

[54] HEAT EXCHANGER

[76] Inventor: Richard C. Perry, 205 S. 6th Ave.,
La Grange, Ill. 60525

[22] Filed: July 7, 1972

[21] Appl. No.: 269,878

[52] U.S. Cl. 165/76, 122/360, 165/175,
165/176, 165/178, 285/137 R, 285/368

[51] Int. Cl. F28f 9/06

[58] Field of Search 165/178, 175, 176, 76;
285/157, 368, 137 R, 137 A

[56] References Cited

UNITED STATES PATENTS

3,286,767	11/1966	Evans.....	165/162 X
3,422,884	1/1969	Otten.....	165/178 X
1,231,928	7/1917	Miller et al.	285/137 R X
1,911,375	5/1933	Lucke.....	165/176
1,782,380	11/1930	Daley.....	165/176
3,326,279	6/1967	Eisberg.....	285/137 R X
2,271,538	2/1942	Brace.....	165/76 X

FOREIGN PATENTS OR APPLICATIONS

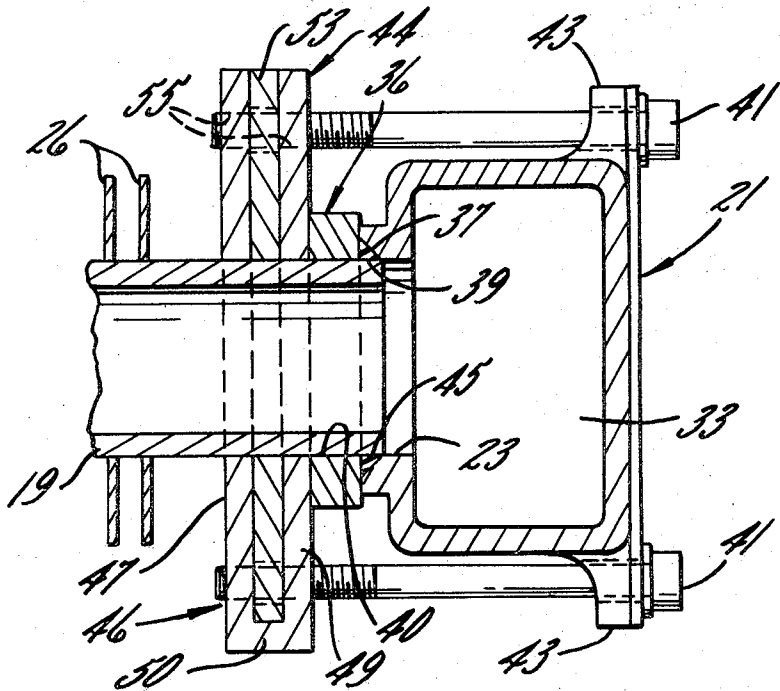
177,200 1922 Great Britain 285/137 R

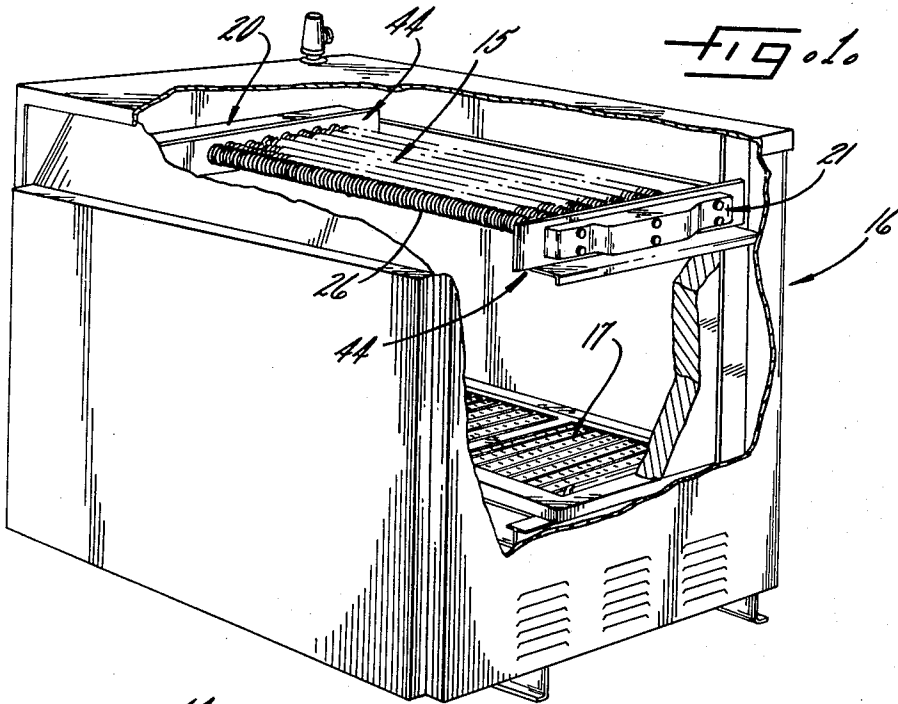
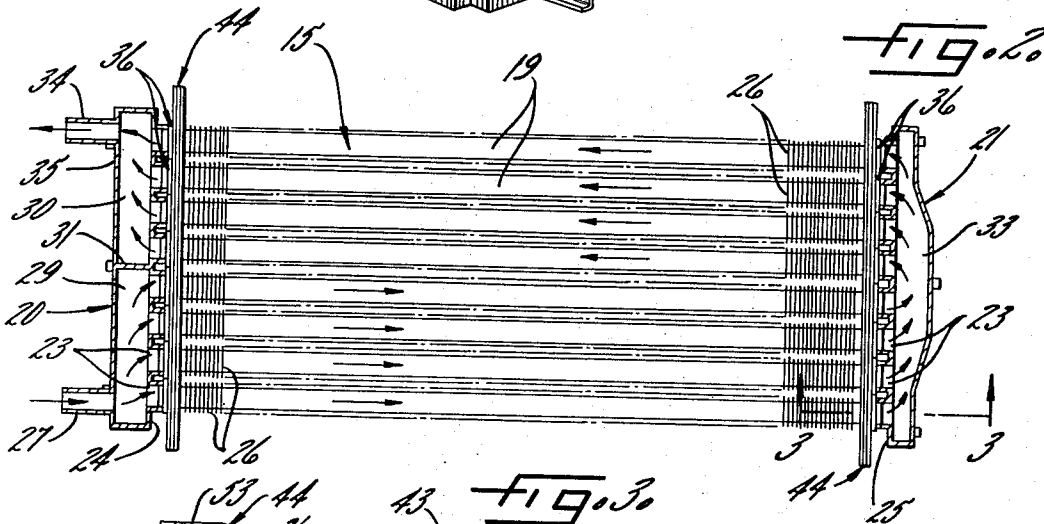
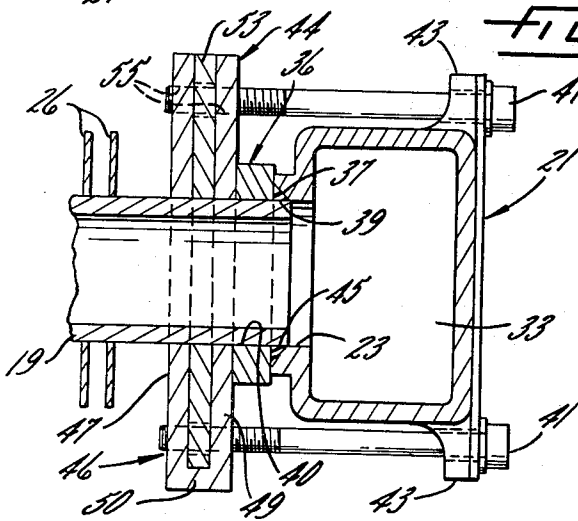
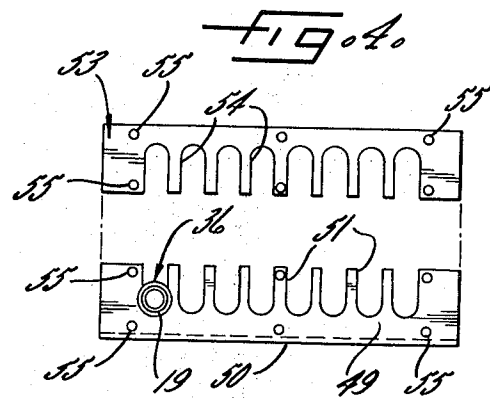
Primary Examiner—Albert W. Davis, Jr.
Assistant Examiner—S. J. Richter
Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig,
Voit & Osann

