged in a radial pattern around a central location of the module.

[0005] In yet another aspect, a method of mounting an exhaust aftertreatment module to a surface is provided. The method comprises selecting a central location on the module and locating mounts in a radial pattern about the central location.

[0006] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[0007]

Fig. 1 is a side view of a locomotive including an engine and aftertreatment module mounted to the locomotive.

Fig. 2 is a side view of a generator including an engine and aftertreatment module mounted to the generator.

Fig. 3 is a top view of the components in an exemplary aftertreatment module.

Fig. 4 is a side view of a aftertreatment module and a mounting system used to mount the module to a machine.

Fig. 5 is a top view of the aftertreatment module from Fig.4 showing the location of mounts included in the mounting system.

Fig. 6 is an isometric view of the mount from Fig. 5.

Fig. 7a is a side view of the mount from Fig. 6 before the aftertreatment module expands relative to a mounting surface.

Fig. 7b is a side view of the mount from Fig. 7a after the aftertreatment module expands relative to the mounting surface.

Fig. 8 is an isometric view of an alternative mount.

Fig. 9 is a flow chart of a method for mounting an aftertreatment module.

Detailed Description

[0008] Figs. 1 and 2 illustrate power systems 1 used to power exemplary machines 2. Fig. 1 shows the power system 1 powering a mobile machine, such as a train locomotive 3. Fig. 2 shows the power system 1 powering a stationary machine, such as a generator 4. The power system 1 may be used to power any of a wide variety of mobile or stationary machines 2, including on-highway trucks or vehicles, off-highway trucks, mining trucks, articulated trucks, earth moving equipment, mining equipment, generators, aerospace applications, other locomotive applications, marine applications, pumps, or other engine powered applications.

[0009] The power system 1 includes an engine 10 and an aftertreatment assembly, system, or module 100. The engine 10 is used to power the machine 2. The engine 10 includes an exhaust pipe 12 that delivers exhaust 14 to the aftertreatment module 100. The exhaust pipe 12 may also include bellows 16.

[0010] The engine 10 may also include many other systems and elements not shown, such as air systems, turbo systems, fuel systems, sensors, cooling systems, peripheries, drivetrain components, hybrid components, exhaust gas recirculation systems, rings, liners, connecting rods, crankshafts, oil pans, oil pumps, flywheels, bearings, etc. The engine 10 may be any type of engine (internal combustion, gas, diesel, gaseous fuel, natural gas, propane, four stroke, two stroke etc.), may be of any size, with any number of cylinders, and in any configuration ("V," in-line, radial, etc.).

[0011] The aftertreatment module 100 is mounted to a machine mounting surface 5 via a mounting system 200. The mounting system 200 may be considered a part of the module 100. The machine mount surface 5 may be part of the machine 2 or for stationary machines 2 the mounting surface may be part of another structure the aftertreatment module 100 is mounted to. The machine mount surface 5 may be the roof 6 of the machine 2 as shown in Fig. 2 or on the bottom surface of a recessed pocket 7 below the surface of the roof 6 as shown in Fig. 1.

[0012] The machine mount surface 5 does not have to be a top surface or roof 6 as shown in Figs. 1 and 2. The machine mounting surface 5 may also be a side surface with the aftertreatment module 100 hanging off the side of the machine 2 or other structure. The machine mounting surface 5 may also be a bottom surface of the machine 2 or other structure, with the aftertreatment module 100 hanging underneath the machine 2 or other structure. The mounting surface 5 may be a variety of surface types. The mounting surface 5 may be a flat surface as shown or it may comprise frame members of an irregular pattern and may combine different parts of the machine 2. The mounting surface 5 may also comprise a combination of surfaces. For instance, the mounting system 200 may be disposed between the bottom of the module 100 and the machine 2 and between the side of the module 100 and the machine 2.

[0013] The aftertreatment module 100 is an apparatus configured to remove constituents, such as NOx and particulates, from the exhaust 14. The aftertreatment module 100 may include many different configurations. A few such aftertreatment modules 100 are disclosed in United States Patent Application Numbers 12/645014, 12/881274, and 12/320425, all of which are fully incorporated herein by reference. The aftertreatment module 100 may be contained in a rectangular box as shown to contain and route the exhaust 14, a structure with another shape, or may be a combination of devices on a single frame connected by conduits.

[0014] Fig. 3 is included to provide an example of one possible combination of components, structure, and layout of the aftertreatment module 100. Again, many other combinations of components, layouts, and structures are possible. Fig. 3 shows two flows of the exhaust 14 entering two inlets 102 from the exhaust pipe 12. Next, the two flows of exhaust 14 pass through a diesel oxidation catalyst (DOC) 104 that oxidizes Carbon Monoxide (CO) and unburnt hydrocarbons (HC) into Carbon Dioxide (CO_2). The exhaust flow is then shown to combine after exiting the DOC 104.

[0015] The aftertreatment module 100 is also shown to include a reductant system 110 having a reductant supply 112, reductant line 114, and reductant injector 116. The reductant supply 112 may be mounted on the aftertreatment module 100 or separate as shown. The reductant supply 112 may include a tank with a supply of reductant, such as urea, and a pump for supplying reductant to the reductant injector 116 through the reductant line 114.

[0016] The reductant injector 116 sprays reductant into the combined flow of exhaust 14. The flow of exhaust 14 is then shown to split again and pass through one of two selective Catalytic Reduction (SCR) devices 118. The SCR device 118 includes a catalyst to reduce NO and NO_2 into N_2 in the presence of the reductant. The exhaust 14 then exits through the outlet 120.

[0017] The inlet 102 and outlet 120 may be located and oriented to allow the exhaust 14 to enter and exit from a number of different directions; including from a top 122, bottom 124, sides 126, front 128, back 130, and center of the aftertreatment module 100. The flow path of exhaust 14 in the aftertreatment module can also have a wide variety of twists, turns, splits, and merges to route the exhaust 14 through the various components that may be included.

[0018] In other configurations, the aftertreatment module 100 may also include one or more diesel particulate filters (DPFs), Catalyzed DPFs (CDPFs), heat sources to regenerate or remove soot from the DPF, mufflers, hydrolysis catalysts, lean NOx traps (LNTs), ammonia oxidation catalysts (AMOXs), combined DPF and SCR devices (CDSs), and any other suitable exhaust treatment device. These others devices may also replace components shown in Fig 3.

