

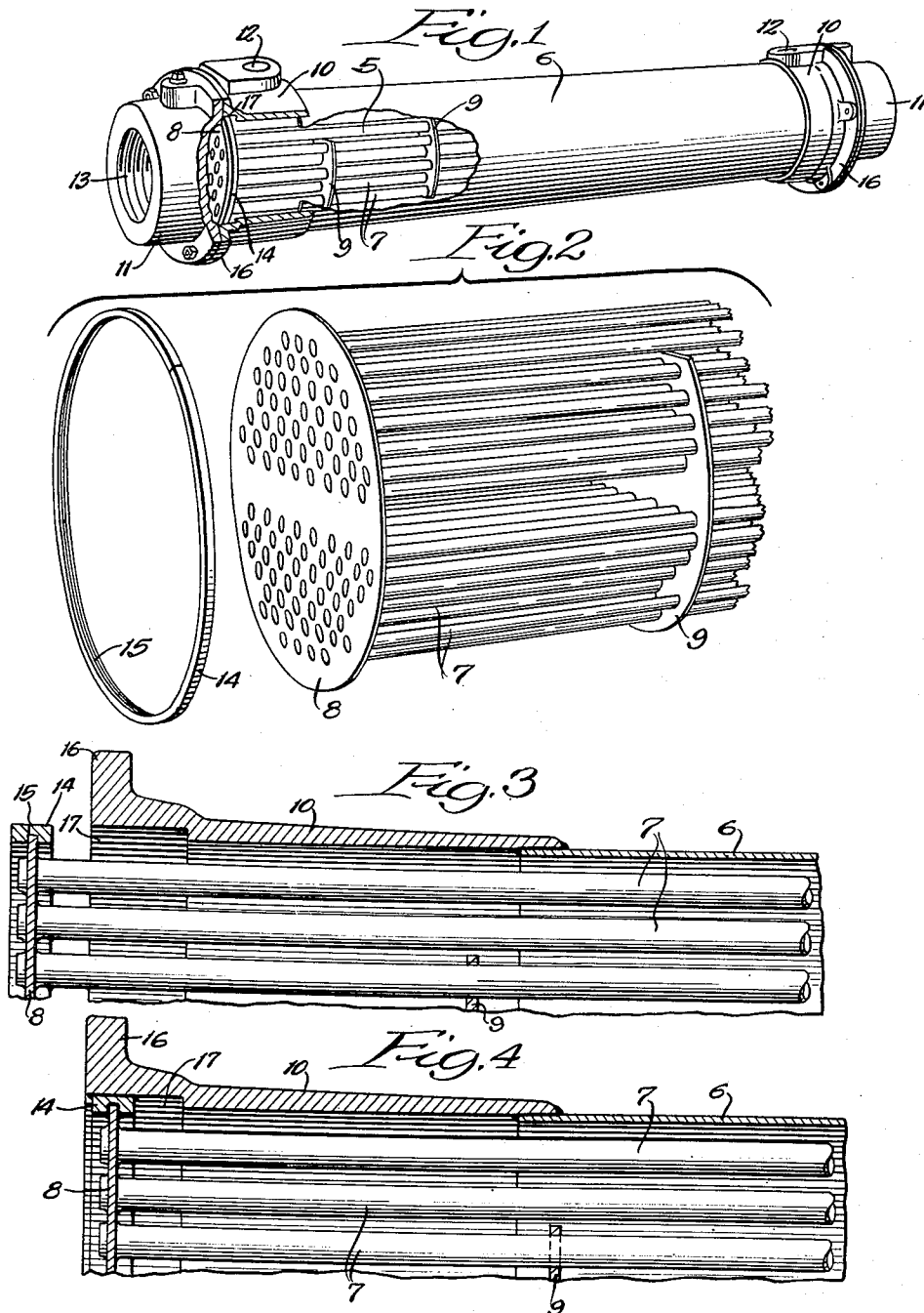
March 5, 1957

D. W. CHRISTENSEN

2,783,980

HEAT EXCHANGER

Filed Dec. 8, 1953



INVENTOR:

Donald W. Christensen.

BY

Lawrence Phelps
ATTORNEY.

1

2,783,980

HEAT EXCHANGER

Donald W. Christensen, Racine, Wis., assignor to Young Radiator Company, Racine, Wis., a corporation of Wisconsin

Application December 8, 1953, Serial No. 396,809

1 Claim. (Cl. 257—236)

This invention relates to heat exchangers, particularly of the type where the core unit comprising a battery of tubes supported in parallel relationship on spaced header plates and intermediate baffles, is encased in a shell. Such an exchanger is often known as a "converter cooler" for use in cooling the oil required in the operation of heavy automotive equipment, as, for example, buses and trucks.

End sleeve fittings, for attachment to the shell, are provided with ports for connection in oil and coolant conduits to permit their flow through the tubes and labyrinth of the core to effect the required heat transfer.

