



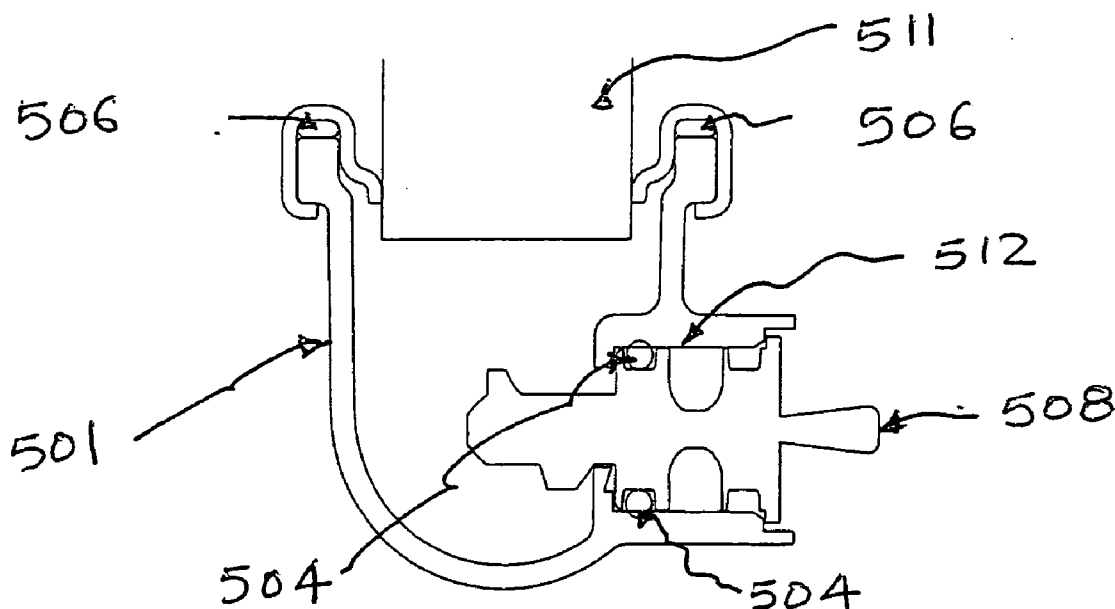
US 20070137845A1

(19) **United States**(12) **Patent Application Publication**
Desai(10) **Pub. No.: US 2007/0137845 A1**(43) **Pub. Date: Jun. 21, 2007**(54) **COATING FOR COMPONENTS HAVING
DAMPENING OR SEALING FUNCTIONS**(52) **U.S. Cl. 165/173**(75) **Inventor: Sameer Desai, Lake Orion, MI (US)**

Correspondence Address:
Valeo, Inc.
Intellectual Property Department
4100 Noth Atlantic Boulevard
Auburn Hills, MI 48326 (US)

(57) **ABSTRACT**

The present invention relates to components which provide an isolation or sealing function at joints or interfaces, said component being comprised of a semi-rigid or flexible material, wherein the flexible material is provided with a surface coating in at least one area. In various aspects of the present invention, particularly useful in automotive applications, isolators, gaskets, O-rings and the like, are provided with coatings that can withstand various environmental conditions, and, particularly, components used in high temperature applications, especially high temperature applications such as those found in automotive applications.

(73) **Assignee: Valeo, Inc., Auburn Hills, MI**(21) **Appl. No.: 11/304,360**(22) **Filed: Dec. 15, 2005****Publication Classification**(51) **Int. Cl.**
F28F 9/02 (2006.01)

