Dec. 21, 1954 H. B. LAWRENCE 2,697,522

FILTER CONSTRUCTION

Filed March 5, 1952 3 Sheets-Sheet 1

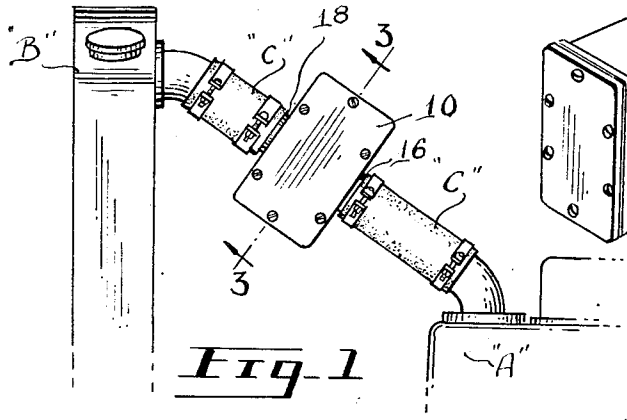


Fig. 1

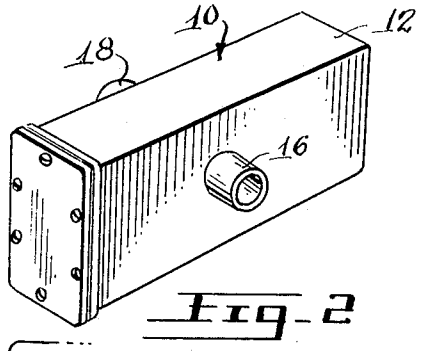


Fig. 2

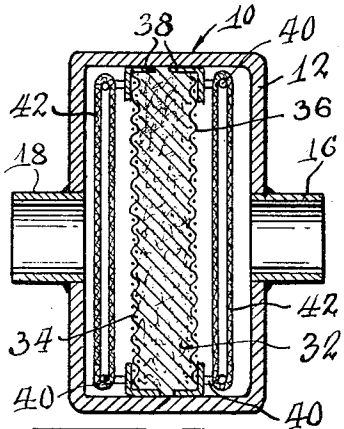


Fig. 3

