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# Heat exchanger assembly

This invention relates to heat exchanger assemblies incorporating a frame which supports one or more cores.

Heat exchangers and radiators, and particularly the type of radiators used to cool internal combustion engines, either on a moving vehicle or on a fixed stationary frame, have usually been constructed as single integral units. Such heat exchangers and radiators have also been constructed by mounting a plurality of cooling cores between a pair of spaced inlet and outlet tanks or by connecting the cooling cores together by hoses. These cooling cores include tubes having fins radiating orthogonally therefrom and provide a means for conducting a fluid coolant from the circulating system of the engine so that it flows from the inlet tank, through the tubes, and into the outlet tank. Air flow, often created by a fan or movement of the vehicles, passes through the radiator to absorb heat from the radiating fins thereby reducing the temperature of the fluid coolant flowing through the tubes.

The heat absorbing air flow often carries debris which clogs and damages the cores. Various attempts have been made to avoid such clogging and damage including arranging multiple core modules angularly in a core mounting frame with respect to air flow in slotted "V" shaped pairs so that the debris is deflected from one of the core faces and directed through the slots. The cores are rotated after a period of use to expose an unclogged core face to the debris laden air flow.

One limitation is that it is costly and time consuming to locate the cores at the proper angular relationship in the first instance and then to locate them again when the cores are rotated. Thus there is a need for a suitable locating means which provides both initial location and rotated location. Previously, the core modules and the inlet/outlet tanks were connected by one or more fluid coolant carrying tubes at each end of the module. Connection of the tubes provided the desired angular relationship of the module to the air flow. However, these multiple tube connections increased the possibility of leakage of the coolant.

Recognising that vehicle frames vibrate and distort during operation, the radiator cores have in the past been resiliently mounted in some manner to prevent rupture and leakage of the radiator cores which might otherwise occur if the cores were rigidly attached to the frame or to the manifold. A resilient mounting seal has been provided to limit vibration and seal against leakage. However, it has been difficult to provide a suitable resilient mounting seal which could accommodate the locating means and provide a beneficial seal between the core and the multiple tube connections.

One previous construction, illustrated in International Patent Application No. WO 79/00605, utilizes two fluid coolant carrying tubes at each end of each core the cores being resiliently mounted in the vehicle frame. However, this construction suffers from the problems outlined above with respect to possible leakage of coolant, and the difficulties of providing a good seal between the core and the multiple tube connections.

In accordance with the invention, a heat exchanger assembly comprises a pair of frame members each having an aperture therein; a core extending between the frame members and having opposed end portions and a spout extending outwardly from each end portion and into the aperture of a respective one of the frame members; complementary locating means on one of the end portions and on the respective frame member for locating the core in a predetermined registration with the frame members; and resilient means resiliently supporting the core between, and sealing the core to, the frame members, the resilient means including a resilient pad positioned between the one end portion and the respective frame member, characterised in that the complementary means comprises an imperforate protuberance and an imperforate detent, and in that the resilient means has a portion resiliently interposed between the protuberance and detent.

The detent and the protuberance are preferably duplicated on opposite sides of the spout on the one end portion and on the respective frame member whereby the core may be located in registration with the frame in two positions between which it is notionally rotated through 180° about the axis of the spout.

An example of an assembly constructed in accordance with the invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical section through one of a plurality of radiator core modules and taken on the line I—I in Figure 6;

Figure 2 is an isometric view illustrating a portion of a core module having a pair of locating protuberances;

Figure 3 is a plan illustrating a resilient pad;

Figure 4 is a side elevation of the pad in partial section on the line IV—IV in Figure 3;

Figure 5 is a side elevation as seen from the line V—V in Figure 2; and,

Figure 6 is a plan showing the angular relationship of adjacent core modules of the assembly as seen from the line VI—VI in Figure 1.

