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HEAT EXCHANGER

Filed Sept. 24, 1962

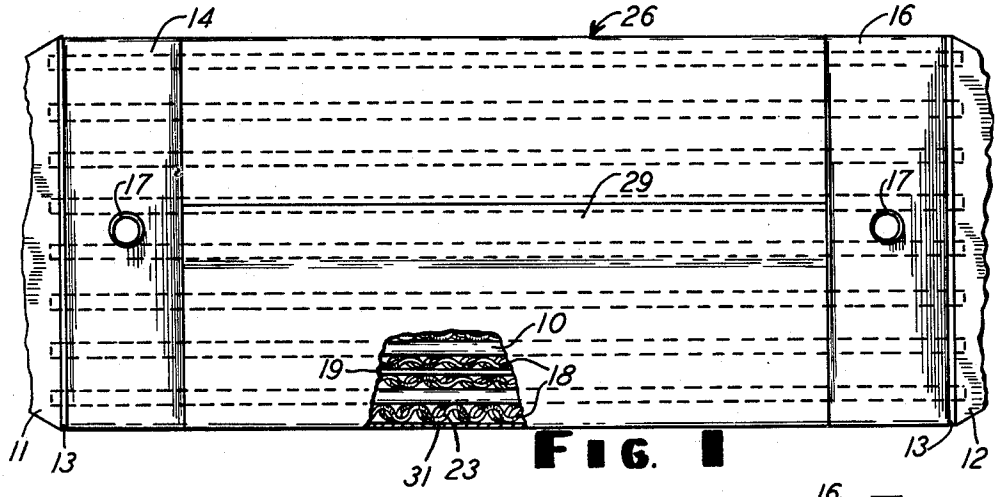


FIG. 1

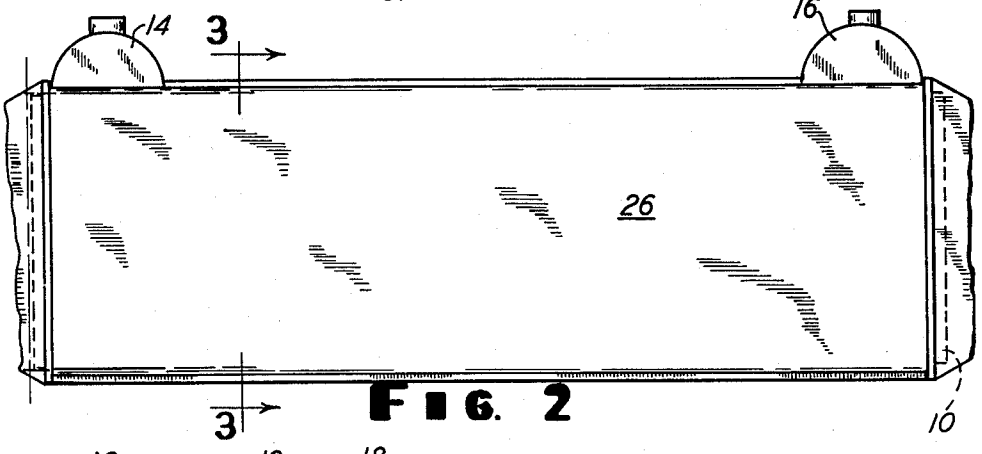


FIG. 2

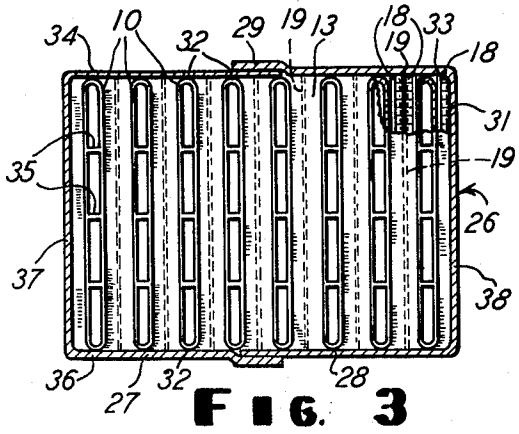


FIG. 3

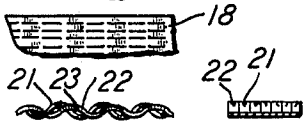


FIG. 4

FIG. 5 FIG. 6

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HEAT EXCHANGER

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6 Claims. (Cl. 165—160)

This invention relates to a heat exchanger, and more particularly it relates to an exchanger wherein two fluids are employed for operation and both fluids have separate and enclosed passes.

