The present invention involves a gear assembly of a fuel pump for improved supply of fuel to an automotive engine from a fuel tank. The assembly includes an inner gear and an outer gear matingly cooperating with the inner gear for rotation about an axis. The assembly further includes a pump cover including a cover surface adjacent the inner and outer gears and a pump body including a body surface adjacent the inner and outer gears opposite the pump cover. The cover surface has a primary inlet porting and a secondary outlet porting formed thereon and separated between seal areas. The body surface of the pump body includes a primary outlet porting and a secondary inlet porting separated between seal areas. In use, the inlet portings and the outlet portings of the pump body and the pump cover cooperate together, respectively, such that fuel entering through the inlet portings pass therethrough at a rate at which the gear assembly moves. Also, the outlet portings of the pump body and the pump cover cooperate together to allow fuel to pass therethrough at the rate at which the gear assembly moves.
GEROTOR FUEL PUMP HAVING PRIMARY AND SECONDARY INLET AND OUTLET PORTINGS

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a gear assembly of a gerotor fuel pump for improved efficiency in supplying fuel to an automotive engine from a fuel tank.

[0002] Gerotor fuel pumps that have a gear assembly with a ring slidably disposed around the outer diameter have been widely used in automotive applications. Such fuel pumps have been used because of their low cost and relatively high efficiency.

[0003] However, the efficiency of many such fuel pumps and problems associated therewith can still further be improved. For example, many current gerotor fuel pumps experience pressure pulsation at an inlet area adjacent the bottom of the fuel tank of a vehicle. As a result, relatively high noise is experienced between the tank and the fuel pump. Additionally, in many situations, such gerotor fuel pumps may experience relatively high acceleration and pressure fluctuations therethrough potentially resulting in cavitations and reduced efficiency. Moreover, manufacturers of fuel pumps are also concerned about avoiding potential hydraulic lock when the fuel is at a high pressure within the pump.

BRIEF SUMMARY OF THE INVENTION

[0004] Thus, it is one aspect of the present invention to provide a gerotor fuel pump for improved efficiency in supplying fuel to an automotive engine from a fuel tank, wherein the gerotor fuel pump includes an improved porting system to reduce local velocity acceleration within the fuel pump for avoiding potential cavitations, pressure pulsations, and relatively high noise.

[0005] It is another aspect of the present invention to provide a gerotor or gear assembly having a porting system for improved supply of fuel to an automotive engine from a fuel tank. In one embodiment, the gear assembly includes an inner gear and an outer gear matingly cooperating with the inner gear for rotation about an axis. The assembly further includes a pump cover having a cover surface adjacent the inner and outer gears and a pump body having a body surface adjacent the inner and outer gears opposite the pump cover. The cover surface has an inlet aperture formed therethrough. The cover surface further has a primary inlet porting and a secondary outlet porting formed thereon wherein the primary inlet porting is formed from the inlet aperture at a first inlet end and radially extends therealong at a second inlet end. The secondary outlet porting radially extends between first and second outlet ends.

[0006] In another aspect of the present invention, the gerotor or gear assembly having a porting system includes an inlet porting and an outlet porting, wherein the inlet porting has a greater length than the outlet porting to reduce inlet fuel velocity, prevent potential cavitations, and reduce noise.

[0007] The body surface of the pump body has an outlet aperture formed therethrough. The body surface further has a primary outlet porting and a secondary inlet porting formed thereon. The primary outlet porting is formed at the outlet aperture. The primary and secondary inlet portings are configured to allow fuel to pass therethrough at a rate at which the gear assembly moves. The primary outlet porting radially extends therealong in alignment with the secondary outlet porting. The secondary inlet porting is in alignment with the primary inlet porting.

[0008] In another aspect, the present invention allows for improved efficiency by allowing fuel to pass therethrough at a rate corresponding to the rate at which the gear assembly moves.

[0009] It is yet another aspect of the present invention to provide a gerotor fuel pump for improved supply of fuel to an automotive engine from a fuel tank. The fuel pump comprises a pump housing and a motor mounted within the housing and having a shaft extending therefrom. The fuel pump further includes the gear assembly mentioned above. The primary outlet porting is formed at the outlet aperture and in alignment with the secondary outlet porting. The primary and secondary inlet portings are configured to allow fuel to pass therethrough at a rate corresponding to the rate at which the gear assembly rotates. The primary and secondary outlet portings are configured to allow fuel to pass therethrough at a rate corresponding to the rate at which the gear assembly rotates. The primary outlet porting radially extends therealong in alignment with the secondary outlet porting. The secondary inlet porting is in alignment with the primary inlet porting.