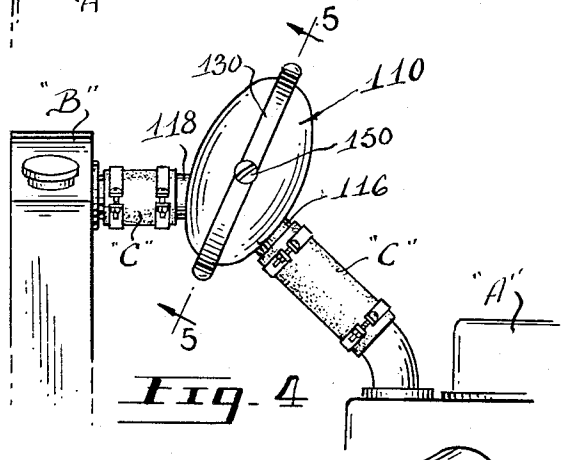


Fig. 4

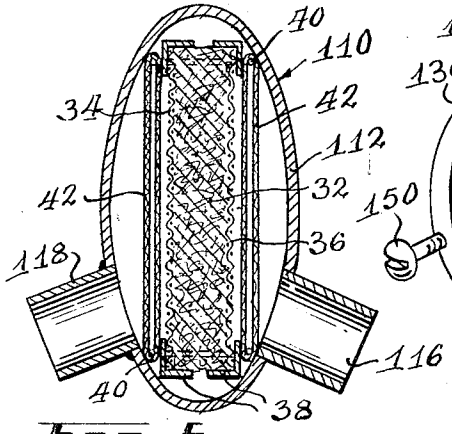


Fig. 5

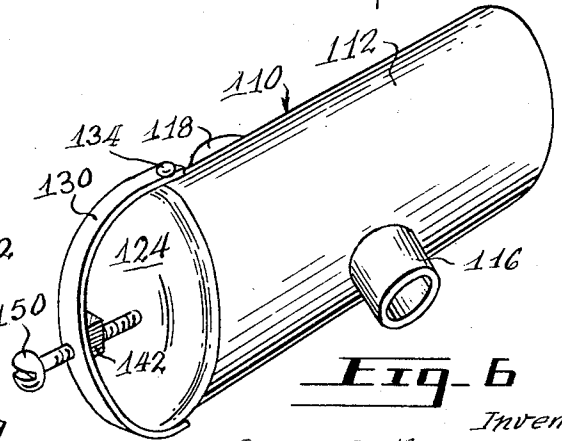


Fig. 6

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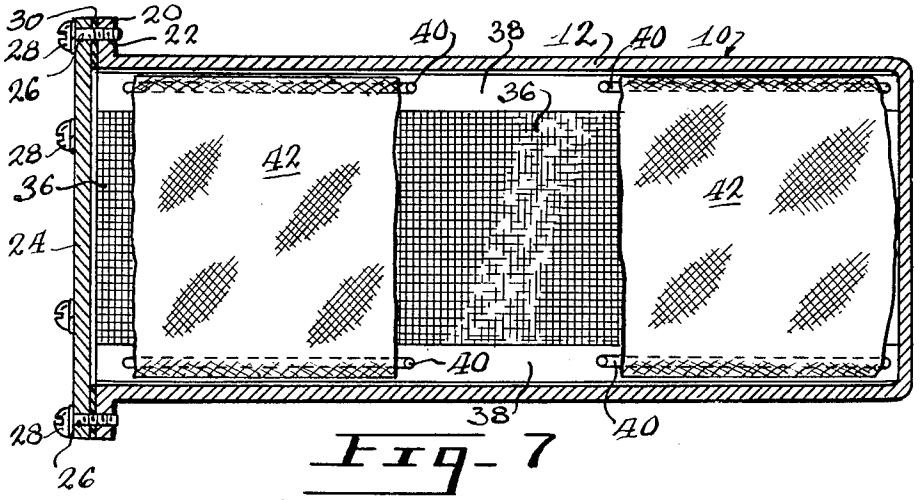


