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#### (54) FILTER ASSEMBLY

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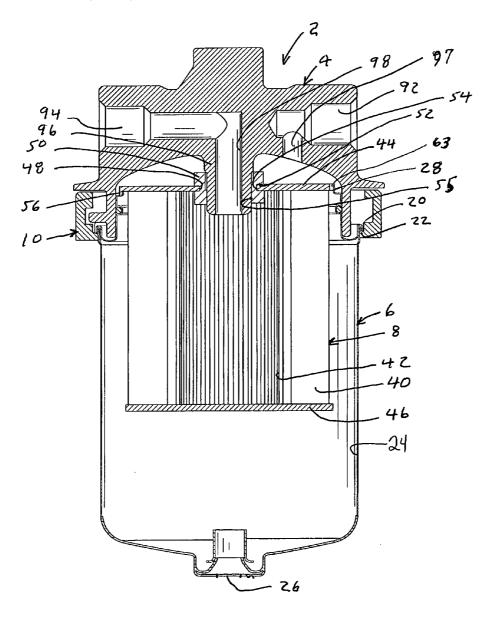
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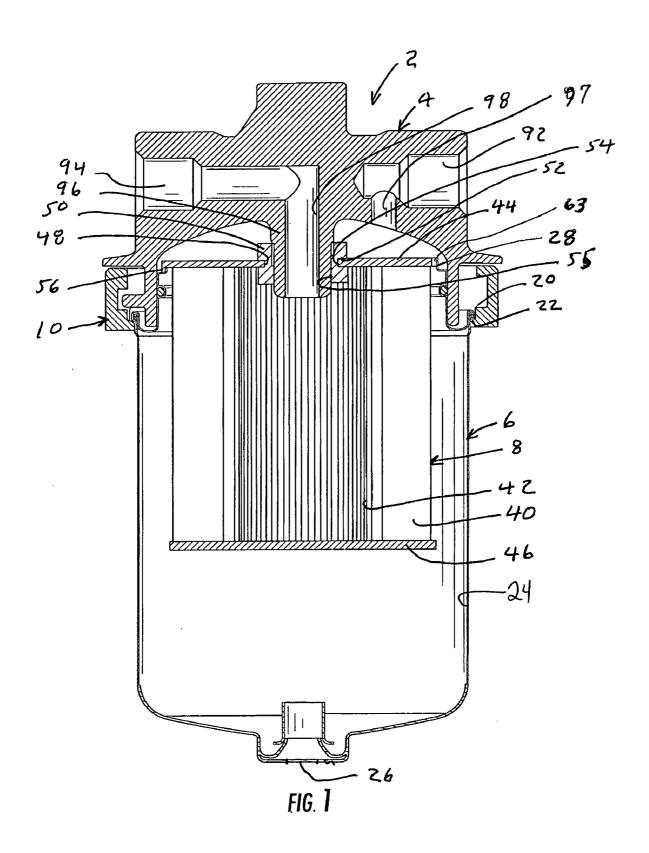
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## (57) ABSTRACT

A fuel filter assembly includes a header and a can-shaped housing removeably attached to the header. The can-shaped housing has an upper rim portion provided with a plurality of notches therein. A filter unit has an upper end cap provided with a plurality of tabs extending from the periphery and positioned within the notches of the housing. The spacing of the notches about the axis of the housing must be the same as the spacing of the tabs about the axis of the filter unit to permit the filter unit and housing to be properly assembled, thereby preventing the use of an incorrect filter unit within the housing. Additionally, the header has a plurality of key slots that receive the tabs on the filter unit. The spacing of the key slots and tabs must be the same to permit the housing and received filter unit to be properly connected to the header.





