# United States Patent [19]

**Ireland et al.**

[11] **3,800,866**

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[54] **RADIATOR ASSEMBLY**


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[73] Assignee: **Stewart-Warner Corporation,** Chicago, Ill.



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[21] Appl. No.: **327,140**

[52] **U.S. Cl.** ..... **165/122,** 165/51

[51] **Int. Cl.** ..... **F24h 3/10**

[58] **Field of Search** ..... 165/122–126, 165/57



[56] **References Cited**

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*Attorney, Agent, or Firm*—Augustus G. Douvas; Norton Lesser



[57] **ABSTRACT**

A static annular radiator having fluid passageway means and radial air passageway means. Fluid inlet and outlet means are provided for the fluid passageway means. Air propelling means are located coaxially of the annular radiator for effecting air flow radially through the air passageway means.


**1 Claim, 7 Drawing Figures**

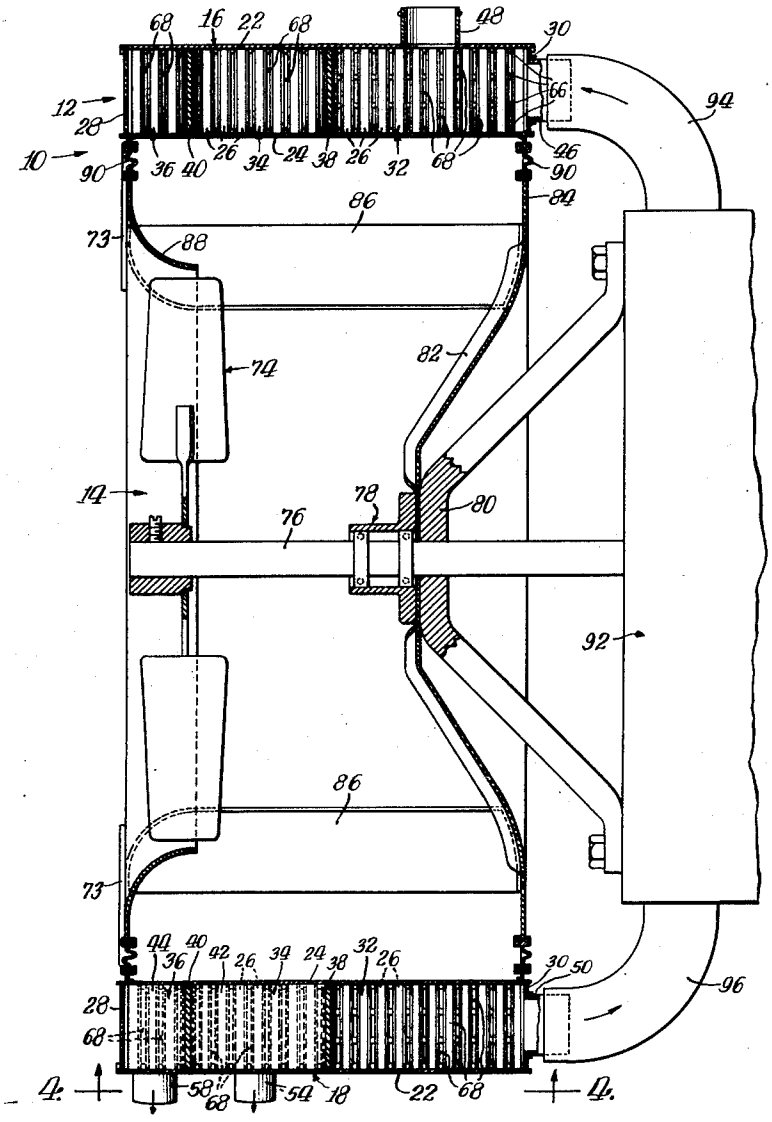


Fig. 1.

