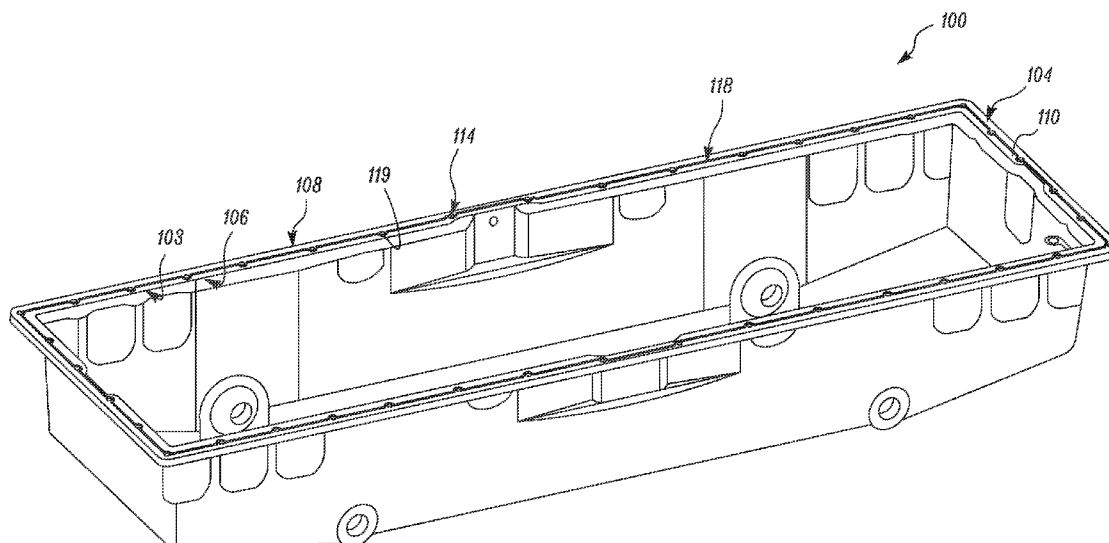




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(19) **United States**(12) **Patent Application Publication**
Halla(10) **Pub. No.: US 2014/0319829 A1**(43) **Pub. Date: Oct. 30, 2014**(54) **COMPONENT HAVING A FLANGE
DEFINING A GROOVE THEREIN**(71) Applicant: **Caterpillar Inc.**, Peoria, IL (US)(72) Inventor: **Eric E. Halla**, Peoria, IL (US)(21) Appl. No.: **14/325,531**(22) Filed: **Jul. 8, 2014****Publication Classification**(51) **Int. Cl.**
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(2013.01)USPC **285/368; 403/337**(57) **ABSTRACT**

A component is provided. The component is configured to bear on a complementary surface. The component includes a flange located on a periphery of the component. The flange of the component defines an extended provided therein. The flange of the component also defines a plurality of apertures therethrough. The plurality of apertures extended through the flange and are structured and arranged to receive fasteners therethrough. Further, the groove on the flange includes first portions and second portions. The first portions of the groove extend between adjoining apertures of the plurality of apertures and the second portions of the groove are detour portions in proximity to the apertures of the plurality of apertures. The groove is structured and arranged to receive a sealant therein. The sealant forms continuous seal along the periphery of the component in response to the flange being pressed against the complementary surface.



