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(54) **Radiator with integrated header tank and pump**

(57) A radiator (10) with molded plastic header tanks (14,18) has an electric coolant pump and housing assembly (20) integrally formed with the outlet header tank (18). A first half (24) of the pump housing is integrally molded into the header tank (18) and a low point and across a smooth and wide transition. The second half

of the pump housing (26) mates at a sealed circular seam to the first half, with an electric coolant pump (28) held closely inside the two. No fasteners are needed to mount the pump, and the assembly minimizes parts and potential leak points.

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Description

TECHNICAL FIELD

[0001] This invention relates to vehicle power train cooling systems in general, and specifically to a vehicle cooling system radiator with an integrated pump.

BACKGROUND OF THE INVENTION

[0002] Vehicle engine and power train cooling systems have historically used a mechanical, belt driven pump to circulate liquid coolant through an engine jacket and fan cooled radiator. The cooling system can have broader application than just engine cooling, as by incorporating oil and/or transmission fluid coolers in the radiator header tanks. The belt driven pump is a direct way to utilize engine power for both pump and radiator fan, though not necessarily an efficient way, given the attendant limitations on pump placement and matching engine speed to pump and cooling demand, which are not inherently consistent quantities.

[0003] It has been proposed in the patent literature to replace the standard mechanically driven coolant pump (sometimes called a water pump) with an electric pump, which provides the potential to control the pump independent of engine speed. Typically, such pumps are simply illustrated schematically as being located somewhere in the coolant to engine jacket line, with little or no structural detail as to how that would actually be accomplished. A few disclosures show more detailed drawings, such as USPN 4,836,147 (pump located in the radiator to engine jacket return line), USPN 4,996,952 (pump connected to the engine jacket inlet and outlet pipe manifold) and USPN 5,970,925 (pump connected to the panel shaped fan shroud along with the fan and other controls).

SUMMARY OF THE INVENTION

[0004] The subject invention provides a new level of electric coolant pump structural integration by integrating the pump housing directly molded plastic radiator header tank.

[0005] In the preferred embodiment disclosed, a first half of the pump housing is molded directly into the radiator tank, located at a lower point relative to the radiator core. The first housing half is molded with a smooth, integral transition into the body of the tank, and the second half of the pump housing mates to the integral first half at a parting seam. An electronically driven coolant pump is installed water tight inside the two housing halves, and no separate mounting of the pump is necessary. The pump housing thus has a minimal number of potential leak joints, including only the seam between the two pieces of the housing and a single connection between the housing and the rest of the engine cooling system. The transition portion of the radiator tank pro-

vides an integral coolant sump to feed the pump, and the constant head of coolant above the sump (provided by the coolant fill in the higher portions of the radiator core) acts to continually prevent cavitation in the pump itself.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Figure 1 is a perspective view of a radiator and integrated pump housing according to the invention; Figure 2 is a side view of Figure 2;

Figure 3 is a bottom view of a lower radiator tank showing the housing and pump disassembled.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0007] Referring first to Figure 1, a down flow type vehicle radiator is indicated generally at 10. Radiator 10 includes a standard tube and fin type central core 12, in which the tubes, not illustrated in detail, would run vertically. At the top, a an upper molded plastic header tank 14 would act as the inlet for heated engine coolant received through a stub pipe inlet 16 from a standard internal combustion engine cooling jacket, and, at the bottom, a lower header tank 18 provides the outlet for the core 12. The pipes and plumbing incorporated in the rest of the coolant system are conventional and not separately illustrated, for the most part. Radiator 10 would be fixed to a vehicle front body structure by conventional means, such as vibration isolation pads. Core 12 and upper tank 14 are standard design, basically, and would not differ significantly from corresponding components in standard radiators. The lower header tank 18, however, is molded with a novel structure that is the subject matter of the subject invention. A pump and housing assembly, indicated generally at 20, forms an integral part of lower tank 18, and thus of radiator 10. Engine coolant entering the top tank 14 and flowing down through core 12 is cooled, assisted by a standard forced air fan, not separately illustrated, and enters lower tank 18. From there, it is forcibly pumped through assembly 20 and into a coolant distribution manifold, part of which is indicated at 22, and then back into the engine cooling jacket. Only one potential leak joint would exist between assembly 20 and manifold 22, which would be sealed by a standard clamp or other means. There would be a minimum of potential leak joints within assembly 20 itself, and no leak joints relative to lower tank 18, as will be described next.