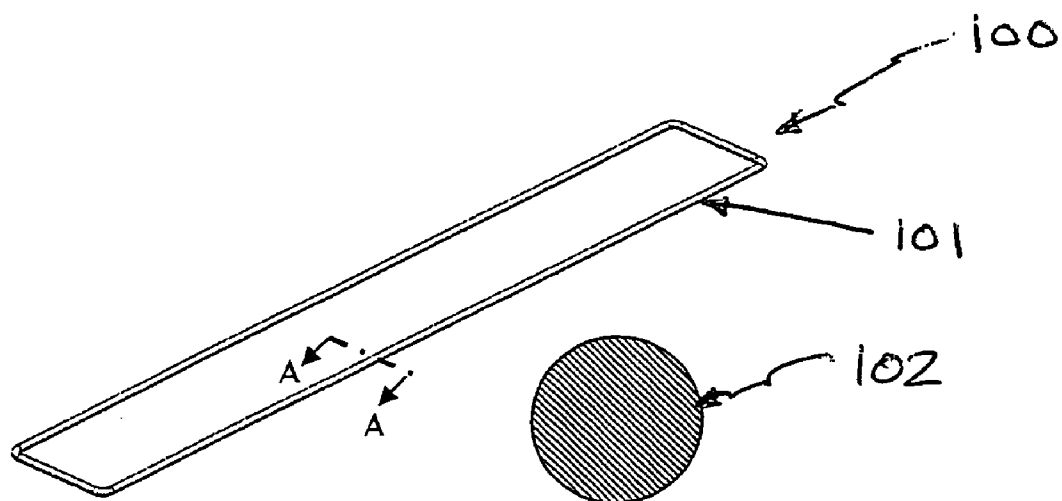


FIG. 1

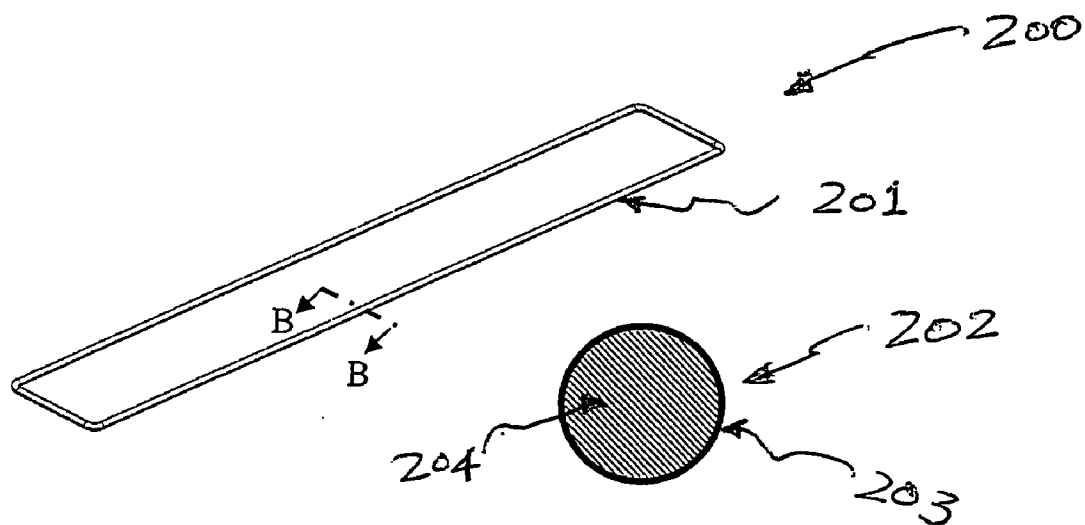


FIG. 2

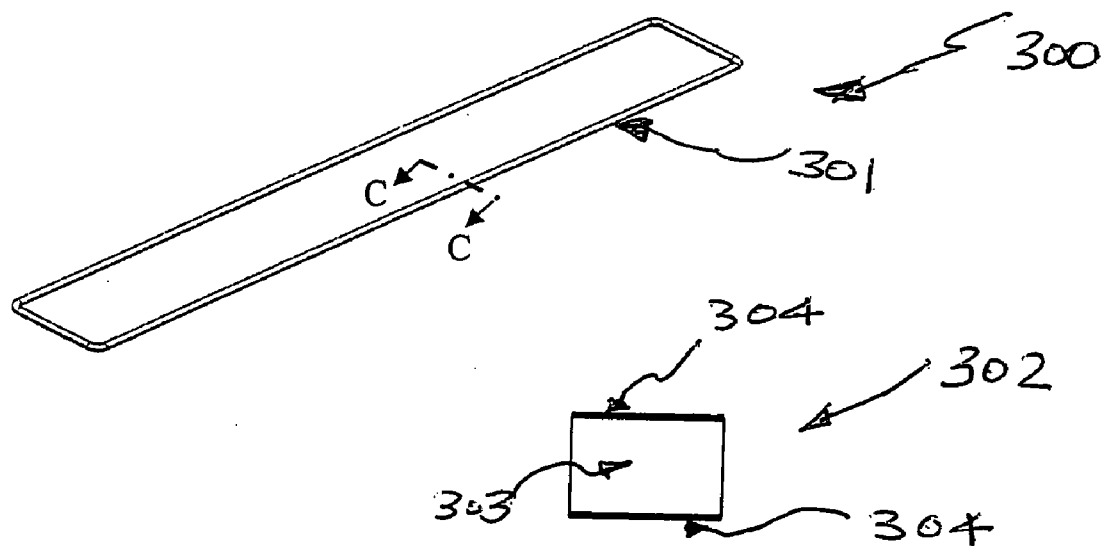


FIG. 3