In order to seal off the oil flow through the tubes from the labyrinth around them within the shell, it is imperative to have the core-unit header-plates bonded to the shell. The bonding is usually brazing, effected by induction or torch flame heating a silver solder alloy positioned concentric with the junction of the header plates and the sleeves mounted on the shell. Where, as heretofore generally has been the case, these header plates are comparatively light, thin metal there is a very limited area of contact between the header plates and the sleeve. Since the strength of brazed joints is conditioned upon the area of contact between the metals involved, joints formed with the above-noted header plates per se are often rather weak, subjecting the heat exchangers of this type and use to the hazard of easy fracture and subsequent leakage.

The main objects of this invention, therefore, are to provide an improved form of header-plate and shell-sleeve joint which will permit of a stronger bond than heretofore obtainable; to provide an improved form of joint for units of this kind which materially increases the area of the bonding surfaces intermediate the core-unit header-plates and the embracing shell-sleeve; and to provide an improved form and arrangement of the parts between which the bond is formed and which permits an improved method of assembling the parts preparatory to their being bonded.

In the accompanying drawings,

Fig. 1 is a perspective view, partly broken away to show the interior, of a conventional heat exchanger of the above-noted type and embodying this invention;

Fig. 2 is an enlarged fragmentary, exploded perspective of one header-plate and ring forming a part of this invention;

Fig. 3 is an enlarged, fragmentary, sectional view showing the relative positions of the several parts of the assembly incident to placing the ring on the core-unit header-plate, and

Fig. 4 is a similar view showing the parts in their bonded assembled positions.

The essential concept of this invention involves a pair of telescoping members one of which is in the form of an expansion ring embraceable over and seatable on a header plate and the other is in the form of a sleeve which supports the ring and is telescopically supported on the housing shell.

A conventional heat exchanger, of the above-noted

2

converter type, for embodiment in which this invention has been devised, comprises in the main a core unit 5 and supporting shell 6, equipped with end fittings having ports for connecting the exchanger in the respective conduits for the fluid and coolant between which heat transfer is to be effected.

The core unit 5, for exchangers of this type, generally is formed of a bundle of thin-wall tubes 7 supported in spaced parallel relationship on a pair of headers 8. The ends of the tubes 7 are bonded to the header plates 8. Baffles 9 of appropriate number and form, are arranged in axially-spaced position on the tubes 7.

The shell 6, generally a casting, mounts at each end fittings in the form of sleeve members 10 and attachable end caps 11. The sleeve members 10 are formed with ports 12 and the end caps 11 have axial openings 13 which respectively permit the exchanger to be interposed in the fluid (oil) and coolant conduits to effect heat transfer flows through the tubes 7 and the labyrinth surrounding such tubes.

In order to fluid-seal the labyrinth flow against communication with the flow through the tubes it is imperative to bond the header plates 8 of the core unit 5 within the sleeve members 10. These header plates 8, being rather thin metal, it will be obvious that by the conventional practice of bonding the header plates directly to the sleeve members 10, the bonding area is extremely limited. This, of necessity, constitutes a rather fragile joint which, under the rough usage to which some automotive vehicles are often subjected, makes for easy fracture. The consequence of such fracture is a leakage of the fluid and/or coolant between the labyrinth and the tubes, with a resultant loss in efficiency in the heat exchanger operation, if not its complete ineffectiveness.

The herein disclosed embodiment of this improved header-plate-shell joint, in its simplest form, comprises providing a ring 14 dimensioned and recessed to embrace and seat a header plate 8 and telescopically fitted within a suitably recessed sleeve member 10.

The ring 14 may be of almost any form of split ring so as to permit expansion thereof to embrace and firmly set itself on the header plate 8. The ring 14 is of a thickness several times greater than the thickness of the associated header plate 8 and imparts a substantial peripheral rigidity thereto. Preferably, the inner face of the ring 14 is formed with a groove or recess 15, substantially as thick as the header plate 8, to provide a seat for the perimeter of the header plate 8, as shown in Figs. 3 and 4.

The sleeve 10, of which there would be a pair for each heat exchanger, preferably is a casting. It is dimensioned internally to slide snugly over one end of the shell 6. As here shown, the sleeve, one for each end of the shell 6, has the outer end enlarged to provide a flange 16 whereto is attached one of the appropriate end caps 11, in the usual manner. Inwardly of the flange 16, the sleeve 10 is formed with an annular recess 17 extending axially inward a short distance from the face of the flange 16. The internal diameter of this recess is equal to the external diameter of the ring 14 when encircling and seating the header plate 8. The header plate 8, in this instance, is substantially equal to the inside diameter of the sleeve 10, inwardly of the sleeve recess 17, and hence substantially equal to the outside diameter of the shell whereon the sleeve 10 is telescoped.

When the core unit 5 and shell 6 have been duly assembled, by the method hereinafter set forth, and each of the sleeves is positioned on the shell, as shown in Fig. 4, each ring 14 is sweat bonded to the respective header plate 8 and to the respective sleeve 10, as indicated by the exaggerated black areas around the abutting faces of these parts, as shown in Fig. 4. At its opposite end each

3

sleeve 10 is also bonded to the shell 6, as indicated by the black areas in Fig. 4.