[0010] The following description of the preferred embodiment of the present invention is not intended to limit the scope of the invention to this preferred embodiment, but rather enable any person skilled in the art to make and use the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a cross-sectional view of a fuel pump having a gear assembly in accordance with one embodiment of the present invention;

[0012] FIG. 2a is an exploded inlet view of the gear assembly in FIG. 1;

[0013] FIG. 2b is an exploded exit view of the gear assembly in FIG. 1;

[0014] FIG. 3a is a cover surface view of a pump cover of the gear assembly in accordance with one embodiment of the present invention;

[0015] FIG. 3b is a cross-sectional view of the pump cover taken along lines 3b-3b in FIG. 3a;

[0016] FIG. 3c is another cross-sectional view of the pump cover taken along lines 3c-3c in FIG. 3a;

[0017] FIG. 3d is yet another cross-sectional view of the pump cover taken along lines 3d-3d in FIG. 3a;

[0018] FIG. 4a is a body surface view of a pump cover of the gear assembly in accordance with one embodiment of the present invention;

[0019] FIG. 4b is a cross-sectional view of the pump body taken along lines 4b-4b in FIG. 4a;

[0020] FIG. 4c is another cross-sectional view of the pump body taken along lines 4c-4c in FIG. 4a;

[0021] FIG. 4d is yet another cross-sectional view of the pump body taken along lines 4d-4d in FIG. 4a;
DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, a fuel pump of the present invention is generally shown at 10. The fuel pump 10 includes a housing 12 and a motor 14 mounted within the housing 12. Preferably, the motor 14 is an electric motor with a shaft 18 extending therefrom. A gerotor or gear assembly 20 having inner and outer gears is fitted onto the shaft 18 and is encased within the pump housing 12 between a pump body 22 and a pump cover 24. The gerotor assembly 20 fits onto the shaft 18 such that the assembly is free to move axially along the shaft 18 and rotates with the shaft 18. Therefore, the gerotor assembly “float” between the pump cover 24 and the pump body 22. The fuel pump is of a conventional type which is further described in U.S. Pat. No. 6,113,360 and U.S. patent application Ser. No. 10/256,359 which are assigned to the same assignee as the present application and are hereby incorporated by reference into the present application.

The gerotor assembly 20 has a central axis which is coincident with the axis of the shaft 18. The shaft 18 passes through a shaft opening 26 in the pump body 22, through the gear assembly 20, into a cover recess 28, and abuts a thrust button 30. The shaft 18 is journaled within a bearing 32. The pump body 22 has a fuel outlet (not shown) leading from an outlet porting 82. Pressurized fuel is discharged through the fuel outlet (not shown) and cools the motor 14 while passing over the motor 14 to a pump outlet 42 at an end of the pump 10 which is axially opposite a fuel inlet 44.

As shown in FIGS. 2a and 2b, the gear assembly 20, in this embodiment, has a lifting and lubricating feature for the fuel pump 10. The gear assembly 10 includes an inner gear 50 and an outer gear 52 which is disposed about the outer diameter of the inner gear 50. The inner gear 50 and the outer gear 52 are in camming relationship to cooperate with each other for supplying fuel to the automotive engine from the fuel tank. As will be described in greater detail below, the inner and outer gears 50, 52 are both toothed. The inner gear 50 is toothed along its outer diameter and the outer gear 52 is toothed along an inner wall to cooperate with the inner gear 50. The gear assembly further includes a cram ring 54 which is slideably disposed about the outer diameter of the outer gear. As shown, the height of the cram ring 54 determines the distance between the pump body 22 and the pump cover 24. FIGS. 2a and 2b illustrate an exploded view of the gear assembly 20. As shown, the pump cover 24 generally includes a primary inlet porting 84, seal areas 49 and 51, and a secondary outlet porting 86. The primary inlet porting 84 is a low pressure fuel side of the pump cover 24 and may be defined by the configuration of the gear assembly. The secondary outlet porting 86 is a high pressure fuel side of the pump cover. As shown, each of the seal areas 49, 51 is formed between one of the portings 84, 86.

