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(54) COVER HUB WITH SEALING RING

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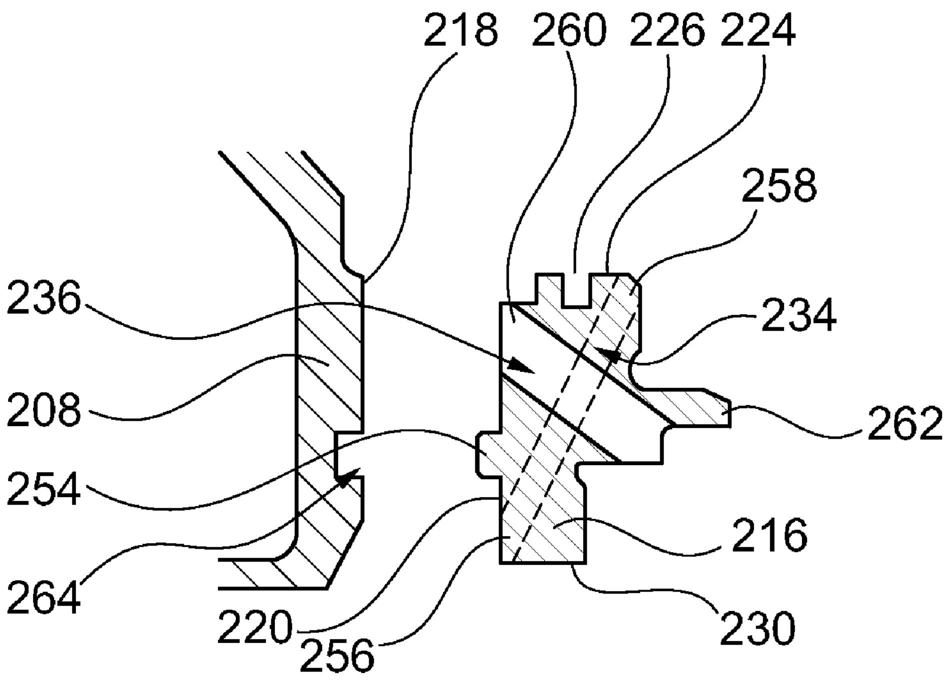
(57) **ABSTRACT**

A cover hub for a torque converter includes a radial wall arranged for axial alignment with a cover of the torque converter, a first circumferential surface including an opening for receiving a seal, and a second circumferential surface disposed radially inside of the first circumferential surface and arranged for sealing to a transmission input shaft. The hub has a first fluid passage exiting the hub at a first axial side of the opening and a second fluid passage, circumferentially offset from the first fluid passage and exiting the hub on a second axial side of the opening, opposite the first axial side, and a first circumferential protrusion for sealing the hub to the cover.