Fig. 7

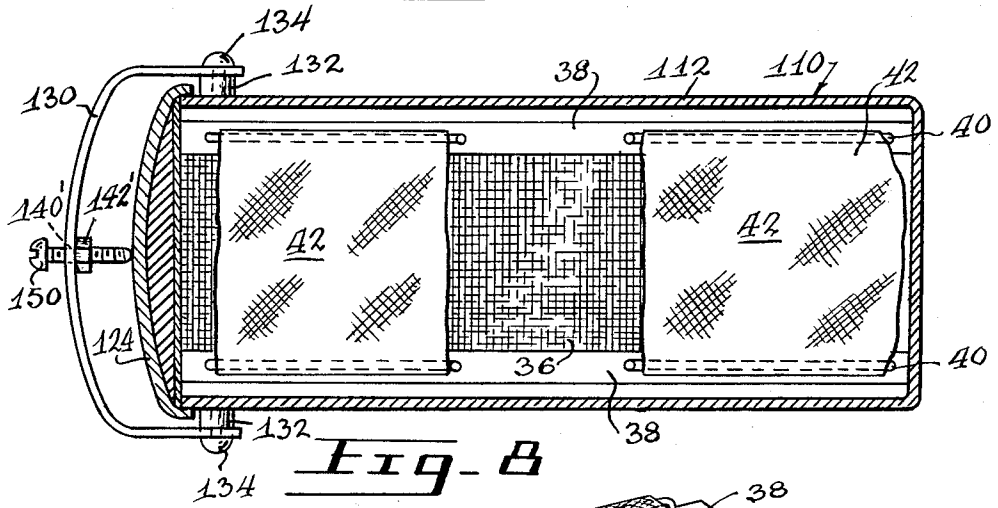


Fig. 8

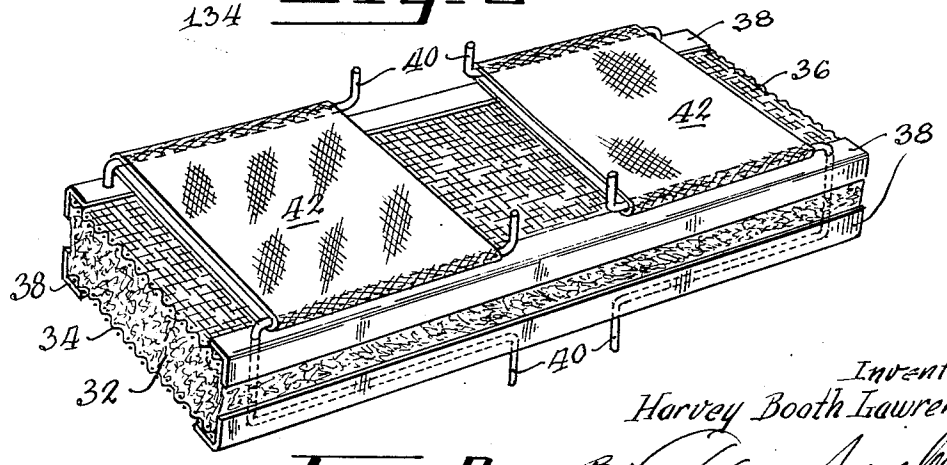


Fig. 9

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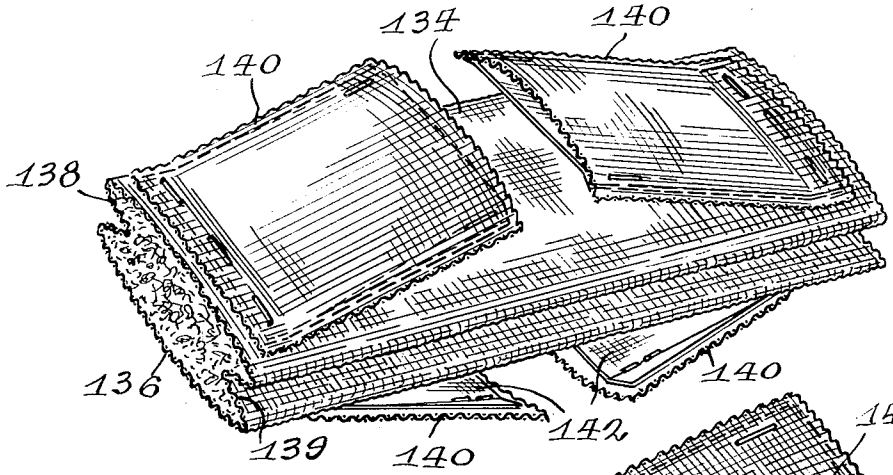