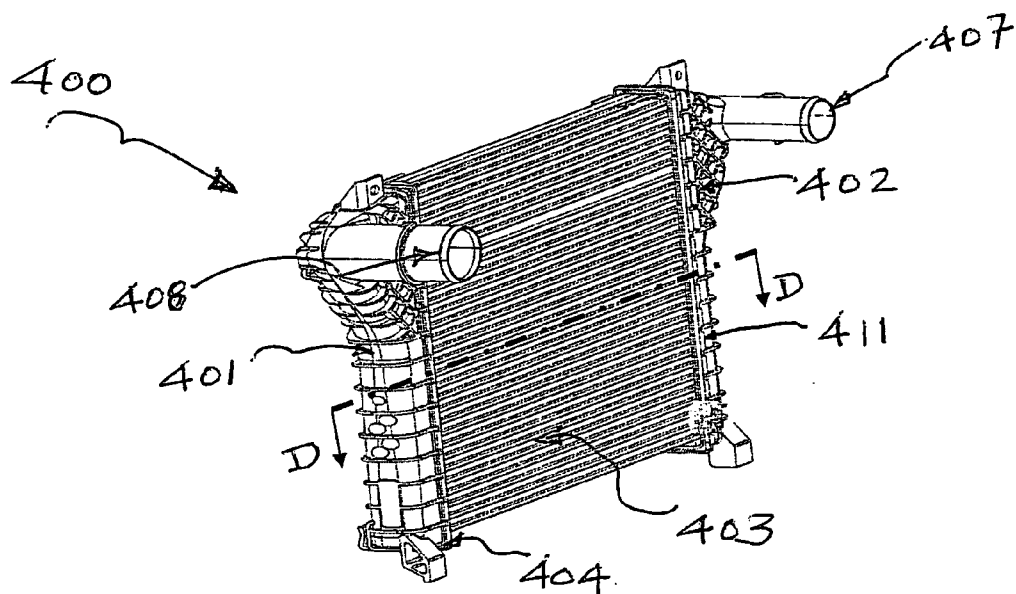


FIG. 4a

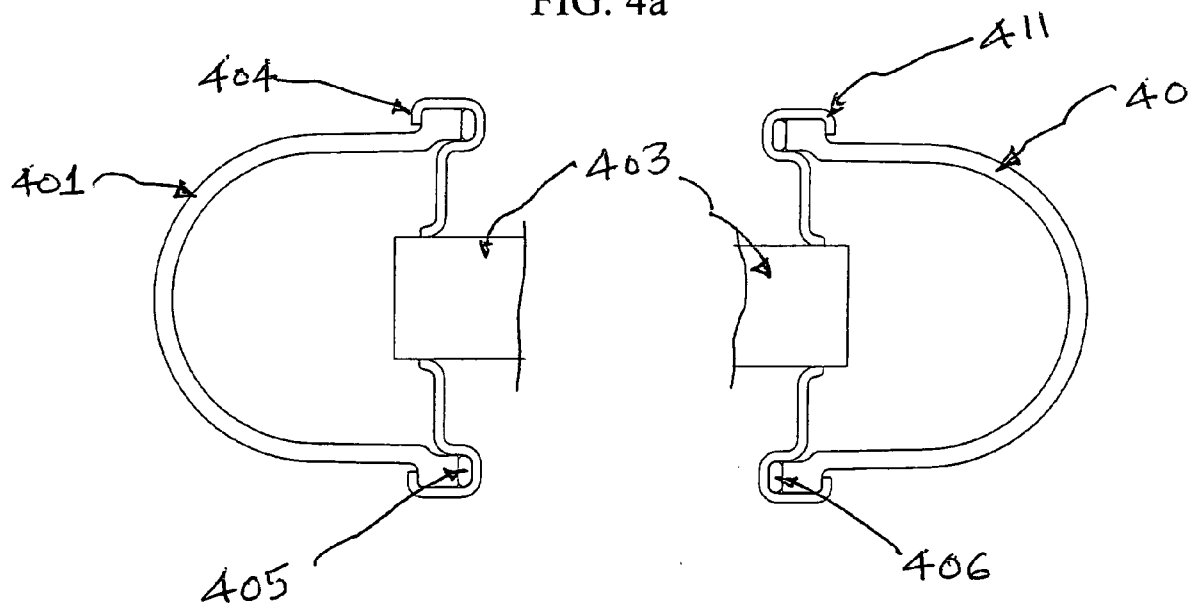
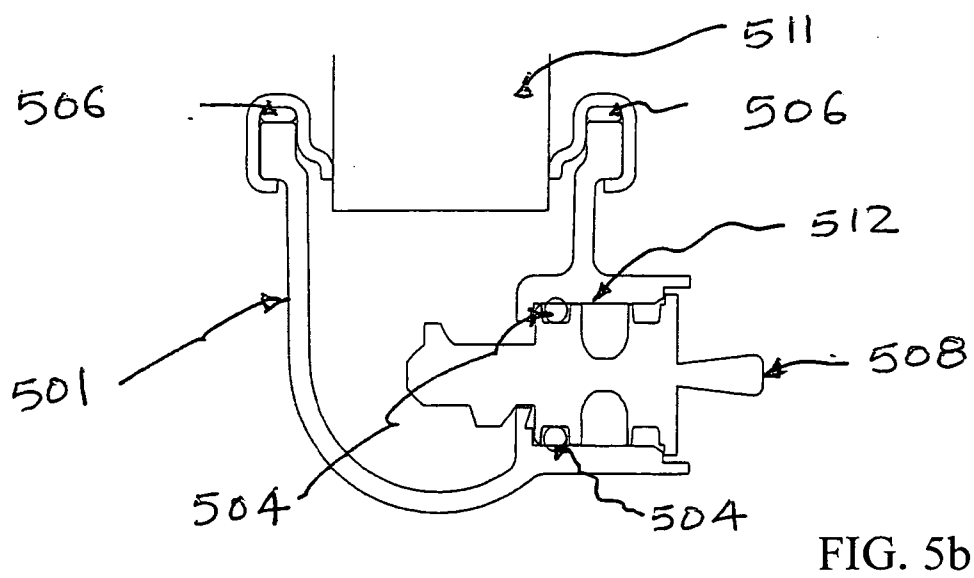
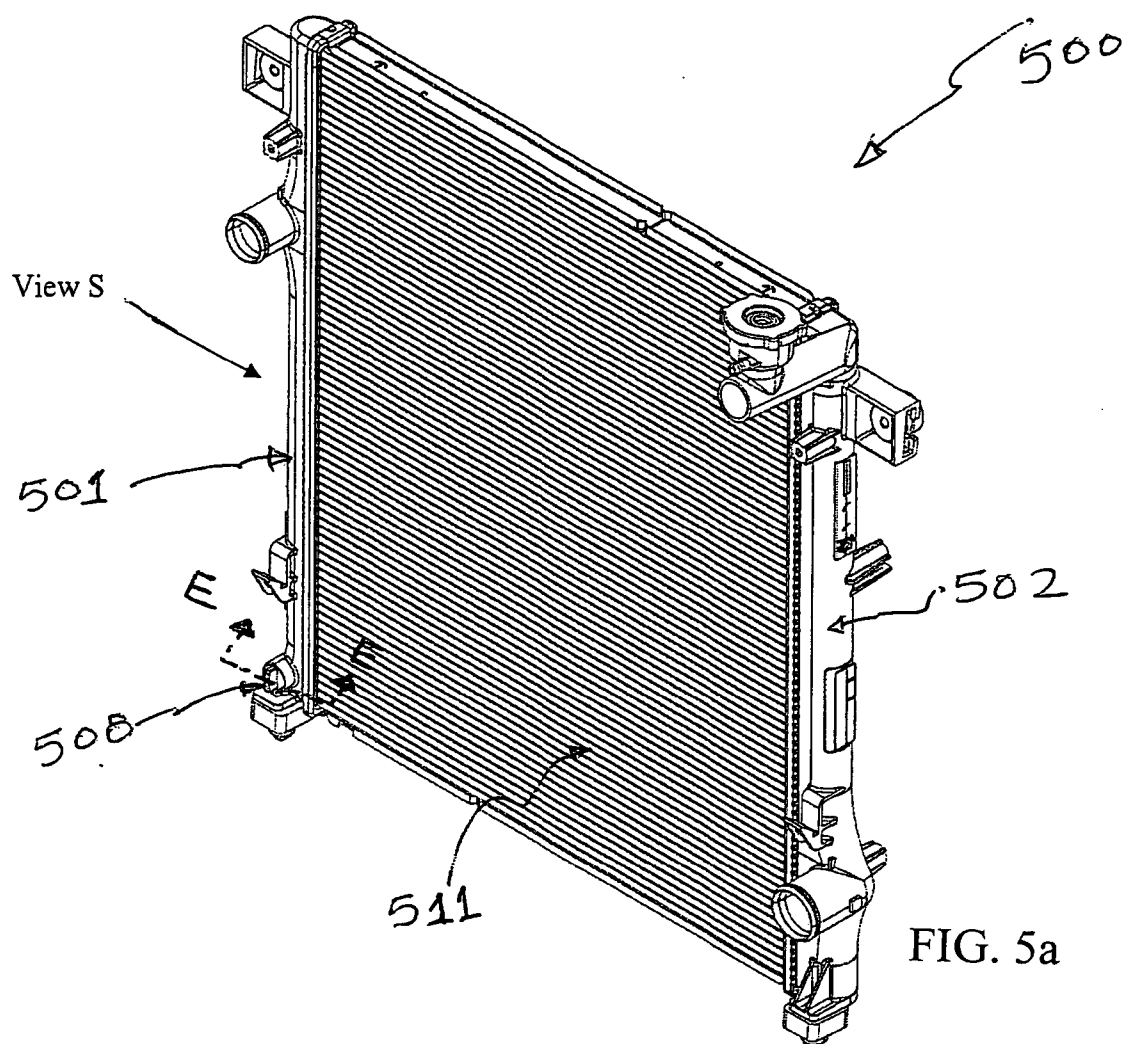


