March 7, 1967 E. P. ODDY 3,307,622

ROUND TANK HEAT EXCHANGER

Filed Dec. 30, 1964 2 Sheets-Sheet 1

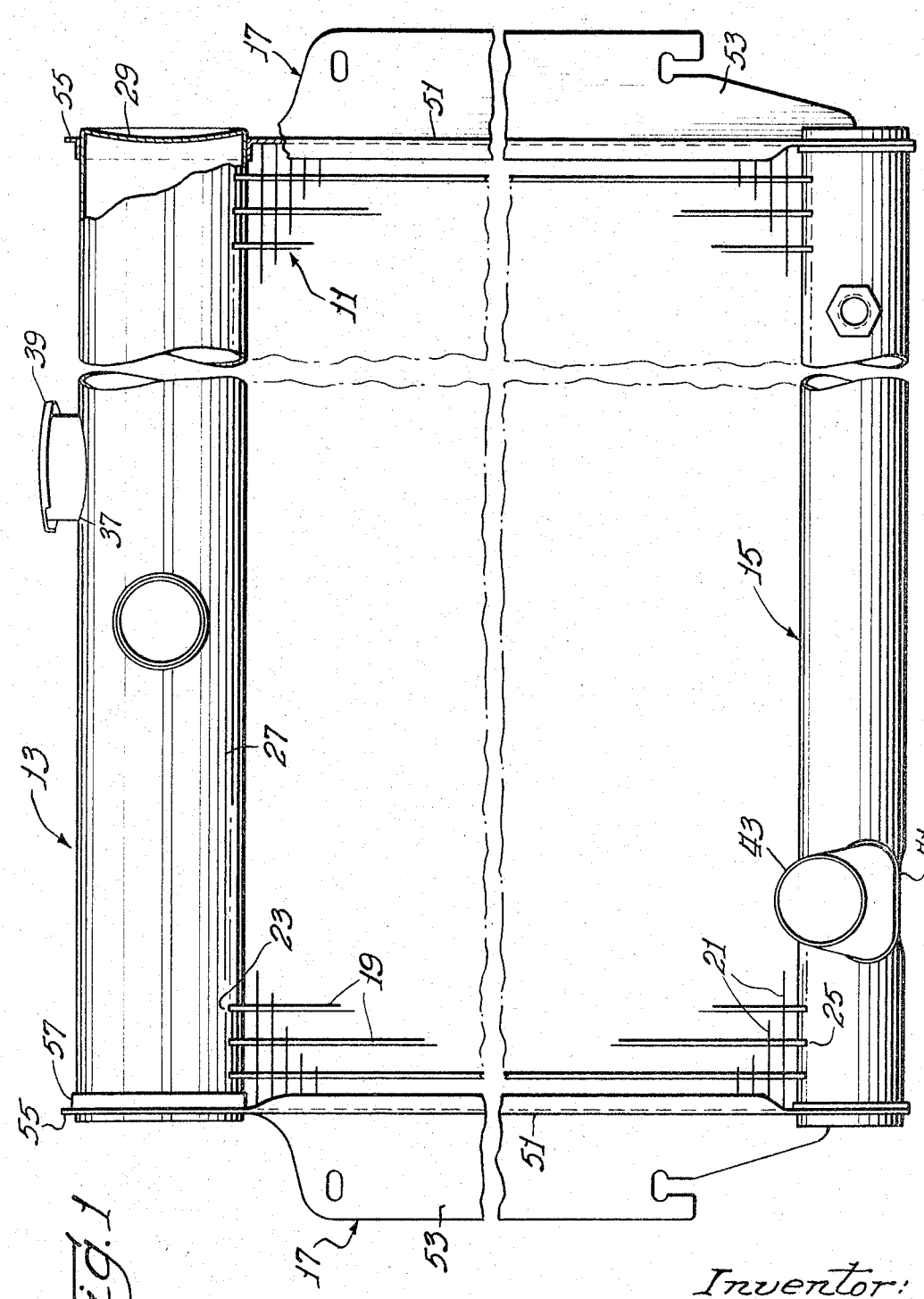

Fig. 1

Inventor:
Edward P. Oddy

By: John W Butcher Atty

March 7, 1967 E. P. ODDY 3,307,622

ROUND TANK HEAT EXCHANGER

Filed Dec. 30, 1964 2 Sheets-Sheet 2