[0019] As seen best in Fig. 4, the top 122, bottom 124, sides 126, front 128, and back 130 of the module 100 may form the rectangular box structure. The bottom 124 may form a module mount surface 132 that connects the aftertreatment module 100 to the mounting system 200, which connects the aftertreatment module 100 to the machine 2. The module mount surface 132 may also be formed by other parts of the aftertreatment module 100 or a structure connected to the aftertreatment module 100. The module mount surface 132 may also be formed by a combination of surfaces. For instance; the top 122, sides 126, front 128, or back 130 could be used to form all or part of the module mount surface 132.

[0020] The exterior surface of the aftertreatment module 100 may be made from sheet metal, so the aftertreatment module 100 may require a frame 134 as seen best in Fig. 4. In the example shown, the frame 134 is associated with the bottom 124 of the module 100. The frame 134 may include cross members that provide rigidity and structural support to the aftertreatment module 100. The frame 134 is located and sized as needed for the given arrangement.

[0021] The mounting system 200 includes a plurality of mounts 202. The mounts 202 are a means for mounting or connecting the module 100 to the mounting surface 5. The mounting system 200 may also include an extension 203 to fill the gap between the aftertreatment module 100 and the mounting surface 5.

[0022] Seen best in Fig. 5, the mounts 202 are located about a central location 204. The mounts 202 may be arranged, at least approximately, in a pattern along radial circles 206 about or around the central location 204. The pattern of mounts 202 may also be somewhat symmetrical about or around the central location 204. As seen in Fig. 4, the mounts 202 may be located along (under or over or to the side of) members of the frame 134 to provide a point of attachment.

[0023] The mounts 202 include a direction of travel 208. The mounts 202 have a degree of freedom to move in the direction of travel 208. The direction of travel 208 for each mount 202 is aligned with a radial direction of expansion 210 that passes, at least approximately, through the central location 204.

[0024] One embodiment of the mount 202 is shown in Fig. 6. In this embodiment, the mount 202 is shown to include a module mount 212 and a machine mount 214.

The module mount 212 is mounted to the module mount surface 132 and the machine mount 214 is mounted to the machine mount surface 5. Both the module mount 212 and machine mount 214 may have "U" shaped cross-section. The module mount 212 is sized to fit within the machine mount 214 with a distance of travel 216 defined by the total difference or gap between the outside of the module mount 212 and the inside machine mount 214. In another embodiment, the mount 202 may be arranged with the module mount 212 sized to fit within the machine mount 214.

[0025] A slide bar 218 extends through and connects the module mount 212 and the machine mount 214. The slide bar 218 is aligned in the direction of travel 208 to provide the distance of travel 216 in relative movement between the module mount 212 and machine mount 214. One or both ends of the slide bar 218 outside the module mount 212 may include caps 220. The caps 220 may be formed by a nut threaded to the end of the slide bar 218 as shown, or a bend in the slide bar 218, a welded block, or a variety of other ways.

[0026] Bolts 222 may be used to attach the module mount 212 to the module mount surface 132 and the machine mount 214 to the machine mount surface 5. An insulating plate or pad 224 may be sandwiched between the module mount 212 and module mount surface 132 and between the machine mount 214 and the machine mount surface 5. Other embodiments may not include the insulating plates 224. Gussets 226, as seen on the backside of the module mount 212 in Fig. 6, may also be added to components of the mount 202 as needed for strength.

[0027] Another embodiment of the mount 202 is shown in Fig. 8. In this embodiment, the machine mount 214 includes a channel 228 and a portion of the module mount 212 rides along the channel 228 in the direction of travel 208. As shown, top plates 230 overhang bottom plates 232 forming the channel 228. The module mount 212 includes a "T" shaped bar 234. A bottom end of the "T" shaped bar 234 is trapped in the channel 228 and the top of the "T" shaped bar 234 is secured to the frame 134 by a nut 236. In other embodiments, the module mount 212 and channel 228 may have a wide variety of other complimentary shapes to allow movement in the direction of travel 208. As before, the module and machine mounts 212, 214 may also be reversed.

Industrial Applicability

[0028] The module 100 will grow or expand as it heats. Fig. 5 shows a module length L 1 growing to L2 and a module width W1 growing to W2 as a result of thermal expansion. Of course the height and other aspects of the module 100 will also grow during this process.

[0029] The module 100 is heated by the hot exhaust 14 passing through it. In other embodiments, the module 100 may also be heated by a heat source used to regenerate a DPF. The module 100 may be heated above an ambient temperature by as much as approximately 490 degrees Celsius or higher.

[0030] While this disclosure is not limited to only large modules 100, it may also be particularly applicable to larger modules 100 for some of the reasons described herein. Large modules 100 may be characterized as a module 100 longer than 2 meters and wider than 1 meter. Large modules 100 may also be heavy, possibly weighing more than 2000 lbs. In one embodiment, the length L1 of the module 100 may be approximately 4 meters and the width W1 may be approximately 2 meters. In this embodiment, the weight of module may be as much as 5000 lbs. At approximately 480 degrees Celsius the module 100 may grow or expand by as much approximately 26 mm in length and 12 mm in width from the dimensions at ambient conditions. Of course this is just one example of dimensions and degree of growth to illustrate the basic magnitude of the dimensions involved. Other embodiments may have a wide variety of shapes, sizes, coefficients of thermal expansion, and temperature changes involved.

[0031] While the module 100 has become hot and grown as described above, the mounting surface 5 may have remained relatively cold and not expanded nearly as much. The difference in temperature between the module 100 and mounting surface 5 may be as high as approximately 430 degrees Celsius. In other embodiments, the temperature difference may become even greater. As a result, the mounting surface 5 may not have expanded as much as the module 100 and stresses will result if the module 100 is rigidly attached to the mounting surface 5. These stresses could cause fatigue and failure of rigid mounts or buckling or even tearing of the module 100 or mounting surface 5 or another part of the machine 2.

[0032] In order to reduce these stresses from thermal expansion and prevent damage a movable mount may be needed. This movable mount may be designed to pivot or slide. The movable mount could also be an elastomeric or rubber isolation mount that deforms instead of pivoting or sliding. These solutions, however, have shortcomings. First, these mounts would allow the module 100 to move under dynamic or impact loads. Because the modules 100 may be heavy and the machines 2 may be mobile (with the associated starts, stops, vibrations, bumps, and collisions) these dynamic and impact loads and momentum forces may be large. Significant movement of the module 100 could cause weight imbalances, cause fatigue, and increase stress.

[0033] Second, the movable mounts will also need to account for movement in more than one direction of travel. Because the module 100 may be large, the amount of thermal expansion in more than just length may be significant and therefore expansion in other directions will need to be accounted for. While the rubber isolation mount would account for movement in different directions, the mechanical sliding or pivoting mounts may require a complex design that may be expensive. The complex design may also be relatively weak requiring many more mounts to be used.