FIG. 4b



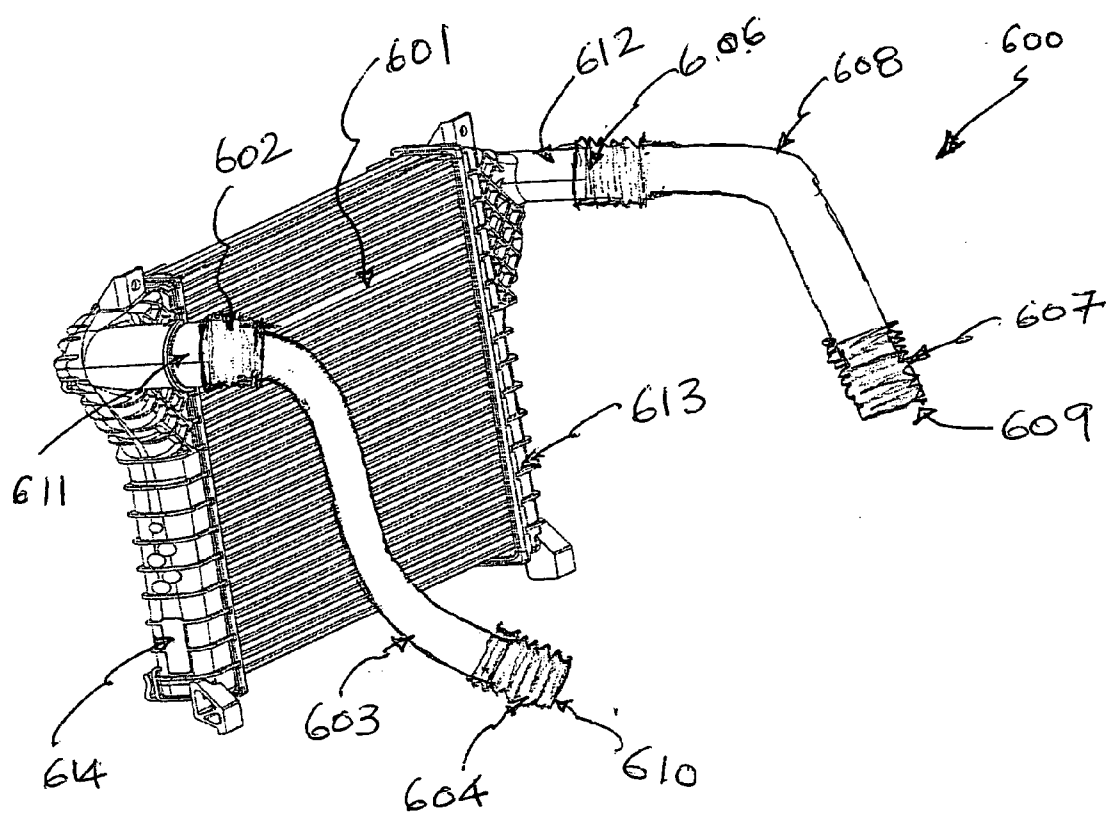


FIG. 6

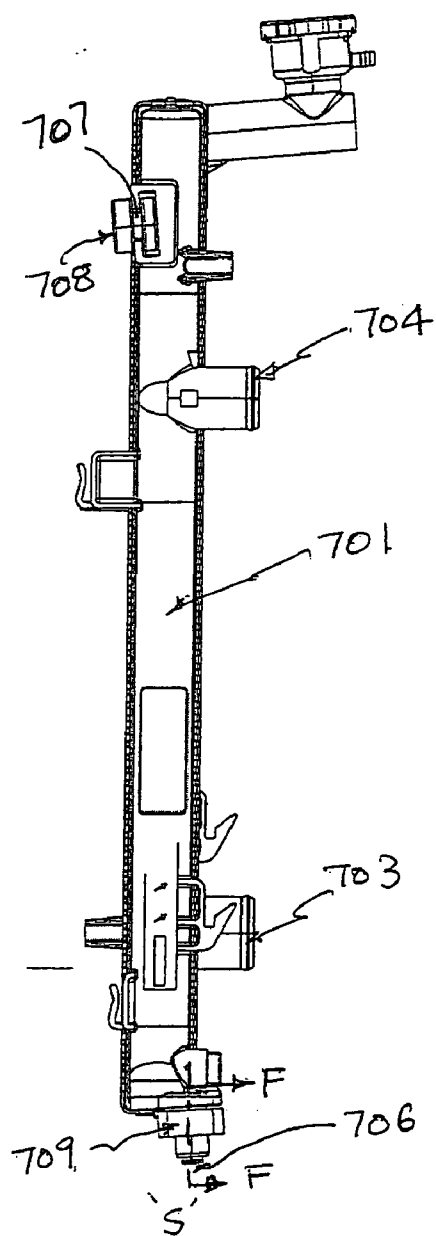


FIG. 7a

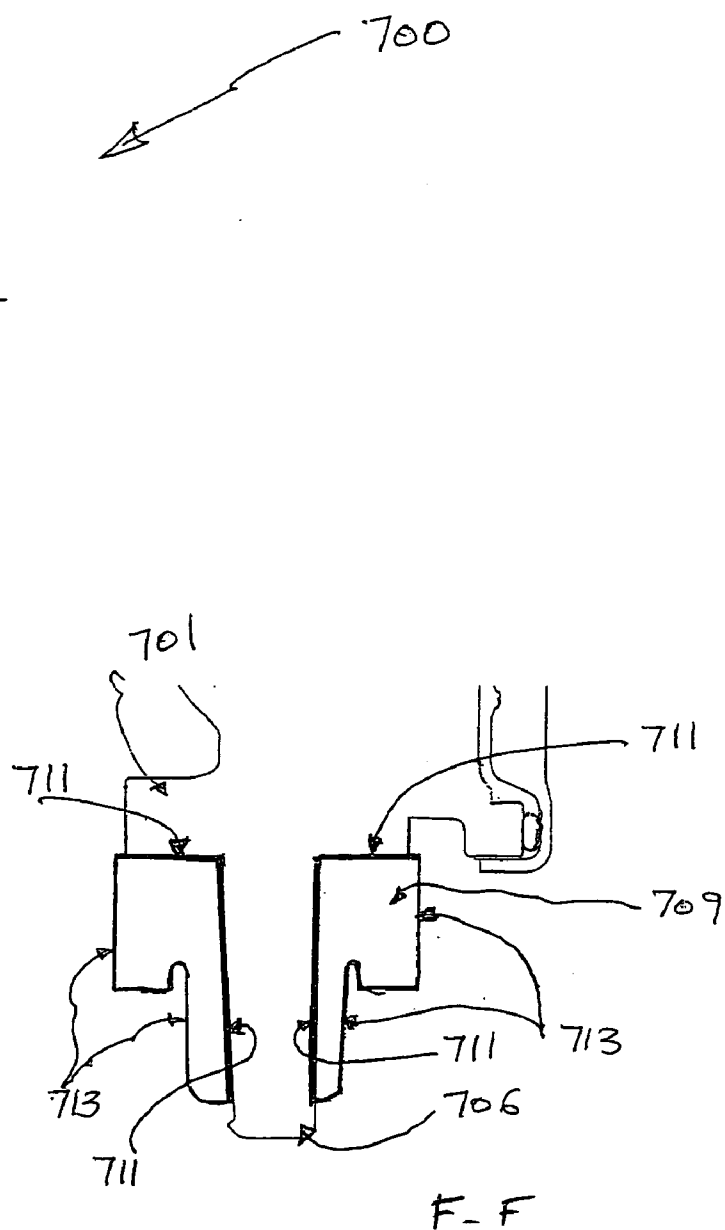


FIG. 7b

COATING FOR COMPONENTS HAVING DAMPENING OR SEALING FUNCTIONS

FIELD OF THE INVENTION

[0001] The present invention relates to components, and, in particular components having dampening or sealing functions, and in particular, coated components, useful in numerous applications, including automotive applications

BACKGROUND OF THE INVENTION

[0002] The higher temperature limits use of certain specific polymeric compounds which are either very expensive or in some cases do not perform to desired performance targets.

[0003] The known art such as JP 63054218, JP1295078, CZ9602831, JP2002309166, JP2001326055 etc all indicate the compound for gasket and some coating or treatment to improve the performance of the gasket in specific areas of applications but not for heat exchanger components sealing.

[0004] The application EP0791798 identifies the coating for certain component of heat exchanger which can improve the performance of the product. EP0791798 covers more of a rigid and specific components and not the flexible sealing components.

[0005] In order to improve the performance of the gasket for specific environment such as high temperature application a coating is provided to the gasket. The coating improves the performance of the gasket by preventing or slowing the environmental impact on the gasket material.

[0006] Such coating for heat exchanger components are sited in EP0791798 and EP0791798 covers rigid like bodies and specific components but not sealing components which are more flexible. Without having higher performing gasket one can not economically manufacture the final product.

[0007] The requirements for higher performance in heat exchangers mean that heat exchangers must withstand environmental conditions at a level and for a longer time period, in some cases, than in the past. Solutions to these higher performance needs have not been adequately addressed in the prior art, particularly as it relates to gaskets used in such applications. Particularly lacking are adequate solutions which, for example, solve the problems associated with higher performance heat exchangers—especially as it relates to temperature and chemical resistance which included oxidation as well.

SUMMARY OF THE INVENTION

[0008] The present invention relates to components which provide a sealing function at joints or interfaces, said component being comprised of a flexible material, wherein the flexible material is provided with a surface coating in at least one area. In various aspects of the present invention, particularly useful in automotive applications, gaskets, and, in particular, are gaskets provided with coatings, that can withstand various environmental conditions. Various aspects of the invention provide for coated gaskets that are useful in high temperature applications, especially high temperature applications such as those found in automotive applications.

[0009] In various aspects of the present invention, a gasket that has been coated is provided, for use in engine cooling