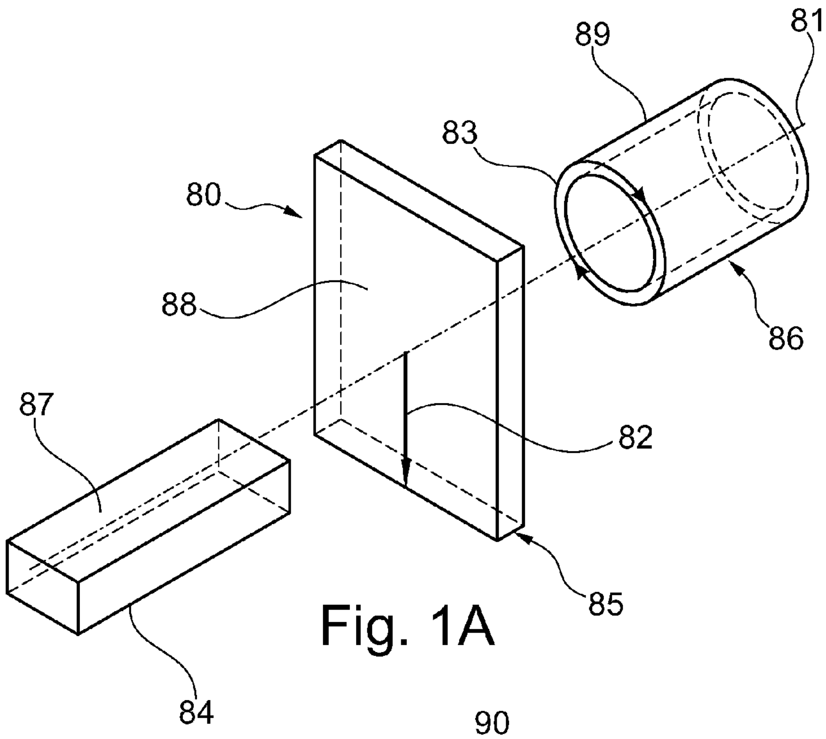


Fig. 1A

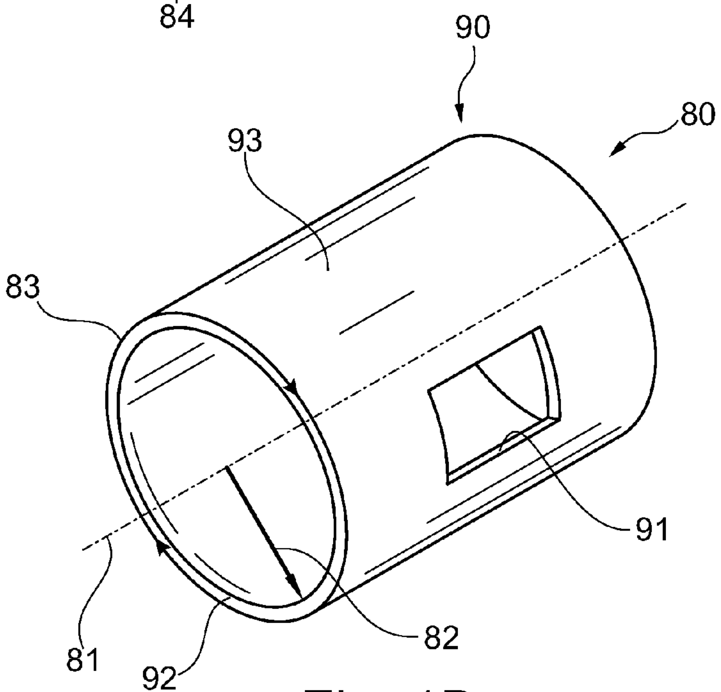


Fig. 1B

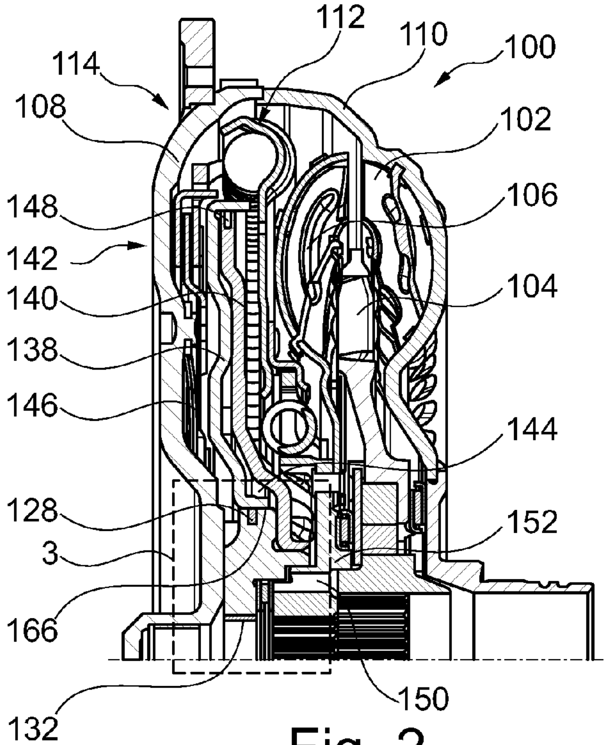


Fig. 2
Prior Art

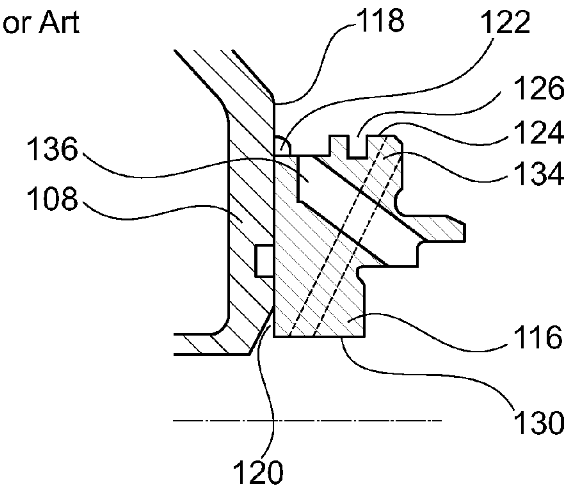


Fig. 3
Prior Art

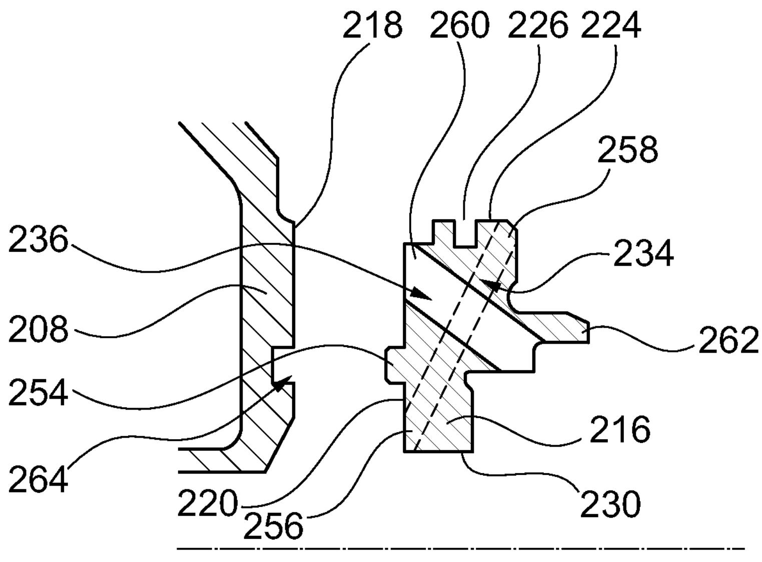

218
260
226
224
258
236
234
208
262
254
216
264
220
256
230

Fig. 4

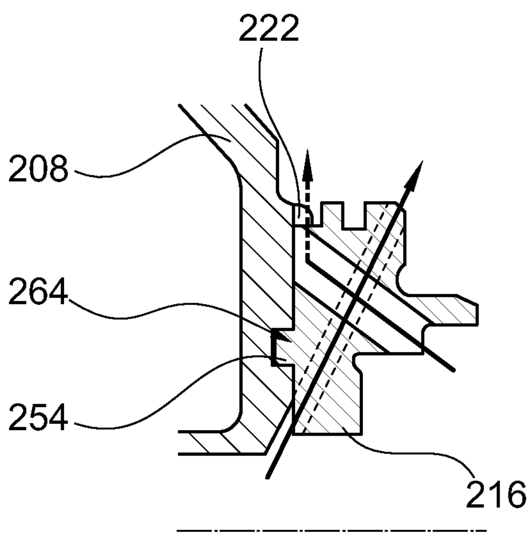

222
208
264
254
216

Fig. 5

COVER HUB WITH SEALING RING

FIELD

[0001] The invention relates generally to a torque converter cover hub, and more specifically to a torque converter cover hub with a sealing ring.