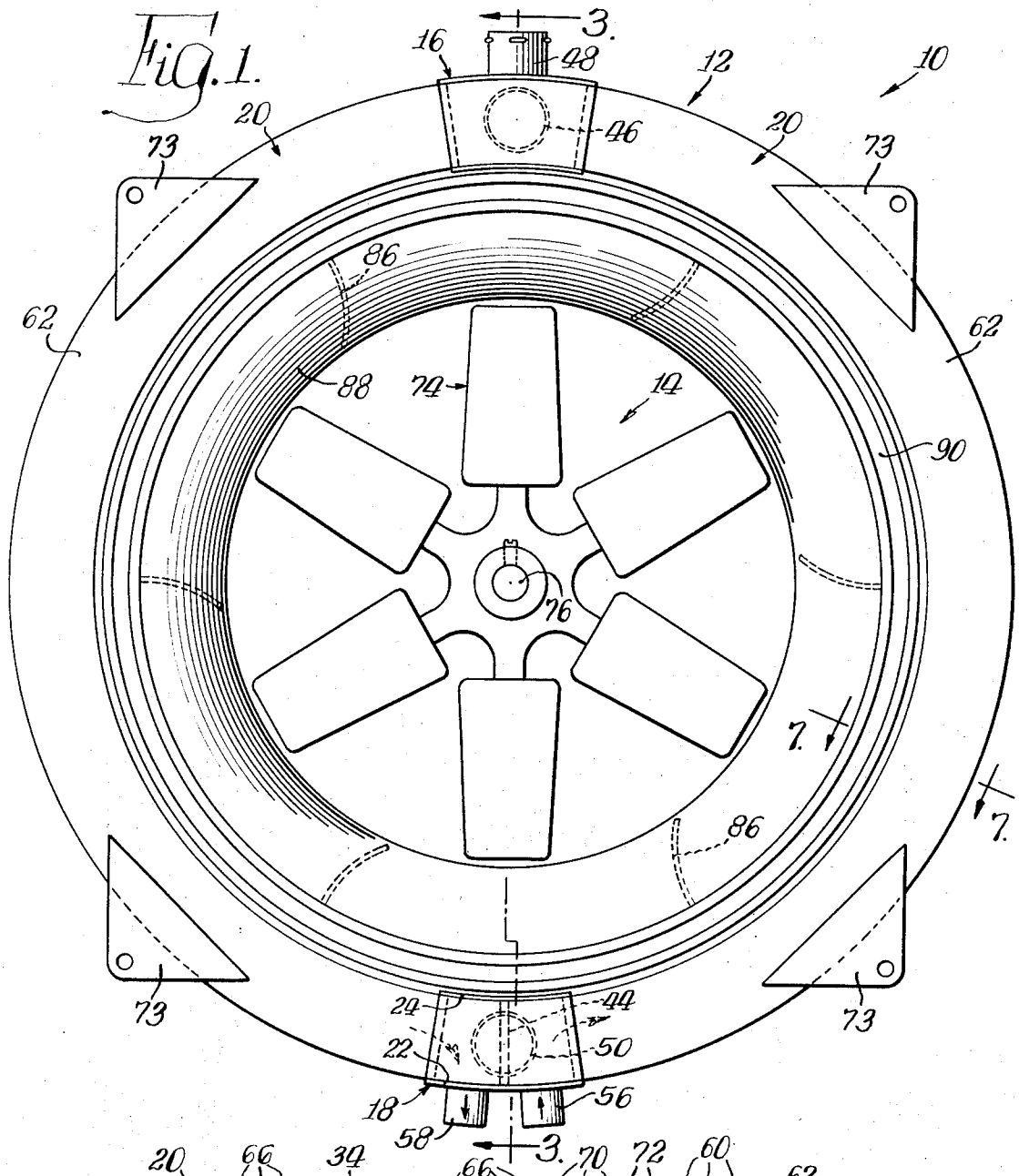

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Fig. 4.