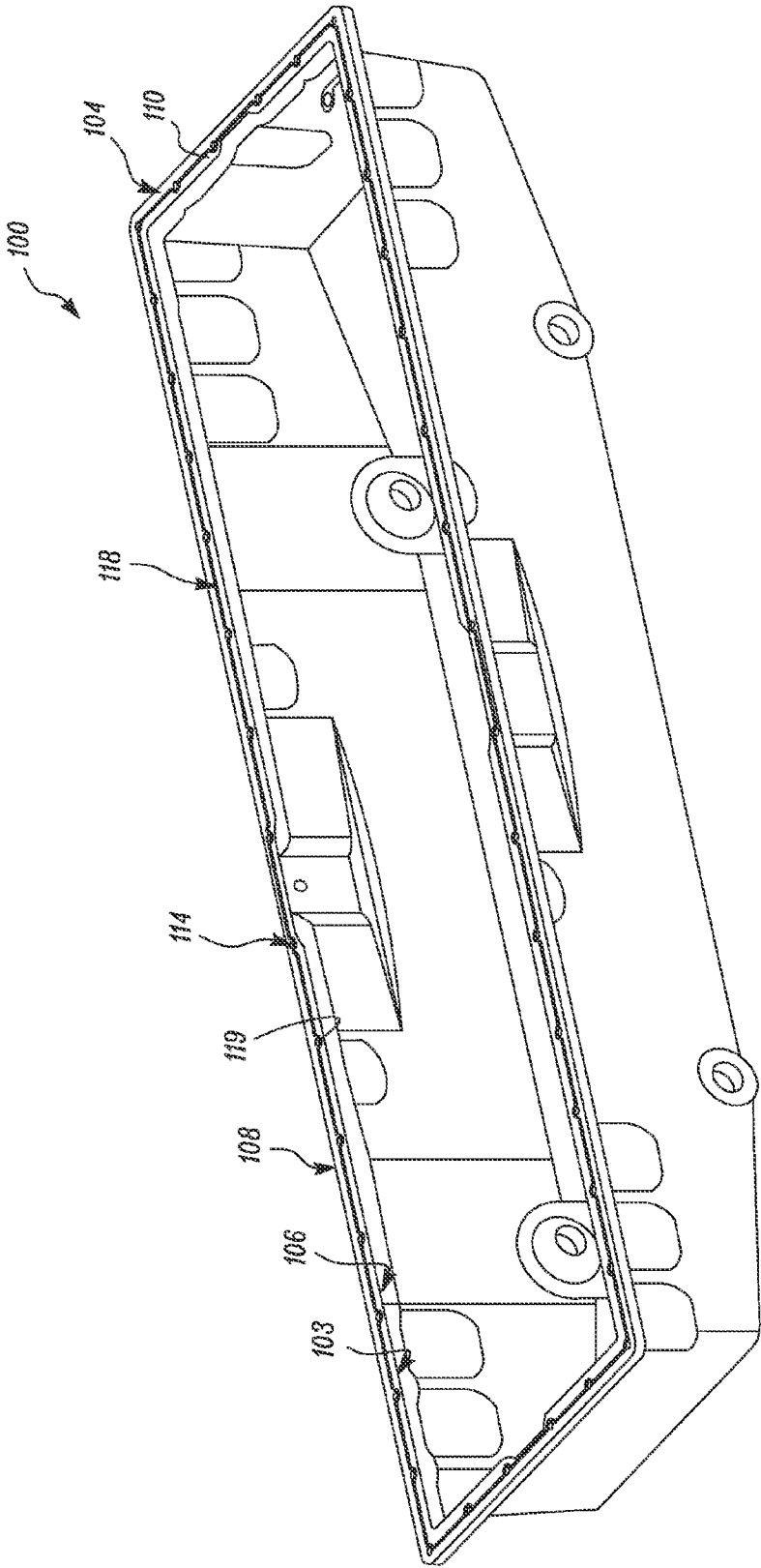


FIG. 1

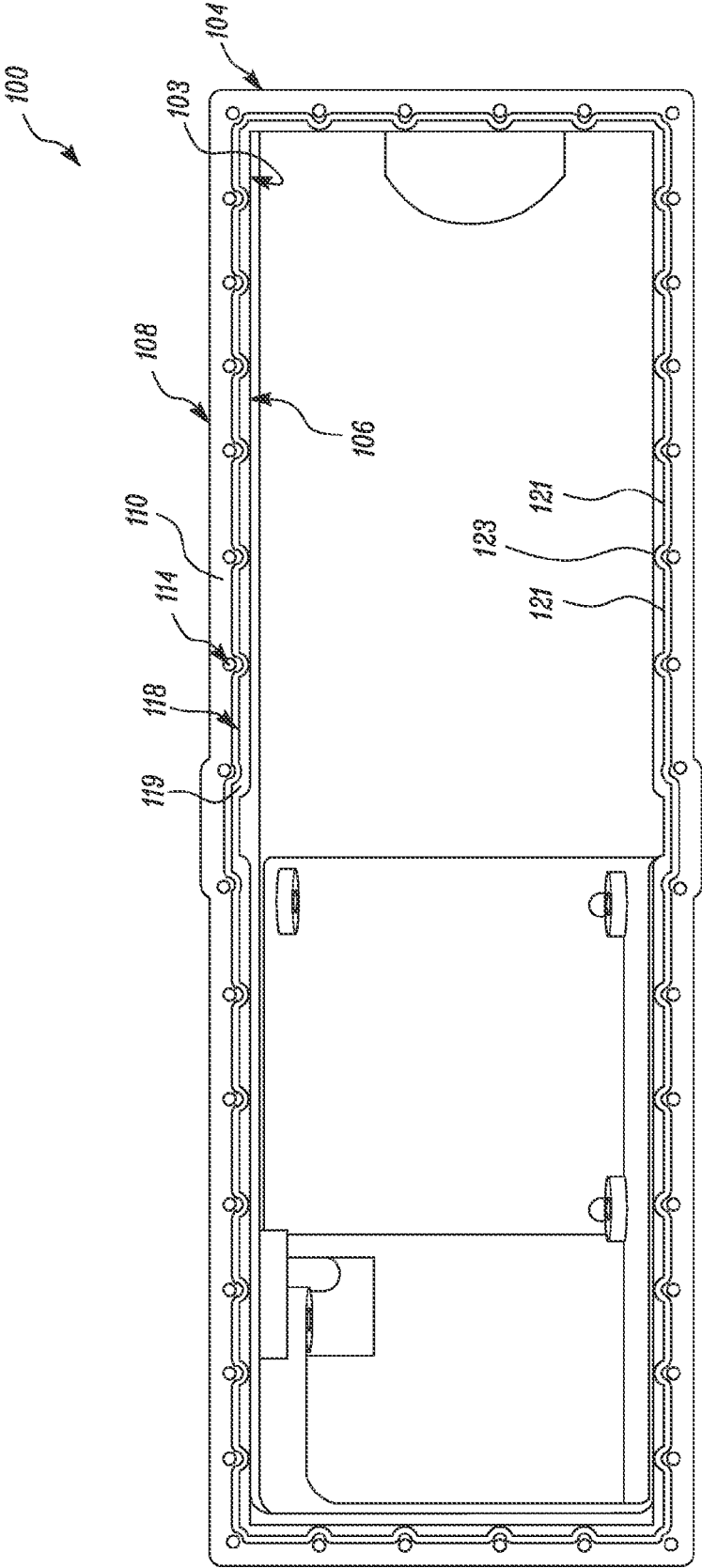


FIG. 2

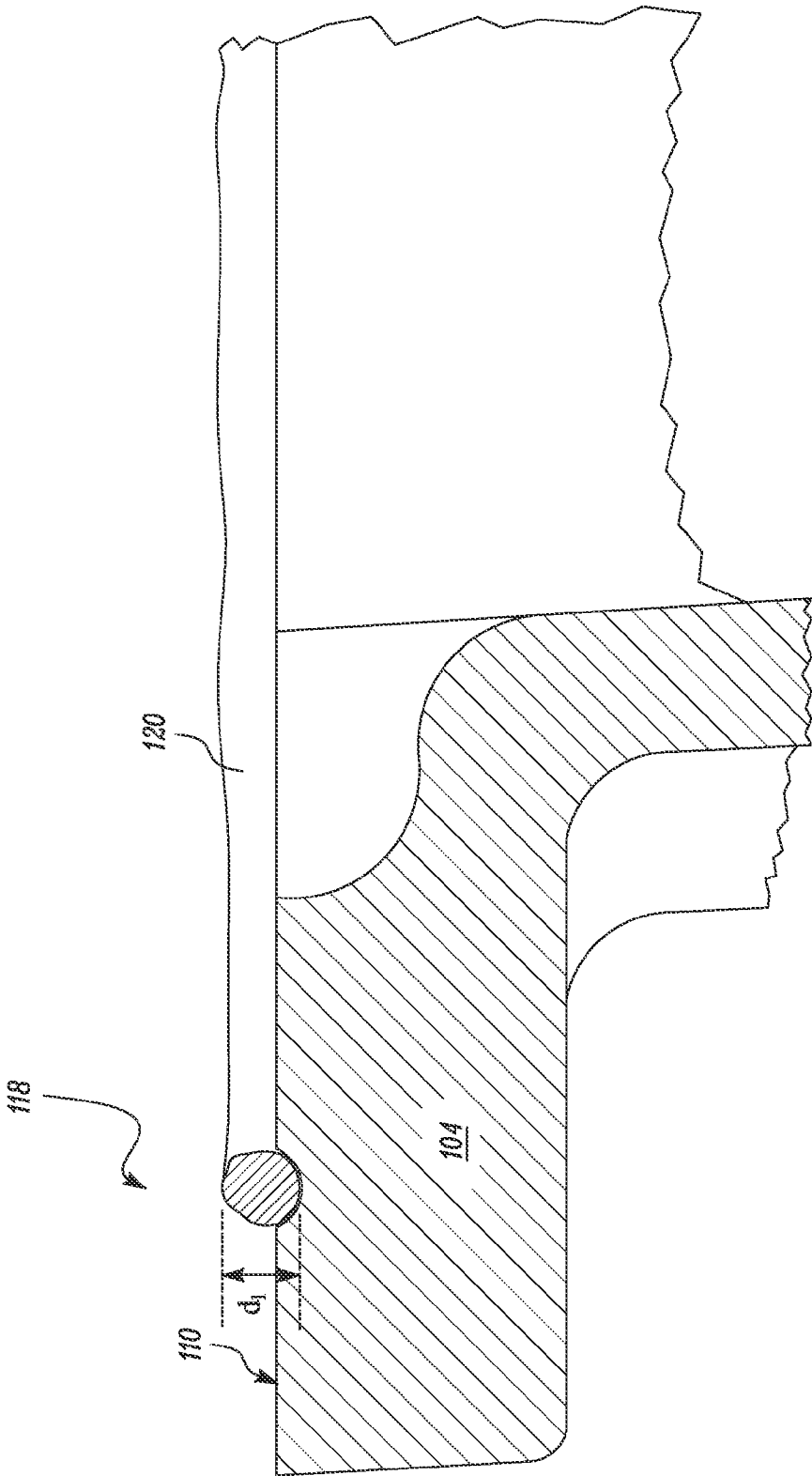


FIG. 3

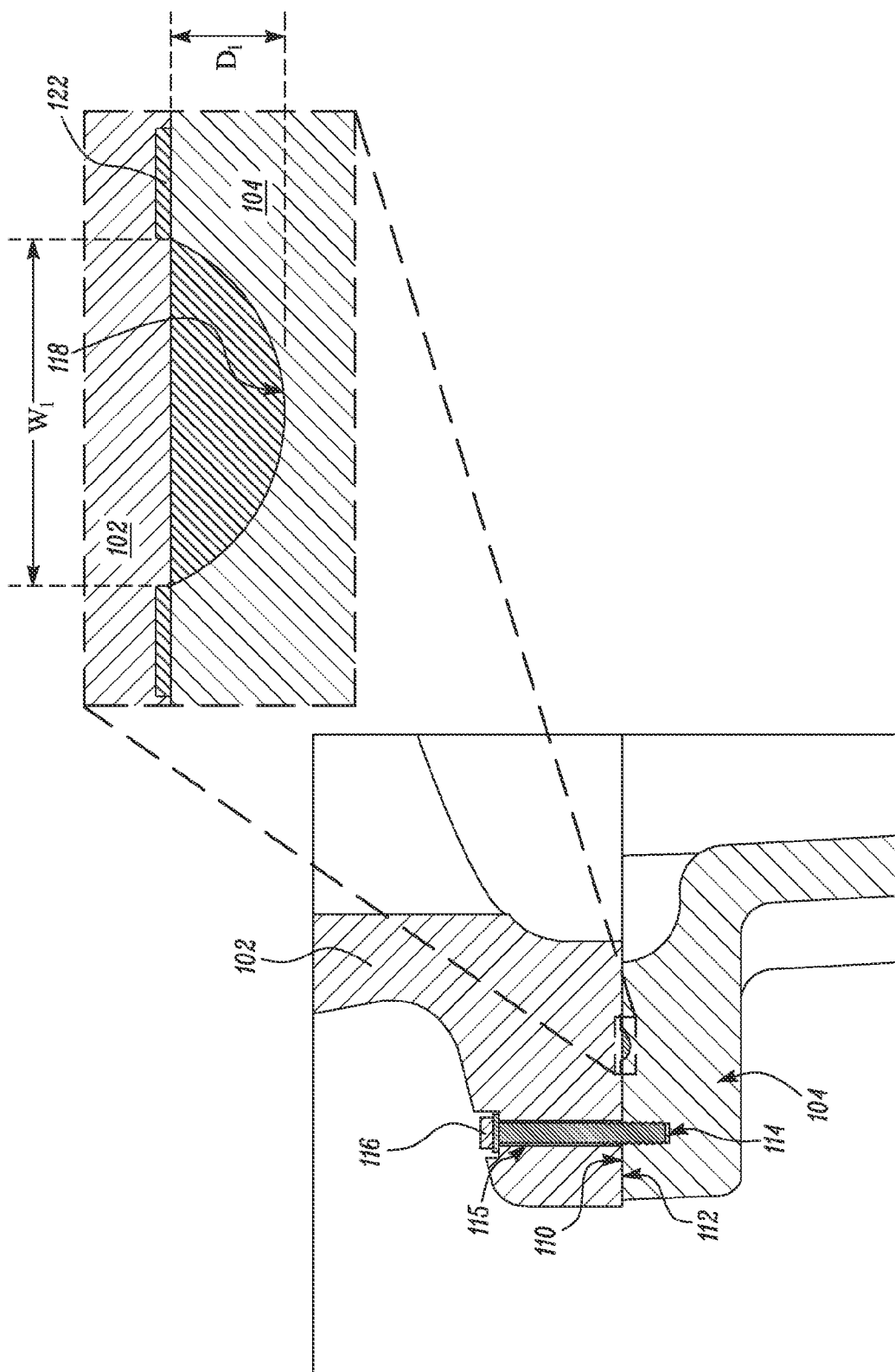


FIG. 4

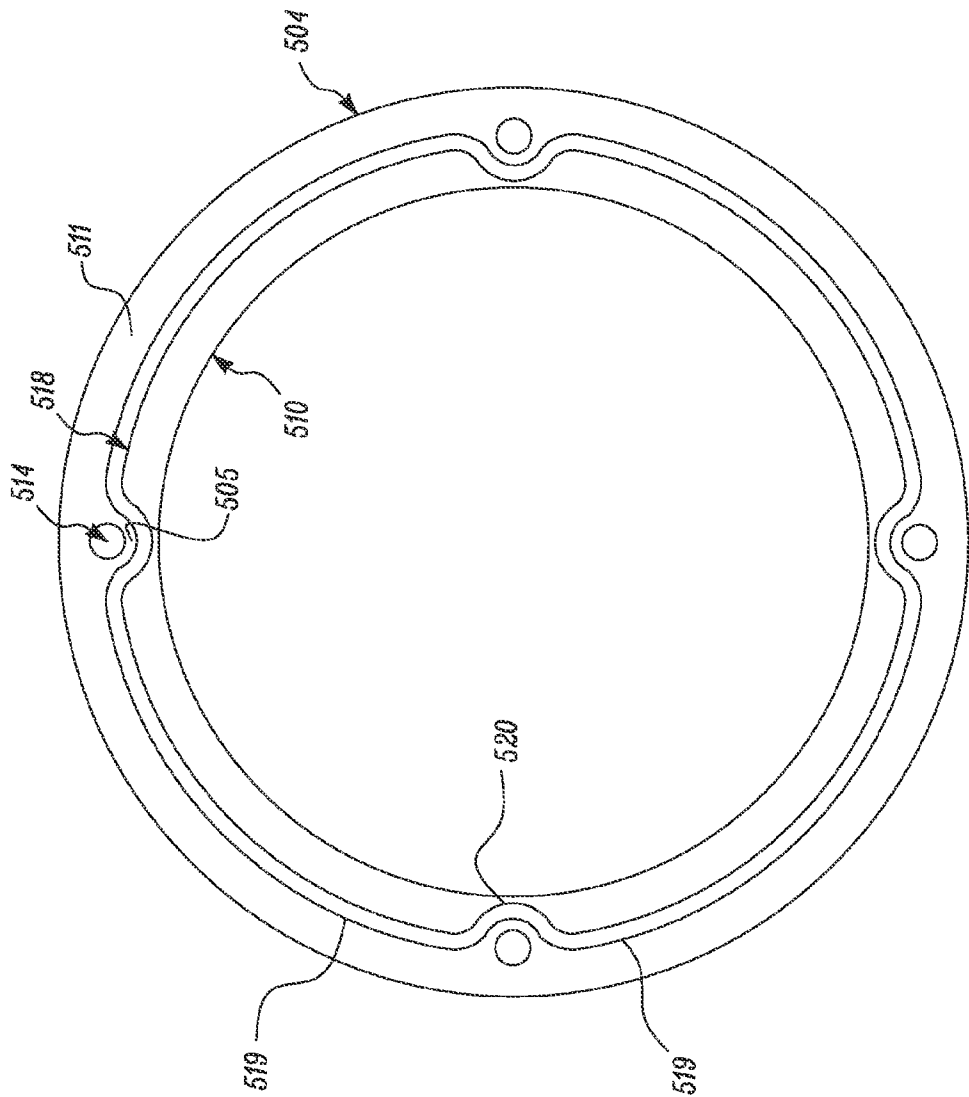


FIG. 5

COMPONENT HAVING A FLANGE DEFINING A GROOVE THEREIN

TECHNICAL FIELD

[0001] The present disclosure relates to a component, and more particularly to a component having a flange defining a groove therein.

BACKGROUND

[0002] Machines typically include various types of assemblies having two mating components which require a sealed interface between them. The sealed interface may prevent leakage of fluid from the assembly. The mating components may include, for example, an oil pan and an engine housing of an engine.

[0003] Various methods and apparatuses have been proposed to affect fluid tight sealing between the mating components. Known solutions include the use of sealants that are provided at the interface between the mating components. An amount of the sealant and a shape of the sealant dispensed between the mating components may be difficult to control. Various geometries may be provided in the two mating components to control the amount and shape of the sealant. However, such geometries may not ensure uniform dispensing of the sealant along the interface. Further, the mating surfaces may require precision machining in order to form such geometries. The precision machining of the mating surfaces may require special tooling arrangements, thereby increasing inventory and manufacturing costs.