[0034] Third, these mounts may also need to account for large distances of travel because they may need to accommodate growth over the entire length L1 or width W1 of the module 100.

[0035] Fourth, rubber isolation mounts can be expensive and may lack strength, requiring a large number of them to be used. The rubber isolation mount will also be subjected to temperature cycles and the elements, which could cause degradation. The rubber isolation mount may also have a limited range of motion and may need to be tall in order to provide the amount of movement needed for a large module. Being tall may make the rubber isolation mount weak and more expensive.

[0036] The mount may also be designed with a rigid mount in one corner or one area and movable mounts elsewhere for support and to account for the thermal expansion. This mount arrangement may concentrate all the stress from dynamic loads on this rigid mount and therefore this rigid mount will need to have the extra expense required to withstand this stress. Meanwhile the movable mounts will still have the same issues described above. The module 100, especially a large module 100, may also need to be designed with more strength to carry the load to the rigid mount.

[0037] The possible failures described above may especially be an issue on a large module 100 that would not be easy to service because of its weight, location, size, and large number of mounts.

[0038] The mounting system 200 disclosed mitigates many of the issues described above. First, the mount system 200 locks the module 100 from movement as a result of dynamic or impact loads. Because all the mounts 202 have only a single or limited directions of travel 208 that are all different, movement of the module 100 in any one direction is prevented. The radial and symmetric pattern of mounts 202 also helps prevent allowing any unconstrained direction of travel from the module 100 as a whole.

[0039] Second, because of the orientation and locations of the mounts 202 they can be designed with only a single direction of travel. Because each mount 202 has a direction of travel 208 aligned or oriented with the radial direction of expansion 210 passing through a common or shared central location 204, the module 100 can expand or grow without being constrained. Therefore, the mounts 202 only need a single direction of travel 208. Only having a single direction of travel 208 allows the mounts 202 to be less complex, more robust, and cheaper.

[0040] Third, the distance of travel 216 is reduced. Because the mounts only need to account for growth outward from the central location 204, the distance of travel needed is cut in half. The mounts 202 no longer need to accommodate for the growth over the entire length or width of the module 100, the mounts 202 only need to account for growth outward from the central location 204.

[0041] Fourth, the mount 202 design does not necessarily rely on rubber or another elastomeric material that may be expensive and may degrade and offer limited range. In another aspect, the symmetrical and radial pattern of mounts 202 may help even distribute stresses. This distribution of stress may be particularly important on large modules 100.

[0042] The central location 204 may be selected as the intersection of the midway point of the module length L1 and the midway point module width W 1. Thought of in a different way, the central location 204 may be selected so that the thermal expansion in opposite directions from the central location 204 is roughly equal. For example, given the module 100 dimensions provided above, the module 100 would grow 13mm (1/2 of 26 mm expected distance of expansion) in the length direction from the central location 204 and 6mm (1/2 of 12 mm expected distance of expansion) in the width direction from the central location 204.

[0043] The selection of the central location 204 could also be somewhat arbitrary and thereby biased in one direction without a significant impact on the performance of the mounting system 200. Therefore the central location 204 is understood to relate to any location generally near the center of the module 100. However, if the central location 204 becomes biased too far to one side or corner it could cause stress as the direction of travel 208 of the mounts 202 cannot align unconstrained to the expansion of module 100.

[0044] In one embodiment the central location 204 may be within the central 50% of the total length L1 of the module 100. In another embodiment the central location 204 may be within the central 50% of the total width W1 of the module 100. In another embodiment the central location 204 may be within the both the central 50% of the total length L1 and within the central 50% of the total width W 1 of the module 100. In yet another embodiment the central location 204 may be within the central 25% of the total length L1 of the module 100. In another embodiment the central location 204 may be within the central 25% of the total width W1 of the module 100. In yet another embodiment the central location 204 may be within the both the central 25% of the total length L1 and within the central 25% of the total width W 1 of the module 100.

[0045] All of the mounts 202 may share a common design with enough distance of travel 216 to account for the maximum expected growth of the module 100, although mounts 202 closer to the central location 204 could be designed with a smaller distance of travel 216. For example, given the dimensioned example provided above, the mount 202 would be designed or configured with a distance of travel 216 of at least 13 mm.

[0046] Figs. 7a and 7b show an example of how the distance of travel 216 may be achieved. Fig 7a shows the mount 202 before the module 100 expands Fig 7b shows the same mount as Fig 7a after the module 100 expands. In both Fig. 7a and 7b the mounting surface 5 remains relatively cold and therefore does not significantly grow. In Fig 7a the module mount 212 is biased towards central location 204. In Fig 7b the module mount 212 is shown having slid, shifted, or traveled to the right along the slide bar 218, away from the central location 204.

[0047] Fig. 8 shows an alternative embodiment with the distance of travel 216 being achieved by the "T" shaped bar 234 sliding, shifting, or traveling in the channel 228. In yet another embodiment, the mount 202 may be designed with the distance of travel 216 being achieved by a pivoting action in the direction of travel 208 instead of a shifting or sliding. In yet another embodiment, the mount 202 may include an elastomeric material or rubber to achieve the distance of travel 216.

[0048] The insulating plate 224 may be used to limit heat transfer between the module 100 and the mounting surface 5. The prevention of heat transfer is also a reason why the module 100 is not mounted with a large surface area contacting the mounting surface. By limiting the heat transfer, the mounting surface 5 is kept relatively cool and therefore cheaper metal or other materials can be used. The bellows 16 help account for the growth and movement of the module 100 relative to the engine 10 and other machine 2 components.

[0049] Fig. 9 illustrates a method for mounting 300 in line with the mounting system 200 apparatus described above. A first step 301 is selecting a central location 204. A second step 302 involves configuring the mounts 202 to have a distance of travel 216 of at least the expected thermal expansion from the central location 204. A third step 303 involves locating the mounts 202 in a radial pattern about the central location 204. A fourth step 304 involves aligning the direction of travel through the central location 204.

[0050] The mounting system 200 may also be applied to devices other than an aftertreatment module 100. The mounting system 200 may be applicable to any circumstance where one device is mounted to another and large temperature gradients develop between the two, thus causing thermal stress.

[0051] Although the embodiments of this disclosure as described herein may be incorporated without departing from the scope of the following claims, it will be apparent to those skilled in the art that various modifications and variations can be made. Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the disclosure. It is intended that the specification and examples be considered as exemplary only, with a true scope being indicated by the following claims and their equivalents.