As shown in FIGS. 2a-3d, the pump cover 24 includes a cover surface 25 adjacent the inner and outer gears 50, 52. Specifically, the cover surface 25 is adjacent the inner gear cover face and the outer gear cover face. The cover surface 25 has an inlet aperture 27 and has a primary inlet porting 84 and a secondary outlet porting 86 formed thereon. The primary inlet porting 84 is formed from the inlet aperture 27 at a first inlet end 31 and radially extends therealong at a second inlet end 33. The secondary outlet porting 86 radially extends between first and second outlet ends 35, 37. The primary inlet porting 84 has a radial width which increases toward the second inlet end 33. The primary inlet porting 84 further has a first depth at the first inlet end 31 and decreases toward the second inlet end 33 to a second depth as it extends along the cover surface. Thus, the primary inlet porting 84 has a varying width and a varying depth. In this embodiment, the primary inlet porting 84 has a depth of about 4.0 millimeters at the first inlet end 31 and tapers or decreases to about 2.0 millimeters at the second inlet end 33. The secondary outlet porting 86 has a depth of about 1.0 millimeters, having a substantially constant depth. As shown, the primary inlet porting 84 and the secondary outlet porting 86 of the pump cover 24 are separated by seal areas 88, 89.

As shown in FIGS. 4a-4d, the pump body 22 generally includes a secondary inlet porting 80, seal areas 47 and 48, and a primary outlet porting 82 formed on the pump body surface. The secondary inlet porting 80 is a low pressure fuel side of the pump body 22 and may be defined by the configuration of the gear assembly. The primary outlet porting 82 is a high pressure fuel side of the pump body 22. As shown, each of the seal areas 47, 48 is formed between one of the portings 80, 82.

The pump body 22 includes a body surface 41 adjacent the inner and outer gears 50, 52 opposite the pump cover 24. Specifically, the body surface 41 is adjacent the inner gear body face and the outer gear body face. The body surface 41 has an outlet aperture 43 formed therethrough. The body surface 41 further has a primary outlet porting 82 and a secondary inlet porting 80 formed thereon. The primary outlet porting 82 is formed at the outlet aperture 43 and is in alignment with the secondary outlet porting 86. The primary and secondary inlet portings 84, 80 are configured to allow fuel to pass therethrough at a rate corresponding to the rate at which the gear assembly moves or rotates. The primary outlet porting 82 radially extends therealong in alignment with the secondary outlet porting 86. The secondary inlet porting 80 is in alignment with the primary inlet porting 84.

In this embodiment, the primary and secondary outlet portings 82, 86 are configured to allow fuel to pass
thereafter at a rate corresponding to the rate at which the gear assembly rotates. The primary outlet porting 82 has a radial width which decreases toward the second outlet end 37. The primary outlet porting also has a first depth at the first outlet end 35 and flares or increases to the second outlet end 37 to a second depth. Thus, the primary outlet porting 82 has a varying width and a varying depth as it extends along the body surface. In this embodiment, the primary outlet porting 82 has a depth of about 2.0 millimeters at the first outlet end 35 and increases to about 4.0 millimeters at the second outlet end 37. The primary outlet porting and the secondary inlet porting cooperate to allow fuel to pass therethrough at a rate at which the gear assembly rotates. The secondary inlet porting 80 has a depth of about 1.0 millimeters, having a substantially constant depth. In this embodiment, each of the seal areas mentioned above is about 0.93 pitch length of the inner gear or less than 1.0 pitch length of the inner gear.

[0037] The inlet portings and the outlet portings have predetermined pitch values so that during normal operations, the fuel pump allows fuel to pass therethrough at a rate corresponding to the rate at which the gear assembly rotates. The inlet portings have a greater pitch value than the outlet portings. For example, the inlet and outlet portings have a pitch value ratio of approximately 3:2, wherein the pitch value ratio is based on the pitch of the inner gear. In this embodiment, the inlet portings have a pitch value of 2.54 and the outlet portings have a pitch value of 1.60.

[0038] As shown in FIGS. 2a and 2b, the inner gear 50 has a substantially disc shape with an outside camming surface 56 which is a first toothed surface. The inner gear further includes an inner cover face 58 and an inner body face 60. The inner gear 50 further has a center aperture 62 formed therethrough to define an axis A of rotation which is perpendicular to the inner cover face 58 and the inner body face 60.