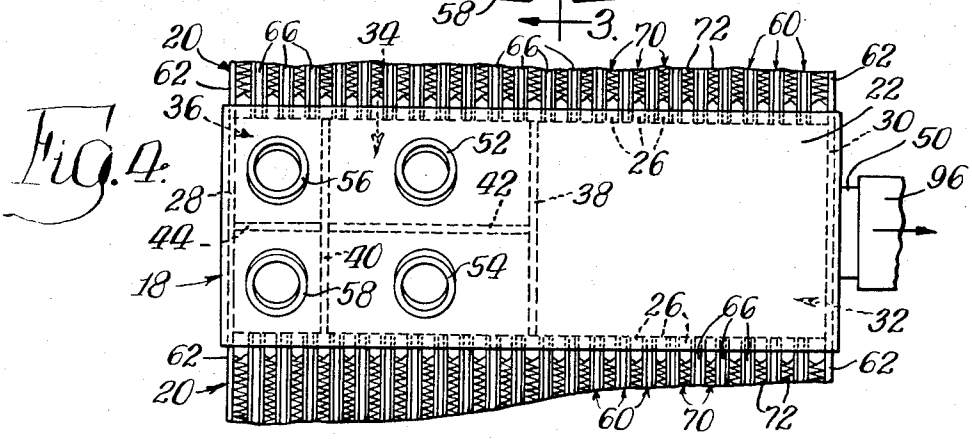

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Fig. 2.