Claims

1. An exhaust aftertreatment module (100) comprising a plurality of mounts (202) for connecting the module (100) to a surface (5),
   wherein the mounts (202) are arranged around a central location (204) of the module (100) and the mounts (202) have a direction of travel (208) aligned with a radial direction of expansion (210) that passes through the central location (204).

2. The exhaust aftertreatment module (100) of claim 1, wherein the mounts (202) are located in a radial and symmetric pattern about the central location (204).

3. The exhaust aftertreatment module (100) of any of claims 1 -2, wherein the mounts (202) have only a single direction of travel (208).

4. The exhaust aftertreatment module (100) of any of claims 1 -3, wherein components of the mounts (202) slide relative to each other to achieve a distance of travel (216) along a direction of travel (208).

5. The exhaust aftertreatment module (100) of claim 4, wherein the mounts (202) include:

   a module mount (212) fixed to the module (100);
   a machine mount (214) fixed to the surface (5), wherein a gap is defined between the module mount (212) and machine mount (214); and
   a slide bar (218) fixed to one of the module mount (212) and machine mount (214) and in sliding engagement with the other of the module mount (212) and machine mount (214), wherein the slide bar (218) is disposed in the direction of travel (208) and the gap defines the distance of travel (216).

6. The exhaust aftertreatment module (100) of any of claims 1 -5, wherein the mounts (202) are between a roof (6) of a mobile machine (3) and a bottom (124) of the module (100).

7. The exhaust aftertreatment module (100) of any of claims 1 - 6, wherein the arrangement of mounts (202) prevent the module (100) from dynamic movement.

8. A method of mounting an exhaust aftertreatment module (300) to a surface (5) comprising:

   selecting a central location (204) on the module (100); and
   locating mounts (202) in a radial pattern about the central location (204).

9. The method (300) of claim 8, further including:

   aligning a direction of travel (208) of the mounts (202) with a radial direction of expansion (210) that passes through the central location (204).

10. The method (300) of any of claims 8 - 9, further in-

cluding:

configuring the mounts (202) to have a distance of travel (216) of at least an expected amount of thermal expansion from the central location (204).