A heat exchanger core mounting apparatus is designated 10, Figure 1, and comprises a core supporting frame which includes a pair of spaced apart inlet and outlet header plates 12,12*a*. A main inlet tank 14 is secured to

adjacent inlet plate 12 by bolts 15 and a main outlet tank 14*a* is secured to adjacent outlet plate 12*a* by bolts 15*a*. A plurality of core modules, including but not limited to 16,16*a*,16*b*, are mounted between plates 12,12*a* and are located in angular relationship with respect to an air flow as indicated by an arrow designated 18, see also Figure 6. Thus, air flow passes across an upstream side 20 of plates 12,12*a*, through core modules 16,16*a*, 16*b* and across a downstream side 22 of plates 12, 12*a*.

Means 24 are provided for locating core modules 16,16*a*,16*b* in predetermined registration with plates 12,12*a*. By predetermined registration is meant that core modules are located generally in "V" shaped pairs (Fig. 6) so that one edge 26 of each core 16,16*a*,16*b* is adjacent upstream side 20 of plates 12,12*a* and another edge 28 of each core 16 is adjacent downstream side 22. The upstream edges 26 of adjacent cores are in close enough proximity to resist flow therebetween. However, the downstream edges of adjacent cores are in close proximity to permit air flow therebetween in such a manner that a slot 30 is formed of a sufficient size to permit the passage of debris therethrough. The means 24 for locating preferably includes first and second locating members such as detents 32 formed in plates 12,12*a* and corresponding protuberances 34 formed on each core 16.

Means 36 are provided for sealingly and resiliently mounting each core 16,16*a*,16*b* with plates 12,12*a*. One of such means 36 is between an inlet end 38 of core 16 and inlet plate 12 and another of such means 36 is between an outlet end 40 of core 16 and outlet plate 12*a* in a manner so as to accommodate locating means 24.

Plates 12,12*a*, Figures 1 and 6, include apertures 42 and also includes the plurality of first locating members or detents 32 adjacent upstream side 20 and adjacent downstream side 22. A plurality of connector bars 13, which do not inhibit air flow, may be used to interconnect plates 12,12*a*.

Cores 16,16*a*,16*b* include a plurality of tubes 44 having a plurality of very closely spaced cooling fins 46 radiating orthogonally therefrom. A core inlet tank 48, see also Figures 2 and 5, is at inlet end 38 of core 16 and a core outlet tank 50 is at outlet end 40 of core 16. Tanks 48,50 each include spout 52 provided for extending into aperture 42 of plates 12,12*a* and also include at least one, and preferably a pair of, second locating members such as protuberances 34 spaced equidistantly from spout 52. Spouts 52 of each core 16,16*a*,16*b* lie on a common axis which, in the form illustrated, is the vertical geometric centerline or longitudinal axis of the core. In this manner each core 16, 16*a*,16*b* is pivotally mounted between plates 12,12*a* by virtue of spouts 52 being a pivotal axis. Protuberances 34 are of a construction sufficient for engagement with detents 32. As best illustrated in Figures 1 and 6, a pair of protuberances 34 engage a pair of detents 32, one of the protuberances 34 and engaged detents 32 being adjacent upstream side 20 and another of the protuberances 34 and engaged detents 32 being adjacent downstream side 22 for securing any of the cores 16,16*a*,16*b*, or others, in the desired predetermined registration with plates 12,12*a*. More specifically, detents 32 are located in a predetermined registration so that when engaged by a given pair of protuberances 34 on a given core 16,16*a*,16*b*, etc., edge 26 of core 16*a*, for example, is in flow resisting proximity with adjacent core 16*b* at upstream side 20 and edge 28 of core 16*a* is in flow permitting proximity with adjacent core 16 at downstream side 22 forming slot 30. Protuberances 34 can engage either the upstream or downstream detents 32 when core 16 is rotated 180 degrees so that either edge 26,28 is adjacent upstream side 20 or downstream side 22 for exposing either one of the similar opposed faces 68 (only one of which is shown in Figure 1) of core 16.