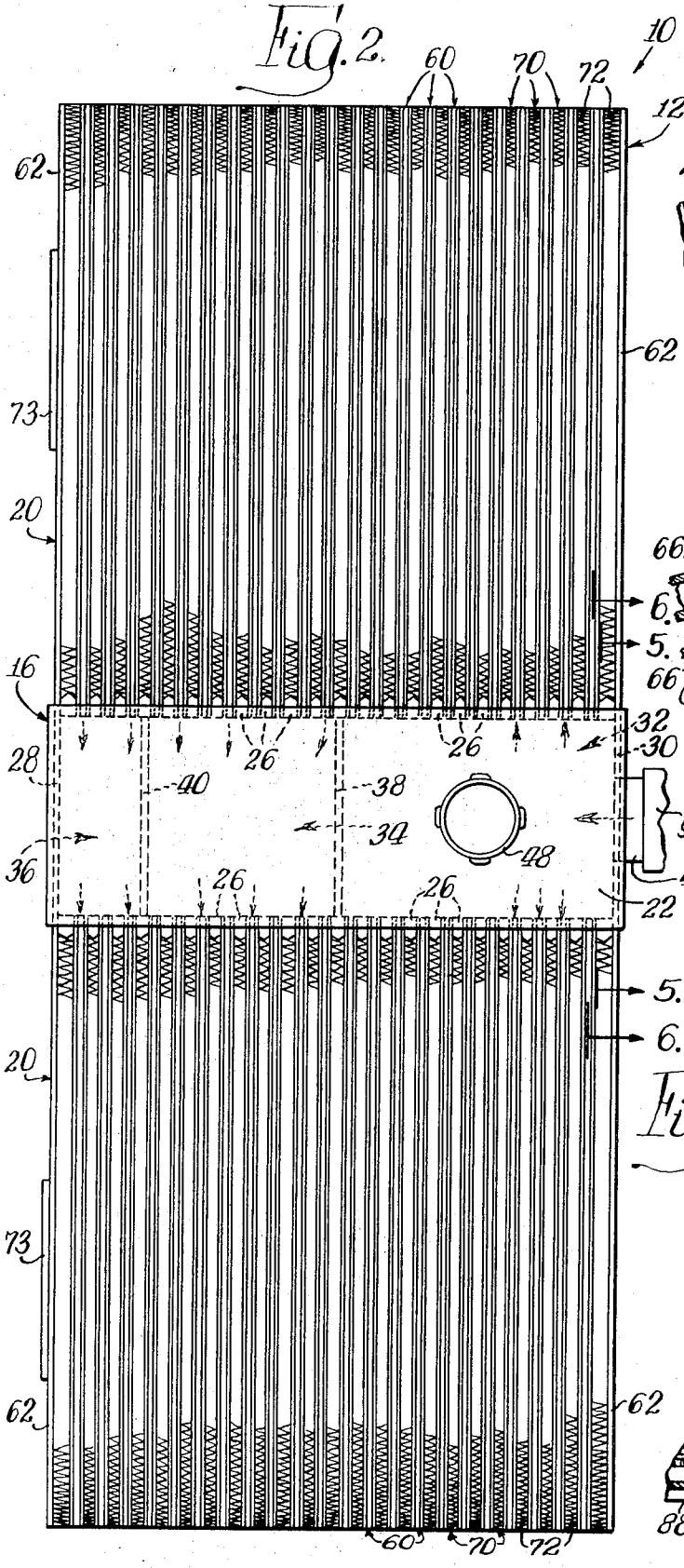



Fig. 5.

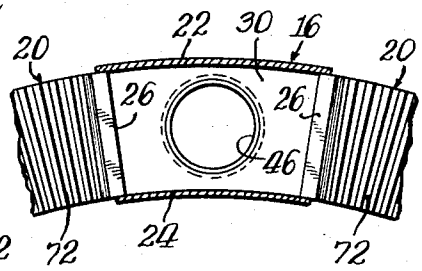



Fig. 6.

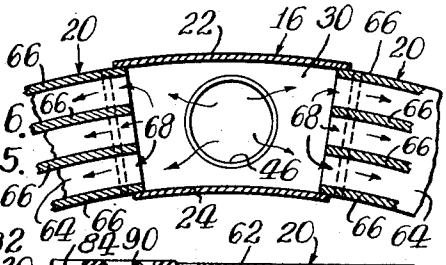



Fig. 7.