[0008] Referring next to Figures 2 and 3, molded integrally into lower tank 18 is a first pump housing half 24, which forms essentially a right angle to tank 18. First pump housing half 24 is generally cylindrical in shape and opens at one end into essentially the entire thickness or depth of tank 18, not just through a relatively small diameter pipe stub type outlet, similar to inlet 16,

as would be typical. In addition, there is a smooth, curved transition from the molded body of tank 18 into first pump housing half 24, so that flow from tank 18 into it would be very unrestricted and smooth. In addition, as best seen in Figure 2, the lower portion of pump housing first half 24 rests below outlet tank 18. Mating to first housing half 24 at a circular seam is a second housing half 26, also generally cylindrical in shape. The two housing halves 26 and 24 could be joined together by threads and a gasket, or an ultrasonic weld, or other robust and leak free method. The second housing half 26 necks down to a cylindrical outlet 28, which is directly connectable to manifold 22, by a standard hose clamp or the like. Located within the two mated housing halves 24 and 26 is an electric coolant pump 30 of either the axial flow or centrifugal variety, which would make a close press fit within and between the two housing halves 24 and 26. Provision would have to be made for electric wires to pass through the housing of the assembly 20 and to pump 30, but the wire access and the circular seam between the two housing halves 24 and 26 would represent the only potential leak points out of assembly 20, both of which would be static and easily sealed. No other fasteners or connectors would be necessary to mount pump 30, beyond just placing and sealing it within the two housing halves 24 and 26. Consequently, the assembly 20 is very compact and efficient in terms of number of parts and installation operations needed.

[0009] Referring again to Figure 1, in operation, the pump 30, resting in a low position relative to core 12 and lower tank 18, has a continual column or "head" of coolant sitting above it within the interior of tank 18 (and also within the core 12, for the down-flow orientation), and is therefore less subject to cavitation than a conventionally located coolant pump. In addition, when the system is off, the low location of pump 30, resting above a head of coolant, helps assure that it would not entrain air when restarted, a great advantage insofar as most electric pumps are not self priming. Furthermore, a conventionally mounted electrical coolant pump generally has a housing that is simply located "in-line" somewhere in the plumbing of the coolant system. Consequently, it has a reduced diameter inlet and outlet at each end, to mate with the coolant line that it is located in, with the consequent flow restriction. Here, flow is restricted only at one end, at the end with the outlet 28, while the other end is essentially wide open into outlet tank 18, with very little flow restriction. Thus, the smooth, wide transition from the back of the first housing half 24 into the lower tank 18 provides all the advantages of a fastener free mounting of the pump 30, part reduction, minimal leak joints and a less restricted flow. Molding the lower tank 18 with the integral first housing half 24 adds no additional manufacturing steps and little additional material, and so is very cost effective, as well.

[0010] Variations in the disclosed embodiment could be made. Theoretically, the assembly 20 could be