Heat exchangers having two separate and enclosed passes are well known in the art, such that the two fluids in the respective passes are completely contained for circulation through the exchanger. The efficiency of an exchanger of this type is dependent upon the pressure drop of the fluid pressure in the exchanger, and accordingly it is important that the exchanger be built sufficiently sturdy to accommodate a desirable pressure and of course to also securely retain the fluids in their separate passes without leakage or impedance to flow.

Accordingly, it is an object of this invention to provide a heat exchanger which accommodates a high internal pressure in both the fluids flowing through the exchanger.

Still another object of this invention is to provide a heat exchanger wherein the core of the exchanger comprising the usual tubes and fins are fixtured and physically enclosed and supported by a casing surrounding the core and the core and casing are bonded for compact and sturdy assembly.

Still a further object of this invention is to provide a heat exchanger having a casing which can be adjusted to snugly and securely engage and thereby support the exchanger core with the adjustment being adaptable to the size of the core within the limits of tolerance in the manufacture of a core.

Still a further object of this invention is to provide a heat exchanger with a core surrounded by a casing in contact with the core and the entire assembly being arranged so that the core and casing can be all bonded together in one bonding operation, such as that well known in the art.

Other objects and advantages will become apparent upon reading the following description in light of the accompanying drawings wherein:

FIG. 1 is a top plan view of a fragment of a heat exchanger incorporating a preferred embodiment of this invention, and with a part thereof broken away.

FIG. 2 is a side elevational view of the exchanger shown in FIG. 1.

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2 and with a corner of the view broken away.

FIG. 4 is a side elevational view of a fragment of a fin disposed within the exchanger shown.

FIG. 5 is a top plan view of the fin fragment shown in FIG. 4.

FIG. 6 is an end elevational view of the fin fragment shown in FIG. 4.

This particular heat exchanger has application in the oil cooler art and it will thus be described in connection with that art. Thus the exchanger is shown to include a plurality of tubes **10** extending through the length of the exchanger in a parallel and spaced-apart relation, and a

header **11** is disposed at one end of the exchanger and a header **12** at the other end of the exchanger. The headers **11** and **12** include end plates **13** which have openings therein of the shape of the tubes shown in FIG. 3 such that the tubes can of course project through the plates **13** and extend therebeyond as shown in the dotted lines in FIGS. 1 and 2. It will therefore be understood that the headers **11** and **12** conduct oil or other fluid into the tubes **10** for the passage between the headers, depending upon the direction of flow of the fluid. This therefore of course makes a fluid-tight and separate pass for the water or other fluid to flow through the exchanger.

Oil or other fluid will also be conducted through the exchanger through a second and separate pass which includes the tanks or headers **14** and **16** having the fittings **17** thereon. Thus it will of course be seen that the oil can pass between the headers **14** and **16** and through the exchanger in the spaces between the tubes **10** and thereby the usual exchange of heat will occur as the fluids move through their respective passes in the well-known manner.

The spaces between the tubes **10** are shown to be occupied by fins **18** which are of a serpentine shape and rolled or punched to be of the offset strip form providing for efficient heat exchange between the fins **18** and the tubes **10**. Thus FIGS. 1 and 3, for instance, show two rows of fins **18** and an intermediate spacer plate **19** disposed in the space between every two successive tubes **10**. Also, a single fin **18** is disposed at the outside surface of the outer tubes **10** as shown on the one side in FIGS. 1 and 3.