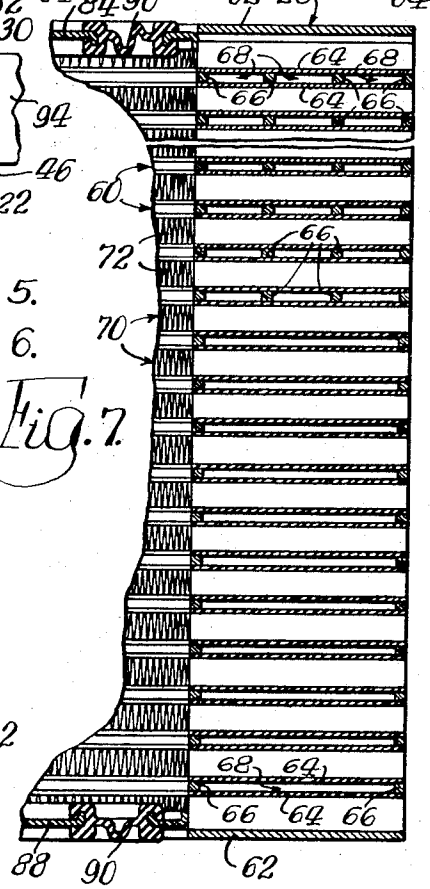
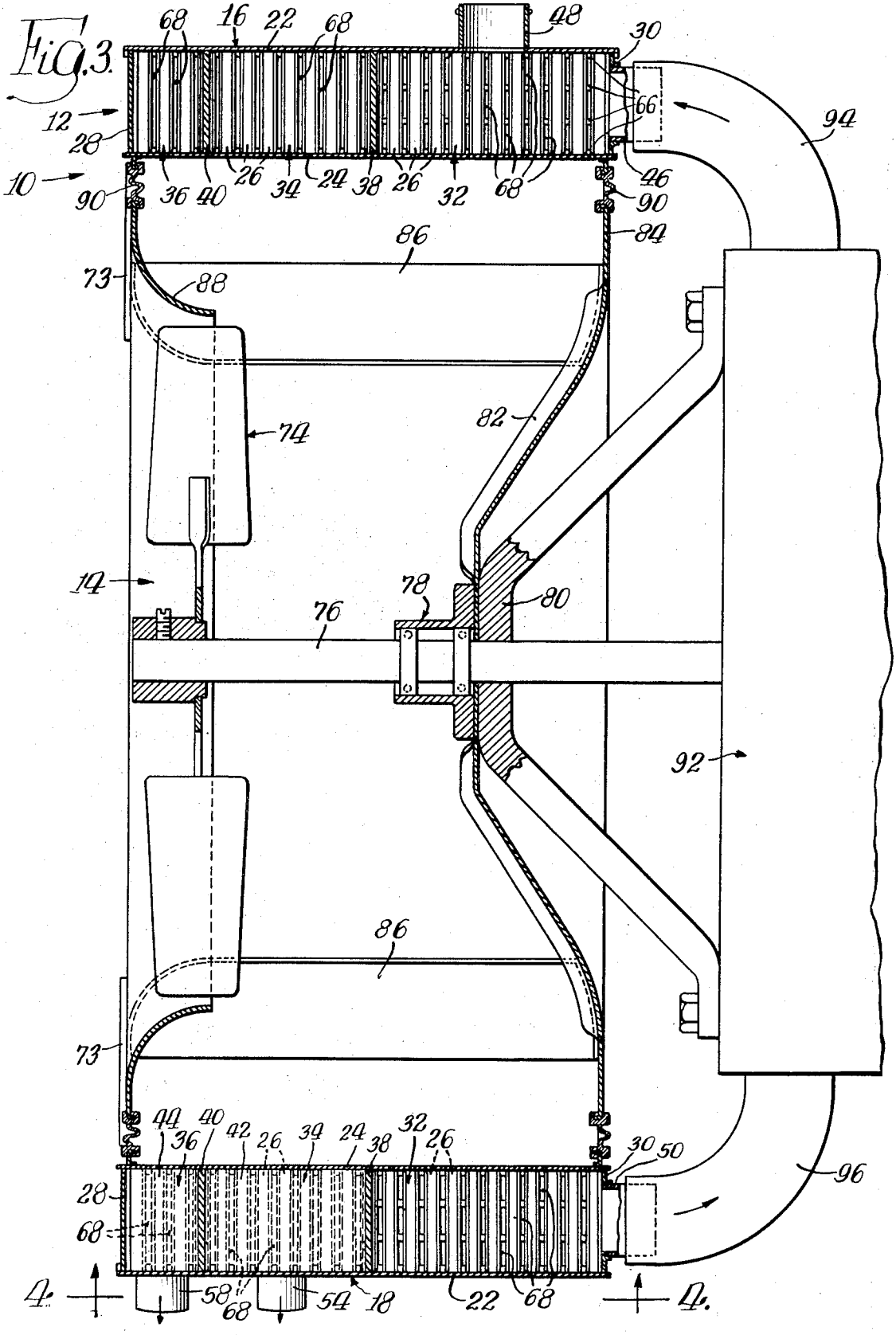


Fig. 3.


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# RADIATOR ASSEMBLY

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to a radiator assembly comprising an annular radiator for use in the cooling system of a truck, off-road vehicle, or the like.

2. Description of the Prior Art

Conventionally, vehicle radiator assemblies comprise a vertical flat, slab-type radiator, and a fan located immediately rearwardly of the radiator. Air distribution over and through the radiator core is inefficient for a number of reasons. First, because the core is generally larger than the diameter of the fan, air is not distributed over the entire surface of the core. Secondly, because the fan is positioned quite close to the radiator, air flow through the core is very uneven. Thirdly, because of the space limitations in a vehicle and the relative motion between parts, it is impossible to provide an effective fan shroud, and, hence, the fan operates at a very low efficiency.