BACKGROUND

[0002] Torque converter cover hubs are known. Examples are shown in U.S. Pat. No. 5,667,043 to Dehrmann et al. and commonly-assigned United States Patent Publication No. 2011/0120829 to Vanni et al.

BRIEF SUMMARY

[0003] Example aspects broadly comprise a cover hub for a torque converter including a radial wall arranged for axial alignment with a cover of the torque converter, a first circumferential surface including an opening for receiving a seal, and a second circumferential surface disposed radially inside of the first circumferential surface and arranged for sealing to a transmission input shaft. The hub has a first fluid passage exiting the hub at a first axial side of the opening, a second fluid passage, circumferentially offset from the first fluid passage and exiting the hub on a second axial side of the opening, opposite the first axial side, and a first circumferential protrusion for sealing the hub to the cover.

[0004] In an example embodiment, at least a portion of the first fluid passage intersects the radial wall or the second circumferential surface. In an example embodiment, at least a portion of the first or second fluid passage intersects the first circumferential surface. In an example embodiment, the hub includes a second circumferential protrusion, axially opposite of the first protrusion, for engaging a clutch seal plate.

[0005] Other example aspects broadly comprise a cover assembly for a torque converter including a cover having a first radial wall with a circumferential recess and a cover hub. The hub has a second radial wall with a first circumferential protrusion extending axially into the recess, a first circumferential surface arranged for sealing to a piston plate for the torque converter, a second circumferential surface disposed radially inside of the first circumferential surface and arranged for sealing to a transmission input shaft, and first and second fluid passages exiting the hub at the first circumferential surface.

[0006] In an example embodiment, the first circumferential surface includes an opening for receiving a seal, at least a portion of the first fluid passage extends from the radial wall or the second circumferential surface and exits the hub at a first axial side of the opening, and at least a portion of the second fluid passage exits the hub on a second axial side of the opening, opposite the first axial side. In an example embodiment, the hub is fixed to the cover by a discontinuous weld. In some example embodiments, the cover assembly includes a piston plate with a third circumferential surface and a seal disposed in the opening for sealing the third circumferential surface to the hub. In an example embodiment, the cover assembly includes a seal plate and the hub includes a second circumferential protrusion extending in an axially opposite direction from the first protrusion and fixed to the seal plate.

[0007] Other example aspects broadly comprise a torque converter including a cover assembly having a cover shell with a first continuous recess, and a cover hub. The cover hub is fixed to the shell by a discontinuous weld and includes a second continuous recess engaged with the first recess to seal the hub to the cover shell. The torque converter also includes a piston plate sealed to the cover hub and a seal plate fixed to the hub. In an example embodiment, the hub has a circumferential surface arranged for sealing to a transmission input shaft, a first passage extending from a first axial side of the circumferential surface, through the hub, to a chamber at least partially formed by the cover shell and the piston plate, and a second passage extending from a second axial side of the circumferential surface, opposite the first axial side, through the hub, to a chamber at least partially formed by the piston plate and the seal plate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The nature and mode of operation of the present invention will now be more fully described in the following detailed description taken with the accompanying drawing figures, in which:

[0009] FIG. **1**A is a perspective view of a cylindrical coordinate system demonstrating spatial terminology used in the present application;

[0010] FIG. **1**B is a perspective view of an object in the cylindrical coordinate system of

[0011] FIG. **1**A demonstrating spatial terminology used in the present application;

[0012] FIG. **2** is a cross-section view of a top half of a prior art torque converter;

[0013] FIG. **3** is a detail view of boxed portion **3** in FIG. **2** with several components removed for clarity;

[0014] FIG. **4** is a detail view of an alternative embodiment of the hub and shell of FIG. **3** including a sealing ring shown before assembly;

[0015] FIG. **5** is a detail view of the hub and shell of FIG. **4** shown after assembly.

DETAILED DESCRIPTION

[0016] At the outset, it should be appreciated that like drawing numbers appearing in different drawing views identify identical, or functionally similar, structural elements. Furthermore, it is understood that this invention is not limited only to the particular embodiments, methodology, materials and modifications described herein, and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the present invention, which is limited only by the appended claims.