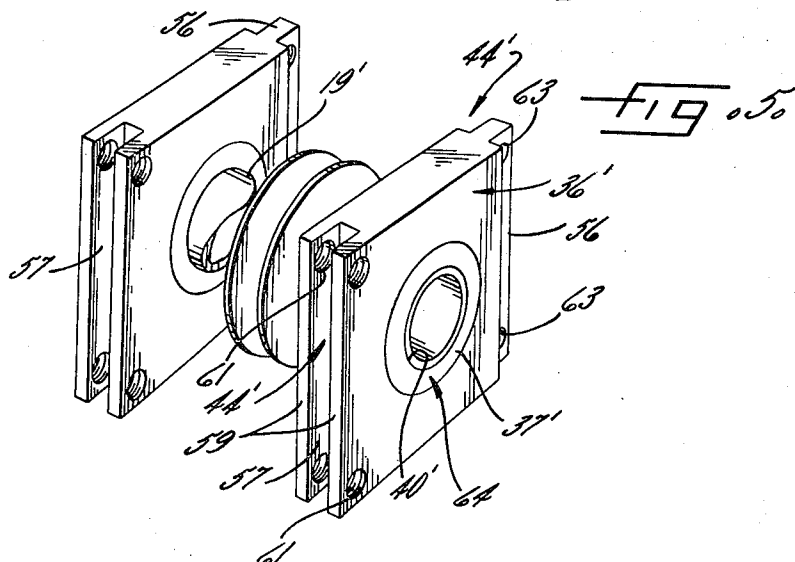
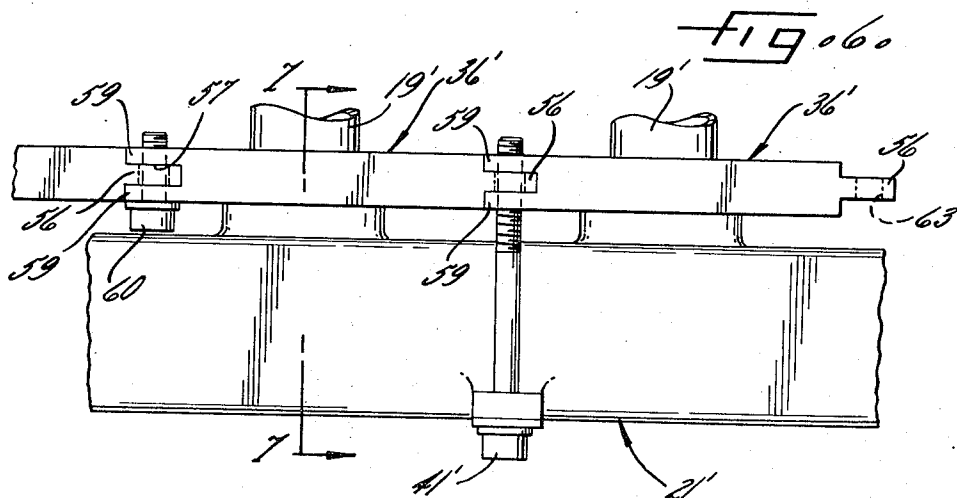
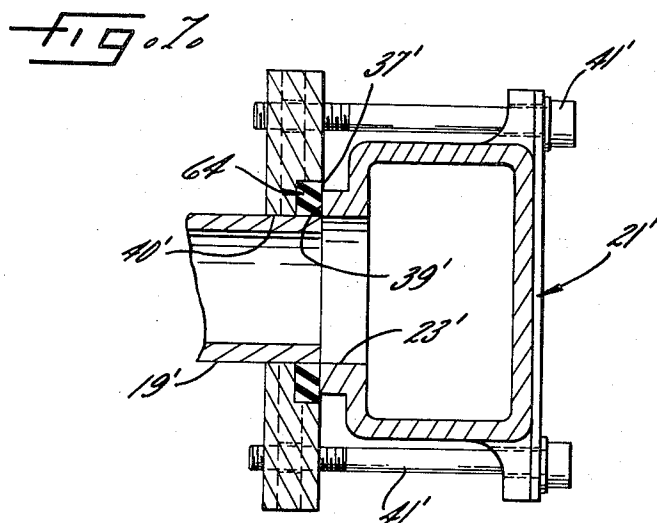
[57] ABSTRACT