[0004] U.S. Publication Application Number 2010/0147253 describes an oil pan for an internal combustion engine. The oil pan includes a body that defines a reservoir cavity. A collector cavity is defined by at least one wall of the body and is provided in fluid communication with the reservoir cavity. An oil supply passage is defined by at least one wall of the body and is in fluid communication with the collector cavity.

SUMMARY OF THE DISCLOSURE

[0005] In one aspect of the present disclosure, a component is provided. The component is configured to bear on a complementary surface. The component includes a flange located on a periphery of the component. The flange of the component defines an extended provided therein. The flange of the component also defines a plurality of apertures therethrough. The plurality of apertures extended through the flange and are structured and arranged to receive fasteners therethrough. Further, the groove on the flange includes first portions and second portions. The first portions of the groove extend between adjoining apertures of the plurality of apertures and the second portions of the groove are detour portions in proximity to the apertures of the plurality of apertures. The groove is structured and arranged to receive a sealant therein. The sealant forms continuous seal along the periphery of the component in response to the flange being pressed against the complementary surface.

[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 perspective view of an exemplary component having a flange;

[0008] FIG. 2 is a top view of the flange shown in FIG. 1, illustrating a groove provided on the flange, according to an embodiment of the present disclosure;

[0009] FIG. 3 is a cross sectional view of the component of FIG. 1 showing a sealant bead provided within the groove;

[0010] FIG. 4 is a cross sectional view of the component of FIG. 1, however illustrated as being bolted to a complementary surface to further illustrate the groove containing a sealant and the component being sealed against the complementary surface; and

[0011] FIG. 5 is a top view of a flange, according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0012] Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or the like parts. FIG. 1 is a perspective view of an exemplary component 100. The component 100 may embody any component used in a machine associated with various industries, such as, construction, mining, automotive, power generation, and the like. In the illustrated embodiment, the component 100 is an oil pan 100 associated with an engine (not shown).

[0013] The engine, associated with the oil pan 100, may be an internal combustion engine such as, for example, a reciprocating piston engine. The engine may be a spark ignition engine or a compression ignition engine. The engine may be fueled by gasoline, diesel, biodiesel, dimethyl ether, alcohol, natural gas, propane, hydrogen, combinations thereof, or any other combustion fuel known in the art.

[0014] The cylinder block 102 (see FIG. 4) of the engine has a plurality of cylinders (not shown). Each of the plurality of the cylinders may be configured for housing a piston (not shown). The piston may be configured to have a translatory movement within the cylinder. The piston may be coupled to an eye end of a connecting rod (not shown). Further, a fork end of the connecting rod may be coupled to a crankshaft (not shown). The connecting rod may be configured to convert the translatory movement of the piston to a rotary movement of the crankshaft.

[0015] The cylinder block 102 of the engine may include a number of passages that allows fluids, such as, engine coolant and/or oil to flow therethrough. The engine coolant is used for cooling the engine components, whereas the oil may be used for lubrication and/or actuation of various engine components, some of which are disclosed above. The oil is generally collected in the oil pan 100 when the engine is not operating, and may be pumped therefrom to flow through the engine components, by an oil pump (not shown). The oil pan 100 is mounted to an underside of a cylinder block 102 of the engine, so that the oil dripping from various engine components gets collected in the oil pan 100.

[0016] The oil pan 100 disclosed herein has a substantially rectangular shape. Further, the oil pan 100 may be made of a metal or a polymer. In one example, the oil pan 100 may be made of steel, such as mild steel. Further, the oil pan 100 may be manufactured using a casting process, although other methods of forming may also be used, if desired. In the illustrated embodiment, the oil pan 100 is embodied as a top open and downwardly closed container.

[0017] Referring to FIG. 1, the oil pan 100 includes a flange 104. The flange 104 extends in an outward direction from an upper periphery 103 of the oil pan 100. The flange 104 has inner and outer surfaces 106, 108. The inner and outer surfaces 106, 108 may be co-planar. Further, the flange 104 has

an upper surface 110. When assembled with the cylinder block 102, the upper surface 110 of the flange 104 is configured to bear against a complementary surface 112 (see FIG. 4) of the cylinder block 102. The upper surface 110 of the flange 104 includes a plurality of apertures 114. Further, the cylinder block 102 of the engine may also include a plurality of apertures 115 (see FIG. 4) corresponding to the apertures 114. The apertures 114 on the flange 104 and the apertures 115 on the cylinder block 102 are configured to receive fasteners 116 (see FIG. 4) therethrough. The fasteners 116 may be any of a bolt, stud, rivet, screw, pin, and the like. The fasteners 116 are configured to connect the cylinder block 102 on top of the oil pan 100.