[0017] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this invention belongs. Although any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the invention, the following example methods, devices, and materials are now described.

[0018] FIG. **1**A is a perspective view of cylindrical coordinate system **80** demonstrating spatial terminology used in the present application. The present invention is at least partially described within the context of a cylindrical coordinate system. System **80** has a longitudinal axis **81**, used as the reference for the directional and spatial terms that follow. The adjectives "axial," "radial," and "circumferential" are with respect to an orientation parallel to axis **81**, radius **82** (which is orthogonal to axis **81**), and circumference **83**, respectively. The adjectives "axial," "radial" and "circumferential" also are regarding orientation parallel to respective planes. To clarify the disposition of the various planes, objects **84**, **85**, and **86** are used. Surface **87** of object **84** forms an axial plane. That is, axis **81** forms a line along the surface. Surface **88** of object **85** forms a radial plane. That is, radius **82** forms a line along the surface. Surface **89** of object **86** forms a circumferential plane. That is, circumference **83** forms a line along the surface. As a further example, axial movement or disposition is parallel to axis **81**, radial movement or disposition is parallel to radius **82**, and circumferential movement or disposition is parallel to circumference **83**. Rotation is with respect to axis **81**.

[0019] The adverbs "axially," "radially," and "circumferentially" are with respect to an orientation parallel to axis **81**, radius **82**, or circumference **83**, respectively. The adverbs "axially," "radially," and "circumferentially" also are regarding orientation parallel to respective planes.

[0020] FIG. **1**B is a perspective view of object **90** in cylindrical coordinate system **80** of FIG. **1**A demonstrating spatial terminology used in the present application. Cylindrical object **90** is representative of a cylindrical object in a cylindrical coordinate system and is not intended to limit the present invention in any manner. Object **90** includes axial surface **91**, radial surface **92**, and circumferential surface **93**. Surface **91** is part of an axial plane, surface **92** is part of a radial plane, and surface **93** is part of a circumferential plane.

[0021] The following description is made with reference to FIGS. **2-3**. FIG. **2** is a cross-section view of a top half of a prior art torque converter. FIG. **3** is a detail view of boxed portion **3** in FIG. **2** with several components removed for clarity. Prior art torque converter **100** includes impeller **102**, stator **104**, and turbine **106** enclosed within a housing formed by cover shell **108** and impeller shell **110**. During particular operating conditions of converter **100**, clutch and damper assembly **112** may be hydraulically engaged as described below to bypass fluid operation of the impeller, stator, and turbine.

[0022] Cover assembly **114** includes shell **108** and cover hub **116** as shown in more detail in FIG. **3**. Shell **108** includes radial wall **118** and cover hub **116** includes radial wall **120**, axially aligned with wall **118**. By axially aligned, we mean that the walls are lying adjacent to one-another. That is, they are touching. In an example embodiment, the shell and hub may be fixed together by continuous weld **122**, for example, to maintain axial alignment of walls **118** and **120**, and to seal hub **116** to cover **108**.

[0023] Hub **116** includes circumferential surface **124** including opening **126** for receiving seal **128** (FIG. **2**), for example, and surface **130** disposed radially inside of surface **124** and arranged for sealing to a transmission input shaft (not shown) at bushing **132** (FIG. **2**), for example. Fluid passage **134** exits hub **116** to the right of opening **126** as shown in FIG. **3**. Fluid passage **136** exits hub **116** to the left, or the opposite side, of opening **126** as shown in FIG. **3**. Although passages **134** and **136** are shown in the same section view, it should be understood that the passages are circumferentially offset as evidenced by the dashed lines on passage **134** where the passages appear to intersect. That is, the fluid passages are independent of one another so that there is no fluid exchange from passage **134** to passage **136**, or vice versa.