Means 36, see also Figures 3 and 4, comprises inlet resilient mounting member 54 and an outlet resilient mounting member 56, each member including a single lip 58 for sealing between aperture 42 and spout 52 and peripheral resilient mounting strip 60. Each member includes resilient locating detent pads 62 formed to accommodate protuberances 34 on one side 64 and to accommodate detents 32 on another side 66. As illustrated in Figure 1, inlet resilient member 54 is between core inlet tank 48 and inlet plate 12, whereas outlet resilient member is between core outlet tank 50 and outlet plate 12*a*. Apertures 70 are formed through pads 62 to limit air entrapment between detents 32 and protuberances 34.

With the parts assembled as set forth above, hot fluid is introduced into main inlet tank 14 and then flows downwardly through tubes 44 of core 16 and into the main outlet tank 14*a*. The fluid is cooled in the core 16 in the usual manner. As the fins 46 on faces 68 of the core 16 which are receiving air flow are erroded or abraded due to sand particles and the like in the air flow it may become necessary to rotate the core 16 and into the main outlet tank 14*a*. The loosen or remove bolts 15 and partially separate the core 16 from the input plate 12 and the output plate 12*a* and rotate core 16, in place, 180°. The entire assembly is then positioned back in place. Generally, the resilient means 36 will not be rotated but will be left affixed to the core 16.

The present heat exchanger structure is useful for cooling internal combustion engines such as are used in vehicles and in stationary installations. The possibility of leakage is minimized by providing only a single fluid communication between each core 16, its inlet

plate 12 and its outlet plate 12*a*.

## Claims

1. A heat exchanger assembly (10) comprising a pair of frame members (12,12*a*) each having an aperture (42) therein; a core (16) extending between the frame members and having opposed end portions (38,40) and a spout (52) extending outwardly from each end portion and into the aperture of a respective one of the frame members; complementary locating means (32,34) on one of the end portions and on the respective frame member for locating the core in a predetermined registration with the frame members; and resilient means (56) resiliently supporting the core between, and sealing the core to, the frame members, the resilient means including a resilient pad (54,56) positioned between the one end portion and the respective frame member, characterised in that the complementary means comprises an imperforate protuberance (34) and an imperforate detent (32), and in that the resilient means has a portion (64,66) resiliently interposed between the protuberances (34) and detent (32).

2. An assembly according to claim 1, wherein the detent (32) and the protuberance (34) are duplicated on opposite sides of the spout on the one end portion and on the respective frame member whereby the core may be located in registration with the frame in two positions between which it is notionally rotated through 180° about the axis of the spout.

3. An assembly according to claim 1 or claim 2, wherein the or each detent (32) and protuberance (34), and resilient pad (54,56) are also provided on and between the other end portion (38,40) and the respective frame member (12,12*a*).

4. An assembly according to any one of the preceding claims, including a plurality of the cores (16) extending between the frame members (12,12*a*), a plurality of the resilient means for resiliently and sealingly supporting the cores between the frame members, and a plurality of imperforate detents (32) and complementary imperforate protuberances (34) for locating the cores in predetermined registration with the frame members.

## Revendications

1. Ensemble échangeurs de chaleur (10) comprenant deux éléments de châssis (12,12a), ayant chacun une ouverture (42); un coeur (16) s'étendant entre les éléments de châssis et ayant des parties d'extrémité opposées (38,40) et un goulot (52) s'étendant vers l'extérieur à partir de chaque partie d'extrémité et dans l'ouverture de l'élément de châssis correspondant; des moyens de positionnement complémentaires (32,34) sur une des parties d'extrémité et sur l'élément de châssis correspondant pour placer le coeur dans une position prédéterminée par rapport aux éléments de châssis; et des moyens élastiques (56) pour supporter élastiquement le coeur entre, et pour entre le coeur étanche par rapport aux éléments de châssis, les moyens élastiques comprenant un patin élastique (54,56) placé entre la partie d'extrémité précitée et l'élément de châssis correspondant, caractérisé en ce que les moyens complémentaires comprennent une protubérance imperforée (34) et un creux imperforé (32), et en ce que les moyens élastiques ont une partie (64,66) interposé élastiquement entre la protubérance (34) et le creux (32).