In an effort to overcome certain of the foregoing deficiencies, rotary radiators have been proposed. However, they present at least one additional serious problem—namely, the difficulty of providing and maintaining satisfactory rotary seals at the connections between stationary and rotating liquid-transfer tubing.

## SUMMARY OF THE INVENTION

The radiator assembly unit of the present invention comprises a static annular radiator and air propelling means located coaxially thereof. With this arrangement, air is distributed about the entire radiator, and the flow of air through the radiator is substantially uniform. As a consequence, a vehicle engine of a given size can be cooled with a unit which is smaller than a conventional flat radiator; correspondingly, a unit of given size can cool a larger engine than a conventional flat radiator of the same size.

The indicated radiator arrangement also permits a fan shroud to be mounted close to the outer diameter of the fan of the air propelling means. This improved shroud location contributes to uniform air flow through the radiator, and materially increases the efficiency of the fan. As a consequence of the latter factor, the fan of the present unit, when compared with a fan of the same size associated with a conventional flat radiator, provides greater air flow at the same speed of operation and the same air flow at a lower speed of operation. The lower speed of operation for a given air flow demand results in lower horsepower requirements and decreased noise generation.

In the specific embodiment of the invention disclosed herein, the annular radiator is divided into three parts: one for the engine coolant, one for transmission oil, and one for hydraulic fluid; hence, three otherwise separate cooling units are integrated as a single unit.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a radiator assembly incorporating the principles of the present invention;

FIG. 2 is a top view of the radiator assembly of FIG. 1;

FIG. 3 is a sectional view, taken substantially along the line 3—3 in FIG. 1, looking in the direction indicated by the arrows;



FIG. 4 is a partial bottom view of the radiator assembly of the present invention, taken substantially along the line 4—4 in FIG. 3, looking in the direction indicated by the arrows;

FIG. 5 is a sectional view, taken substantially along the line 5—5 in FIG. 2, looking in the direction indicated by the arrows;

FIG. 6 is a sectional view, taken substantially along the line 6—6 in FIG. 2, looking in the direction indicated by the arrows; and

FIG. 7 is a sectional view, taken substantially along the line 7—7 in FIG. 1, looking in the direction indicated by the arrows.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is indicated generally by the reference numeral 10 a radiator assembly which embodies the principles of the present invention and which is adapted to simultaneously cool three separate fluids. The radiator assembly 10 comprises a static annular radiator 12 and air propelling means 14 located coaxially thereof.

The annular radiator 12 includes diametrically opposed first and second tank portions 16 and 18, and a pair of substantially semi-circular core portions 20.

The tank portions 16 and 18 (FIGS. 2–5) are each comprised of a radially outer wall 22, a radially inner wall 24, two sets or series of axially spaced side bars 26, and end walls 28 and 30. Interiorly, the tank portions 16 and 18 are each divided into first, second and third sections 32, 34 and 36 by means of transverse partitions 38 and 40; and the second and third sections 34 and 36 of the second tank portion 18 are in turn subdivided into two separate compartments by means of axial partitions 42 and 44. Additionally, a first fluid inlet tube 46 is secured in the end wall 30 of the first tank portion 16; and auxiliary fluid transfer tube 48 is secured in the outer wall 22 of the first tank portion 16; a first fluid outlet tube 50 is secured in the end wall 30 of the second tank portion 18; a second fluid inlet tube 52 and a second fluid outlet tube 54 are secured in the outer wall 22 of the second tank portion 18 on either side of the partition 42; and a third fluid inlet tube 56 and a third fluid outlet tube 58 are secured in the outer wall 22 of the second tank portion 18 on either side of the partition 44.