Fig. 10

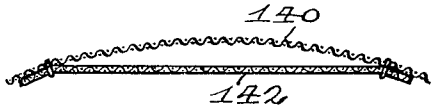


Fig. 12

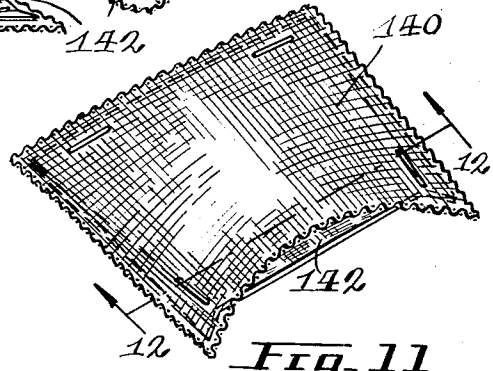


Fig. 11

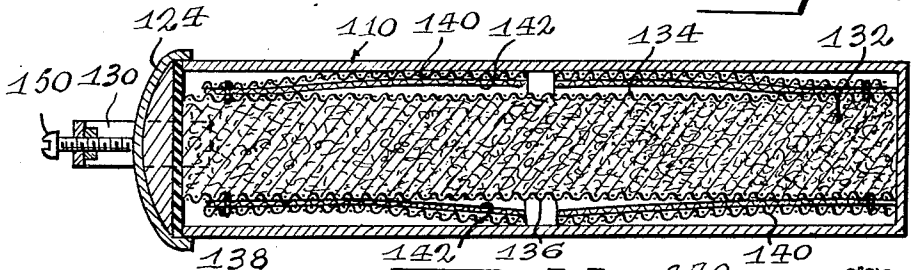


Fig. 13

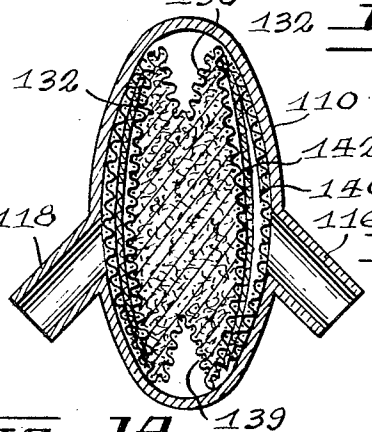


Fig. 14

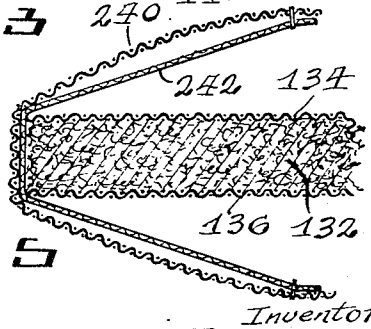


Fig. 15

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FILTER CONSTRUCTION

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Application March 5, 1952, Serial No. 274,901

14 Claims. (Cl. 210—164)

The present invention relates to filtering apparatus and particularly to apparatus of this nature adapted for use in connection with the water cooling system of a motor vehicle engine.

The water circulated in the usual fluid cooling system between the engine of the car and the radiator becomes loaded with dirt, rust and the like which are deposited in the system wherever the movement of the water is slowed up or impeded, particularly in the radiator. Over a period of time, these deposits clog up the radiator so that the cooling efficiency of the system is considerably reduced. When this happens, the radiator has to be flushed, and in extreme cases removed and completely cleaned. This necessarily puts the vehicle out of commission as well as consuming considerable time and labour. This is particularly true in the case of heavy duty vehicles which run up a lot of mileage, for example, trucks, buses or the like, particularly when such vehicles have seen several years service.

Attempts have been made to overcome these problems by providing various forms of liquid filters which are usually placed in the water cooling system between the engine and the radiator, but, most of these known filter constructions present certain disadvantages. For example, some of these prior art filter constructions utilize complex baffle plate and filter screen arrangements which while acting as efficient sediment traps, also slow down the circulation of the cooling water to an inefficient degree. Further, many of these earlier filter constructions, by reason of their complex structure are expensive to manufacture and are not easily installed or removed for cleaning without the services of a skilled mechanic.

The present invention recognizes these difficulties and aims to furnish a satisfactory solution to them by providing a liquid filter construction of simple uncomplicated design, which, while it is capable of functioning efficiently in the manner desired, can be easily and economically manufactured and installed in the liquid cooling system of any motor vehicle with the minimum of modification.

Accordingly, the invention is embodied in a liquid filter construction adapted to be placed in the cooling system of a motor vehicle between the engine and the radiator. The preferred construction of the present filter comprises essentially of a casing having an open end, a closure for the casing which is adapted to be removably secured over the casing open end, and a removable filter core assembly mounted longitudinally within the casing. The casing includes an inlet and an outlet opening on opposite sides and the filter core assembly divides the casing into two compartments in register with the casing openings. The core assembly is removable from the casing as a unit and includes a liquid pervious central layer of metallic material which is sandwiched between upper and lower packing retaining members.

The packing retaining members each consist essentially of a substantially rectangular section of metallic mesh supported at each side so as to be disposed in opposed relationship to each other forming confining top and bottom walls between which is retained the central metallic filter packing. The packing retaining members are held in register with each other and in spaced apart relationship in one form of construction by means of flexible secondary filter retaining members, preferably formed portions of flexible rod or wire. These are disposed so that a minor portion of each of the filter retaining members passes through the upper and lower packing retaining members and is then bent over so that a major portion of the member extends along the exterior of one of the packing retaining members in spaced apart relationship therewith. In another form of construction, a single piece of metallic mesh material is formed into an open ended rectangular casing having interconnected top, bottom and side walls. The top and bottom walls constitute upper and lower packing retaining members while the intervening side walls serve to maintain the packing retaining members in spaced apart register. In this construction the secondary filter retaining members consist of additional sections of metallic mesh screen secured to the upper and lower packing retaining members so as to extend above the members from each end.