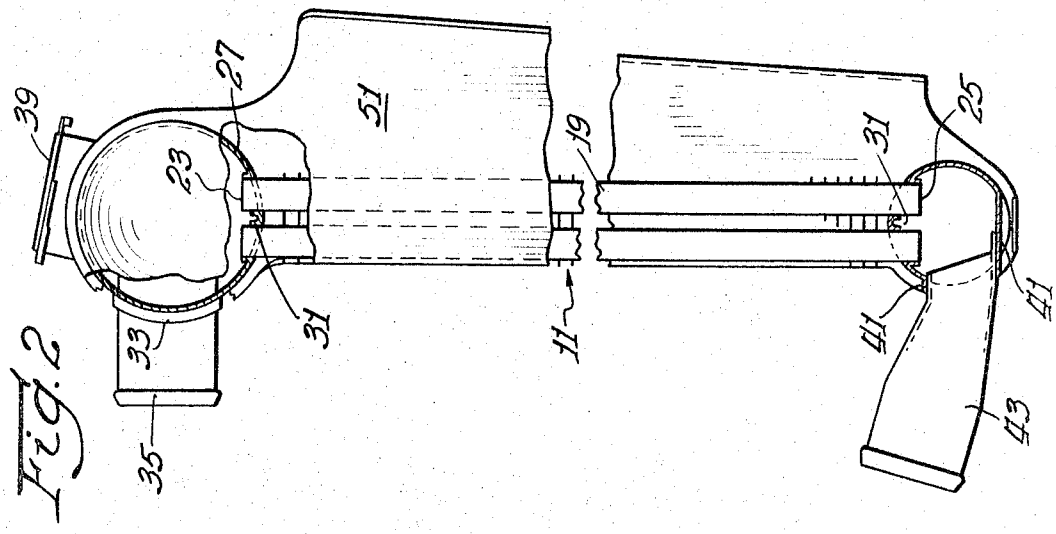

Fig. 2

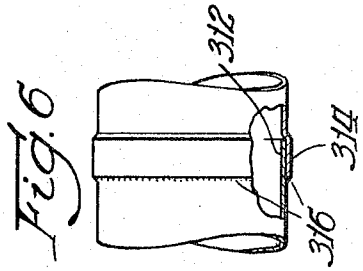

Fig. 6

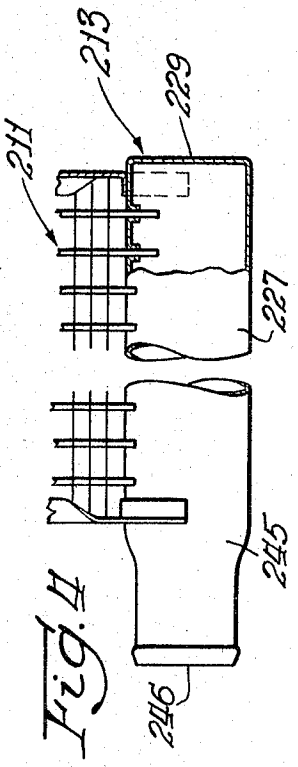

Fig. 4

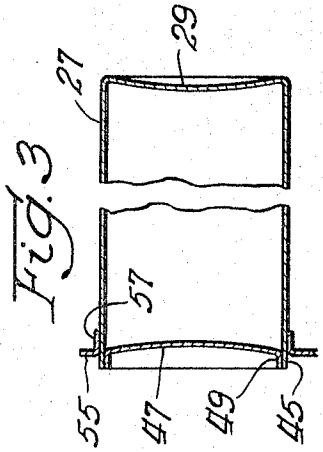

Fig. 3

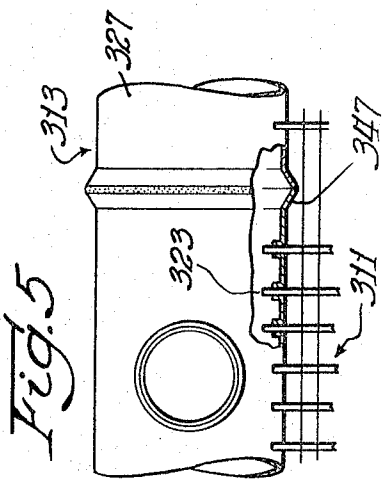

Fig. 5

Inventor:
Edward P. Oddy
By: John W Butcher Atty.