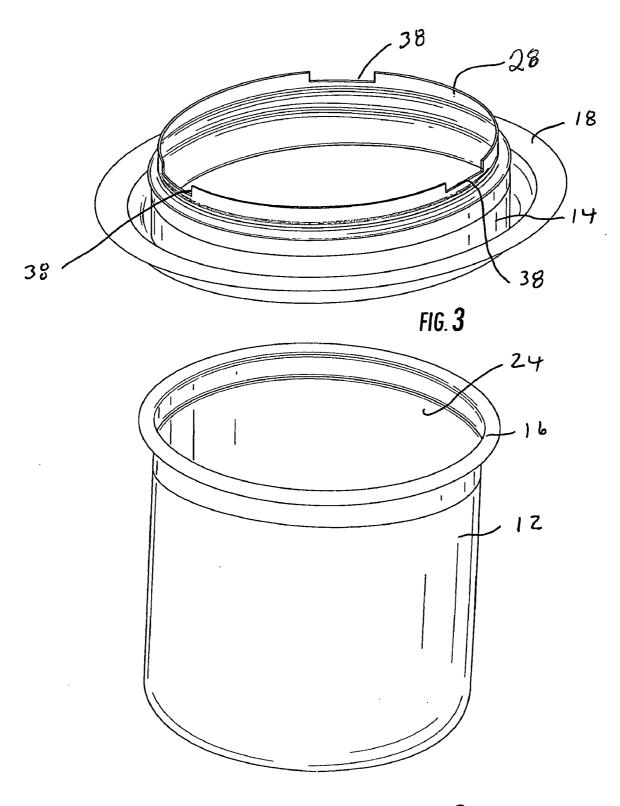
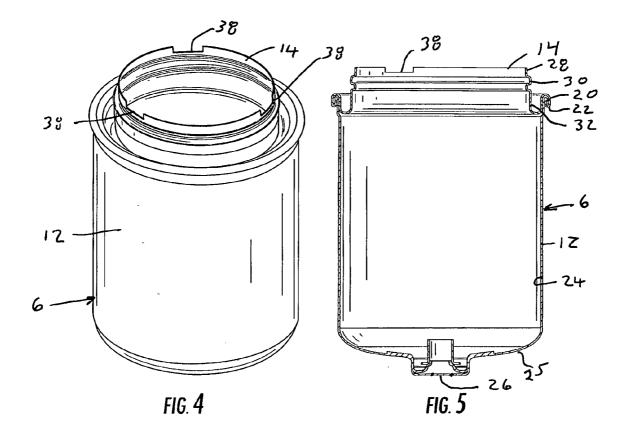
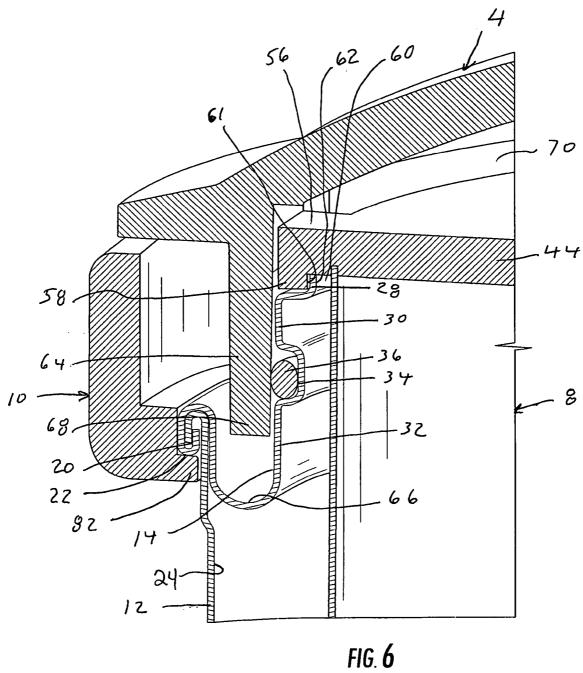


FIG. 2





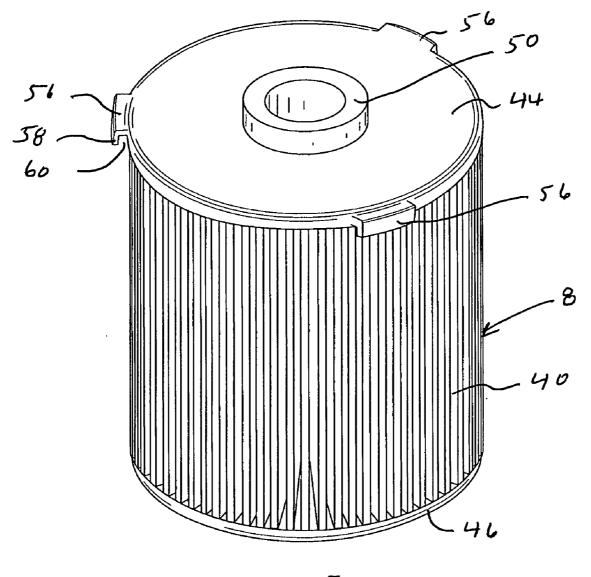
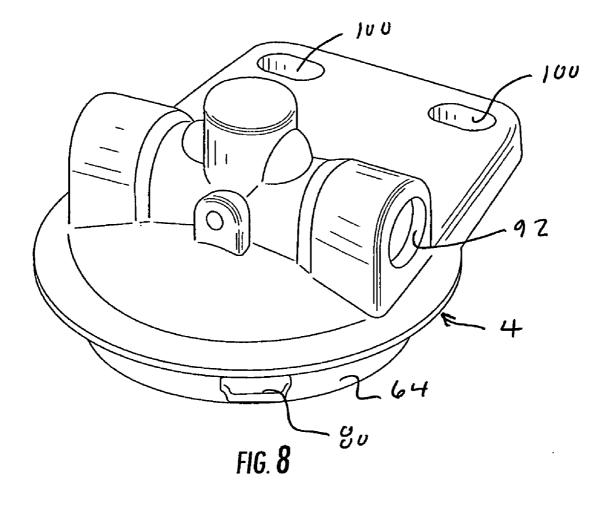
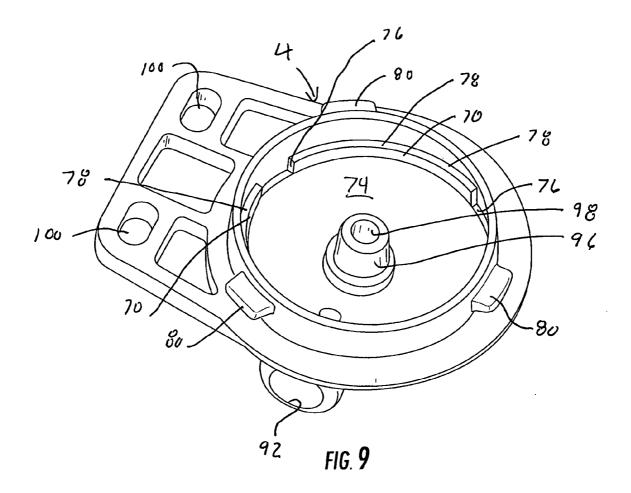
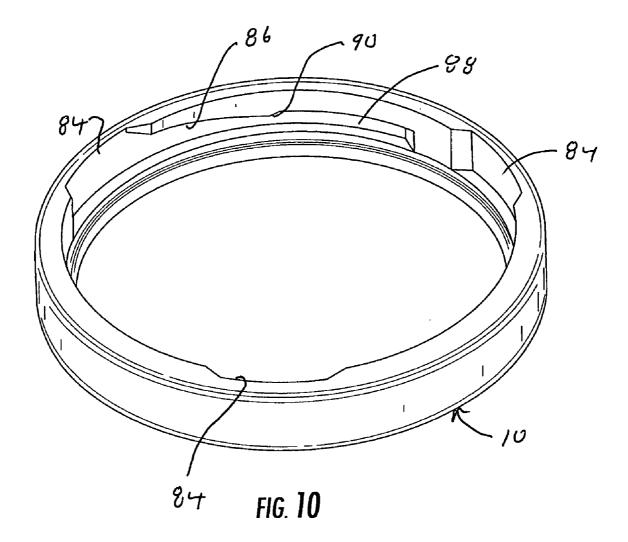