[0039] In this embodiment, the inner cover face 58 has a plurality of inner concave grooves 64 radially formed thereon and spaced apart from each other to provide lifting or floating of the inner gear 50 when rotating about axis A. In this embodiment, the plurality of inner concave grooves 64 are radially aligned with each other on the inner cover face 58 of the inner gear 50. As shown in FIGS. 5a-5c, each of the inner concave grooves 64 is radially formed on the inner cover face 58 and extends, for example about 30°-120° and preferably about 90°, therewithin based on the number of inner concave grooves. In this embodiment, each of the inner concave grooves 64 is separated by a flat or planar surface in each end, for example about 5°-20° and preferably about 10°, therewithin on the inner cover face 58 of the inner gear 50 depending on the number of inner concave grooves.

[0040] As shown, the inner body face 60 has a plurality of inner convex grooves 66 radially formed thereon and spaced apart from each other. Each of the inner convex grooves 66 is opposite with a respective inner concave groove 64 of the inner cover face 58. In this embodiment, each of the inner convex grooves 66 is formed on the inner body face 60 of the inner gear 50 and radially extends, for example about 30°-120° and preferably about 90°, therewithin depending on the number of inner convex grooves. Each of the inner convex grooves 66 are convexly formed, for example about 5°-60° and preferably about 30° on the end with about 30° flat on the middle (see FIG. 5c), on the inner body face 60 of the inner gear 50 based on the number of inner convex grooves.

[0041] In this embodiment, the inner gear includes three inner concave grooves and three inner convex grooves. However, it is to be understood that the plurality of inner concave grooves and the plurality of inner convex grooves may include any number of groove greater than one groove formed on the inner gear without falling beyond the scope or spirit of the present invention.

[0042] As shown, the inner gear 52 further includes a plurality of exit holes 68 formed therethrough and spaced apart between each of the inner concave grooves 64. In this embodiment, each of the exit holes 68 is formed through one of the inner convex grooves 66 and extends, for example about 30°, therewithin.

[0043] As shown in FIGS. 2, 6, and 7, the outer gear 52 has a substantially planar shape. The outer gear 52 includes an annular wall 70 having an inside camming surface 72. Inside camming surface 72 cammingly engages about the outside camming surface 56 of the inner gear 50 to matingly cooperate with the inner gear 50 for rotation about the axis A. As shown, the inside camming surface 72 is a second toothed surface which matingly cooperates with the first toothed surface of the outside camming surface 56. In this embodiment, the outer gear has one more tooth than the inner gear. As shown, the inner gear and the outer gear are off-center from each other. In this embodiment, during normal use when the gears rotate, the camming surfaces of the gears cooperate such that the cavities 38 changes the volume between the outer and the inner gear and that the number of separate cavities are equal to the number of the teeth of the inner gear.

[0044] The outer gear 52 has an outer cover surface 74 and an outer body surface 76. In this embodiment, the outer cover surface 74 has a plurality of outer concave grooves 78 radially formed thereon and spaced apart from each other to provide improved lifting or floating of the outer gear 52 when rotating about the axis A. In this embodiment, each of the outer concave grooves 78 extends about 17° about the outer cover surface 74. As shown, each of the outer concave grooves 78 is concavely formed on the outer cover surface 74 of the outer gear 52 and extends about 17° thereabout. In this embodiment, the plurality of the outer concave grooves are radially aligned with each other on the outer cover surface of the outer gear.

[0045] Thus, the outside camming surface 56 has teeth formed radially thereon and the inside camming surface 72 has teeth formed radially thereon. The teeth of the inner gear 50 is configured to matingly cooperate with the teeth of the outer gear 52 for rotation of the axis A. As shown, the teeth of the outer gear 52 is greater in number than the teeth of the inner gear 52. For example in this embodiment, the inner gear has six teeth while the outer gear has seven teeth. This allows rotation of the outer gear 52 about the inner gear 50 during normal operation of the fuel pump. As shown, the c. ring 54 is slidable disposed about the outer gear 52.