United States Patent Office

3,307,622
Patented Mar. 7, 1967

3,307,622

ROUND TANK HEAT EXCHANGER

Edward P. Oddy, Detroit, Mich., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Filed Dec. 30, 1964, Ser. No. 422,184
3 Claims. (Cl. 165—151)

This invention relates to heat exchangers. More particularly, it relates to heat exchangers of the type commonly used in automotive cooling systems, having a core, and flow distribution headers.

Conventional automotive heat exchangers, or radiators as they are commonly designated, generally include distribution headers extending longitudinally across opposite ends of a heat transfer core and provide fluid communication between coolant tubes within the core and the remainder of the cooling system.

The headers are usually fabricated structures of generally rectangular cross-section, made of easily deformable corrosion resistant metal such as copper or aluminum. The headers generally include a flat base plate provided with apertures through which the coolant tubes extend and to which they are soldered in liquid tight relation. A stamped header body portion is secured to the base plate about its outer periphery along liquid tight seams to define the header volume. The seams may be formed by any one of a number of commonly used fabrication methods, such as soldering, brazing, or welding.

As can be appreciated, heat exchangers including distribution headers of the type described inherently pose significant constructional and operational difficulties.

First, successful sealing of the peripheral seams between the base plate and the body portion of the header requires the use of time consuming and expensive fabrication procedures.

Additionally, a substantial quantity of soldering or brazing material must be used to effect a satisfactory liquid tight seam, and these seams always present possible sources of leakage during operation as the headers are usually subjected to substantial pressures, and at times, severe vibration.

In addition, the generally rectangular cross-section of the header limits the operating pressures to which it may be subjected without distortion.

Attempts made to overcome the various problems attendant to conventional automotive heat exchanger design have been generally unsuccessful. In every case, the header configuration required the use of at least one fabrication seam extending the entire length of the header. Additionally, end caps secured to the body along transverse seams to seal off the ends of the header body were also required.

Attempts to alter the cross-sectional configuration of the header to improve the pressure withstanding capacity have required that the headers be laterally displaced from the core, and connected to the coolant tubes through laterally extending channels. This arrangement increased the sensitivity of the heat exchanger to vibration damage and also severely restricted fluid flow.

Accordingly, it is the principal object of the present invention to provide an improved automotive type heat exchanger.

A further object of the present invention is to provide an automotive type heat exchanger having headers formed of longitudinally seamless bodies.

It is a further object of the present invention to provide an automotive type heat exchanger having headers formed of longitudinally seamless bodies including an integrally formed closed end.

It is a related object of the present invention to provide an automotive type heat exchanger having fabricated headers which require only a minimal seam area and wherein the only seams required are transverse to the longitudinal axis of the header.

It is a still further object of the present invention to provide an automotive type heat exchanger having headers adapted to withstand substantial operating pressures without distortion and wherein the headers are aligned with the longitudinal axis of the core.

Further objects and advantages of the invention will become apparent with reference to the following description and the accompanying drawings.

In the drawings:

FIGURE 1 is a partially broken away elevational view, partially in section showing an apparatus constructed in accordance with the present invention;

FIGURE 2 is a side elevational view partially in section, of the apparatus of FIGURE 1;

FIGURE 3 is a fragmentary view of a portion of the apparatus of FIGURE 1;

FIGURE 4 is a fragmentary view of a portion of the apparatus of FIGURE 1 showing an alternate form of construction;

FIGURES 5 and 6 are fragmentary elevational views partially in section showing alternate forms of the invention.

Very generally, the present invention is directed to an automotive heat exchanger having an improved header construction. An illustrated embodiment of a heat exchanger constructed in accordance with the present invention is shown in FIGURES 1 and 2.