A heat exchanger includes two spaced, hollow headers each with a plurality of openings through one side. A plurality of finned tubes are connected between the headers and communicate through the openings with the insides of the headers. Interfitting parts mounted on opposite ends of the tubes are clamped together with the headers by bolts to hold sealing surfaces between the tubes and the headers together with a watertight fit, the bolts being removable to unclamp the parts with the headers to enable the tubes to be removed individually and replaced.

1 Claim, 7 Drawing Figures







HEAT EXCHANGER

BACKGROUND OF THE INVENTION

This invention relates to a heat exchanger in which heat may be transferred either to or from a liquid flowing through the exchanger. More particularly, the invention relates to an exchanger of the type in which a plurality of finned tubes extend between hollow headers which serve to direct the flow of fluid through the tubes so that heat either may be added or taken from the fluid by reason of being conducted through the fins on the tubes.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a new and improved heat exchanger of the above general character which is easier and less expensive to service and repair and in which it is much easier to replace defective tubes than was possible heretofore in prior heat exchangers. A more specific object is to accomplish the foregoing with a heat exchanger in which the defective tubes may be removed and easily replaced with new tubes so that, when one or more tubes become defective in service use, this does not necessitate the replacement of the entire exchanger.

A further object is to provide an exchanger in which the tubes are releasably clamped together with the headers as a unitary assembly so that individual tubes may be unclamped and lifted from the assembly for replacement.

The invention also resides in the novel manner of mounting and arranging the parts of the exchanger to enable defective tubes to be removed individually from the exchanger.

These and other objects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a water heating unit with parts broken away to show a heat exchanger embodying the novel features of the present invention.

FIG. 2 is an enlarged view of the exchanger with certain parts shown in cross section.

FIG. 3 is an enlarged fragmentary elevational view taken substantially along lines 3—3 of FIG. 2.

FIG. 4 is an enlarged exploded elevational view of parts of the exchanger.

FIG. 5 is a fragmentary perspective view of parts of an alternative embodiment of the present invention.

FIG. 6 is an enlarged fragmentary plan view of parts of the alternative embodiment.

FIG. 7 is an enlarged cross-sectional view taken substantially along line 7—7 of FIG. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the drawings for purposes of illustration, the present invention is embodied in a heat exchanger 15 such as may be used in a hot water heater 16 to heat water flowing through the exchanger. Herein, the exchanger is mounted adjacent the top of the heater above a burner 17 located in the bottom of the heater. More particularly, the exchanger includes eight tubes 19 of equal length extending parallel to each other between two spaced headers 20 and 21. The opposite

ends of the tubes communicate with the hollow insides of the headers through spaced openings 23 in the front wall 24 of the rear header 20 and in the rear wall 25 of the front header 21. Fixed around each of the tubes a plurality of rings or fins 26 for absorbing heat from the burner to heat the water flowing through the tubes.