[0018] FIG. 2 is a top view of the oil pan 100, according to an embodiment of the present disclosure. As illustrated in FIGS. 1 and 2, the flange 104 includes a groove 118 formed therein. The groove 118 forms a continuous loop along the upper surface 110 of the flange 104. A shape of the groove 118 is decided such that the groove 118 holds an optimum amount of a sealant therein, and also conforms to a shape of the sealant configured to be received therein. The groove 118 may have any curved shape, for example, circular or elliptical, such that the groove 118 is devoid of any sharp edges along the cross-section. In one example, the groove 118 may have a depth D_1 to width W_1 ratio of 3:1. However, it should be noted that the depth D_1 to width W_1 ratio may vary based on various factors, such as dimensions of the flange 104 and the complementary surface 112, weight of the oil pan 100, and the like. Further, in an embodiment, the groove 118 may be provided substantially along a center of a width of the upper surface 110. The groove 118 runs between adjoining apertures 114 of the flange 104. In the illustrated embodiment, the groove 118 includes first portions 121 between adjoining apertures 114.

[0019] Further, the groove 118 partly surrounds each of the plurality of apertures 114. Specifically, the groove 118 extends towards an inner end 119 of the flange 104, when the groove 118 passes adjacent to each of the plurality of apertures 114. In the illustrated embodiment, the groove 118 includes second portions 123 (see FIG. 2). The second portions 123 are detour portions provided in proximity to the plurality of apertures 114. More particularly, the second portions 123 extend from two consecutive first portions 121 (see FIG. 2) towards the inner end 119 of the flange 104. The second portions 123 may ensure that the groove 118 is substantially devoid of any sharp turns along the length of the groove 118. In the illustrated embodiment, the first portions 121 are linear. Further, the second portions 123 are curvilinear. However, alternate configurations of the first and second portions 121, 123 are possible within the scope of the present disclosure.

[0020] In an embodiment, the groove 118 may be provided within the flange 104 during the manufacturing process of the oil pan 100. For example, the groove 118 may be formed during casting of the oil pan 100. In another embodiment, the groove 118 may be provided within the flange 104 using a machining process after the oil pan 100 is formed. For example, a ball mill may be used to machine the groove 118 within the flange 104. Alternatively, any other machining processes may also be used for the machining the groove 118.

[0021] As illustrated in FIG. 3, the groove 118, as disclosed herein, is configured to receive a bead 120 of the sealant therein. In one example, a depth d_1 of the bead 120 of the sealant may approximately range between 3 mm to 5 mm. However, the depth d_1 of the bead 120 may vary based on

applications, sealant properties and required sealant volume. The sealant may be configured to seal an interface between the oil pan 100 with the cylinder block 102 in order to enable a leak proof assembly. As shown in the accompanying figures, a portion of the bead 120 is received within the groove 118, whereas the remaining portion of the bead 120 protrudes out from the groove 118. The sealant may be selected from a wide range of available sealants, having properties such as corrosion resistance, adhesion, and/or insolubility with a fluid that may come in contact the sealant. In the illustrated embodiment, the sealant is a curable sealant. The sealant may be in a viscous or liquid state. On curing, the sealant is configured to seal the cylinder block 102 and the oil pan 100. In one example, the sealant may be a Room Temperature Vulcanization (RTV) silicone. Further, the bead 120 of the sealant may be introduced within the groove 118 either manually or by using automated means. In one example, an injection apparatus (not shown) may be used to provide the bead 120 within the groove 118.

[0022] As discussed earlier, the upper surface 110 of the flange 104 is configured to bear on the complementary surface 112 of the cylinder block 102. Referring to FIG. 4, the fasteners 116 are aligned with the plurality of apertures 114, 115 provided on each of the flange 104 and the cylinder block 102 and inserted therewithin. During assembly, the fasteners 116 may be tightened to provide a clamping force on the cylinder block 102 and the oil pan 100. The clamping force may press the upper surface 110 of the flange 104 against the complementary surface 112 of the cylinder block 102.

[0023] On account of the clamping force experienced by the upper surface 110 of the flange 104, the bead 120 of the sealant may spread out around an area surrounding the groove 118, forming a layer 122 of the sealant between the complementary surface 112 of the cylinder block 102 and the upper surface 110 of the flange 104. The sealant may also fill in the gaps formed between the upper surface 110 and the complementary surface 112 on account of surface roughness and/or manufacturing tolerances provided therebetween. It should be noted that a thickness of the layer 122 of the sealant formed between the oil pan 100 and the cylinder block 102 may be based on the depth d_1 of the bead 120 and the amount of clamping force exerted during assembly. On curing, the sealant is configured to seal an interface between the upper surface 110 of the flange 104 and the complementary surface 112 of the cylinder block 102. In one example, the cylinder block 102 may be pressed against the oil pan 100 using a separate clamping apparatus (not shown). The fasteners 116 and the sealant may together ensure a leak proof and secure assembly of the cylinder block 102 and the oil pan 100.