Flexible pads of woven fabric material, preferably of fairly close weave, are mounted on the flexible filter retaining members so as to extend across each pair of members in spaced apart relationship above the screen surface of the packing retaining members preferably at each end of and on both of the packing retaining members. This also provides a resilient means of holding the filter core assembly in the correct spaced apart relationship with the interior walls of the main casing.

The casing proper can be made of substantially rectangular form in general cross section, or alternatively, the casing can be substantially elliptical, or circular form in general cross section.

In the rectangular form of casing, the open end of the casing is provided with an outwardly extending flange and the casing closure member is of equal outer dimension to the casing flange so that they can be secured together by means of bolts or screws passing through the outer periphery of the closure member and the outstanding flange of the casing.

In the elliptical form the closure member is preferably of diecast construction having an outer peripherical flange the inside circumference of which is slightly greater than the outer dimensions of the open end of casing. With this closure construction, the closure member is placed over the open end of the casing so that the peripherical flange overlaps the casing walls adjacent the open end. A substantially U shaped strap member is pivotally mounted adjacent to the open end of the casing and is provided with a central portion which serves as a support for a threaded bolt or screw. The pivoting of the strap member over the closure member and the tightening of the bolt against a central portion of the closure member thus locks the closure member into sealing contact with the open end of the casing. Preferably, a gasket is provided between the casing open end and the closure members in both of these casing constructions so as to insure a liquid-proof seal.

Having thus generally described the nature of the invention particular reference will be made to the accompanying drawings, and in which:

Figure 1 is a diagrammatic view of a preferred construction of a liquid filter in accordance with the invention as it may be installed in a motor vehicle.

Figure 2 is a side view in perspective elevation of the preferred filter construction shown in Figure 1.

Figure 3 is a sectional view of the filter construction shown in Figures 1 and 2 along the line 3—3 of Figure 1.

Figure 4 is a diagrammatic view of an alternate construction of a liquid filter in accordance with the invention as it may be installed in the cooling system of a motor vehicle.

Figure 5 is a sectional view of the filter construction shown in Figure 4 along the line 5—5.

Figure 6 is an enlarged view in perspective elevation of the filter construction shown in Figure 4.

Figure 7 is a longitudinal cross section of the filter construction shown in Figure 2 to illustrate a preferred construction of the removable core assembly and the relative position of the filter core assembly within the casing.

Figure 8 is a longitudinal cross section of filter construction shown in Figure 6 illustrating the construction and relative position of the removable core assembly.

Figure 9 is an enlarged detail view in perspective elevation of a preferred construction of a removable filter core assembly.

Figure 10 is an enlarged detail view in perspective elevation of an alternative construction of a removable filter core assembly in accordance with the invention.

Figure 11 is an enlarged detail view in perspective elevation of one of the secondary filter retaining members as shown in the construction of Figure 10.

Figure 12 is a sectional view of Figure 11 along the line **12—12** to show the attachment of the fabric filter pad.

Figure 13 is a longitudinal cross section of the filter construction shown in Figure 6 and embodying a filter core assembly as shown in Figure 10.

Figure 14 is a transverse sectional view of a filter construction as shown in Figure 6 and embodying a core assembly as shown in Figure 10.

Figure 15 is an enlarged detail view partially in cross section of a further alternative form of secondary filter retaining members.