applications. The gasket has preferably be coated with a material or materials which, in addition to being resistant to environmental conditions such as high temperatures, also provide a sealing function.

[0010] Aspects of the present invention provide for improve performance of the gasket through use of (specific) coating materials which, upon application, enhance the application range and overall lifetime of performance of the overall product. In particular aspects of the present invention, the broader application range of the gasket includes use in heat exchanger assemblies, whose lifetime without incident can be increased due to the use of the gaskets of the present invention.

[0011] Substances for coated components, in various aspects of the present invention, comprise, for example, an oxidation control coating substance, an heat emitting coating substance or a chemical resistive coating, or any combination of the above.

[0012] The coated gaskets of the present invention can be made by a number of processes, for example, hand coating, dipping, spray coating, plasma coating, powder coating, or the like. Depending on material used as a coating, when the gasket is made of certain material or materials, preferred methods of making the gasket are by injection molding, compression molding or die cutting etc. The gasket itself can be made of a variety of materials, preferably an elastomeric base material and is subsequently coated with a substance or substances. By substance, it is meant a material, composition, compound or the like that can be used in liquid/solid form and sprayed or blown or used for dipping or otherwise by coating product. A solid or dry form of substance can be subsequently heated or exposed to other chemical agents or UV light or other sources of energy such that they form a continuous coating or surface on the gasket. Preferably, the gasket is 100% coated when an entire surface needs to be protected or 100% coated along specific surfaces when only specific areas of the gasket needs protection. Depending upon where the protection is needed and which areas needed to be coated, the coating method and steps may vary. In general, the entire surface of the gasket is easiest, and in most cases, most economical way to coat. A gasket can be coated with a substance which provides certain protection from environment such as certain types of fluid; optionally, a second substance can be coated on, for example, a gasket, to provide protection from a different environmental, parameters such as heat. Gaskets coated thusly with a substance are thereby by less exposed and/or protected from a variety of environmental factors. Preferred coated gaskets of the present invention have longer life and higher application range due to their sealing properties, particular when used in an automotive vehicle, and, specifically, engine cooling applications. An automotive vehicle, in its broad sense, includes all parts of a motorized vehicle, for example, engine, chassis, tanks, tubes, electrical systems, vehicle comfort parts, bolsters, etc., that somehow linked or in connection with each other through various parts or components.