formed integrally into any radiator tank, be it an upper or lower tank, or a side tank on a radiator of the type with vertical side tanks, and at any location thereon, high, low, or mediate, relative to the core. A relatively low location, such as the very bottom of a vertical tank, is advantageous in creating the continual solid column of coolant within the tank for the pump to work against, however, and it will generally be desired to have the pump located on an outlet tank, so as to pull coolant out of the core, rather than on an inlet tank, so as to push coolant into the core. Potentially, the first pump housing half could be formed integrally into a metal header tank, by stamping or welding, although plastic molding is the more common method with radiator tanks. Especially with a plastic molding, the orientation and location of the first housing half 24, and thus of the whole assembly 20, could be easily changed. This would allow an easy match to an existing coolant manifold. The term "pump housing half" should be understood as a term of art, and not to imply an identity in size or shape between the two housing portions. Any division between the two housing parts that allowed the pump to be inserted between, while still having the first housing "half" integrated with the radiator header tank would provide the basic advantages of easy pump mounting and part and leak joint minimization. Therefore, it will be understood that it is not intended to limit the invention to just the particular embodiment disclosed.

Claims

1. An integrated vehicle radiator (10) and coolant pump assembly (20), comprising in combination;
 - a radiator (10) having a pair of header tanks (14, 18) and an intermediate core (12), one of said header tanks (14, 18) having a first pump housing half (24) integrally formed therewith, a second pump housing half (26) mated to said first pump housing half (24), and, an electric coolant pump (30) contained within said first (24) and second (28) pump housing halves.
2. An integrated vehicle radiator (10) and coolant pump assembly (20) according to Claim 1, further characterized in that said one header tank is an outlet tank (18) and said first pump housing half (24) is located on said outlet tank at a low point relative to said radiator (10).
3. An integrated vehicle radiator (10) and coolant pump assembly (20) according to Claim 1, further characterized in that said first pump housing half (24) and header tank (18) are an integrally molded plastic part.

4. An integrated vehicle radiator (10) and coolant pump assembly (20) according to Claim 1 in which said first (24) and second (26) pump housing halves are generally cylindrical in shape at mate at a circular seam.