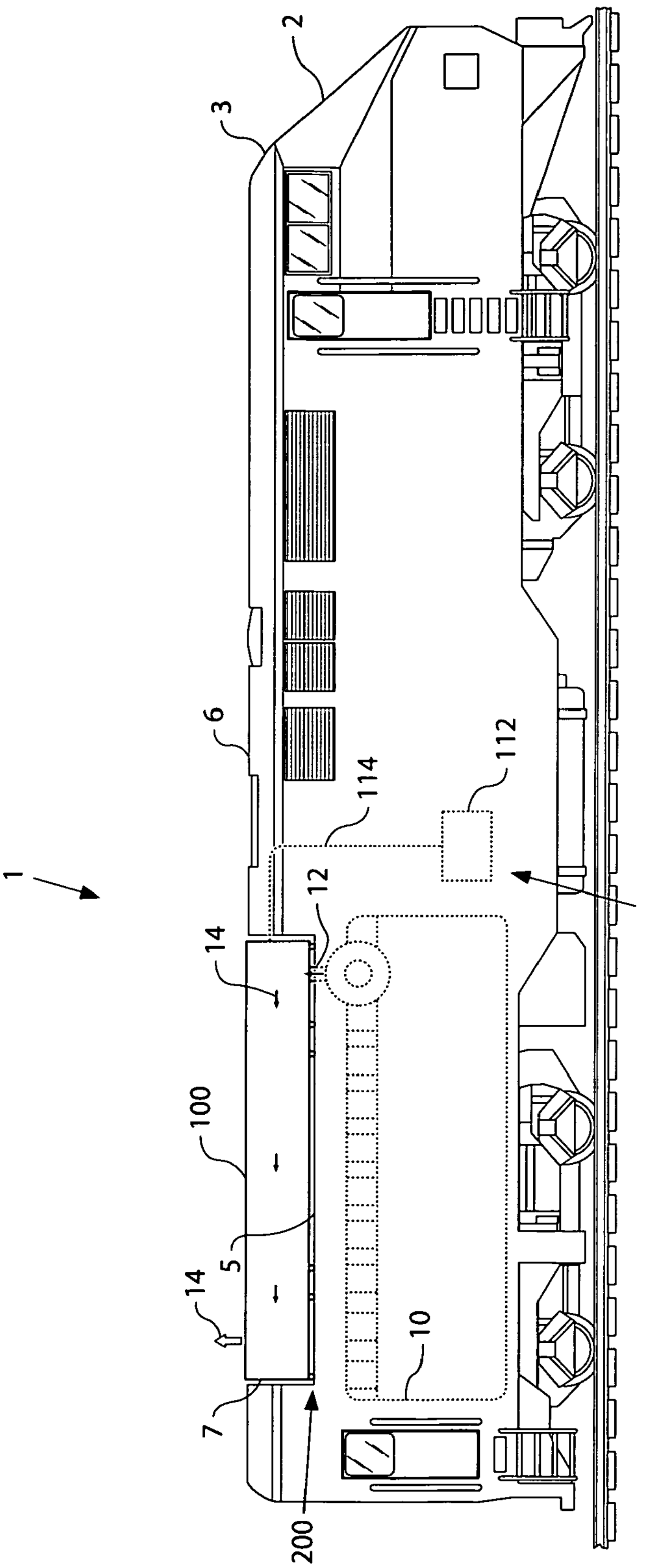


FIG. 1

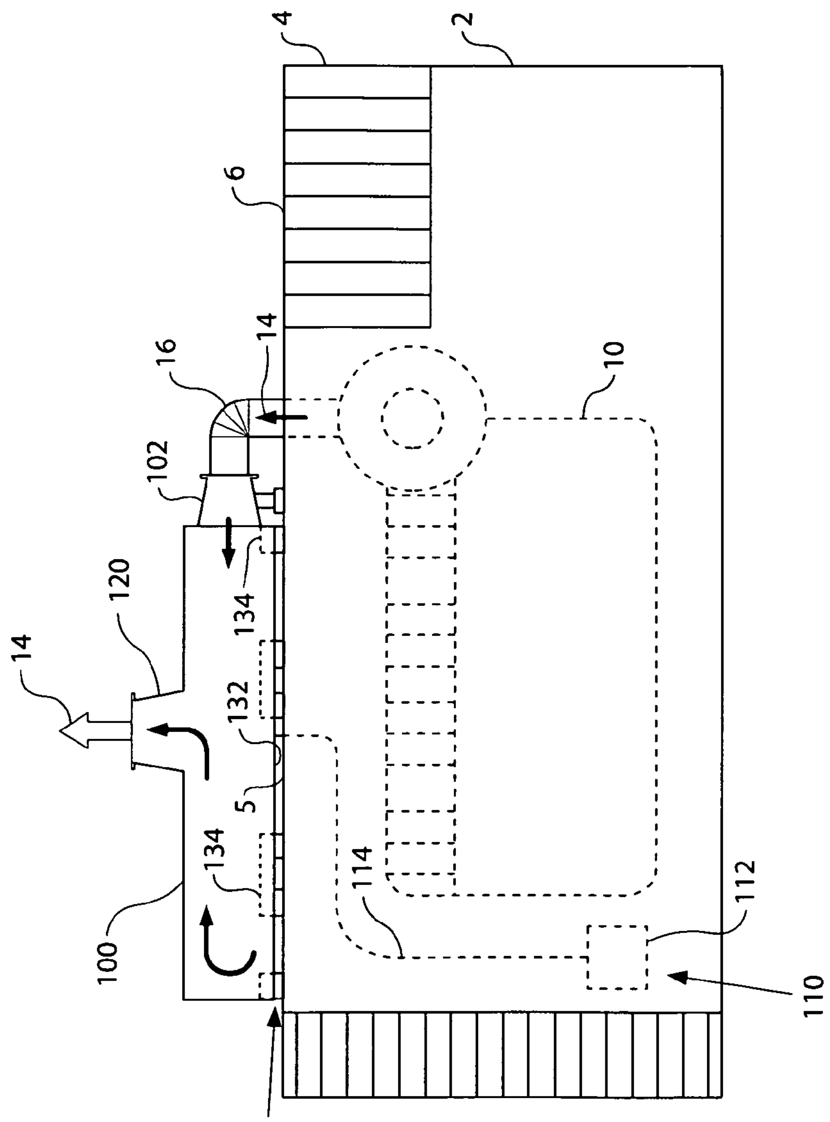
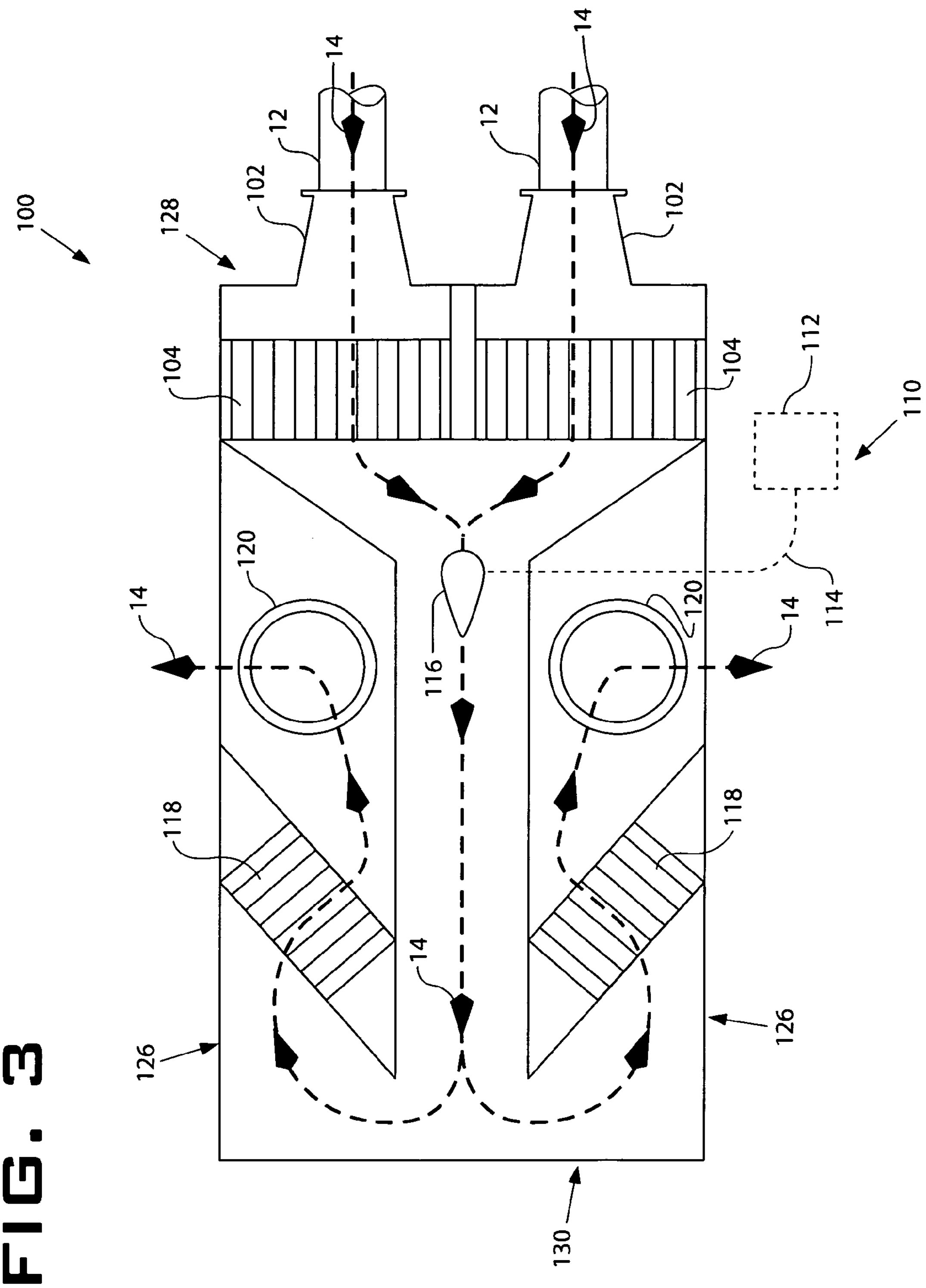


FIG. 2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102
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FIG. 3