FIG. 7







#### FILTER ASSEMBLY

#### TECHNICAL FIELD

[0001] This application relates generally to filter assemblies employed in connection with internal combustion engines. More particularly, the present application relates to filter assemblies having a replacement cartridge for removing foreign particles and/or separating water from fuel of the fuel supply system of an internal combustion engine.

#### BACKGROUND

[0002] It has long been recognized that trouble-free operation of an internal combustion engine requires some form of filtering of the fuel consumed by the engine. In particular, the absence of high standards of quality control in diesel fuel supplies dictates that an effective fuel filter be incorporated into the fuel supply system for a diesel engine. It is not uncommon for diesel fuel to contain significant quantities of abrasive particles and water. The abrasive particles present the potential for permanent damage to components of the fuel injection system. The abrasive particles can adversely affect the performance of the fuel injection pump by destroying the ability of the fuel injection pump to precisely meter and deliver fuel at high pressures. The presence of water in the diesel fuel supply can cause rusting of engine components, and during freezing conditions, can result in interruption of the fuel injection system and/or seizure of moving compo-

[0003] A number of conventional fuel filter systems perform the dual functions of removing particulate matter from the diesel fuel and separating water from the fuel. Conventionally, the fuel filter systems employ a disposable filter cartridge which is replaced at pre-established intervals of filter usage. In practice, the filter cartridge requirements may vary depending upon such characteristics as the type and make of the internal combustion engine, the specific applications for which the engine is employed, the climate in which the combustion engine is operated and/or regional characteristics as to the quality of the fuel supply. The filter cartridges thus commonly vary as to their dimensions, their capacity, and the qualities of their filter media.

[0004] One of the problems that is frequently encountered in connection with replacement of the filter cartridge is ensuring that the replaced cartridge is compatible with the filtering requirements for the fuel system. Because numerous types and qualities of filter cartridges may dimensionally conform to the base of a given filter system, the replacement filter cartridge frequently does not comply with the specifications for the filter system, thereby jeopardizing the integrity of the fuel filtering system. Use of an incompatible filter cartridge can have very serious effects on the operation of the internal combustion engine, and may also be unnecessarily expensive when a less costly cartridge is fully suitable. Frequently, either the owner or the maintenance personnel servicing the internal combustion engine are totally unaware of the replacement filter cartridge specifications and requirements and unknowingly jeopardize the integrity of the filtering system by using non-conforming filter cartridges. There are also instances where inferior or improper replacement filter cartridges are intentionally installed without the knowledge of the owner or operator of the vehicle.