2. Ensemble selon la revendication 1, dans lequel le creux (32) et la protubérance (34) sont reproduits en double de part et d'autre du goulot sur la partie d'extrémité précitée et sur l'élément de châssis correspondant, de sorte que le coeur peut être disposé dans une position prédéterminée par rapport au châssis dans deux positions entre lesquelles il a tourné d'une manière imaginaire de 180° autour de l'axe du goulot.

3. Ensemble selon la revendication 1 ou la revendication 2, dans lequel le ou chaque creux (32) et protubérance (34), et le patin élastique (54,56) sont également prévus sur et entre l'autre partie d'extrémité (38,40) et l'élément de châssis correspondant (12,12a).

4. Ensemble selon l'une quelconque des revendications précédentes, comprenant un certain nombre de coeurs (16) s'étendant entre les éléments de châssis (12,12a), un certain nombre de moyens élastiques pour supporter élastiquement et de manière étanche les coeurs entre les éléments de châssis, et un certain nombre de creux imperforés (32) et de protubérances imperforées complémentaires (34) pour positionner les coeurs dans des positions prédéterminées par rapport aux éléments de châssis.

## Patentansprüche

1. Wärmeaustauscheranordnung (10) mit einem Paar von Rahmengliedern (12,12a), deren jedes eine Öffnung (42) darinnen aufweist, mit einem sich zwischen den Rahmengliedern erstreckenden Kern (16) mit entgegengesetzt liegenden Endteilen (38, 40) und mit einem sich von jedem Endteil nach außen und in die Öffnung eines entsprechenden der Rahmenglieder erstreckenden Füllstutzens (52), mit komplementären Anordnungsmitteln (32, 34) auf einem der Endteile und dem entsprechenden Rahmenglied zur Anordnung des Kerns in einer vorbestimmten Ausrichtung mit den Rahmengliedern, und mit elastischen Mitteln (56) zur elastischen Halterung des Kerns zwischen und zur Abdichtung des Kerns gegenüber den Rahmengliedern, wobei die elastischen Mittel ein elastisches Kissen (54,56) angeordnet zwischen dem einen Endteil und

dem entsprechenden Rahmenglied aufweisen, dadurch gekennzeichnet, daß die komplementären Mittel einen nicht gelochten Vorsprung (34) und nicht gelochte Rastmittel (32) aufweisen, und daß die elastischen Mittel einen Teil (64,66) elastisch angeordnet zwischen dem Vorsprung (34) und den Rastmitteln (32) besitzen.

2. Anordnung nach Anspruch 1, wobei die Rastmittel (32) und der Vorsprung (34) auf entgegengesetzten Seiten des Füllstutzens auf dem einen Endteil und auf dem entsprechenden Rahmenglied dupliziert vorgesehen sind, wodurch der Kern in Ausrichtung mit dem Rahmen in zwei Positionen angeordnet ist, zwischen welchen er gedanklich um 180° um die Füllstutzenachse verdreht ist.

3. Anordnung nach Anspruch 1 oder 2, wobei das oder jedes Rastmittel (32) und der Vorsprung (34) und das elastische Kissen (54,56) ebenfalls am und zwischen dem anderen Endteil (38,40) und dem entsprechenden Rahmenglied (12,12a) vorgesehen sind.

4. Anordnung nach einem der vorhergehenden Ansprüche, mit einer Vielzahl von Kernen (16), die sich zwischen den Rahmengliedern (12,12*a*) erstrecken, mit einer Vielzahl von elastischen Mitteln zur elastischen und abdichtenden Halterung der Kerne zwischen den Rahmengliedern, und ferner mit einer Vielzahl von nichtgelochten Rastmitteln (32) und komplementären nichtgelochten Vorsprüngen (34) zur Anordnung der Kerne in vorbestimmter Ausrichtung mit den Rahmengliedern.