The two core portions 20, as shown in FIGS. 2, 6 and 7, are each comprised of a plurality of radial extending core elements 60 and axially outer plates 62. Each core element 60 includes a pair of semi-circular side plates 64 and two or more intermediate semi-circular spacer rods 66. The core elements 60 are suitably secured at their open ends between the side bars 26 of the tank portions 16 and 18, and define a plurality of arcuate fluid passageways 68 communicating at their ends with the tank portions 16 and 18. The arcuate fluid passageways 68 may have disposed therein, if desired, turbulence promoting elements such as internal fins (not shown). Also, the core elements 60 are axially spaced to define intermediate radial air passageways 70 in which are disposed louvered fin means 72. Additionally, one group of core elements 60 is connected to the first sections 32 of the tank portions 16 and 18, a second group of core elements 60 is connected to the second sections 34 of the tank portions 16 and 18, and a third group of core elements 60 is connected to the

third sections 36 of the tank portions 16 and 18. To accommodate the cooling of a greater or lesser number of separate fluids, the number of sections of the tank portions 16 and 18, and the corresponding number of groups of core elements 60, may be increased or decreased as required. And, the number of core elements 60 within each group may be varied to provide the necessary cooling capacity for each different fluid. The annular radiator 12 is typically mounted to a vehicle frame, and, to accommodate such mounting, support flanges 73 are suitably secured to the front plates 62 of the core portions 20.

The air propelling means 14, as shown in FIG. 3, includes a fan 74 which is located adjacent the front side of the annular radiator 12 and which is secured on a drive shaft 76. The shaft 76 is rotatably mounted in primary support means comprised of a bearing assembly 78 secured to a primary support bracket 80. Also connected to the primary support means is secondary support means comprised of a combined secondary support bracket 82 and backplate 84 adjacent the rear side of the annular radiator 12. Axial arcuate braces 86 are secured between the secondary support means 82, 84 and an annular fan shroud 88 adjacent the front side of the annular radiator 12. The axial arcuate braces 86 serve to connect the shroud 88 to the secondary support means 82, 84 for support thereby, and also serve as air deflection vanes. Means, in the form of annular flexible connectors 90, are provided intermediate the annular radiator 12 and the peripheries of the annular shroud 88 and the backplate 84 for absorbing the differential motion and for sealing the gaps therebetween.

When the radiator assembly 10 is installed in a vehicle, the support flanges 73 are secured to the vehicle frame (not shown); the primary support bracket 80 is secured to the vehicle engine, shown diagrammatically at 92 in FIG. 3; the drive shaft 76 is driven by the engine 92 for example through a belt and pulley arrangement (not shown); and the first fluid inlet and outlet tubes 46 and 50 are connected to the engine water jacket and water pump (not shown) through inlet and outlet radiator hoses 94 and 96. Additionally, the auxiliary fluid transfer tube 48 is connected to a water reservoir tank (not shown); the second fluid inlet and outlet tubes 52 and 54 are connected to the vehicle transmission (not shown); and the third fluid inlet and outlet tubes 56 and 58 are connected to the vehicle hydraulic system (not shown). The vehicle engine 92, the vehicle components referred to but not shown, and the connections thereto, are conventional and do not form part of the present invention.

When the engine 92 is operating, water or other coolant heated in the engine 92 is directed therefrom through the inlet radiator hose 94 and the first fluid inlet tube 46 to the first section 32 of the first or upper tank portion 16. The coolant received in the first section 32 bifurcates and flows in parallel down through the first group of core elements 60 of the core portions 20 at each side of the radiator 12. The coolant flowing from the core elements 60 is collected in the first tank section 32 of the second or bottom tank portion 18 and returned through the first fluid outlet tube 50 and the outlet radiator hose 96 to the engine 92. Required reserve coolant is supplied through the auxiliary fluid transfer tube 48 from the reservoir tank connected thereto.