The water enters the exchanger 15 through an inlet 27 in the rear header 20 and flows out of the rear header through four of the openings 23 and into four of the tubes 19 to flow toward the front header 21. As shown in FIG. 2, the inside of the rear header is divided into an inlet chamber 29 and an outlet chamber 30 by a partition 31 so that the water must flow toward the front header and over the burner 17 to be heated. In the front header, the water enters a single large chamber 33 through four of the openings 23 and flows (as indicated by the arrows in FIG. 2) through the large chamber and out through the remaining four openings. The water then makes a second pass over the burner flowing through the other four tubes toward the rear header and into the outlet chamber 30. The latter communicates with the storage tank (not shown) through an outlet 34 in the rear wall 35 of the rear header. Thus, water flowing through the exemplary exchanger passes over the burner twice to be heated.

In accordance with the primary aspect of the present invention, provision is made for releasably clamping the tubes 19 together as a unitary assembly with the headers 20 and 21 to enable tubes which have become defective in service use, as by mineral deposit, leaks and the like, to be removed individually and replaced with new tubes. For this purpose, two sealing members 36 are mounted on each tube, one permanently sealed to the tube adjacent each end of the tube, and sealing surfaces 37 on the members 36 coact individually with sealing surfaces 39 disposed around the openings 23 in the headers. Releasable clamping means hold the headers and the tubes together as a unitary assembly with the surfaces 37 and 39 in sealing engagement. To replace a defective tube in the exchanger, the sealing members may be unclamped from the headers to enable the defective tube with its associated sealing members to be removed from the exchanger for replacement with a new tube. Thus, with the present arrangement, tubes may be replaced quickly and easily without difficulty and without having to replace an entire exchanger simply because one or more of the tubes is defective.

More particularly, as shown in FIGS. 3 and 6, the sealing members 36 are telescoped over the ends of the tubes 19, each tube being received in a central hole 40 in the member and permanently sealed to the member around the entire periphery of the hole. Holding the headers 20 and 21 on the ends of the tubes are the releasable clamping means which herein includes the sealing members 36, two spaced supports 44 and fastening elements in the form of screws 41 connected between the headers and the supports so that the sealing surfaces are clamped together in a watertight fit.

As each of the tubes 19 is mounted essentially in the same manner, for convenience of description, only one mounting arrangement will be described in detail. In the embodiment shown in FIGS. 1 through 4, the sealing member 36 and the support 44 are separate parts of the exchanger 15, the support being mounted on the tube 19 inwardly of and in abutment with the sealing member. More particularly, the sealing member is a

generally circular plate or sealing ring and is fixed on the tube inwardly of the end. A ring gasket 45 mounted around the end portion of the tube adjacent the outer surface of the sealing ring tapers from the ring toward the end of the tube to form one of the sealing surfaces 37. Holding the header 21 clamped against the sealing ring and the sealing surface 37 against its complementary surface 39 are the screws 41. The latter extend through upper and lower tabs 43 on the header and into the support 44 and serve to hold the support, the sealing ring and the header together. Thus, with the screws tightened down, the two sealing surfaces 37 and 39 are wedged together in a watertight fit.

Advantageously, the unique construction of the support 44 enables the tubes 19 to be removed individually from the exchanger 15 once the headers 20 and 21 have been unclamped from the sealing rings 36. To this end, the support comprises an elongated channel 46 which includes parallel inner and outer side walls 47 and 49 extending upwardly from a horizontal base 50. Each of the side walls includes eight upwardly opening slots 51 (see FIG. 4), one for each of the eight tubes. The slots in the outer wall 49 are aligned with the slots in the inner wall 47 so that, when the tubes are inserted into the slot, they extend generally perpendicular to the channel. Between the slots, the walls keep the tubes from moving transversely relative to the support or, in other words, horizontally broadwise toward or away from each other. More particularly, because both ends of the tubes are mounted within similar supports 44, the tubes are held together parallel to each other. In addition, the tubes are held against moving axially with respect to each other as a result of the clamping of the support against the sealing ring.

To hold the tubes 19 downwardly within the slots 51, an elongated bar or flat plate 53 fits between the side walls 47 and 49 of the channel 46 and includes eight downwardly opening slots 54 corresponding to the slots 51. The downwardly opening slots straddle the end portion of the tubes between the walls as the bar is held within the channel 46 by means of a plurality of the screws 41. The latter are fastened through aligned bores 55 in both the walls 47 and 49 and the bar 53 thereby holding the bar between the two walls and against movement upwardly with respect to the channel. Thus, the end portion of adjacent tubes are captivated within the slots 51 and 54 against moving vertically with respect to each other.