FIG. 1.

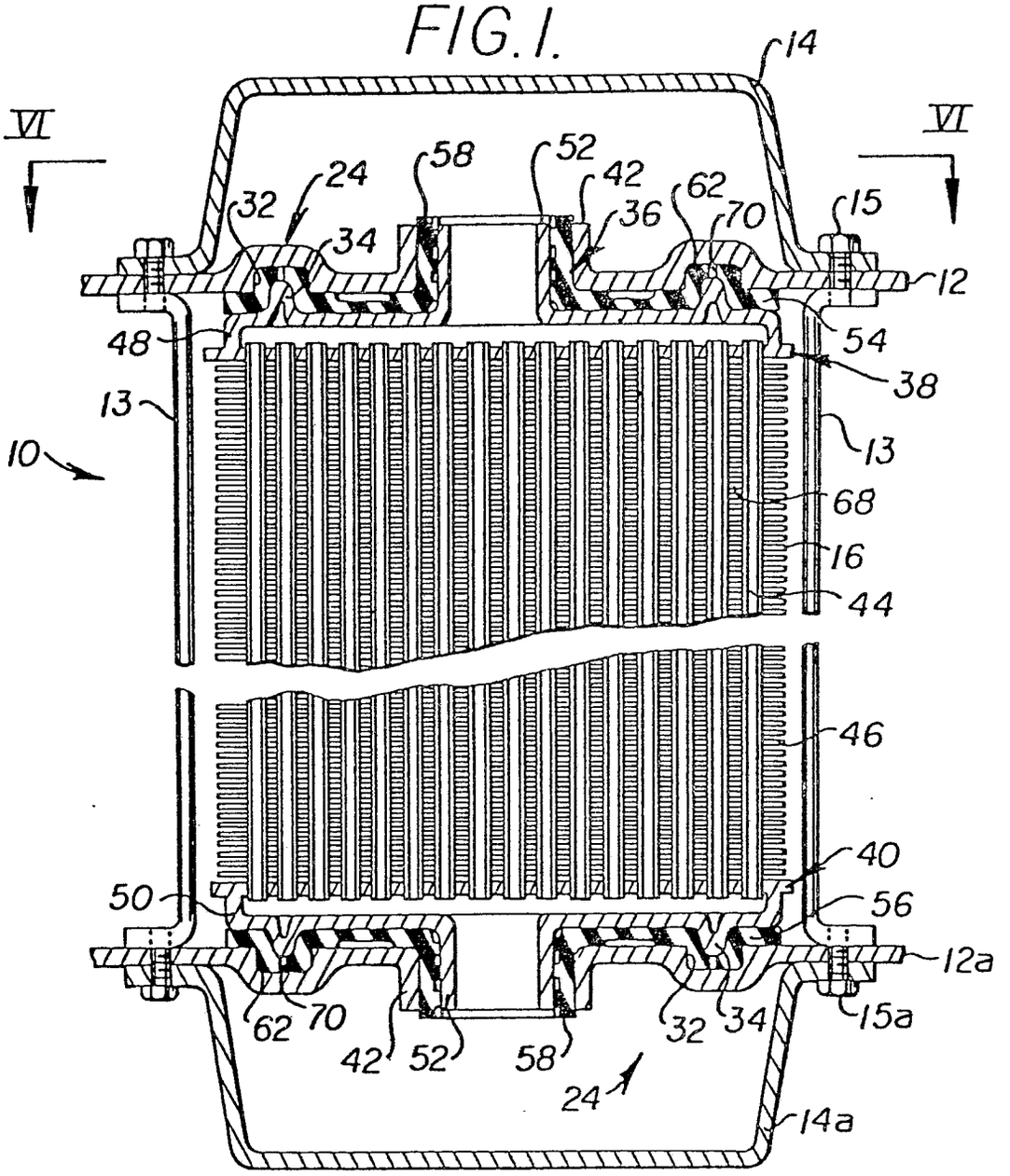
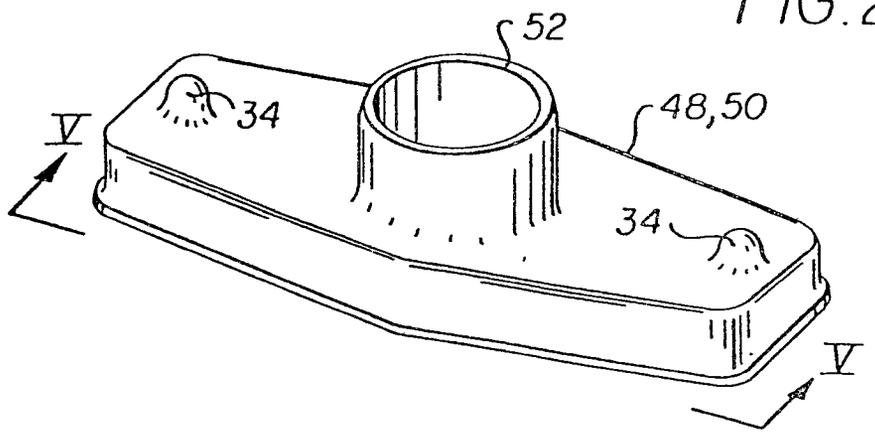