With particular reference to the Figures 1 and 2 of the drawings, a preferred filter construction **10** in accordance with the invention is illustrated as being mounted in the cooling system of a car between the engine A and the radiator B. This is installed by breaking the usual hose connections, inserting the filter assembly **10** and attaching the hose connections C to the filter inlet and outlet tubes by means of suitable clamps. The filter unit **10** consists of a main casing **12** having an open end and on opposite sides, an inlet opening and an outlet opening which are surrounded by tubular connecting members **16, 18**. The casing **12** also includes an outwardly extending flange **20** surrounding the open end wherein there is provided a series of equally spaced apart openings **22**. A closure member **24**, of substantially equal outside dimensions to the casing flange **20**, also includes a series of equally spaced apart openings **26** in register with the openings **22** of the flange **20**. Bolts **28** are adapted to pass through the openings **26** and threadably engage in the openings **22** so as to retain the closure member **24** in sealing contact with the container flange **20**. Preferably, a sealing gasket **30** is provided between the closure **24** and the flange **20**. This removable closure end is to allow for the removal and insertion of the filter core assembly.

The filter core assembly shown in detail in Figures 7, 8 and 9 is removable from the casing **12** as a unit and includes a substantially rectangular liquid pervious pad of metallic filter packing **32** which is sandwiched between top and bottom filter packing retaining members **34, 36**. The filter packing retaining members **34, 36** are each made up of a substantially rectangular section of metallic mesh screening which is reinforced by and it is secured to angle plates **38** which extend along each longitudinal margin.

The top and bottom filter packing retaining members **34, 36** are retained in register with each other and in spaced apart relationship from each other by flexible retaining members **40**. Preferably, the filter retaining members **40** are made up of resilient wire and are formed so as to each have a minor portion passing through the angles **38** of the filter packing units connecting the top and bottom packing retaining members **34—36** and a major portion **41** extending along in spaced apart relationship with the angles **38** at each side of the filter packing retaining members. With particular reference to Figure 9, the filter pad retaining members **40** are preferably located at each end of and on both sides of the removable filter core assembly and are arranged in spaced apart pairs. Woven fabric filter pads **42** are mounted on and extend between each pair of the members **40** above and in spaced apart relationship with the outer surface of the filter packing retaining units. The outer ends of the members **40** are bent upwards so as to retain the filter pads **42** in position as well as providing resilient bearing members which engage the sides of the casing **12** so as to support the filter core assembly in spaced apart relationship from the inner walls of the casing. The filter pads **42** and the supporting members **40** extend inwardly from each end of the filter core assembly but terminate short of the center portion of this assembly so as to leave a clear central space at each side which, when the filter core assembly is in position within the casing **12**, is in register with the inlet and outlet tubular members **16, 18**.

With particular reference to Figures 4, 5 and 6 of the drawings, an alternative form of filter casing **110** is shown as being connected between the engine A and the radiator B of a motor vehicle. This construction includes a casing **112** which is of a substantially elliptical form in general cross section. The casing **112** includes an open end, and inlet opening tube members **116, 118** are provided on opposite sides of the casing **112** as in the previous rectangular casing construction. The removable filter core assembly is of identical construction to that utilized in the rectangular type of casing. The closure member **124** of this construction is preferably a diecast member of elliptical form having an outer peripherical flange which is adapted to overlap the open end of the casing **112**. A substantially U-shaped strap member **130** is pivotally mounted adjacent the open end of casing **112**, by means of spacers **132** and rivets **134**. A centrally disposed opening **140'** is provided in the joining section of the U-shaped strap **130** and a threaded nut **142'** is attached to the underside of the strap in register with this opening. A threaded bolt **150** is threadably engaged in the nut **142'** and is adapted to bear, when tightened, against a central portion of the closure member **124** so as to force it into sealing contact with the open end of the casing **112**.

The central liquid pervious packing **32** of the removable core assembly preferably consists of a pad of nonrustable metallic shavings. Pads of this nature are utilized at the present time as scouring agents and can be readily purchased in made up form. The upper and lower filter packing retaining members **34, 36**, employ a screen mesh **35** of fairly close weave so that as the cooling water passes through the inlet member **116**, from the engine and out of the outlet member **118** to the radiator in the normal cooling circulation, it is forced through the screen **35** and around the interstices of the metallic packing **32** so as to leave any deposits of dirt or rust in the filter core. The filter packing retaining members **34** and **36** have a lesser resistance to liquid flow than the central packing layer **32**. There is, however, a certain amount of very fine residue or rust that will migrate through the mesh **35** and the packing **32** and the additional filter pads **42** are provided to trap this finer waste. The filter pads **42** have a greater resistance to liquid flow than the central packing layer **32**.