[0046] As shown in FIGS. 2 and 7, pumping cavities 38 are formed between inside camming surface 72 of outer gear 52 and outside camming surface 56 of the inner gear 50. In operation, when the gear assembly rotates, the primary inlet...
porting 84 of the pump cover and the secondary inlet porting 80 of the pump body feed fuel to the cavities at which volumes increase. Moreover, the primary outlet porting 82 of the pump body and the secondary outlet porting 86 of the pump cover receive fuel from the cavities, at which volumes are decreases, and deliver fuel to the outlet.

[0047] The gerotor assembly is preferably made of powered metal, or sintered metal, for example, sintered Nickel steel. It is to be understood that the gerotor assembly could also be made from other non-plastic materials known to those skilled in the art such as aluminum or steel. The fuel pump can be mounted within a fuel tank (not shown) or, alternatively, can be mounted in-line between the fuel tank and the engine of the vehicle.

[0048] It is to be understood that the inner gear and the outer gear are mentioned above in accordance with one embodiment of the present invention. It is understood that the lifting feature mentioned above of the inner and outer gears are not required in the present invention. Thus, other embodiments without concave and convex grooves do not fall beyond the scope or spirit of the present invention.

[0049] The foregoing discussion discloses and describes two preferred embodiments of the invention. One skilled in the art will readily recognize from such discussion, and from the accompanying drawings and claims, that changes and modifications can be made to the invention without departing from the scope of the invention as defined in the following claims. The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

1. A gear assembly of a fuel pump for supplying fuel to an automotive engine from a fuel tank, the assembly comprising:
   an inner gear;
   an outer gear matingly cooperating with the inner gear for rotation about an axis;
   a pump cover including a cover surface adjacent to the inner and outer gears, the cover surface having an inlet aperture formed therethrough, the cover surface having a primary inlet porting and a secondary outlet porting formed thereon, the primary inlet porting being formed from the inlet aperture at a first inlet end and radially extending therealong at a second inlet end, the secondary outlet porting radially extending between first and second outlet ends;
   a pump body including a body surface adjacent the inner and outer gears opposite the pump cover, the body surface having an outlet aperture formed therethrough, the body surface having a primary outlet porting and a secondary inlet porting formed thereon, the primary outlet porting being formed at the outlet aperture and in alignment with the secondary outlet porting, the primary and secondary inlet portings being configured to allow fuel to pass therethrough at a rate at which the gear assembly moves, the primary outlet porting radially extending therealong in alignment with the secondary outlet porting, the secondary inlet porting being in alignment with the primary inlet porting.

2. The assembly of claim 1 wherein the primary and secondary outlet portings are configured to allow fuel to pass therethrough at the rate at which gear assembly rotates.

3. The assembly of claim 1 wherein the inner gear has a substantially disc shape with an outside camming surface and having an inner gear cover face and an inner gear body face.

4. The assembly of claim 3 wherein the outer gear has an annular wall having an inside camming surface to matingly cooperate with the outside camming surface of the inner gear for rotation about an axis, the outer gear having an outer gear cover face and an outer gear body face.

5. The assembly of claim 4 wherein the cover surface is adjacent the inner gear cover face and the outer gear cover face.

6. The assembly of claim 1 wherein the inner gear has a substantially disc shape with an outside camming surface and having an inner gear cover face and an inner gear body face, the inner gear having a center aperture formed therethrough defining an axis of rotation perpendicular to the inner gear cover face and the inner gear body face.

7. The assembly of claim 6 wherein the outer gear has a substantially planar shape, the outer gear including an annular wall having an inside camming surface slidably engaging about the outside camming surface to matingly cooperate with the inner gear for rotation about the axis, the outer gear having an outer gear cover face and an outer gear body face.

8. The assembly of claim 1 wherein the primary inlet porting has a radial width increasing toward the second inlet end.

9. The assembly of claim 8 wherein the primary inlet porting has a first depth at the first inlet end and decreasing toward the second inlet end to a second depth.

10. The assembly of claim 1 wherein the primary inlet porting has a first varying width and a first varying depth.

11. The assembly of claim 1 wherein the primary inlet porting has a depth of about 4.0 millimeters at the first inlet end and decreasing to about 2.0 millimeters at the second inlet end.