[0013] In addition to providing high temperature resistance, various aspects of the present invention provide for coated gaskets with increased chemical resistance as well. In particular embodiments, the substance used for coating the gaskets of the present invention has qualities which include

oxidation resistance, as well as resistance to other chemical effects. Chemical effects that can occur in automotive applications include thermal decomposition of gasket material due to oxidative chemical effect, chemical decomposition of gasket material due to automotive fluid attacking the gasket material and additive leaching effect etc. Two or more effects can work in concert, for example thermal decomposition and chemical decomposition and these two primary effects thereby accelerating the process of decomposition, leading to disruption or stoppage where the key function of desired gasket function or such resulting in a gasket whose application will not satisfy the final products performance requirements.

[0014] As described above, a broader application range is possible, including use at higher operating ranges, for engine cooling related components. By using various aspects of the present invention, lower cost for overall assemblies can be obtained, as lower cost gasket material can be coated with substances to perform the desired functions in the designated operating environment.

[0015] Preferably, the aspects of the present invention of use in automotive application, and, especially use in heat exchanger assemblies or related products, include products where gaskets are necessary to prevent fluid leaks. Coated gaskets are preferably provided with a substance which coats a gasket material, such as rubber, plastic, elastomeric materials, or a combination of one or more of such materials. The substance, therefore, can be applied via a number of methods, for examples those which can be selected from many of the known methods such as dipping, spraying, plasma coating etc; with subsequent curing, if needed, at room or elevated temperature suitable to match base material and coating material compatibilities. The substances used, in preferred embodiments, provide not only a thermally stable coating or barrier, but also a chemically resistant and oxidatively resistance barrier, as well as be able to adequately seal interfaces such as aluminum header to plastic or metallic fluid manifold interfaces to prevent fluid leaks. For examples, use of coated gaskets that seal are found, for example on charge air cooler applications where coated gaskets can seal the interfaces between manifold and aluminum header to prevent leakage of air or gaseous fluid as defined based on requirement of life expectancy for the product and/or of environmental conditions.

[0016] Various aspects of the present invention relate to heat exchanger products where gasket material with localized or general substances coating is used to prevent fluid leaks.

[0017] Coatings useful in the present invention can also be used on isolators or dampers or similar components used in heat exchanger or heat exchanger module assemblies (heat exchanger assemblies). Providing such coating can reduce friction, and improve thermal resistance. Other examples of such coatings is the application to the heat exchanger handling hoses wherein the substance, once coating is applied on both sides of the hose, for example, for charge air cooler applications where hot air as a fluid with some trace of oil is managed, the coating will provide resistance from high heat to the base material mainly plastic or rubber hosing or combination of plastic and elastomeric hose system. With such resistance to heat the application range of various prior art systems can be expanded to cover higher heat and

pressures through improved thermal and chemical resistance of the product. Examples of liquid coatings include those such as thermal barrier type coating like IC-105 from Techline Coating. Preferred are coating that practically eliminate or highly reduce oxidation by isolating the majority of the base material from higher temperatures. Higher temperature applications (greater than 380 degrees F. for an extended period of time) are found in many heat exchanger applications, and, therefore, coated gaskets are, preferably, able to withstand higher temperatures.

[0018] Other examples of coatings useful for applications of the present invention include thermally dissipative type coating with or without additional coating substances, which can provide, in addition to heat management, a chemical resistance. For higher temperature applications, thermally dissipative coating presents a thermally cured heat emitting coating, that can be combined with other materials, such as pigment, to provide corrosion protection as well as being applied as a thin film, so not to reduce surface area by filling in surface porosity.

[0019] Coating of the present invention can be applied as one coat or as multiple coats. Preferred is one coat but depending on the application, additional coats may be warranted. In applications, such as gaskets, one or more coats in preferred. For applications such as those having hoses as components, a continuous process such as bath of coating through which extruded hose passes through to get coated and subsequently cured or dried and cut to required length and formed to needed shape, is preferred. Other methods are also anticipated in aspects of the present invention. For example, one can envision a component comprising an extruded hose, cut and formed, and then dipped in a coating bath, followed up with curing stage.

[0020] In various aspects of the present invention, an assembly comprising a heat transfer device, such as a heat exchanger, or a dampening or an isolator component, is provided. In assemblies of such type, at least one component provides a dampening function. This dampening component, e.g. an isolator or a component having a dampening function, comprises a flexible material, more preferably, the dampening component is made up of a majority of flexible material or enough material so that the dampening component exhibits or reduces vibration and thus prevents or dampens the vibrations. The dampening component, over at least part of the surface of flexible material, has a coating on at least one area.

[0021] An assembly may also comprise other components, such as hoses or other flexible or semi-rigid materials (preferred are elastomeric materials). Hoses, for example, can carry fluid at a certain temperature and pressure. The hoses are, in many cases, reinforced to provide resistance to pressure and temperature using many other additives to resist heat and chemical exposures. The hoses need to maintain their functions over long periods of time and resist fluid leakage as well as, maintain these shapes and properties, for desired periods of time. For example, the assembly may comprise a heat transfer device comprising at least one component for providing heat transfer fluid communication (fluid transfer component) such as a tube, hose, pipe or other such flexible means of transport of fluid. As stated above, preferably, the fluid transfer component is made up of a majority of flexible material or enough material so that the

component maintains some flexibility. The fluid transfer component, over at least part of the surface of the flexible material, has a coating on at least one area.

[0022] Methods of making a coated component are other aspects of the present invention. Preferable, a coated component that has a dampening component (is this really the same as a gasket—or is the gasket a fluid retention component correct gasket and hoses do not have dampening needs—isolator is a dampening component) is made by dip or spray method. Correspondingly, a fluid retention component is made by coating the elastomeric material with a substance, by a dip or spray method.

[0023] Contrarily, a fluid transfer component is made by: 1) taking a flexible tube, 2) providing for a liquid batch of coating substance, 3) dipping the tube in the batch, and 4) letting the tube dry or cure in the oven or in the natural environment.

[0024] Also the same fluid transfer component can be made by: 1) extruding the tube with necessary components; 2) providing a liquid batch of coating substance; 3) pulling the tube through the batch of coating substance; 4) letting the tube with coating dry or cure in a desired environment; 5) cutting the tube to desired length; 6) forming the final shape of the tube. This method allows for coating whenever needed, for example, on both sides of the tube. If one of the sides does not require coating, surface modification of such side can be made so coating will not to stick to that side.

[0025] If only an outside surface needs to be coated, for example, a spray method can be used. The most preferred method is a dipping process.