With reference to Figures 10 through 12 an alternative form of filter core assembly is shown wherein top **134** and bottom **136** packing retaining members are provided by the top and bottom walls of an open ended rectangular casing preferably formed from a single piece of metallic mesh screen. The interconnected side walls of the casing provide spacing members **138, 139** which maintain the packing retaining members **134, 136** in register and in spaced apart relationship. The side walls or spacing members are preferably shaped so as to be turned inwards towards the center of the casing to add rigidity to the structure.

As in the previous constructions a substantially rectangular pad of metallic filter packing **132** is sandwiched between the packing retaining members **134, 136**. Sections of wire mesh screen are secured to each end of the members **134, 136** to constitute filter pad retaining members **140**. These are disposed with their inner ends in spaced apart relationship and woven filter pads **142** are secured to each of the members **140**. Preferably the filter pads **142** are tensioned on the members **140** so as to give the members **140** a slightly arcuate form adding rigidity as is shown in Figures 11 and 12.

As a still further alternative, the filter pad retaining members **140** may be elongated rectangular portions of wire mesh bent into substantially U-shaped form to provide interconnected pairs of filter pad retaining members **240** as shown in Figure 15. In this form the filter pads **242** are co-extensive and secured adjacent the outer ends of the U form to give the desired tensioned stiffening effect.

Figures 13 and 14 are longitudinal and horizontal cross sections respectively of a casing construction as is shown in Figure 6 to illustrate in more detail the relative position of the filter core assembly of Figure 10 as it would appear in operative position. The inwardly curved side portions **138, 139** of the packing retaining casing leaves a space between the inner walls at each end of the casing wherein a softening agent or additional filtering material may be inserted.

It has been found on experiment, that a vehicle equipped with a filter unit constructed in accordance with the present invention can be run for approximately 10,000 miles without any appreciable detraction in the cooling efficiency of the water cooling system. It is preferred, however, to have the removable filter core

assembly itself cleaned and reinserted in the filter unit. A removable filter core assembly constructed in accordance with the invention has been found to stand up to at least four cleanings of this nature so that a vehicle can be operated with the present filter assembly for approximately 20,000 miles without any additional cost over and above the initial purchase price of the filter unit. When the removable filter core assembly has been cleaned approximately four times, and therefore may not be working at its maximum efficiency, the present filter unit can be restored to its initial efficiency by the discarding of the original filter core assembly and the insertion of a new filter core.

I claim:

1. A liquid filter comprising, a casing having one open end, and including opposed inlet and outlet openings, a removable closure for said casing open end, a filter core assembly mounted in said casing so as to divide the interior of said casing into two compartments in register with said casing openings, said filter core assembly being removable and including a central inner liquid pervious layer of metallic packing material sandwiched between upper and lower packing retaining members of mesh screen of lesser resistance to liquid flow than said central packing layer, said packing retaining members being of sufficient outer dimensions to frictionally engage the interior of said casing, flexible filter pad supporting means extending from adjacent each end of each of said packing retaining members, and a plurality of filter pads of fabric material having a greater resistance to liquid flow than said central packing layer, each of said filter pads being mounted on certain of said flexible filter pad supporting means in alignment with and in spaced apart relationship from each of said packing retaining members, each of said filter pads being so supported on one end of each of said packing retaining members in spaced apart opposed relationship relative to an adjacent filter pad mounted on the other end of each of said packing retaining members, said filter pads being disposed to partially divert a flow of liquid passing through said casing between the inlet and outlet openings through said packing retaining members, a portion of each of said packing retaining members being unobstructed by said filter pads, whereby a major portion of said liquid first passes through one set of said filter pads and through one of said packing retaining members, central packing and the other of said packing retaining members and finally through a further set of said filter pads so as to filter and remove foreign matter from said liquid, said filter pads being adapted to filter out fine particles of foreign matter, said packing retaining members and said central packing being adapted to filter out coarser particles of foreign matter.