[0005] U.S. Pat. No. 5,035,797, which is assigned to the assignee of the present invention, discloses a key system for a

filter system intended to address issues of filter cartridge compatibility. Fuel filter systems commonly comprise fuel inlet and outlets disposed in a base or header and a disposable filter cartridge that mounts to the base. Disposable filter cartridges constructed according to this invention have slots which are designed to mate with axial projections of the base. The projections interfere with the use of an incompatible cartridge by interfering with the mounting and sealing of the cartridge to the base.

[0006] Fuel filters have typically been constructed in the form of a metal can, permanently enclosing the filter element in a single use assembly. While these assemblies have proved to be effective and reliable, they are less than ideal in terms of waste of materials and disposal cost.

[0007] Increased awareness of environmental protection and recycling of materials have led to a need for more efficient filtration systems having a minimum disposable component. In addition, environmental protection agencies seeking to reduce the volume of waste items associated with the automotive and trucking industries may no longer permit unrestricted disposal of used fuel filters into the normal waste stream, thereby necessitating specialized and consequently more expensive disposal.

#### SUMMARY OF THE INVENTION

[0008] According to one aspect of the disclosure there is provided a fuel filter assembly including a header and a housing removeably attached to the header. The housing has an upper edge portion having a plurality of notches therein. A filter unit is positioned within the housing, forming a cartridge assembly. The filter unit has an upper end cap provided with a plurality of tabs extending from the periphery thereof, the tabs being positioned in the notches in the housing.

[0009] According to a further aspect, the header may include a downwardly extending skirt having an inner surface and a plurality of circumferentially spaced key slots in the inner surface. The key slots are equal in number to and have the same circumferential spacing as the tabs and are adapted to receive the tabs when the housing and received filter unit are inserted into the header.

[0010] According to another aspect of the disclosure, there is provided a filter unit for a fuel filter assembly that includes a unit element having a generally cylindrical profile. The filter element includes upper and lower end caps at the ends of the filter element. The upper end cap has a plurality of tabs that extend from the outer periphery thereof. The distal end of each of the tabs has a down-turned finger portion spaced from the filter element to form a gap between the inside surface of the down-turned finger portion and the filter element.

[0011] According to a yet another aspect of the disclosure, there is provided a filter unit and housing assembly for connection to a header of a fuel filter assembly that includes a housing having an upper edge portion, the upper edge portion having a plurality of notches therein spaced about the housing, the filter unit includes a plurality of tabs extending from the outer periphery of the upper end cap. The tabs are equal in number to the notches in the housing and are spaced about the axis of the filter unit in the same configuration as the spacing of the notches about the axis of the housing, with the tabs being positioned in the notches.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a vertical sectional view of a filter assembly according to the present disclosure;

[0013] FIG. 2 is a perspective view of the bottom portion or bowl of the housing of the filter assembly of FIG. 1;

[0014] FIG. 3 is a perspective view of the top portion or cap of the housing of the filter assembly in claim 1;

[0015] FIG. 4 is a perspective view of the housing with the cap of FIG. 4 attached to the bowl of FIG. 3;

[0016] FIG. 5 is a vertical sectional view of the combined cap and bowl of FIG. 4;

[0017] FIG. 6 is an enlarged partial vertical sectional view in perspective of a portion of the filter assembly of FIG. 1 showing the details of the interconnection of the header, housing and filter unit;

[0018] FIG. 7 is a perspective view of the filter unit used in the filter assembly of FIG. 1;

[0019] FIG. 8 is a top perspective view of the header of the filter assembly of FIG. 1;

[0020] FIG. 9 is a perspective view of the bottom inside of the header shown in FIG. 7; and

[0021] FIG. 10 is a perspective view of the locking collar of the fuel filter assembly of FIG. 1.

#### DETAILED DESCRIPTION

[0022] Referring to the drawings and particularly FIG. 1, the fuel filter assembly 2 comprises generally a header 4 to which is removeably attached a can-shaped housing 6. A filter unit 8 is positioned within the can-shaped housing 6 as shown. A locking collar 10 serves to attach the can-shaped housing 6 containing the filter unit 8 to the header 4.

[0023] The can-shaped housing 6 may be formed from two separate components as shown in FIGS. 2 and 3, each fabricated from a suitable material such as steel. The two pieces include a bottom bowl-shaped member 12 and top cap 14. The bowl-shaped member 12 has a circular flange 16 adjacent its upper end that extends perpendicular to the axis of the bowl as shown in FIG. 2. The top cap 14 as shown in FIG. 3 has a circular flange 18 that extends perpendicular to the axis of the top portion. The two flanges 16 and 18 provide means whereby the bowl-shaped 12 and top portion 14 are joined together by a conventional rolled seam 20. The resulting seam 20 provides a circumferentially extending shoulder 22 about the housing 6 as shown in FIGS. 8 and 9.

[0024] The bowl-shaped member 12 is hollow, has a cylindrical wall portion 24 and is closed at its lower end 25. An aperture 26 is provided in its lower end 25 as shown on FIGS. 1 and 5 that is adapted to receive a drain cock (not shown). The drain cock is typically used for draining water separated from the fuel, and can also serve the ecological function of draining fuel from the housing 6 before the housing is separated from the header 8.