This bonding is done in the conventional manner. With the assembled parts standing on end and with rings of silver solder alloy laid around the corners where the heavy back fillets appear in Fig. 4, either by induction or by conventional torch flame the solder rings are melted. Well known capillary action draws the molten silver solder alloy in between the contacting faces of the ring 14 and the header plate 8 and the sleeve 10 and also forms fillets in the corners constituted by the adjacent right angle faces of these parts—as shown by the excessively black portions in Fig. 4.

An improved method of assembly is practiced for the aforesaid construction and relative arrangement of the rings 14 and sleeves 10. After the rings 14 and sleeves 10 have been duly constructed, that improved method involves substantially the following steps:

1. The requisite baffles 9, placed on 4 or 6 tubes 7 with the usual spacers, are suitably secured together and the assembly inserted into the shell 6;

2. This preliminary assembly is then stood on end, whereupon all of the tubes 7 are inserted into the baffles 9 and the requisite header plates 8 are set over and bonded to the ends of the tubes 7, in the conventional manner, to complete the core unit 5;

3. One sleeve 10 is then slipped over the respective end of the shell 6 and after proper positioning on the shell is bonded thereto, as shown in Fig. 3;

4. The core unit 5 is then shifted axially of shell 6 to so expose one header plate 8 as to permit a ring 14 to be expanded and placed over the header plate 8, the perimeter of the plate becoming seated in the ring recess 15, as shown in Figs. 3 and 4;

5. The core unit 5 is then shifted back into the shell 6 to locate the ring 14 properly in the sleeve recess 17, as shown in Fig. 4;

6. The ring 14 is then brazed to the header plate 8 and to the sleeve 10, in the manner hereinbefore explained;

7. The other sleeve 10 is then placed on the other end of the shell 6 and shoved inwardly a sufficient distance to so expose the other header plate 8 as to permit a ring 14 to be expanded and placed around the plate 8, as explained above;

8. With the second ring 14 in place, the second sleeve 10 is pulled outwardly on the shell 6 to properly position the header-plate-ring assembly in the sleeve recess 17;

9. So positioned, the second sleeve 10 is thereupon bonded to the shell 6 and to the ring-header plate assembly, as hereinbefore explained, preferably in that order.

As will be noted from Fig. 4, a consequence of using this form and arrangement of parts is the obtaining of a very considerable surface area of bonding between the header plates 8 and the sleeves 10. That area is many times greater than has been obtained heretofore with the conventional practice of bonding the header-plates 8 directly to the sleeve or shell. Such a joint, as that herein dis-

4

closed, is, indeed, so rigid as to practically remove all hazard of fracture even under the most extraordinary conditions occurring in the use of automotive vehicles equipped with oil converters embodying this invention.

It will be understood, of course, that certain variations and modifications of this particular embodiment may be made without departing from the spirit of this invention as defined in the following claim.

I claim:

A heat exchanger embodying a shell and a core unit permanently bonded together to form an integrated and inseparable assembly, the shell comprising a tubular intermediate element and a pair of sleeves telescopically received on and metallicity bonded to the opposite ends of the intermediate element whereby the shell is of a predetermined over-all axial length, the sleeves each having a short annular recess extending inwardly from the outer end thereof and the remainder of each sleeve having a uniform smaller bore therethrough of substantially the same diameter as the outer surface of said intermediate element whereby at least one of said sleeves may initially be slid inwardly along said intermediate member to fully expose an associated end of said intermediate member, the core unit comprising a pair of thin rolled metal header plates spanned by a plurality of tubes the ends of which tubes are bonded to the respective header plates whereby the core unit has an over-all axial length less than the over-all axial length of the shell so that the header plates are disposed wholly within the annular recesses in the outer ends of said sleeves, each header plate being of a diameter slightly less than the diameter of its associated sleeve recess whereby to present an annular space around each header plate when received within its associated sleeve, and a ring embracing each of the header plates and filling the aforementioned annular space and telescopically contacting the respective sleeves within the annular recesses, each ring having an annular circumferential groove in the inner surface thereof receiving the periphery of its associated header plate and each ring being of a thickness several times greater than the thickness of said header plates and being metallicity bonded to the respective header plates and sleeves.

References Cited in the file of this patent

UNITED STATES PATENTS

1,289,350	Zimmerman	Dec. 31, 1918
1,599,370	Muhleisen	Sept. 7, 1926
1,994,779	McNeal	Mar. 19, 1935
2,061,980	Price	Nov. 24, 1936
2,083,679	Adams	June 15, 1937
2,202,494	Jacocks	May 28, 1940
2,298,996	Woods	Oct. 13, 1942
2,512,748	Lucke	June 27, 1950

FOREIGN PATENTS

314,261	Germany	Sept. 5, 1919
---------	---------	---------------