[0024] Clutch and damper assembly **112** includes piston plate **138**, seal plate **140**, and clutch pack **142**. The clutch pack is clamped by the piston plate when pressure in chamber **144** between the piston plate and seal plate is higher than pressure in chamber **146** between the piston plate and the cover shell. Pressurized oil enters chamber **144** through passage **134**, and chamber **146** through passage **136**. Passage **136** may connect to the transmission through orifice **150** in hub **152** and a channel disposed between the input shaft and the stator shaft (not shown), for example. Passage **134** may connect to the transmission through a passage extending along the length of the input shaft, for example.

[0025] Seals **128** and **148**, and piston **138** cooperate to divide chambers **144** and **146**. Similarly, continuous weld **122** seals hub **116** to shell **108** so that pressurized oil directed from the input shaft channel to passage **134** to clamp the clutch cannot leak into chamber **146** by flowing between the hub and the shell. Similarly, the continuous weld prevents higher pressure oil in chamber **146** from leaking into passage **134** when the clutch is unlocked. A continuous weld is expensive and adds additional heat to the hub and shell that may result in distortion or warpage.

[0026] The following description is made with reference to FIGS. **4-5**. FIG. **4** is a detail view of an alternative embodiment of the hub and shell of FIG. **3** including a sealing ring shown before assembly. FIG. **5** is a detail view of the hub and shell of FIG. **4** shown after assembly. Hub **216** includes circumferential surface **224** including opening **226** for receiving seal **128**, for example, arranged for sealing to a piston plate (i.e., piston plate **138** in FIG. **2**). Piston plate **138** includes circumferential surface **166**. In an example embodiment (not shown), seal **128** is disposed in opening **226** for sealing surface **166** to hub **216**. Hub **216** includes circumferential surface **230** disposed radially inside of surface **224** and arranged for sealing to a transmission input shaft in a manner similar to sealing of surface **130** described above.

[0027] Fluid passage **234** exits hub **216** to the right of opening **226** as shown in FIG. **4**. Fluid passage **236** exits hub **216** to the left, or the opposite side, of opening **226** as shown in FIG. **4**. Otherwise stated, passage **236** extends from the right axial side of circumferential surface **230**, through hub **216**, to chamber **146** (FIG. **2**) at least partially formed by cover shell **208** and piston plate **138**. Passage **234** extends from the left axial side of circumferential surface **230**, through hub **216**, to chamber **144** at least partially formed by piston plate **138** and seal plate **140**

[0028] Although passages **234** and **236** are shown in the same section view, it should be understood that the passages are circumferentially offset as evidenced by the dashed lines on passage **234** where the passages appear to intersect. That is, the fluid passages are independent of one another so that there is no fluid exchange from passage **234** to passage **236**, or vice versa.

[0029] Hub **216** includes circumferential protrusion, or sealing ring, **254** for sealing the hub to the cover. By circumferential protrusion, we mean that protrusion **254** is a continuous loop extending from radial surface **220**. Portion **256** of passage **134** intersects radial wall **220** and circumferential surface **230**. Portion **258** of passage **234** intersects circumferential surface **224**. Although only portion **258** is shown to intersect surface **224**, in other embodiments (not shown), portion **260** of passage **236** intersects surface **224**. Hub **216** includes circumferential protrusion **262**, axially opposite of protrusion **254**, for engaging clutch seal plate **140** (FIG. **2**). That is, in a torque converter assembly, seal plate **140** and hub **216** are fixed together at protrusion **262**.

[0030] Cover **208** includes radial wall **218** with circumferential recess, or opening, **264**. Similar to protrusion **254**, recess **264** extends continuously in a circumferential direction from radial surface **218**. As best shown in FIG. **5**, circumferential protrusion **254** extends axially into recess **264**. That is, the protrusion and recess are complementarily shaped such that the protrusion may be assembled into the recess with minimal clearance. Hub **216** is fixed to cover **208** by discontinuous weld **222**. That is, weld **222** does not form a complete ring around hub **216** in the way that weld **122** forms a complete ring around hub **116** to seal the hub to the cover. Because hub **216** includes axial protrusion **254** fitted into cover recess **264**, weld **222** does not need to seal the hub to the cover and can be a series of smaller welds that is less expensive and less prone to distortion when compared with a continuous weld. The tight fit between the hub protrusion and the cover recess acts to seal the components together to prevent fluid exchange as described above. That is, the minimal clearance creates a high resistance to fluid flow between the hub and cover, effectively sealing the hub to the cover.

