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HEAT EXCHANGER WITH HEADER TANKS

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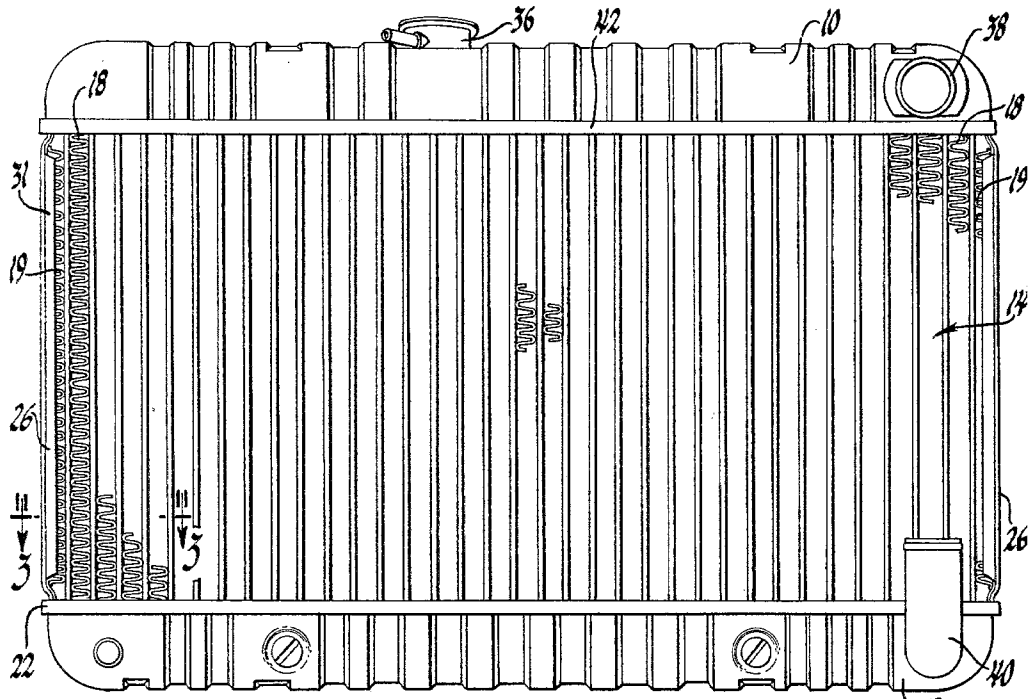


Fig. 1

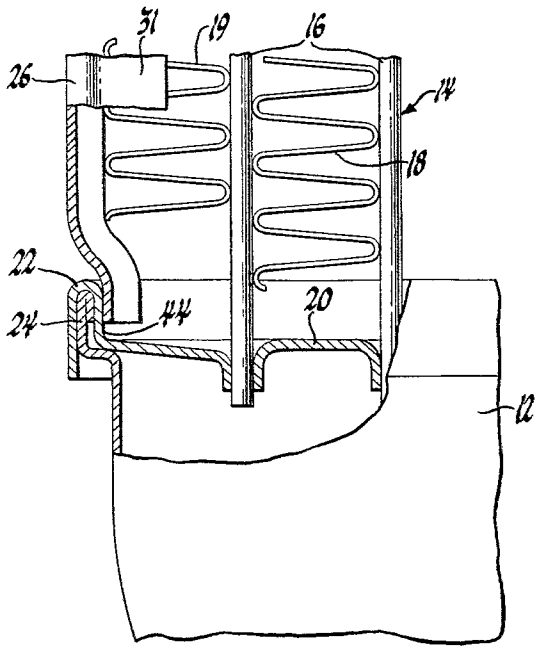


Fig. 2

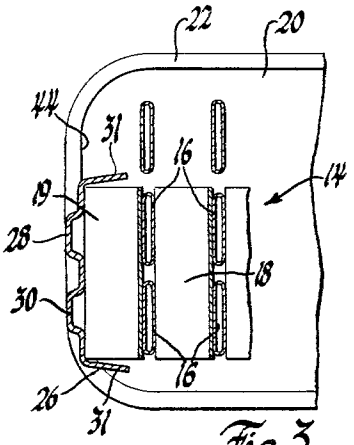


Fig. 3

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HEAT EXCHANGER WITH HEADER TANKS

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4 Claims. (Cl. 165—81)

This is a continuation of application Serial No. 14,264, filed March 11, 1960, now abandoned.