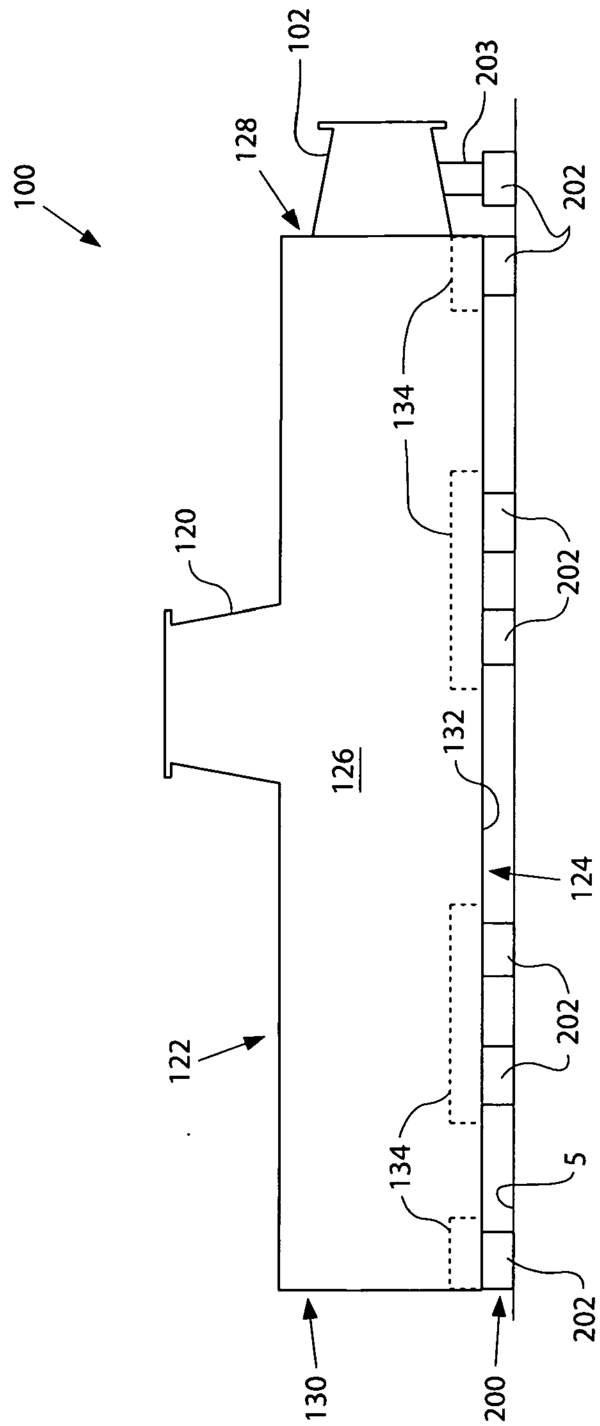
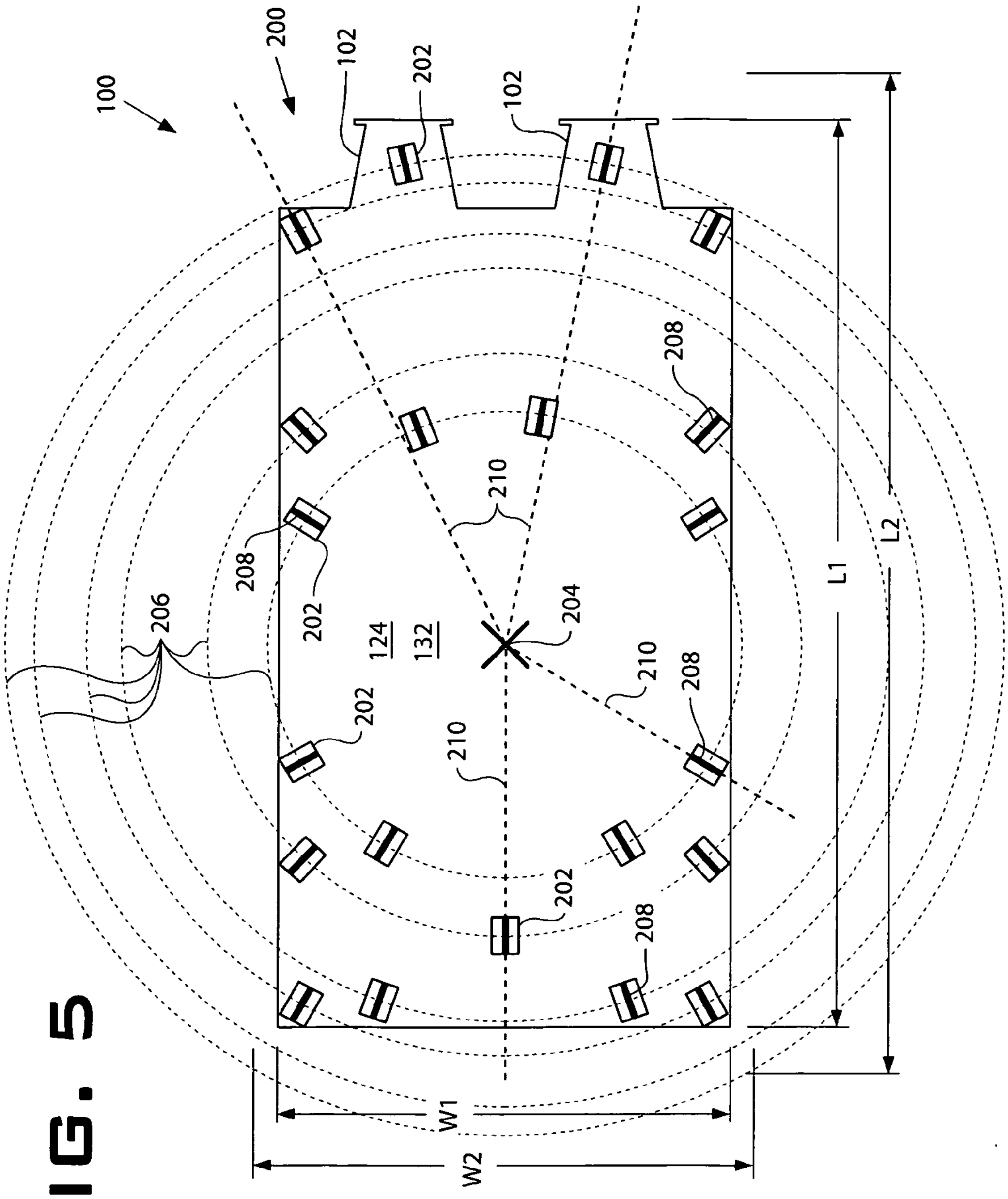


FIG. 4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200
102
202
102
208
210
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206
124
132
204
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210
202
208
L1
L2
W1
W2