14
VI
VI
58
52
42
24
32
62
36
70
15
34
12
48
54
38
13
13
10
68
16
44
46
40
50
56
12a
62
70
42
52
58
32
34
15a
24
14a

FIG. 2.


52
V
34
48,50
34
V

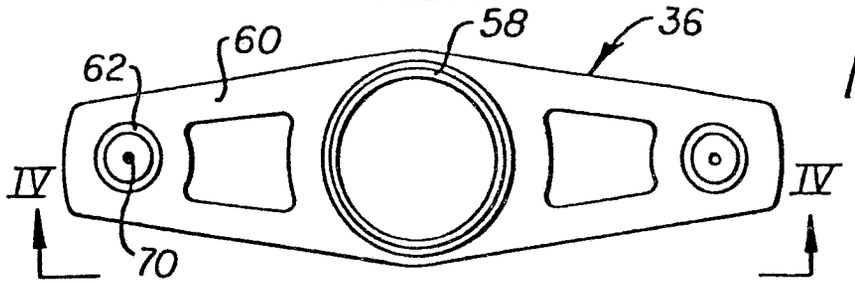



FIG.3.

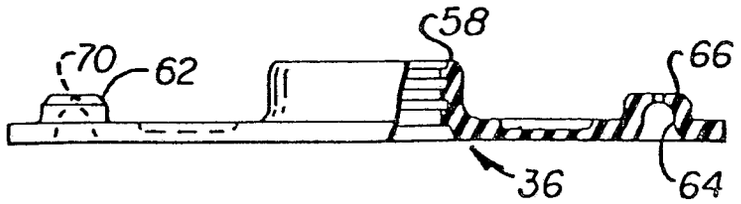



FIG.4.

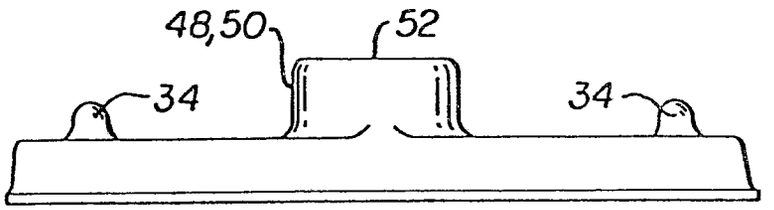



FIG.5.

FIG.6.