This invention relates to heat exchangers and more particularly to heat exchangers such as condensers, evaporators or vehicle radiators in each of which header tanks are connected by and intercommunicate with a core.

Heat exchangers serving as condensers, evaporators or radiators conventionally employ header tanks for containing one fluid and communicating by means of cores for conducting that one fluid in heat exchange relation with a second fluid. In any given heat exchanger of this type, the temperature, and hence the expansion and contraction of exchanger material, varies within a greater range intermediate the lengths of the header tanks than at the ends of those tanks. As a result, the core, especially if it includes parallel tubes connecting the tanks, expands and contracts unevenly in the direction normal to the lengths of the tanks. The tube sheet in each tank is therefore distorted or changed with each variation in temperature and joinder of the core to the tanks is strained and may prove defective in service as evidenced by leakage. Side members have been employed to enclose each core and solidly connect the tanks to form a rigid structure. In the case of automobile radiators, the side members have often been of a material differing from that employed in the radiator core. The core has often been made of copper or aluminum whereas the side members are usually made of steel. This aggravates the situation because of the difference in expansion coefficients. There is a decided advantage in making the side members of steel, not only because of the cost factor, but also because the strength of steel is needed to prevent bulging of the core under the high coolant pressures employed in modern car radiators.

An object of the present invention is to provide an improved heat exchanger of compact construction and characterized by its capability to restrain core distortion due to internal pressure of the fluid handled and to avoid or minimize metal strain which heretofore accompanied temperature changes.

A feature of the present invention is a heat exchanger having a header tank slidably retaining at least one end of a relatively rigid side member with the latter constraining a core joined to the tank.

Another feature is a heat exchanger having core restraining side members slidably retained by at least one header tank and preferably by two header tanks communicating through or connected by the core.

These and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

FIGURE 1 is an elevation view representing an automobile radiator construction as one embodiment of the present invention;

FIGURE 2 is an enlarged view of a portion of the radiator shown in FIGURE 1, parts being broken away better to illustrate the construction; and

FIGURE 3 is an enlarged view looking in the direction of the arrows 3—3 in FIGURE 1, some parts being omitted.

In the drawings, an automobile radiator is depicted having a top header tank **10** and a lower header tank **12**. These tanks communicate by way of a tube and center core of integrated construction depicted at **14**. This core is joined to each of the two tanks as best illustrated in FIGURE 2 with relation to the tank **12**. It will be appreciated that the means for joining the tanks **10** and **12** to the core may be varied in carrying out the present invention. In FIGURES 2 and 3, the core **14** is shown as including flat parallel tubes **16** arranged in groups of three with adjacent groups separated by air centers such as the thin corrugated sheet metal air center **18**. The lower ends of the tubes **16** are joined to a tube sheet **20** for communication with the tank **12** and the marginal portion of the tube sheet is reversely flanged as at **22** to grip a peripheral flange **24** formed on the main body or trough-like portion of the tank **12**. Air centers of corrugated metal are not only provided between adjacent groups of the tubes **16** but also at **19** between the outer tubes **16** and the side members **26**. The centers **19** are shorter than the centers **16** in order to conform with them in width and simultaneously permit an offset in each end of each member **26**. Each of the latter is actually a stiffening member and its cross section is made as indicated in FIGURE 3 to increase its effectiveness. The ridges **28** and **30** and the two opposite flanges **31** formed in each side member contributes to the rigidity. The centers **19** could be of greater or lesser width but the uniform width chosen for all centers lends to economies of manufacture.

In FIGURE 3, the tube sheet **20** is shown as being of sufficient width to accommodate three flat tubes in each group extending across the tube sheet. The air centers **18** each separate adjacent groups of tubes as stated but the number of tubes in each group contacted by an air center may be varied. In FIGURE 3 only two of the tubes of a group are shown as being contacted by one air center.