[0025] As shown particularly in FIGS. 5 and 6, the top cap 14 has a cylindrical wall that includes a circular rim portion 28, an upper cylindrical wall portion 30 having an outer diameter greater than the rim portion 28 and a lower cylindrical wall portion 32 having an outer diameter equal to the outer diameter of the upper cylindrical wall portion 30. An inwardly extending circumferential groove 34 is formed between the upper cylindrical wall portion 30 and the lower cylindrical wall portion 32. A sealing ring, such as an O-ring 36, is mounted in the groove 34.

[0026] A plurality of notches 38 is provided in the upper edge of rim portion 28 of the top cap 14 of the housing 6. The notches 38 extend downwardly from the top surface of the rim portion 28 to a point slightly spaced upwardly from the upper cylindrical wall portion 30 as shown in the drawings. There

are three such notches **38** shown although an alternative plurality of such notches may be provided. The three notches **38** shown are symmetrically spaced about the axis of the housing. The spacing between each of the notches may be varied to provide different configurations that are unique to a given fuel filter assembly.

[0027] Although the housing 6 has been shown as being formed from two members, it may be fabricated as a one-piece element. For example, the housing 6 may be a one-piece injection-molded member using a suitable plastic material. The plastic material may be transparent to permit inspection of the water level in the housing. Alternatively, the housing 6 may be cast from aluminum.

[0028] The filter unit 8 includes a filter element 40 having an outer cylindrical profile. The filter element 40 may be a fan folded paper element in the form of a cylinder with a center aperture 42 that typically filters particulates and separates water from fuel. An upper end cap 44 is provided at the top of the filter element 40 and a lower end cap 46 is provided at the bottom of the filter element 40. The end caps 44 and 46 enclose the axially spaced ends of the filter element 40 and provide structure to the paper element. The upper end cap 44 has an aperture 48 that is coaxial with the axis of the aperture 42 through the filter element 40. A grommet 50 is mounted in the aperture 48 of the upper end cap 44. The grommet 50 has a circumferential slot 52 that receives the edge portion 54 defining the aperture 48 in the upper end cap 44 to secure the grommet 50 on the filter unit 8. The grommet 50 has an axial bore 55 therethrough that is coaxial with the axis of the filter element 40.

[0029] The upper end cap 44 of the filter unit 8 includes a plurality of tabs 56 as shown in FIGS. 6 and 7 that extend outwardly from the outer periphery thereof. A down-turned finger portion 58 is provided at the ends of each of the tabs 56 that forms a space or gap 60 between the outer periphery of the filter element 40 and the inner surface 61 of the finger portion 58. The gap 60 should be of a width such that the thickness of the rim portion 28 of the housing 6 can be inserted within the gap 60 and still leave a space between the inner surface 62 of the rim portion 28 and the outer periphery of the filter element 40 as shown in FIG. 6.

[0030] The number of tabs 56 is equal in number to the notches 38 in the housing 6. The tabs 56 are spaced about the axis of the filter unit 8 in a manner identical to the spacing of the notches 38 about the axis of the housing 6. The width of each of the tabs 56 and notches 38 should be such that each tab 56 can be positioned within a corresponding notch 38 with little or no rotational movement occurring between the filter unit 8 and the housing 6. The outer diameter of the upper end cap 44 (excluding the tabs) is less than the inner diameter of the rim portion 28 of the housing 6 so that there is a gap 63 between outer periphery of the upper end cap 44 and the inner surfaces of the rim portion 28 and groove 34 when the filter unit 8 is inserted into the housing 6 as shown in FIG. 1.

[0031] With the arrangement of tabs 56 and notches 38 as described above, the filter unit 8 can be inserted into the top of the housing 6, moved downwardly into the housing 6 and rotated until the tabs 56 are aligned with the notches 38 at the top of the housing 6. Further insertion of the filter unit 8 into the housing 6 will result in the tabs 56 being positioned within the notches 38 and the down turned finger portions 58 being positioned on the outside of the rim portion 28 of the cylindrical wall of the housing 6. The finger portions 58 engage the

outside wall of the rim portion 28 and serve to maintain the filter unit 8 in a centered position coaxial within the housing 6.

[0032] As mentioned above, three notches 38 are provided in connection with the housing 6 that are spaced symmetrically about the axis of the housing 6. With a housing 6 having this configuration, only a filter unit 8 having three tabs 56 with a similar spacing about the axis of the filter unit can be properly inserted into the housing 6. Incompatible housings 6 and filter units 8 cannot be properly assembled.

[0033] The number of, or special orientation of the notches about the axis, can be changed so that only a unit 8 having that configuration of tabs 56 will be accepted within the housing 6. A compatibility matrix is provided comprising an infinite number of configurations of compatible housings 6 and filter units 8 to differentiate between filter assemblies having different flow capabilities, filter media, disposal options, ecological qualities or other characteristics.