FIG. 5

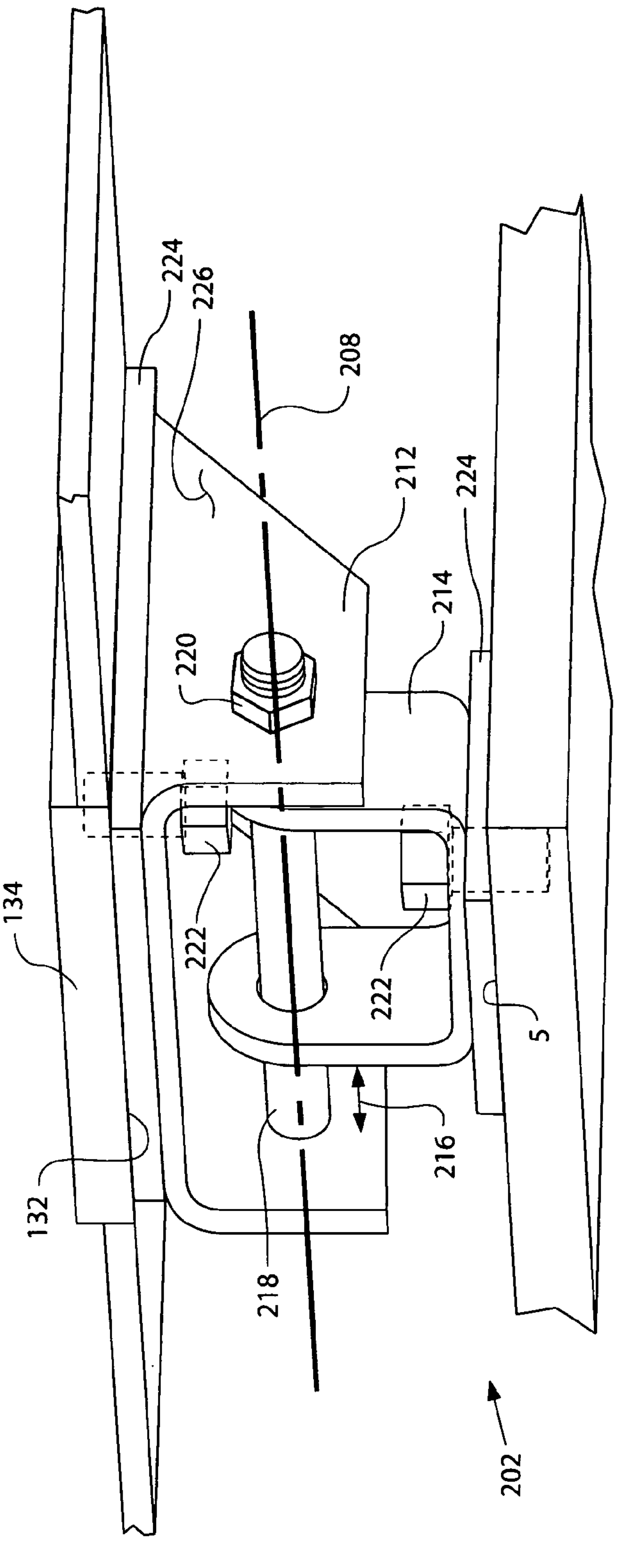
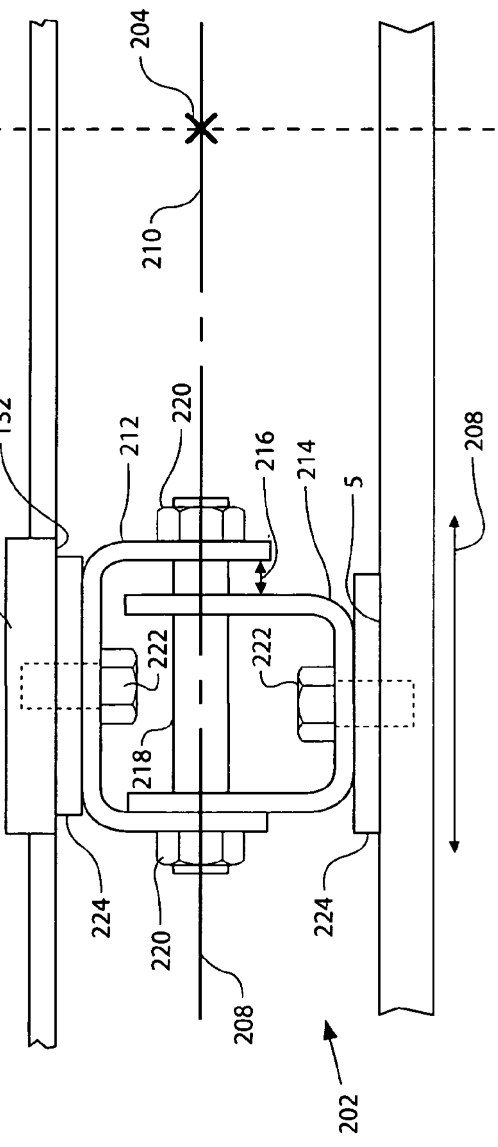


FIG. 6


204
210
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222
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224
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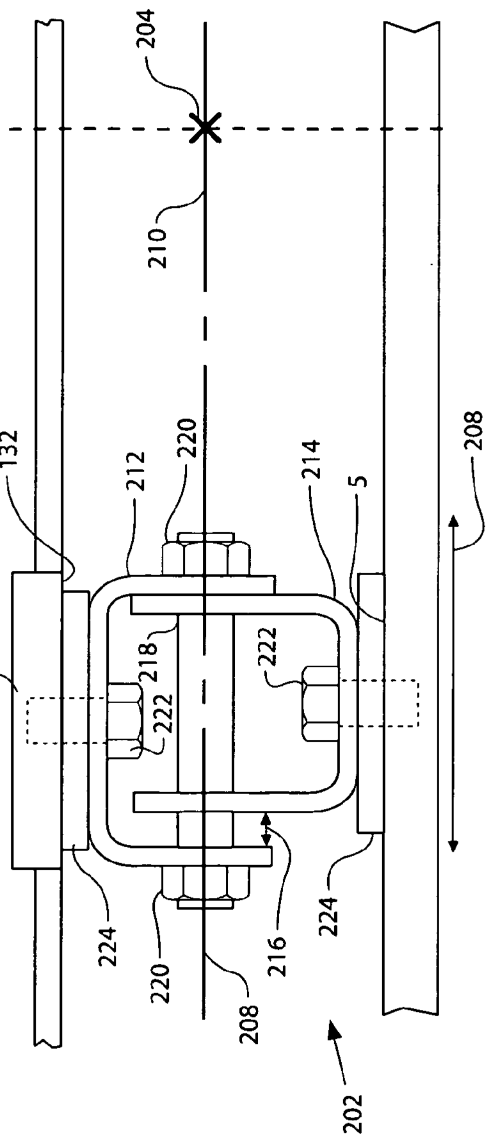
220
208
202

FIG. 7A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224
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220
216
208
202