The particular configuration of fins shown is of a grid or strip type having two offset strips **21** and **22** which provide an intermediate opening **23** through which fluid can flow, and thus the oil, when used, will flow through the opening **23**. With this type of fin **18**, the oil can thus flow along the plane of the fin **18** in either transverse direction, and it will of course at least partially flow through the openings **23** to give maximum heat exchange efficiency by virtue of the turbulence created in the oil. However, the significant feature of the fin is that it is of a type which is firm in the direction toward the tubes **10**, and this feature is for a purpose mentioned hereinafter.

FIG. 3 particularly shows a casing **26** extending endlessly around the exchanger core which consists of the tubes **10** and fins **18**. Further the casing **26** is shown to be in two parts **27** and **28** and these two parts are joined together at the joint portion designated **29**. It will therefore be noted and understood that the inner surface extending endlessly around the casing **26** is in contact with the exchanger core at both the points of contact designated **31** on the fins **18**, and also the points of contact designated **32** on the tubes and **33** on the fins **18**. Thus the exchanger core presents a rectangular cross-sectional shape and the casing **26** presents a similar shape which is in snug and endless contact with the core.

With the arrangement described, the advantage is that the core can of course be assembled and the casing **26** can be disposed therearound and fixtured onto the core by moving the casing parts **27** and **28** toward each other and thus press the sides of the core inwardly and in firm and snug contact throughout the width of the core, as viewed in FIG. 3. With this snug assembly, the entire exchanger can be placed into a bonding bath for the well-known bonding operation so that all the points of contact within

the core and between the core and the casing **26** will be bonded together. It will therefore be seen that the casing **26** provides the means for containing the oil or like fluid for passage along the fins **18**, and also the casing **26** renders the entire assembly sturdy in that it is all an integral exchanger with the core bonded both internally and to the casing **26** for maximum strength. By virtue of this arrangement, the pressures within the exchanger can be raised to maximum quantities without distorting the exchanger and of course without requiring the well-known circularly shaped exchangers employed in, for instance, the oil cooler.

It will therefore be noted that the arrangement is such that the tubes **10** are provided with internal struts **35**, and these struts of course provide for strength across the narrow portions of the tubes **10**, and also the tubes **10** extend between the top side **34** and the bottom side **36** of the casing **26**. Thus the rigid and set dimension of the tube **36** is employed in establishing the core dimension in the direction just mentioned, and the adjustability of the casing **26** between its sides **37** and **38** accommodate the core tolerance in that direction and also permit the snug fixturing and contacting of the core parts.

The exchanger is thus assembled with tube and fins comprising the core described, and these parts are enclosed by the casing **26**, which of course has a necessary opening for accommodation of the headers **14** and **16** along the casing wall **34**. Thus the entire assembly is bonded so that all of the parts shown are attached together in one unit.

It will therefore be noted that the tubes **10** are flattened in their cross-sectional configuration and the struts **35** extend between the flattened sides of the tubes for making the tubes strong in the direction of the struts or supports **35**. Also the fins **18** are strong and resist forces and deflection so that the entire core is arranged with the fins in abutment with the flattened sides of the tubes and bonded thereto to render the core unitary in is construction from the casing side **37** to the casing side **38**. That is, the flattened tubes with struts **35** and the fins being bonded to the tubes, all form a strong structure between the sides of the casing so that high internal fluid pressures will not bulge the tubes **35** or distort the core.

What is claimed is:

1. A heat exchanger comprising a plurality of parallel and spaced-apart tubes having oppositely disposed open end portions, a header fluid-tightly attached to each of said open end portions for directing fluid through said tubes, a plurality of fins disposed between said tubes and being bonded thereto to form a core with said tubes and being arranged for the flow of fluid over said fins, said tubes and said fins extending to common planes on opposite sides of said core, a casing fluid-tightly disposed in planular contact with both said tubes and said fins on said opposite sides and around the entire periphery of said core endlessly in the direction transverse to the axes of said tubes and intermediate said headers and being bonded to said core and to said headers for containment of the fluid flowing over said fins and for strengthening said exchanger, and a fluid inlet and a fluid outlet means on said casing for directing fluid flow through said core.