While the engine coolant is circulated as described, oil from the vehicle transmission is directed into the second fluid inlet tube 52, circulated through the radiator 12, and returned from the second fluid outlet tube 54 to the transmission. More specifically, the transmission oil is circulated through one compartment of the second section 34 of the bottom tank portion 18, the second group of core elements 60 at one side of the radiator 12, the second section 34 of the upper tank portion 16, the second group of core elements 60 at the other side of the radiator 12, and the other compartment of the second section 34 of the bottom tank portion 18.

Also concurrently, oil from the vehicle hydraulic system is directed into the third fluid inlet tube 56, circulated through the radiator 12, and returned from the third fluid outlet tube 58 to the hydraulic system. In particular, the hydraulic system oil is circulated through one compartment of the third section 36 of the bottom tank portion 18, the third group of core elements 60 at one side of the radiator 12, the third section 36 of the upper tank portion 16, the third group of core elements 60 at the other side of the radiator 12, and the other compartment of the third section 36 of the bottom tank portion 18.

To cool the liquids as they flow through the radiator 12, the fan 74 draws air axially inwardly of the radiator assembly 10 and directs the same radially outwardly through the air passageways 70 across the air fin means 72. To be noted is that the shroud 88 is mounted close to the outer diameter of the fan 74. By reason of the described arrangement of the components of the radiator assembly 10, air is distributed about the entire radiator 12, the flow of air through the radiator 12 is substantially uniform, and the efficiency of the fan 74 is maximized. If desired, the direction of air flow through the radiator assembly 10 could be reversed.

During operation of the engine 92 there is a certain degree of vibration thereof. On the one hand, the fan 74 and the shroud 88, which in effect are mounted to the engine 92 as a unit, move conjointly with the engine 92 as the latter vibrates. On the other hand, the radiator 12, which is mounted to the vehicle frame, is isolated from vibrations, not only of the engine 92 but also of the fan-shroud mounting, by means of the flexible connectors 90. The foregoing arrangement allows the desired close fit to be maintained between the fan 74 and the shroud 88.

While there has been shown and described a preferred embodiment of the present invention, it will be understood by those skilled in the art that various rearrangements and modifications may be made therein without departing from the spirit and scope of the invention.

The invention claimed is:

1. An annular radiator assembly for use in cooling different types of vehicle fluids with one of said fluids being the coolant of an engine supported on a vehicle frame and another of said fluids being primarily an oil fluid, a pair of tanks in diametrically opposite positions with each tank having a pair of radially spaced axially extending walls, each tank having axially spaced radial walls between the respective pair of said radially spaced walls to define a plurality of sections for each tank with each section in each tank corresponding to a respective one of said fluids, a series of axially spaced side bars for each tank section extending between the

respective pair of radially spaced walls, a plurality of pairs of semicircular cores connected to each tank section between the respective side bars for communicating fluid between the corresponding sections of said diametrically opposite tanks with the space between said cores defining radially extending air passageways, means for communicating said fluids to and from selected corresponding tank sections, a fan adjacent one axial end of said diametrically opposite tanks, a drive shaft located coaxially of said semicircular core elements, primary support means mounting said drive shaft on said engine for rotation by said engine to rotate said fan, a back plate extending from said primary support means radially of said drive shaft to a radial position spaced adjacent the opposite axial end of said tanks from said fan, an annular shroud adjacent said one axial end of said tanks closely encircling said fan for cooperating with said backplate to direct air moved by said fan in a radial direction through said air passageways, means for supporting said tanks on said vehicle frame, respective secondary resilient support means connected between said shroud and the adjacent axial end of said tanks and between said backplate and said opposite axial end of said tanks for resiliently supporting said cores and tanks relative said shroud, backplate, fan and engine, and a plurality of circumferentially spaced axially extending arcuate struts fixed at opposite axial strut ends to said shroud and backplate respectively for connecting said shroud to said backplate and having opposite radial edges offset in a circumferential direction for deflecting said air moved in a radial direction.

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