12. The assembly of claim 1 wherein the secondary outlet porting has a depth of about 1.0 millimeters.

13. The assembly of claim 1 wherein the secondary outlet porting has a substantially constant depth.

14. The assembly of claim 4 wherein the body surface is adjacent the inner gear body face and the outer gear body face.

15. The assembly of claim 1 wherein the primary outlet porting has a radial width decreasing toward the second outlet end.

16. The assembly of claim 15 wherein the primary outlet porting has a third depth at the first outlet end and increasing to the second outlet end to a fourth depth.

17. The assembly of claim 1 wherein the primary outlet porting has a second varying width and a second varying depth.

18. The assembly of claim 1 wherein the primary outlet porting has a depth of about 2.0 millimeters at the first outlet end and increasing to about 4.0 millimeters at the second outlet end.

19. The assembly of claim 1 wherein the secondary inlet porting has a depth of about 1.0 millimeters.

20. The assembly of claim 1 wherein the secondary inlet porting has a substantially constant depth.
21. The assembly of claim 1 wherein the primary inlet porting and the secondary outlet porting of the pump cover and the primary outlet porting and the secondary inlet porting of the pump body are separated by seal areas.

22. The assembly of claim 21 wherein each of the seal areas is about 0.93 pitch length of the inner gear.

23. A gear assembly for a fuel pump for supplying fuel to an automotive engine from a fuel tank, the assembly comprising:

an inner gear including a substantially disc shape with an outside camming surface and having an inner gear cover face and an inner gear body face;

an outer gear including an annular wall having an inside camming surface to matingly cooperate with the outside camming surface of the inner gear for rotation about an axis, the outer gear having an outer gear cover face and an outer gear body face;

a pump cover including a cover surface adjacent the inner gear cover face and the outer gear cover face, the cover surface having an inlet aperture formed therethrough, the cover surface having a primary inlet porting and a secondary outlet porting formed thereon, the primary inlet porting being formed from the inlet aperture at a first inlet end and radially extending therealong at a second inlet end, the secondary outlet porting radially extending between first and second outlet ends;

a pump body including a body surface adjacent the inner gear body face and the outer gear body face, the body surface having an outlet aperture formed therethrough, the body surface having a primary outlet porting and a secondary inlet porting formed thereon, the primary outlet porting being formed at the outlet aperture and in alignment with the secondary outlet porting, the primary outlet porting radially extending therealong at a second inlet end, and the secondary outlet porting radially extending between first and second outlet ends; and

therealong at a second inlet end, the secondary outlet porting radially extending between first and second outlet ends,

a pump body mounted within the housing and having a bore through which the shaft extends, the pump body including a body surface adjacent the inner and outer gears opposite the pump cover, the body surface having an outlet aperture formed therethrough, the body surface having a primary outlet porting and a secondary inlet porting formed thereon, the primary outlet porting being formed at the outlet aperture and in alignment with the secondary outlet porting, the primary and secondary inlet portings being configured to allow fuel to pass therethrough at a rate at which the gear assembly rotates, the primary outlet porting radially extending therealong in alignment with the secondary outlet porting, the secondary inlet porting being in alignment with the primary outlet porting, the primary and secondary inlet portings being configured to allow fuel to pass therethrough at a rate at which the gear assembly rotates.

24. The assembly of claim 22 wherein the primary and secondary outlet portings are configured to allow fuel to pass therethrough at the rate at which the gear assembly rotates.

25. A gerotor fuel pump for supplying fuel to an automotive engine from a fuel tank, the fuel pump comprising:

a pump housing;

a motor mounted within the housing and having a shaft extending therefrom;

an inner gear disposed within the housing;

an outer gear disposed within the housing and matingly cooperating with the inner gear for rotation about an axis;

a pump cover mounted within an end of the housing and including a cover surface adjacent the inner and outer gears, the cover surface having an inlet aperture formed therethrough, the cover surface having a primary inlet porting and a secondary outlet porting formed thereon, the primary inlet porting being formed from the inlet aperture at a first inlet end and radially extending therealong at a second inlet end, the secondary outlet porting radially extending between first and second outlet ends;

a pump body mounted within the housing and having a bore through which the shaft extends, the pump body including a body surface adjacent the inner and outer gears opposite the pump cover, the body surface having an outlet aperture formed therethrough, the body surface having a primary outlet porting and a secondary inlet porting formed thereon, the primary outlet porting being formed at the outlet aperture and in alignment with the secondary outlet porting, the primary and secondary inlet portings being configured to allow fuel to pass therethrough at a rate at which the gear assembly rotates, the primary outlet porting radially extending therealong in alignment with the secondary outlet porting, the secondary inlet porting being in alignment with the primary outlet porting, the primary and secondary inlet portings being configured to allow fuel to pass therethrough at a rate at which the gear assembly rotates.