[0034] With reference to FIGS. 8 and 9, the header 4 includes a downward extending skirt 64 into which the cap 14 of the housing 6 is inserted. As shown in FIGS. 1 and 4-6, the inside diameter of the cylindrical wall 24 of the bowl 12 of the housing 6 is larger than the outside diameter of the cylindrical wall portions 30 and 32 of the cap 14, so that upon formation of the rolled seam 20, a U-shaped pocket 66 is formed that extends around the housing 6 with the shoulder 22 formed by the rolled seam 20 on the outside of the housing 6. The filter unit 8 and housing 6 assembly is inserted into the header 4 so that the upper portion of the housing 6 and upper end cap 44 of the filter unit are positioned within the skirt 64 and the sealing ring 36 is in sealing engagement with the inside surface of the skirt 64. The bottom end 68 of the skirt 64 extends into the pocket 66 as shown in FIG. 6.

[0035] The inside surface of the skirt 64 of the header 4 is provided with an inwardly protruding shoulder 70 extending around the upper portion of the inside surface of the skirt 64 and projecting downward from the inside upper surface 74 of the header 4. The shoulder 70 includes a plurality of circumferentially spaced key slots 76 in its bottom surface 78 that are adapted to receive the tabs 56 on the filter unit 8 when the assembly of the housing 6 and filter unit 8 is inserted into the header 4. The number and circumferential spacing of the key slots 76 must coincide with the number and spacing of the tabs 56 on the filter unit 8 to enable the assembly of the housing 6 and filter unit 8 to be properly inserted into the header 4 and secured by the locking collar 10. If the tabs 56 are of different configuration than the keys slots 76, the housing 6 and filter unit 8 assembly will not be properly received in the header 4 to allow the locking collar 10 to be properly secured. Also, if the tabs 56 on the top end cap 44 of the filter unit 8 are not properly located in the notches 38 of the housing 6, the assembly of the filter unit 8 and housing 6 cannot be properly inserted into the header 4 to be locked by the locking collar 10.

[0036] The skirt 64 of the header 4 is provided with a plurality of locking lugs 80 on its outer surface that are engaged by the locking collar 10 to secure the housing 6 to the header 4. The locking collar 10 surrounds the housing 6 and includes an inwardly extending flange 82 as shown in FIG. 6 that engages the circumferential shoulder 22 around the housing 6.

[0037] As shown in FIG. 10, the locking collar 10 is provided with a series of circumferentially spaced cutouts 84 that extend downward from its top surface and communicate with

a circumferentially extending ramp 86. The ramp 86 tapers downward from its connection with the cutout 84 to a non-tapering slot 88 defined by surfaces that lie in a plane perpendicular to the axis of the locking collar 10. A detent portion 90 interconnects the tapering ramp 86 and non-tapering slot 88. The number of cutouts 84 is equal in number to the number of lugs 80 on the skirt 64.

[0038] To attach the housing 8 and filter unit assembly to the header 4, the housing 6, with the filter unit 8 in place, is inserted into the header 4. The tabs 56 on the filter unit 8 extend up into the key slots 76 in the shoulder 70 that extends downward from the inside bottom surface 74 of the header 4. [0039] The locking ring 10 is positioned around the housing 6 and is moved up so that lugs 80 of the header 4 enter the cutouts 84 in the locking ring 10. As the locking ring 10 is rotated, the tapered ramp 86 rides along the lugs 80 of the locking ring 10 whereby the locking ring 10 moves upwardly relative to the header 4 pulling the housing 6 upward with it by virtue of the engagement of the flange 82 with the shoulder 22 on the housing 6. The locking ring 10 is rotated until the detent portion 90 by passes the lugs 80 and the lugs 10 are positioned in the non-tapering slot 88.

[0040] In an alternative header/collar configuration, the header includes radially protruding threads which are engaged by complementary threads on the collar (not illustrated). The collar is rotated so that the threads bring the collar toward the header. The threads include detents to define the fully installed position of the collar with respect to the header. The engagement between the collar 10 and header 4 illustrated in FIGS. 1, 6 and 8-10 should be considered interchangeable with a threaded engagement.

[0041] The header 4 is provided with an inlet port 92 and an outlet port 94 as shown particularly in FIG. 1. The header 4 also includes a central downward extending circular post 96 that is adapted to extend through the grommet 50 in the filter unit 8 when the filter unit 8 and housing 6 assembly is connected to header 4. The inlet port 92 is connected by an inlet passage 97 to the area within the header 4 immediately above the filter unit 8. The output port 92 is connected to the center aperture 42 of the filter unit 8 by means of an outlet passageway 98 extending from the outlet port 94 radially through the header 8 and downwardly through the central downward extending post 96 and opening into center aperture 42 of the filter unit 8.