[0026] A general method of making gaskets, in an aspect of the present invention, for example, would involving molding the gasket material into a form, spraying a coating onto the surface and curing by air drying for a short period.

[0027] In a general method of making components according to aspects of the present invention, and, more particularly, making components that are gaskets or isolators, liquid substances are used, and the component to be coated is formed by preparing the component (i.e. free of all undesirable elements such as oils, grease, moisture, dust, scale, corrosion, and the like), cleaning the component, mixing the substance, if necessary, to disperse any heavier or solid elements that may be in the liquid, spraying or dipping the component, at a minimum, in the area or areas desired to be coated, drying the component with coating, curing if necessary. Preparing, cleaning, and applying substance to a component or components, is employed in preferred methods of the present invention.

[0028] Similarly a dampening component is be molded or extruded into a shape, is dipped and is simultaneously or subsequently spun to allow excessive coating to be removed and then is dried, preferably for a short time period, to cure the coating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] FIG. 1 is schematic frontal and cross sectional views of a typical gasket or O-ring as found in the prior art.

[0030] FIG. 2 is schematic frontal and cross sectional views of a coated gasket, in accordance with an aspect of the present invention.

[0031] FIG. 3 is schematic frontal and cross sectional views of a partially coated gasket, in accordance with an aspect of the present invention.

[0032] FIGS. 4(a) and (b) are a schematic representation, and cross sectional view of a coated gasket positioned in a heat exchanger assembly to prevent leaks at the joint, in accordance with an aspect of the present invention.

[0033] FIGS. 5(a) and (b) are a schematic representation of a heat exchanger assembly and cross sectional view of a coated gasket located in an environment of high temperature, exposure to chemicals, and where a need for decreased oxidation exists, in accordance with an aspect of the present invention.

[0034] FIG. 6 is a schematic representation of coated fluid transfer components for a charge air cooler heat exchanger, in accordance with an aspect of the present invention.

[0035] FIGS. 7 (a) and (b) are schematic representations of coated dampening component used in heat exchanger systems, and a cross section illustrating the placed component, in accordance with an aspect of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] In various aspects of the present invention, a heat exchanger assembly having a transfer device, comprises at least one component, preferably for providing a sealing function. The component can be semi-rigid or flexible; preferably the component is made of flexible material. The component comprised of semi rigid or flexible material, is provided with a surface coating in at least one area. When providing a sealing function, non-limiting examples of components can include gaskets, O-ring or the like.

[0037] In various aspects of the present invention, and, in particularly, in heat exchanger applications, a heat transfer device is provided that comprises a heat exchanger core (core) made of tubes, and, fins and at least manifold having an inlet or outlet, and, preferably, at least one inlet chamber and at least one outlet chamber, for passage a heat transfer fluid (fluid communication), wherein at least one manifold or chamber is sealed against the core using at least one component having a coating in at least one area.

[0038] Substances used as coatings are, in various aspects of the present invention, applied to a surface or surfaces of a component or components. Examples of surface coating include coatings comprising an oxidation control coating or thermally resistive coating or a heat emitting or thermally dissipative coating. The coating, in various aspects of the present invention, also provide resistance to chemical and such environmental conditions—a so called chemically resistive coating.

[0039] In various aspects of the present invention, the component is a gasket or O-ring, or a dampening device for providing a dampening function, for example, an isolator. Particularly in heat exchanger applications, a heat transfer device is provided comprising: at least one component for providing a dampening function, said component being comprised mostly of a flexible material, wherein the flexible material is provided with a surface coating in at least one area. As stated above, the surface coating could be thermally dissipative or resistive coating or other coating, with friction

reducing properties. Particularly, wherein the component is, for example, a gasket, an O-ring, or the like, surface coating is preferably selected from the group consisting of an oxidation control coating, a thermally resistive coating, a heat emitting coating, a chemically resistant coating or a thermally dissipative coating.

[0040] Also in various aspects of the present invention, a heat transfer device comprising at least one component for providing a heat transfer fluid communication function, is found. An example of such a heat transfer device is a connection, tube hose or the like (collectively referred to as 'hose'). In various aspects of the present invention the component is comprised mostly of a flexible material, wherein the flexible material is provided with a surface coating. In heat exchanger applications the surface coating can be thermally resistive or thermally dissipative in type. Particularly wherein the component has flexible material as a base, a coating is preferably selected from the group consisting of an oxidation control coating, a thermally resistive coating, a heat emitting coating or a thermally dissipative coating.

[0041] Referring to FIG. 1 is illustrated a current state of art heat exchanger gasket application. (100) is a rectangular shape gasket with circular cross section (102). Gasket (101) is made of a compound 101 which is formed in shape with either injection molding or compression molding and die cut and turned to make it round. One can envision different shapes and cross section of such gaskets.

[0042] Referring to FIG. 2 is illustrated a gasket in accordance with an aspect of the present invention. (200) is again a rectangular shape gasket with a circular cross section (202). Gasket (201) is made of a base compound (204) and coated with a substance (203). The gasket is first formed using a forming process for example injection molding, compression molding or mandrill process using compound (204). Once formed coating (203) is applied to entire surface of the gasket and is cured at desired condition to form a coated gasket. One can imagine to repeat such coating process with a different coating providing additional protection as product desires and thus forming multilayer coatings.

[0043] Referring to FIG. 3 is illustrated a gasket in accordance with an aspect of the present invention. (300) is again a rectangular shape gasket with a rectangular cross section (302). Gasket (301) is made of a base compound (303) and coated with a substance (304). The gasket is first formed using a forming process for example injection molding, compression molding or mandrill process using compound (303). Once formed coating (304) is applied to top and bottom surface of the gasket and is cured at desired condition to form a coated gasket. The selective coating can be achieved with hand lay-up or roller process. One can imagine to, repeat such coating process with a different coating providing additional protection as product desires and thus forming multilayer coating.

[0044] Referring to FIG. 4a is represented a heat exchanger (400) having one manifold (402) and second manifold (403). Both manifolds are in fluid communication with each other through the core (403) carrying tubes (not shown) and spaced between heat exchanging fins (not shown). Also shown is that manifold (401) and (402) are joined to the core by a header (404) and (411) correspond-

ingly. FIG. 4b which is a cross section of a heat exchanger at line D-D shows the details. As shown in the FIG. 4b manifold (410) and (402) are joined to the core (403) through headers (404) and 411 with gasket (405) and (406) in between. This gasket (405) and or (406) are coated with substance thermal barrier coating. The hot fluid inside the heat exchanger attacks the gasket and its functional life (sealing). With the thermal barrier coating the gasket will be able to meet its functional purpose for longer time and much higher temperatures. It can also be envisioned that only one of the gasket from two shown here need to be coated. Also the coating type can vary with type of heat exchanger; for example, the coating can be a thermally dissipative instead of thermal barrier type. This is dependent on application and material combinations.