The heat exchanger of the illustrated embodiment includes a heat transfer core **11** extending between an inlet distribution header **13** and an outlet distribution header **15**. A pair of side supports **17** extend between the headers adjacent opposite sides of the core to rigidly support the assembly.

The core **11** includes a plurality of thin walled fluid tubes **19** having a generally rectangular cross-section which are disposed within a matrix of closely spaced heat dissipating fins **21** positioned transversely of the tubes and extending between the side supports **17**.

Opposite ends **23** and **25** of the tubes **19** are disposed in fluid communication with the distribution headers **13** and **15** respectively. These headers are generally similarly constructed and differ only in size and function, the header **13** receiving fluid to be cooled and directing it to the core **11** and the header **15** receiving the cooled fluid for distribution back to the remainder of the cooling system. Therefore, the constructional details of the headers described herein should be considered as applicable to both the inlet and outlet headers.

Referring now specifically to the construction of the headers of the embodiment of the invention shown in FIGURES 1 and 2, the header **13** includes an elongated, longitudinally seamless hollow body tank portion **27** having a generally cylindrical cross-section and an integrally formed closed end **29**. The body tank extends the entire width of the core and is formed by a deep drawing process utilizing any readily deformable corrosion resistant metal such as copper or aluminum. As the body tank is seamless, time consuming and expensive closing of longitudinal seams is eliminated and sources of leakage heretofore inherent in header construction are removed. Additionally, as the cross-section of the header tank is generally cylindrical, the header is adapted to withstand substantial operating pressures.

The integrally formed end **29** of the tank body is depicted as being generally dished inwardly toward the interior of the tank. This construction is, however, considered optional, and any convenient shape may be used such as for example an outwardly formed hemispherical end.

As best seen in FIGURE 2, a longitudinally extending zone of the tank body **27** disposed adjacent the core **11** is provided with a series of pierced, apertures defined by flanges **31** through which the tube ends **23** of the core tubes **19** extend in fluid communication with the tank body. The tubes are secured to the flanges as by soldering or the like to form a liquid tight connection.

Additionally, and as best seen in FIGURE 2, the tank body **27** is provided with a flange **33** defining an aperture within which is positioned an inlet tube **35** secured to the tank by soldering or the like and adapted to provide fluid communication to the cooling system.

The tank body **27** is also provided with a flat portion **37** including an aperture within which is disposed a tubular filler neck **39** which provides external access to the cooling system for addition of liquid as necessary.

Similarly, the header **15** is provided with a flange **41** defining an appropriate aperture within which is disposed an outlet tube **43** providing communication to the remainder of the cooling system. The tube **43** is secured to the header body as by soldering to provide a liquid tight joint.

Referring now to FIGURE 3, an open end **45** of the body tank **27** is sealed to define the header volume by an end cap **47** shaped generally similarly to the integrally formed end **29**. The end cap is provided with a generally cylindrical flange **49** which is sized for acceptance within the body portion **27** and which is secured thereto as by soldering or welding to form a sealed header tank.

The side supports **17**, best shown in FIGURES 1 and 2, extend between the headers **13** and **15** and are disposed at opposite ends of the core **11** to provide rigidity to the heat exchanger structure. These members include a longitudinally extending side plate **51** disposed in overlying relation to the ends of the fins **21**. The side plate is provided with a laterally extending fastening bracket **53** adapted to support the heat exchanger in its operating position within a structure, as for example, an automobile, or the like.

The side supports further include end portions appropriately formed for connection to the headers. As shown in the embodiment of FIGURES 1 and 2, these end portions include rims **55** which encircle the header body portions which are provided with laterally extending flanges **57** attached to the header body portion as by soldering or brazing. The particular configuration of the end portions could, however, assume a variety of shapes as dictated by the particular design limitations of the intended application. For example, the rims **55** may not be continuous, but rather need only extend partially about the header bodies with a correspondingly partial flange **57** secured to the body portion **27**. Alternatively, the end portions may include dished portions having a configuration corresponding to the shape of the closed ends **29** and **47**. These dished portions would be fastened to the ends as by soldering to form the rigid heat exchanger assembly.