[0042] With this arrangement, the flow path of the fuel is through the inlet port 92 and inlet passageway 97 into the area above the top of the filter unit 8. The fuel passes through the gap 63 between the outer periphery of the upper end cap 44 and the inner surface of the cylindrical rim portion 28 of the housing 6 into the interior of the housing 6 down around the side of the filter unit 8. Fuel then passes through the filter element 40 into the central aperture 42 and up the central aperture 42 and through the outlet passageway 98 to the outlet port 94.

[0043] To provide for this flowpath, the outer diameter of the periphery of the top end cap 44 (excluding the tabs 56) is less than the inner diameter of the cylindrical rim portion 28 of the housing 8. This results in the gap 63 through which the liquid fuel can flow down past the filter unit 8 into the interior of the housing 6.

[0044] In use, the header 4 is physically attached to a vehicle engine or chassis by means of bolts (not shown) passing through the apertures 100 shown in FIGS. 8 and 9. The header 4 provides an inlet and outlet for the fuel line (not

shown). A suitable filter unit 8 of the type designed to be used with that particular vehicle and with the particular configuration of notches 38 in the housing 6 is inserted into the housing 6 with the tabs 56 positioned in the notches 38 and the finger portions 58 positioned on the outside of the cylindrical rim 28 of the housing 6. The housing 6 is then inserted into the header 4 so that the tabs 38 are received in the key slots 76 in the inside of the header 4. The locking ring 10 is positioned about the housing and moved upwardly so that the flange 82 engages the shoulder 22 on the housing and aligned so that its cutouts 84 align with the lugs 80 on the outside of the header 4. The locking ring is moved toward the header until the lugs 80 are aligned with the ramp 86 whereupon the locking ring is rotated until the lugs 80 pass the detent portion 90 and enter the non-tapering slot 88.

[0045] By providing at least three spaced tabs 56 with down turned finger portions 58, the upper end cap 44 will stay centered and coaxial with the housing 6 by virtue of the fact that the down turned finger portions 56, being in engagement with the outer surface of the cylindrical rim portion 28 of the housing 6, prevents radial movement between the housing 6 and filter unit 8. This ensures that the flow passage between the outer periphery of the top end cap 44 and the inner surface of the housing 8 remains symmetrical about the axis of the housing 6

[0046] The key slots 76 in the header 4 control upward movement of the housing 6 and filter unit 8 into the header 4. If the tabs 56 on the filter unit 8 do not properly align with the key slots 76, and if the tabs 56 are not properly received in the notches 38 in the top of the housing 6, the filter unit 8 and housing 6 assembly will not be received into the header 4 the proper distance. Unless the filter unit 8 and housing 8 assembly is properly inserted into the header 4, the locking ring 10 cannot be rotated properly.

[0047] For example, if the tabs 56 on the filter unit 8 and the notches 38 in the housing 6 do not match so that the tabs are positioned within the notches 38, the tabs 56 will rest on the very top edge of the housing 8. Assuming that the notches 38 in the housing 6 and the key slots 76 in the header 4 are of the same spacial alignment, then, in such a case, when the housing 6 and filter unit 8 assembly is inserted into the header 4, the nonsymmetrical tabs 56 will engage the shoulder 70 rather than enter the key slot 76 and further insertion into the header 4 is prevented. Under this circumstance, the shoulder 22 on the outside of the housing 6 is be positioned at a point axially spaced downward from the lugs 80 on the outside of the header 4 such that when the locking ring 10 is moved upwardly, the inclined slot 86 in the locking ring would not be properly aligned with lugs 80 on the header 4 so that the locking ring 10 can be properly rotated into the locked position. This prevents a housing 6 with a non-matching filter unit 8 from being connected to the header 4.

[0048] Also, even if the tabs 56 on the upper end cap 44 of the filter unit 8 are properly positioned within the notches 38 of the housing 6, if the configuration of the notches 56 doesn't match the configuration of the key slots 76 in the header 4, the housing 6 and filter unit 8 assembly will not be properly received into the header to enable the locking ring to be properly secured. In this case, the top surface of the tabs 56 will engage the shoulder 70 in the header 4 and further insertion of the filter unit 8 and housing 6 assembly will be prevented. As a result, housing 6 will not be in proper axial position relative to the lugs 80 so that when the locking collar 10 is moved upward into a position where it engages the

shoulder 22 on the housing 8, the locking collar 10 can properly engage the lugs 80 to properly lock the filter unit 8 and housing 6 assembly in place. Thus even though the filter unit 8 and housing 6 might match, unless the notches 38 on the housing also match the orientation of the key slots 76 in the header 4, the filter unit 8 and housing 6 cannot be properly attached to the header 6.

**[0049]** By virtue of the above-described construction, a filter cartridge assembly is provided in which an ecological filter unit may be utilized and which provides for an infinite number of configurations to differentiate between filter cartridge assemblies having different flow capabilities, filter unit disposal options and or other characteristics.