26. The fuel pump of claim 25 wherein the primary and secondary outlet portings are configured to allow fuel to pass therethrough at the rate at which the gear assembly rotates.

27. The fuel pump of claim 25 wherein the inner gear has a substantially disc shape with an outside camming surface and having an inner gear cover face and an inner gear body face.

28. The fuel pump of claim 27 wherein the outer gear has an annular wall having an inside camming surface to matingly cooperate with the outside camming surface of the inner gear for rotation about an axis, the outer gear having an outer gear cover face and an outer gear body face.

29. The fuel pump of claim 28 wherein the cover surface is adjacent the inner gear cover face and the outer gear cover face.

30. The fuel pump of claim 25 wherein the inner gear has a substantially disc shape with an outside camming surface and having an inner gear cover face and an inner gear body face, the inner gear having a center aperture formed therethrough defining an axis of rotation perpendicular to the inner gear cover face and the inner gear body face.

31. The fuel pump of claim 30 wherein the outer gear has a substantially planar shape, the outer gear including an annular wall having an inside camming surface slidably engaging about the outside camming surface matingly cooperate with the inner gear for rotation about the axis, the outer gear having an outer gear cover face and an outer gear body face.

32. The fuel pump of claim 25 wherein the primary inlet porting has a radial width increasing toward the second inlet end.

33. The fuel pump of claim 32 wherein the primary inlet porting has a first depth at the first inlet end and decreasing toward the second inlet end to a second depth.

34. The fuel pump of claim 25 wherein the primary inlet porting has a first varying width and a first varying depth.

35. The fuel pump of claim 25 wherein the primary inlet porting has a depth of about 4.0 millimeters at the first inlet end and decreasing to about 2.0 millimeters at the second inlet end.

36. The fuel pump of claim 25 wherein the secondary outlet porting has a depth of about 1.0 millimeters.

37. The fuel pump of claim 25 wherein the secondary outlet porting has a substantially constant depth.
38. The fuel pump of claim 28 wherein the body surface is adjacent the inner gear body face and the outer gear body face.

39. The fuel pump of claim 25 wherein the primary outlet porting has a radial width decreasing toward the second outlet end.

40. The fuel pump of claim 39 wherein the primary outlet porting has a third depth at the first outlet end and increasing to the second outlet end to a fourth depth.

41. The fuel pump of claim 25 wherein the primary outlet porting has a second varying width and a second varying depth.

42. The fuel pump of claim 25 wherein the primary outlet porting has a depth of about 2.0 millimeters at the first outlet end and increasing to about 4.0 millimeters at the second outlet end.

43. The fuel pump of claim 25 wherein the secondary inlet porting has a depth of about 1.0 millimeters.

44. The fuel pump of claim 25 wherein the secondary inlet porting has a substantially constant depth.

45. The fuel pump of claim 25 wherein the primary inlet porting and the secondary outlet porting of the pump cover and the primary outlet porting and the secondary inlet porting of the pump body are separated by seal areas.

46. The fuel pump of claim 45 wherein each of the seal areas is about 0.93 pitch length of the inner gear.

47. The assembly of claim 1 wherein the inlet portings have a first pitch value and the outlet portings have a second pitch value, wherein the first pitch value is greater than the second pitch value.

48. The assembly of claim 47 wherein the first pitch value and the second pitch value are at a pitch value ratio of about 3:2.

49. The gear assembly of claim 23 wherein the inlet portings have a first pitch value and the outlet portings have a second pitch value, the first pitch value being greater than the second pitch value.

50. The gear assembly of claim 49 wherein the first pitch value and the second pitch value are at a pitch value ratio of about 3:2.

51. The gerotor fuel pump of claim 25 wherein the inlet portings have a first pitch value and the outlet portings have a second pitch value, the first pitch value being greater than the second pitch value.

52. The gerotor fuel pump of claim 51 wherein the first pitch value and the second pitch value have a pitch value ratio of about 3:2.

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