2. A liquid filter as claimed in claim 1, wherein the inner packing retaining members each comprise a rectangular section of metallic mesh screening reinforced along the longitudinal edges by opposed angle plates thereto.

3. A liquid filter as claimed in claim 1, wherein said packing retaining members comprise the top and bottom walls of an open ended substantially rectangular casing formed from metallic mesh screening and having interconnected top, bottom and side walls.

4. A liquid filter as claimed in claim 1, wherein said flexible filter retaining members each comprise a substantially rectangular section of metallic mesh screening, one end of each of said members being secured to said packing retaining members and one of said fabric filter pads are secured to each of said flexible filter retainings members.

5. A liquid filter as claimed in claim 4, wherein each of said fabric filter pads is narrower in width than each of said flexible filter retaining members and is secured to said members along the longitudinal marginal edges so as to extend across each of said members in a tensioned form retaining said flexible filter retaining members in an arcuate shape.

6. A liquid filter as claimed in claim 1, wherein the container is of elliptical form in general cross section.

7. A liquid filter as claimed in claim 1, wherein the container is of rectangular form in general cross section.

8. A liquid filter comprising, a casing having one open end, and including opposed inlet and outlet openings, a removable closure for said casing open end, a filter core assembly mounted in said casing so as to divide the interior of said casing into two compartments in register with said casing openings, said filter core assembly being removable and including a central inner liquid pervious layer of metallic packing material sandwiched between upper and lower packing retaining members of mesh screen having a lesser resistance to liquid flow than said central packing layer, said packing retaining members each being of sufficient outer dimensions to frictionally engage the interior of said casing, at least one pair of flexible filter pad supporting members mounted on said packing retaining members and each having a minor portion extending through both of said packing retaining members to retain said members in spaced apart relationship and major portions extending along the exterior of each of said packing retaining members in spaced apart relationship therewith, at least one pair of filter pads of flexible material having a greater resistance to liquid flow than said central packing layer mounted on said flexible supporting members major portions one adjacent each packing retaining member, said filter pads being disposed so as to partially divert a flow of liquid passing between the inlet and outlet openings through said packing retaining members, a portion of each of said packing retaining members being unobstructed by said filter pads, whereby when liquid is caused to flow through said casing between said inlet and outlet openings a major portion first passes through said first filter pad and through one of said packing retaining members, central packing and the other of said packing retaining members and finally through the other of said filter pads.

9. A liquid filter as claimed in claim 8, wherein the container is of rectangular form in general cross section.

10. A liquid filter as claimed in claim 9, wherein the container includes an outwardly extending flange having therein a series of regularly spaced apart openings and surrounding said container open end, said container closure is of equal outer dimensions to said container end flange and includes a series of spaced apart openings in register with said container flange openings, said closure being adapted to be secured in sealing contact to said container flange by a plurality of screws passing through said closure openings and threadably engaging with said container flange openings.

11. A liquid filter as claimed in claim 8, wherein the container is of elliptical form in general cross section.

12. A liquid filter as claimed in claim 11, wherein a substantially U-shaped strap member is pivotally attached to said casing adjacent said open end, a threaded bolt is mounted in a tapped opening disposed substantially centrally of the joining portion of said U-shaped strap member, said closure member being of elliptical form and having an outer peripheral flange adapted to overlap the end walls of said container surrounding said open end, whereby said closure is adapted to be secured in sealing contact to said container by the pivoting of said U-shaped strap over said closure member and the screwing of said threaded bolt against a central portion of said closure member.

13. A liquid filter as claimed in claim 8, wherein the filter packing retaining members each comprise a rectangular section of metallic screening reinforced along the longitudinal edges by opposed angle plates secured thereto.

14. A liquid filter as claimed in claim 8, wherein there are two pairs of said flexible filter retaining members, said pairs of members being disposed in spaced apart relationship, one pair adjacent each end of said filter core assembly, and there is a fabric filter pad mounted between the major portions of each pair of flexible filter retaining members extending above and below said packing retaining members.

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