FIG. 7B

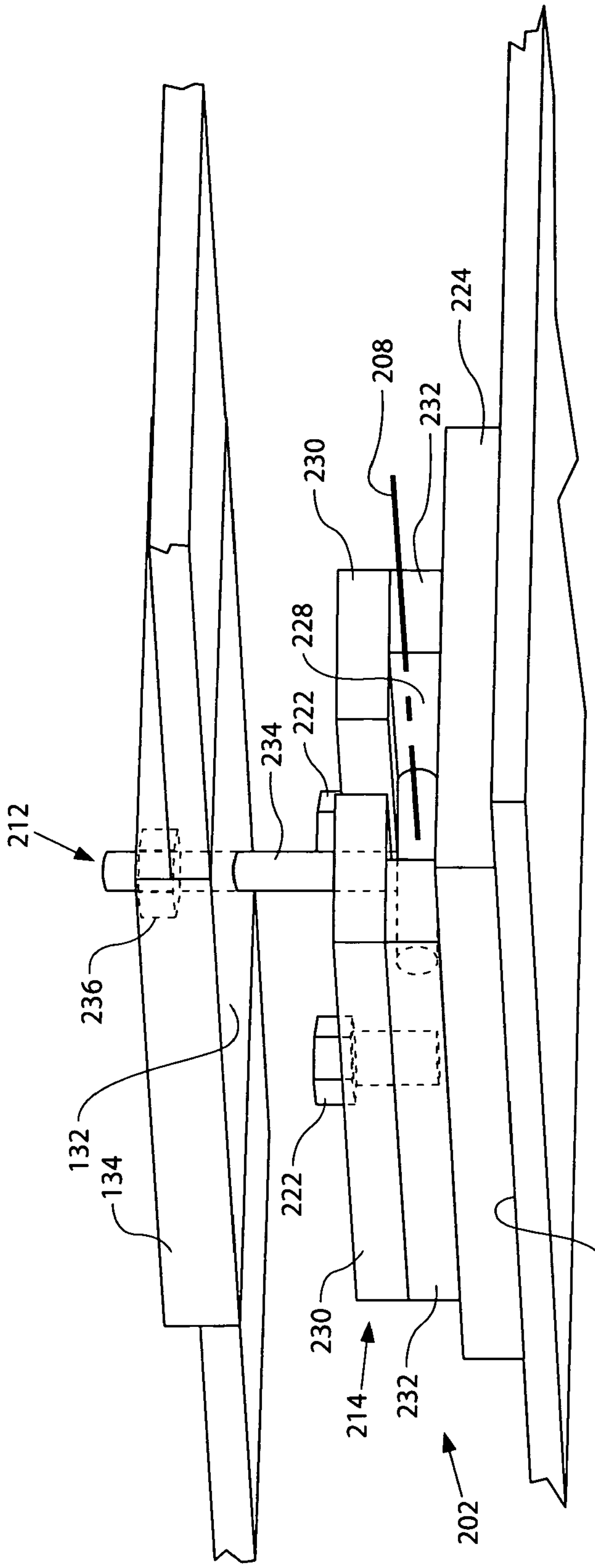
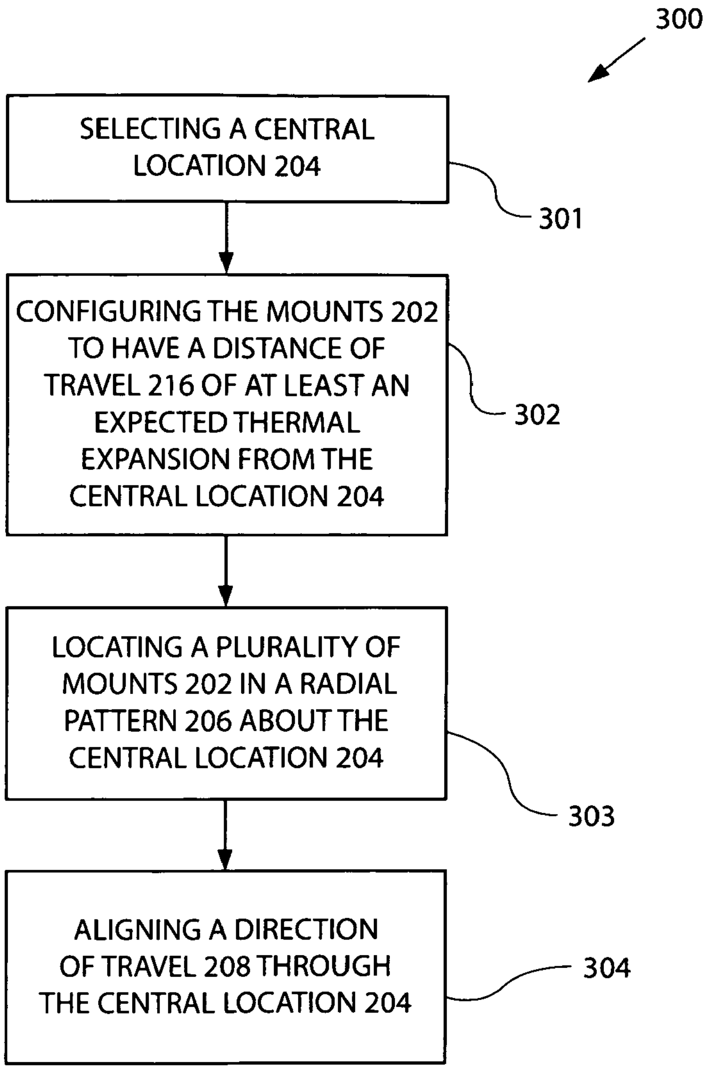


FIG. 8

FIG. 9


300
SELECTING A CENTRAL LOCATION 204
301
CONFIGURING THE MOUNTS 202 TO HAVE A DISTANCE OF TRAVEL 216 OF AT LEAST AN EXPECTED THERMAL EXPANSION FROM THE CENTRAL LOCATION 204
302
LOCATING A PLURALITY OF MOUNTS 202 IN A RADIAL PATTERN 206 ABOUT THE CENTRAL LOCATION 204
303
ALIGNING A DIRECTION OF TRAVEL 208 THROUGH THE CENTRAL LOCATION 204
304

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 00 8177

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 888 615 A1 (FAURECIA SYS ECHAPPEMENT [FR]) 19 January 2007 (2007-01-19) * page 8, line 5 - page 9, line 17; figures 4-6 * -----	1-4,8,9	INV. F01N13/18
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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	5 January 2012	Zebst, Marc

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
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P : intermediate document

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E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 8177

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
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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