[0050] Only when a correctly configured filter unit has been fully received and retained with the housing can the filter unit and housing (cartridge assembly) properly engage with the header to permit the cartridge assembly to be properly secured to the header. This will ensure that the cartridge assembly will be one that is compliant with the specifications of the fuel system of that particular vehicle.

[0051] While preferred embodiments have been shown and described, various substitutions and modifications may be made thereto. Accordingly, it is understood that the present embodiments have been described by way of illustration and not limitation.

What is claimed:

- 1. A fuel filter assembly comprising:
- a header;
- a housing removeably attached to said header, said housing including an upper edge portion having a plurality of notches therein; and
- a cartridge unit within said housing, said cartridge unit having an upper end cap provided with a plurality of tabs extending from the periphery thereof, said tabs being positioned in said notches in said housing.
- 2. The fuel filter assembly of claim 1 wherein said tabs include a finger portion at the ends thereof positioned against the outer surface of the housing.
- 3. The fuel filter assembly of claim 2 wherein there are at least three tabs.
- 4 The fuel filter assembly of claim 3 wherein said housing has an axis, said notches have a predetermined angular spacing about said housing axis, and said tabs have an angular spacing coincident with said angular spacing of said notches.
- 5. The fuel filter assembly of claim 1 wherein said header includes radially protruding features and said housing includes a circumferential rim on its outer surface, and said filter assembly further including a locking ring for engaging said features and said rim for locking said housing to said header.
- 6. The fuel filter assembly of claim 5 wherein said housing comprises two parts, the first part being an upper cap portion having said notches therein and said second part being a bowl-shaped lower portion, said first and second parts being connected by a rolled seam, said rolled seam providing said circumferential rim on said housing.
- 7. The fuel filter assembly of claim 2 wherein said header includes a downwardly extending skirt having an inner surface and a plurality of circumferentially spaced key slots in the inner surface, said key slots being equal in number to said tabs and having the same circumferential spacing as said tabs and being adapted to receive said tabs when said housing is attached to said header.

- **8**. The fuel filter assembly of claim **7** wherein said header has a rim extending around the upper portion of the inside surface of said skirt, said key slots being formed in said rim.
- 9. The fuel filter assembly of claim 7 wherein said skirt has an outer surface, said outer surface having a plurality of lugs thereon, and further including a locking ring for attaching said housing to said header, said locking ring having a portion in engagement with said housing and an upper surface with a plurality of slots extending downwardly therefrom in the internal surface that communicate with a slanted internal ramp thereof, each said slot aligned to receive one of said lugs therein to permit said locking ring to be moved upwardly and rotated with the keying lugs riding along the slanted ramp.
- 10. The fuel filter assembly of claim 9 wherein said header has a fuel inlet and a fuel outlet, said fuel inlet communicating with the interior of said header at a point above cartridge unit, said upper end cap having a periphery excluding said tabs that is spaced from said upper edge portion of said housing to form a gap for fuel to flow into the interior of said housing.
- 11. The fuel filter assembly of claim 10 wherein said filter unit has a center aperture and said header has a center post extending into said aperture, said fuel outlet connected to the center aperture by a passageway extending though said center post.
- 12. The fuel filter assembly of claim 1 wherein said housing is molded from plastic or metal.
  - 13. A filter unit for a fuel filter assembly comprising: a filter element having a generally cylindrical profile; upper and lower end caps at the ends of said filter element, said upper end cap having a plurality of tabs extending from the peripheral edge thereof, the distal end of each of said tabs having a down-turned finger portion spaced from the filter element to form gap between an inside surface of said down-turned finger portion and the filter element.

- 14. The filter unit of claim 13 wherein there are at least three tabs.
- **15**. The filter unit of claim **13** wherein the tabs have a predetermined spacing about the axis of the filter element.
- 16. The filter unit of claim 13 wherein said filter element has a center aperture and said upper end cap has an aperture coaxial with the center aperture, and further including a grommet mounted in the aperture in said upper end cap.
- $17.\,\mathrm{A}$  filter cartridge assembly for connection to a header of a fuel filter assembly comprising:
  - a housing having an upper edge portion, said upper edge portion having a plurality of notches therein spaced about an axis of the housing,
  - a filter unit including a filter element having a generally cylindrical outer profile and an upper and lower end cap, said upper end cap having a plurality of tabs extending from an outer periphery thereof, said tabs being equal in number to said notches in said housing and being spaced about the axis of said filter unit in the same configuration as the spacing of said notches about the axis of said housing, said tabs being positioned in said notches.
- 18. The filter cartridge assembly of claim 17 wherein each of said tabs has a down-turned portion at its end, said down-turned portion positioned against an outside surface of the housing.
- 19. The filter cartridge assembly of claim 18 wherein there are at least three notches.
- 20. The filter cartridge assembly of claim 18 wherein the periphery of said upper end cap excluding said tabs is radially spaced from said upper edge portion of said housing to form a gap between the upper end cap and the housing.

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