[0045] Referring to FIG. 5a shows a heat transfer device (500) is shown a coated gasket in a O-ring form having a thermally dissipative coating, in accordance with an aspect of the present invention. The heat transfer device is a heat exchanger (500) that has two manifolds (501) and (502) and a core (511) allowing manifolds to communicate with each other.

[0046] One of the manifolds (501) has drain function which consists of a bore (512) in the manifold. A drain cock (508) is inserted in to this bore which carries an O-ring (504) which is coated with thermally dissipative coating. The O-ring (504) provides sealing function and to allow its functional life to be longer at higher temperatures the thermally dissipative coating will dissipate the heat faster and thus will not allow heat build up within the body allowing it to last longer. FIG. 5b shows a cross sectional view of section E-E of FIG. 5a.

[0047] Referring to FIG. 6 is shown a system (600) in accordance with an aspect of the present invention, where heat exchanger (601) for example a charge air cooler which is connected to other parts of vehicle through fluid transferring hose system which consists of a section which formed of a rigid plastic (608) and (603) and flexible components (606) and (602). The hoses are connected to heat exchanger manifolds (613) and (614) through ports (611) and (612). The connection can be made in many different ways, for example, a so-called clamp system or quick connect system. The hoses in such a system can have more than one rigid plastic section or more than one flexible elastomeric section. Semi-rigid and/or flexible elastomeric sections are coated with thermal barrier coating to allow them to function at higher temperature and resist oxidation and maintain strength.

[0048] Referring to FIG. 7a is shown a heat exchanger assembly (700) in accordance with an aspect of the present invention, having manifold (701) and (702), in fluid communication through core (705). The manifolds (701) and (702) carry with them features like (706) and (707) which can be a standing post or a nesting feature which can accept a dampening device (708) and (709). These dampening devices can be made of multiple material such as steel and elastomeric material or rigid plastic and elastomeric material of the damper isolates the heat exchanger from vibration and hard contact with adjoining vehicle interfaces. Heat of operation has manifold (701) and (702) reaching high temperatures during operation, leading to rapid damper material degradation than required functional life if uncoated. FIG.

7b shows Section F-F of FIG. 7a and illustrates the inset (710) of damper (709) mounted on a feature (706) with coating (711) applied to an area where manifold (701) and feature (706) interface with damper and coating (713). Coating is applied to the area where damper interfaces with other vehicular nesting features (not shown). The coating (711) is thermally resistive coating, and coating (713) is friction reducing coating in conjunction with thermally dissipative coating, thereby forming a co called 'mixed coating.' Functions for all the surfaces, if under the same conditions, can also preferably use only one type of coating that can applied to the complete surfaces, using, for example, a dipping process. Manifold (701) has inlet (704) and outlet (703) for heat transfer fluid.

What is claimed is:

1. A heat exchanger assembly comprising:
 - a heat transfer device;
 - at least one component comprising a flexible material for providing sealing function; and
 - at least one surface coating on the at least one component;
 - wherein the flexible material is provided with a surface coating in at least one area.
2. A heat exchanger assembly as in claim 1, wherein the heat transfer device comprises a core made of tubes, and at least one manifold, wherein the at least one manifold is sealed against the core at the at least one component.
3. A heat exchanger assembly as in claim 1, wherein the heat transfer device comprises a core made of tubes, and at least one manifold, and wherein the core or manifold is contacted by one or more parts outside of the core.
4. A heat exchanger assembly as in claim 3, wherein the at least one component is an isolator and wherein the isolator is located between the core and the one or more parts outside of the core.
5. A heat exchanger assembly as in claim 2, wherein the component is a gasket, an O-ring, or the like.
6. A heat exchanger assembly as in claim 3, wherein the surface coating is selected from the group consisting of an oxidation control coating, a thermally resistive coating, a heat emitting coating or a thermally dissipative coating.
7. A heat exchanger as in claim 5, wherein the surface coating is selected from the group consisting of an oxidation control coating, a thermally resistive coating, a heat emitting coating, a chemically resistant coating or a thermally dissipative coating.

8. A heat exchanger as in claim 4, wherein the surface coating is selected from the group consisting of an oxidation control coating, a thermally resistive coating, a heat emitting coating, a chemically resistant coating or a thermally dissipative coating.

9. A heat exchanger assembly as in claim 5, wherein the surface coating comprises an oxidation control coating or a thermally resistive coating.

10. A heat exchanger assembly as in claim 7, wherein the surface coating comprises an oxidation control coating or a thermally resistive coating.

11. A heat exchanger assembly as in claim 7, wherein the surface coating is a thin film and comprises an heat emitting coating or a thermally dissipative coating.

12. A heat exchanger assembly as in claim 7, wherein the surface coating comprises a chemical resistive coating.

13. A heat exchanger assembly as in claim 3, wherein the at least one component provides a dampening function.

14. A heat exchanger assembly as in claim 3, wherein the at least one component is coated with a thermally dissipative or chemically resistive coating.

15. A heat exchanger assembly as in claim 13, wherein the coating is a friction reducing coating or a mixed coating.

16. A heat exchanger assembly as in claim 3, wherein the heat exchanger assembly exists as part of a motorized vehicle, and the at least one component is a heat transfer fluid component, the component designed such that the heat transfer fluid component allows fluid to be in fluid communication with the manifold and another part of the vehicle when present in the assembly.

17. A heat exchanger assembly as in claim 13, wherein the coating is a thermally resistive or thermally dissipative coating.

18. A heat exchanger assembly as in claim 14, wherein the at least one component is a fluid transfer component.

19. A heat exchanger assembly as in claim 18, wherein the fluid transfer component is a flexible or semi-rigid tube or pipe or the like, and the coating is located on both the inner and outer surface of the tube or pipe or the like.

20. A method for producing a component for use in a heat exchanger assembly comprising:

- preparing a component;
- cleaning the component;
- applying a substance to the component to form a coating;
- drying or curing the coating.

* * * * *