Referring now to FIGURE 4, there is shown an alternate arrangement for the open ends **45** of the inlet and outlet headers. In this embodiment, a header **213** having a cylindrical seamless body portion **227** is formed in a manner similar to the body portion **27** of the embodiment of FIGURES 1 and 2. A similar header (not shown) is provided for the opposite end of a core **211** similar to the core **11**.

The body portion **227** is provided with an integrally formed end **229** similar to the end **29** of the body portion **27**. However, an open end **245** is provided with a tubular extension **246** adapted to connect the header to the remainder of the cooling system. In this manner, the header cylindrical body portion is not only longitudinally seamless but the transverse seam or the seam between the open end **45** and the end cap **47** is eliminated as are the seams between the header body portion and the inlet and outlet tubes **35** and **43**.

Referring now to FIGURES 5 and 6, there is shown an alternate form of header construction. In this arrangement, a header **313** is formed of a pair of coaxial longitudinally seamless deep drawn cylindrical body portions **327** secured together at open ends **347** by soldering or the like.

The open ends **347** may be flanged and butted together as shown in FIGURE 5 or may be joined as in FIGURE 6 wherein one tube includes a sleeve portion **312** and the other an expanded ring portion **314** which is overlapped with the sleeve and welded as at **316**.

Each tank body portion **327** includes an integrally formed closed end (not shown) and is provided with a base zone including flanged apertures to accept tube ends **323** from a coaxially disposed core **311**.

As in the embodiment of FIGURES 1 and 2 the headers so formed are longitudinally seamless and have only one transverse seam. Additionally, as the headers are generally cylindrical in cross-section and disposed coaxially with the core substantial operating pressure may be utilized.

While the specific details of the several embodiments of the invention have been herein shown and described, changes and alterations may be resorted to without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. An automotive type heat exchanger comprising: a core including a plurality of coolant tubes; flow distribution headers disposed at opposite ends of said core in fluid communication with said tubes, at least one of said headers including a pair of elongated deep drawn longitudinally seamless hollow body tanks said tanks including a plurality of inwardly directed flanges defining apertures receiving said coolant tubes in liquid-tight relation, each said hollow seamless body tank having an open end and an integrally formed closed end, said tanks being disposed with said open ends in abutting relation and secured together in liquid tight relation to form said header and defining a chamber in fluid communication with each of said coolant tubes.

2. An automotive type heat exchanger comprising: a core including a plurality of coolant tubes; flow distribution headers disposed at opposite ends of said core in fluid communication with said tubes, at least one of said headers including a pair of elongated deep drawn longitudinally seamless hollow body tanks having an integrally formed closed end and an open end including an outwardly directed flange, said tanks being disposed with said flanges in abutting relation and secured together in liquid tight relation to form said header and defining a chamber in fluid communication with each of said coolant tubes.

3. An automotive type heat exchanger comprising: a core including a plurality of coolant tubes; flow distribution headers disposed at opposite ends of said core in fluid communication with said tubes, at least one of said headers including a pair of elongated deep drawn longitudinally seamless hollow body tanks each having an open end and an integrally formed closed end, the open end of one of said tanks including a longitudinally extending sleeve and the open end of the other of said tanks including an expanded ring, said tanks being disposed in end to end relation with said expanded ring in overlying relation with said sleeve, and being secured together in liquid tight relation at said overlying ends to form said header and defining a chamber in fluid communication with each of said coolant tubes.

References Cited by the Examiner

UNITED STATES PATENTS

1,278,243	9/1918	Sonneborn	165—175
1,688,574	10/1928	Cotton	29—157.4 X
1,689,789	10/1928	Lasicer	29—157.4
1,692,154	11/1928	Broido et al.	29—157.4
2,063,988	12/1936	Dick	165—150
2,763,923	10/1956	Webb	165—178 X
2,991,047	7/1961	Bailys	165—153
3,153,447	10/1964	Yoder et al.	165—175 X
3,191,673	6/1965	Young	165—151

ROBERT A. O'LEARY, *Primary Examiner.*

M. A. ANTONAKAS, *Assistant Examiner.*