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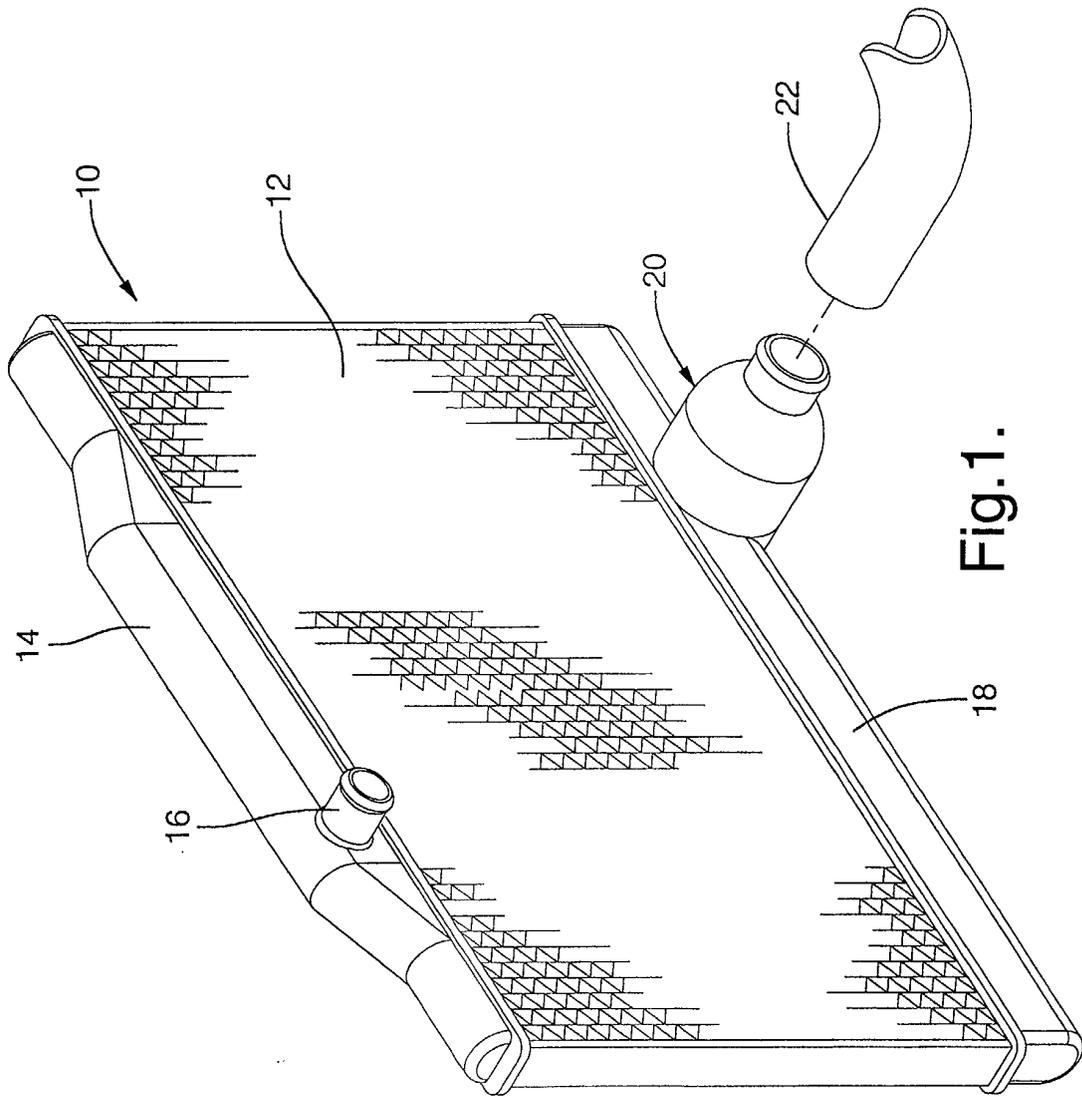
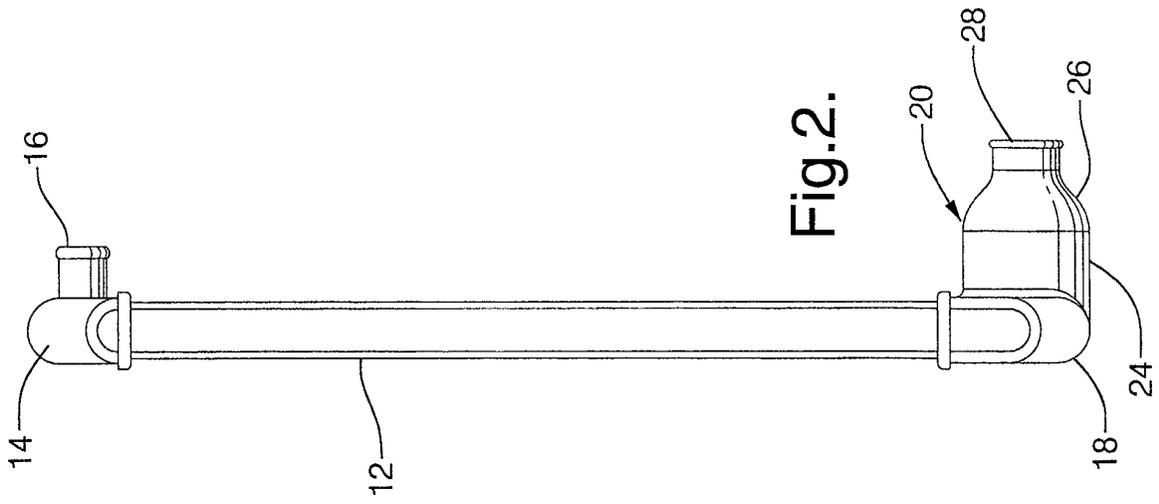
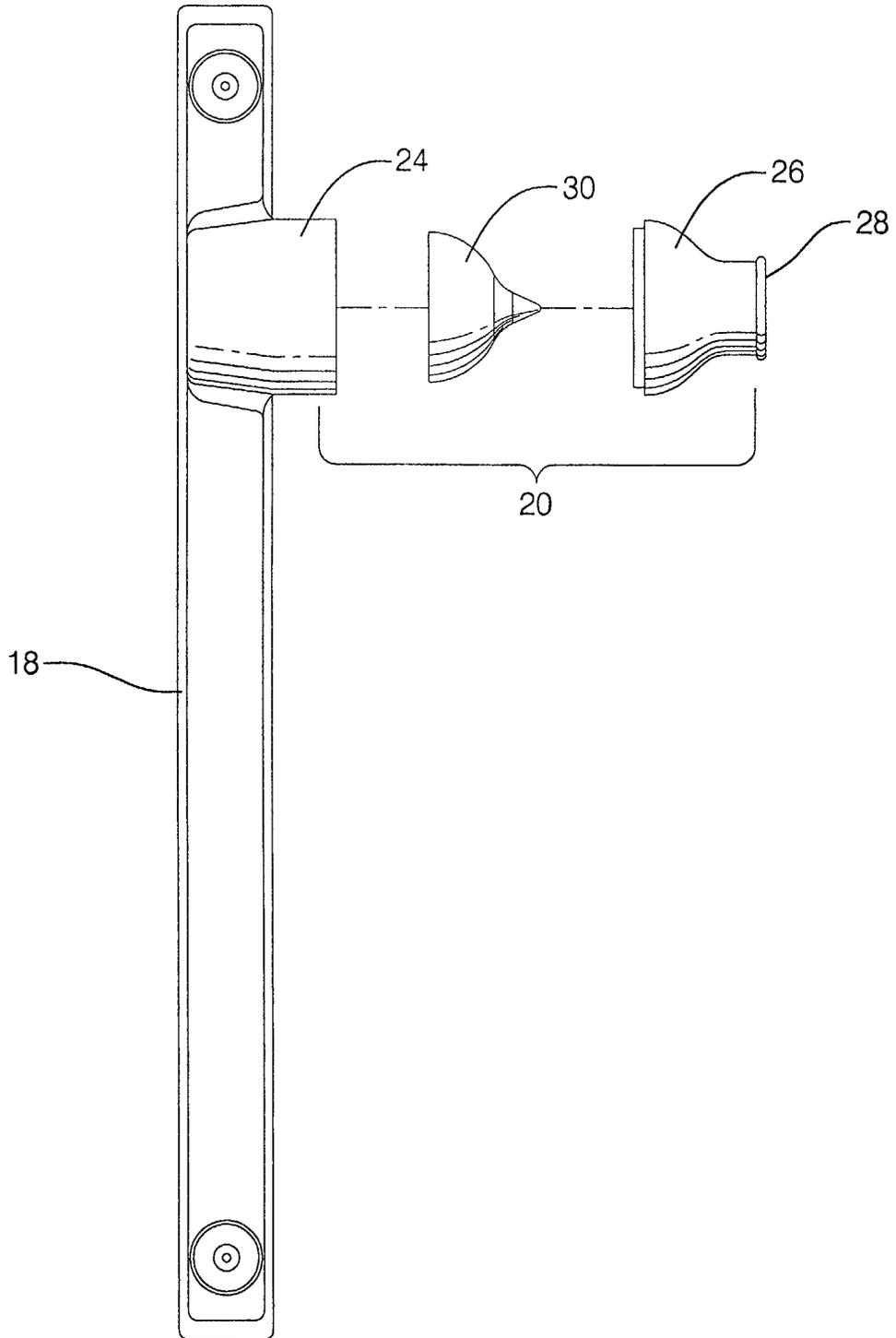


Fig.3.





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EUROPEAN SEARCH REPORT

Application Number
EP 02 08 0605

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
X	EP 0 584 850 A (DSM) 2 March 1994 (1994-03-02) * the whole document *	1-4	F01P5/10
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			TECHNICAL FIELDS SEARCHED (Int.CI.7)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		10 March 2003	Kooijman, F
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 08 0605

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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