[0024] FIG. 5 is a top view of a flange 504, according to another embodiment of the present disclosure. The flange 504 may be a part of a component, for example, an oil pan. The flange 504 has a cylindrical design. The flange 504 may form a part of the engine. The flange 504 may in outwards from an upper periphery 510 of the component having the flange 504. Further, the flange 504 includes an upper surface 511. The flange 504 includes a plurality of apertures 514 provided therein. The plurality of apertures 514 on each of the flange 504 and a complementary surface (not shown) of a mating component (not shown) are configured to receive fasteners (not shown).

[0025] The flange 504 also includes a groove 518 provided on the upper surface 511 of the flange 504. The groove 518 may be provided along a center of a width of the upper surface

511, and runs between adjacent apertures **514**. In the illustrated embodiment, the groove **518** may include first portions **519** between adjacent apertures **514**. Further, the groove **518** surrounds each of the plurality of apertures **514**. The groove **518** extends towards an inner end **505** of the flange **504**, when the groove **518** passes adjacent to each of the plurality of apertures **514**. In the illustrated embodiment, the groove **518** includes second portions **520** extending from consecutive first portions **519** towards the inner end **505** of the flange **504**. The groove **518** disclosed herein is configured to receive the sealant, in a manner similar to that explained with respect to FIGS. 2-4. The sealant and the fasteners are used to secure the component having the flange **504** with the mating component which may be received thereon. In the illustrated embodiment, the first portions **519** are circular. Further, the second portions **520** are curvilinear. However, alternate configurations of the first and second portions **519**, **520** are possible within the scope of the present disclosure.

INDUSTRIAL APPLICABILITY

[0026] Machines typically include various types of assemblies having two mating components which require a sealed interface between them in order to prevent fluid leakage therefrom. A sealant may also be provided between the mating surfaces of the components to seal the interface. However, controlling an amount of sealant and shape of the sealant dispensed between the mating surfaces generally requires precision machining of one or both of the mating surfaces. Further, the sealant may not be uniformly dispensed between the mating surfaces

[0027] The present disclosure relates to the flanges **104**, **504** provided with the grooves **118**, **518**, respectively. The grooves **118**, **518** receive the curable sealant therein. The grooves **118**, **518** of the present disclosure may form a continuous loop along the respective upper surfaces **110**, **511** of the flanges **104**, **504** in such a manner that the groove **118**, **518** are substantially devoid of any sharp edges or turns. The grooves **118**, **518** may ensure a uniform deposition of the sealant. Further, an amount of the sealant and the shape of the sealant bead may also be controlled due to the predefined cross-section of the grooves **118**, **518**. Thus, the sealant may cure optimally and provide a leak-proof interface between the oil pan **100** and the cylinder block **102**.

[0028] The upper surfaces **110**, **511** of the flanges **104**, **504** and the complementary surface **112** may not require precision

machining as surface roughness of the mating components may provide a better grip for the liquid sealant. Further, the grooves **118**, **518** may be formed in the respective flanges **104**, **504** during a casting process. Alternatively, the grooves **118**, **518** may be formed by a rough machining process, such as ball milling. This may reduce tooling and inventory costs associated with precision machining of the flanges **104**, **504**. Further, a manufacturing time and complexity may also be reduced. Moreover, on curing, the sealant fills in the gaps or voids formed between the mating surfaces on account of surface roughness of the mating surfaces and/or the manufacturing tolerances provided therebetween, thereby providing improved sealing. The grooves **118**, **518**, as disclosed herein, may be incorporated on existing components. One of ordinary skill in the art will appreciate that the solution of the present disclosure may be utilized in connection with a variety of components and is not limited to that of the application disclosed herein.

[0029] While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by those skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machines, systems and methods without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

What is claimed is:

1. A component configured to bear on a complementary surface, the component comprising:
 - a flange located on a periphery of the component and defining an extended groove therein; and
 - a plurality of apertures extended through the flange and being structured and arranged to receive fasteners there-through;
 wherein the groove being formed to include first portions and second portions, the first portions being extended between adjoining apertures of the plurality of apertures and the second portions of the groove being detour portions in proximity to the apertures of the plurality of apertures; and
 - wherein the groove is structured and arranged to receive a sealant therein and form a continuous seal along the periphery of the component in response to the flange being pressed against the complementary surface.

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