2. A heat exchanger comprising a plurality of flattened tubes disposed parallel and spaced apart and having open end portions, support means disposed within said tubes and connected between the flattened sides thereof for strengthening said tubes, a header in fluid-flow communication with each of said open end portions, a plurality of fins disposed between said tubes at the flattened sides thereof and being bonded thereto to present a unitary structure with said tubes and said support means, said tubes and said fins disposed with the two opposite edges of both being aligned along common planes to present a core with a predetermined rectangular cross-section defined by both said edges and by only said fins on sides of said rectangular cross-section intermediate said common planes, and a case of said predetermined rectangular cross-section and two parts disposed entirely between said headers in continuously snug and bonded contact with the rectangular periphery of said core and with said parts being bonded together for confining the flow of fluid over said fins and being adjustable along said common planes prior to bonding.

3. A heat exchanger comprising a plurality of parallel and spaced-apart tubes having oppositely disposed open end portions, a header fluid-tightly attached to each of said open end portions for directing fluid through said tubes, a plurality of fins disposed between said tubes and being bonded thereto to form a core with said tubes and being arranged for the flow of fluid over said fins, said tubes and said fins having equal lateral extents and both extending to one common plane on each opposite side of core, only said fins extending along the other opposite sides of said core, a casing disposed in planular contact with and bonded to both said tubes and said fins on the first said opposite sides of said core and bonded to said fins on the other said opposite sides of said core and extending around the entire periphery of said core endlessly in the direction transverse to the axes of said tubes and intermediate said headers and being fluid-tightly bonded to said core and to said headers for containment of the fluid flowing over said fins and for strengthening said exchanger, and a fluid inlet means and a fluid outlet means on said casing for directing fluid flow through said core.

4. A heat exchanger comprising a plurality of flattened tubes disposed parallel and spaced apart and having open end portions, two spaced-apart headers in fluid-flow communication with said open end portions, a plurality of fins disposed between said tubes at the flattened sides thereof and being bonded thereto, said tubes and said fins disposed to present a core with a rectangular cross-section by said tubes and said fins being coextensive on the first two opposite sides and with said core having only said fins on the other two opposite sides, a rectangular case of two parts disposed entirely in the space between said headers and in endless bonded contact along all said sides of said core, said parts being overlapped and movable toward and away from each other and said flattened sides along said first two opposite sides prior to bonding to adjust to said core size at said other two opposite sides and thereby abut said fins, and header means in fluid-flow communication with said case for directing fluid over said core.

5. A heat exchanger comprising a plurality of parallel and spaced-apart tubes having flat sides and oppositely disposed open end portions, a header fluid-tightly attached to each of said open end portions for directing fluid through said tubes, a plurality of fins disposed between said tubes on said flat sides thereof and being bonded thereto to form a core with said tubes and being arranged for the flow of fluid over said fins and with said core being of a predetermined cross-sectional shape, said tubes extending in side limits to one common plane on each of two opposite sides of said cross-sectional shape and with only said fins extending along the other two opposite sides, a casing of said cross-sectional shape and in two halves adjustably nested together and in contact with said tubes at said side limits on the first said opposite sides and with said casing being in contact with said fins on the other said opposite sides and being fluid-tightly disposed in endless contact with the periphery of said core intermediate said headers and being bonded to said core and to said headers for containment of the fluid flowing over said fins and for strengthening said exchanger, and header means in fluid-flow communication with said casing for directing fluid over said core.

6. A heat exchanger comprising a plurality of parallel and spaced-apart tubes having two oppositely disposed open end portions, a header fluid-tightly attached to each

of said open end portions for directing fluid through said tubes, a plurality of fins disposed between said tubes and being bonded thereto to form a core with said tubes and being arranged for the flow of fluid over said fins, each of said tubes extending completely across said core between the outer limits of two opposite sides of said core and with said tubes being elongated in their extents between said opposite sides and being internally strutted for support in the two directions between said tubes, a two-piece casing fluid-tightly disposed in endless contact with the periphery of said core intermediate said headers and being bonded to said core and to said headers for containment of the fluid flowing over said fins and for strengthening said exchanger, the pieces of said casing being movable toward and away from each other

in said two directions to adjust to said core in said two directions between said tubes prior to bonding.

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