The top header tank **10** is provided with a filler neck as at **36** and an inlet connection **38** and the bottom or lower header tank **12** is provided with an elbow connection **40** for the discharge of coolant to the engine.

Each end of each side member **26** is interposed between the core **14** and a flange **22** or the equivalent flange means **42** of one of the header tanks **12** or **10**. These side members are placed in slidable engagement with the opposed and facing surfaces on the flange means or continuous flange of each tank. One of these surfaces is shown at **44** in FIGURES 2 and 3.

The parts of the heat exchanger or radiator are assembled and joined as in conventional practice—i.e.—by soldering or brazing. The tubes, air centers and side members as well as the portions of the header tanks are all joined to make an integral, leakproof and rigid unit. It is to be understood, however, that the four surfaces such as the surface **44** are preferably not solidly fixed to the side members **26** but are left in such condition that they will move with relation thereto. It is also to be understood that each side member **26** need not be slidably related to both header tanks as illustrated and is preferable but only with relation to one of the tanks.

When a heat exchanger, made in accordance with the present invention, is placed in service, there is no attempt to overcome expansion by force in the application of a rigid and relatively unyielding frame around the core or the use of straps with a resultant distortion of the tube sheets and strain on the joinder of the tubes to the tube sheets. The core is free to expand or contract in a vertical direction or in a direction normal to the tank lengths with no or a minimum of strain on the metal parts and, at the same time, the rigid side members **26**

prevent bulging of the core in the horizontal direction. The tank material or the continuous flange or tube sheet of each header tank acts in tension to hold the side members against the outward and horizontal displacement tendency which is occasioned by the coolant pressure within the core. This firm containment of the core in a horizontal direction is combined with adequate joinder of the tanks by the core in a vertical direction and a minimizing of difficulties due to expansion in a structure which is self-contained and compact.

I claim:

1. A heat exchanger such as an automobile radiator, said exchanger comprising two elongated and parallel header tanks with tube sheets joined by a core, said core comprising a continuous structure extending in the direction of the lengths of said tanks to define air passages extending in the direction of the widths of said tanks, said core also including tubes connecting said tube sheets, rigid side members at the ends of said tanks and cooperating with said tanks in surrounding said air passages, one of said tanks having two components which constitute one of said tube sheets and a tank body, one of said components having a flange at one side of the exchanger and extending in the direction of the other tank and an inside surface facing the opposite side of the exchanger, an outwardly facing surface on one end of one of said rigid side members slidably engaging said inside surface to resist any bulging tendency of said core, and the arrangement being such that tank distortion is minimized during changes in exchanger temperature because of the slidable engagement.

2. A heat exchanger of the automobile radiator type, said exchanger comprising two elongated and parallel header tanks and a structurally continuous core extending approximately from one end to the other of each tank, each of said tanks including a tube sheet, said core defining air passages and including tubes cooperating with and connecting the tank tube sheets for enclosing a liquid, each of said tanks having two components including its tube sheet, one of said two components of each of said tanks having a flange at each end, said flange extending toward the other tank and having an inner surface facing toward the exchanger interior, rigid side members contacting said core and cooperating with said tanks in surrounding said core and said passages, and an outwardly facing surface on each end of each of said rigid side members slidably engaging the corresponding flange inner surface to prevent any tendency of a tube sheet to distort during changes in exchanger temperature.

3. A heat exchanger of the automobile radiator type, said exchanger comprising two elongated and parallel header tanks and a core, each of said tanks comprising two components including a tank body and a tube sheet, said core having flat tubes connecting the tube sheets of said tanks and corrugated sheet metal air centers separating the flat sides of said tubes and cooperating with the latter in defining air passages open to outside air flow, rigid side members cooperating with said tanks in constraining said core and surrounding said air passages, each of said rigid side members having at least one end with an outwardly facing surface, one of said two components of one of said tanks having a flange extending toward the other of said tanks, said flange having an inner surface facing the exchanger interior and in slidable contact with said outwardly facing surface, and the arrangement being such that the slidable contact minimizes tank distortion during changes in exchanger temperature and the rigid side members resist any bulging tendency of the said core.

4. A heat exchanger as set forth in claim **3**, said flange being continuous and extending around the perimeter of the corresponding tank.

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