[0031] Of course, changes and modifications to the above examples of the invention should be readily apparent to those having ordinary skill in the art, without departing from the spirit or scope of the invention as claimed. For example, although the protrusion and recess extend in a circumferential direction, they are not necessarily cylindrical in shape. For example, in some applications, the pair may have a polygonal shape with straight sides and rounded corners. This may be especially important if the particular application necessitates torque transmission through the hub because the polygonal shape limits the torque transmitted through the weld. Although the invention is described by reference to specific preferred and/or example embodiments, it is clear that variations can be made without departing from the scope or spirit of the invention as claimed.

What we claim is:

1. A cover hub for a torque converter comprising:

a radial wall arranged for axial alignment with a cover of the torque converter;

a first circumferential surface including an opening for receiving a seal;

a second circumferential surface disposed radially inside of the first circumferential surface and arranged for sealing to a transmission input shaft;

a first fluid passage exiting the hub at a first axial side of the opening;

a second fluid passage, circumferentially offset from the first fluid passage and exiting the hub on a second axial side of the opening, opposite the first axial side; and,

a first circumferential protrusion for sealing the hub to the cover.

2. The cover hub of claim **1** wherein at least a portion of the first fluid passage intersects the radial wall or the second circumferential surface.

3. The cover hub of claim **1** wherein at least a portion of the first or second fluid passage intersects the first circumferential surface.

4. The cover hub of claim **1** wherein the hub includes a second circumferential protrusion, extending in a direction axially opposite of the first protrusion, for engaging a clutch seal plate.

5. A cover assembly for a torque converter comprising:

a cover including a first radial wall with a circumferential recess; and,

a cover hub including:

a second radial wall with a first circumferential protrusion extending axially into the recess;

a first circumferential surface arranged for sealing to a piston plate for the torque converter;

a second circumferential surface disposed radially inside of the first circumferential surface and arranged for sealing to a transmission input shaft; and,

first and second fluid passages exiting the hub at the first circumferential surface.

6. The cover assembly of claim **5** wherein:

the first circumferential surface includes an opening for receiving a seal;

at least a portion of the first fluid passage extends from the radial wall or the second circumferential surface and exits the hub at a first axial side of the opening; and,

at least a portion of the second fluid passage exits the hub on a second axial side of the opening, opposite the first axial side.

7. The cover assembly of claim **5** wherein the hub is fixed to the cover by a discontinuous weld.

8. The cover assembly of claim **5** further comprising:

a piston plate with a third circumferential surface; and,

a seal disposed in the opening for sealing the third circumferential surface to the hub.

9. The cover assembly of claim **8** further comprising:

a seal plate, wherein the hub includes a second circumferential protrusion, extending in an axially opposite direction from the first protrusion and fixed to the seal plate.

10. A torque converter comprising:

a cover assembly including a cover shell with a first continuous recess and a cover hub, fixed to the shell by a discontinuous weld and including a second continuous recess engaged with the first recess to seal the hub to the cover shell;

a piston plate sealed to the cover hub; and,

a seal plate fixed to the hub.

11. The torque converter of claim **10** wherein the hub further comprises:

a circumferential surface arranged for sealing to a transmission input shaft;

a first passage extending from a first axial side of the circumferential surface, through the hub, to a chamber at least partially formed by the cover shell and the piston plate; and,

a second passage extending from a second axial side of the circumferential surface, opposite the first axial side, through the hub, to a chamber at least partially formed by the piston plate and the seal plate.

* * * * *