As seen from the foregoing, the present arrangement enables one or more old and defective tubes 19 to be removed individually from the exchanger 15 and replaced with new tubes without having to replace the entire exchanger. This may be done very simply and easily first by removing the screws 41 to disconnect the headers 20 and 21 from the opposite end of the tubes. Then, after removing the bars 53 from the channels 46, the defective tubes may be lifted from the channels and replaced with new tubes.

An alternative embodiment of the present invention is shown in FIGS. 5, 6 and 7, and in this form, the support 44' of the clamping means for holding the header 21' and the tube 19' together is integrally formed with the sealing members 36'. More particularly, each member is formed as a generally rectangular sealing plate and includes a central hole 40' receiving the one end portion of the tube 19' and, as with each of the circular sealing rings 36, the tube is sealed permanently with the

sealing plate around the entire periphery of the hole. The support 44' includes an elongated tongue 56 formed integrally with one side of the plate and projecting outwardly therefrom. A groove 57 is formed in the opposite side of the sealing plate and is defined by two parallel flanges 59 integrally formed with and extending vertically along the side of the sealing plate. As shown in FIG. 6, the tongues and grooves of adjacent sealing plates interfit with 21 the each other and are held together by additional parts of the clamping means, namely, upper and lower screws 60 fastened through aligned holes 61 and 63 in the flanges and tongues respectively, to hold the sealing members together so to provide the support for clamping the headers on the tubes.

As in the first described embodiment, the headers 20' and 21' are clamped to the sealing members or plates 36' by screws 41' to effect a watertight seal between the ends of the tubes 19' and the openings 23' in the headers. In the alternative embodiment, a sealing gasket 64 is embedded in each of the sealing plates around the periphery of the hole 40' and is engaged by a sealing surface 39' formed around the opening in the header, the outer surface of the gasket serving as the corresponding sealing surface 37'.

To replace defective tubes 19' in the alternative embodiment, the screws 41' must be removed first to unfasten the header 21' from the sealing plates 36'. Then, by selectively removing the screws 60 to loosen the defective tube, the latter can be lifted from the unit and replaced with a new tube. Advantageously, the tongues 56 (see FIG. 5) in the two sealing plates at the opposite ends of each tube face in the same direction and likewise the grooves 57 in the two sealing plates open in the same direction and opposite that of the tongue. This arrangement enables each tube to be turned endwise so that either end of the tube may align to fit on either the front header 21 or the back header 20 notwithstanding the orientation of the grooves and tongues exposed in the exchanger 15 prior to inserting the new tube.

I claim as my invention:

1. A heat exchanger including two hollow headers spaced from each other and each having a plurality of openings through one side thereof, a plurality of finned tubes extending generally parallel with each other between said headers and communicating through said openings with the insides of said headers, a plurality of generally circular sealing plates each with a central hole extending therethrough, two of said plates being mounted on each of said tubes, said two plates being telescoped over the opposite end portions of each tube with each plate being sealed permanently to the tube around the entire periphery of each hole, a set of outwardly facing sealing surfaces on said sealing plates around said holes, a second set of sealing surfaces formed around said openings and facing said first-mentioned surfaces, two spaced support channels each with inner and outer side walls extending parallel to each other and upwardly from a horizontal base, said two channels being mounted adjacent opposite ends of the tubes and extending transversely thereof with each of said outer walls abutting said sealing plates, a plurality of upwardly opening first slots formed in each of said side walls with each slot axially aligned with a corresponding slot in the other side wall and receiving the end portion of one of said tubes, two bars 7 each of said bars telescoped edgewise between said inner and outer

5

of said channels side walls, each of said bars including a plurality of downwardly opening second slots receiving the end portions of said tubes between said side walls, and screw means extending through said channels and said bars to hold each of said bars downwardly within its associated channel to captivate the adjacent end portions of said tubes laterally within said first and

6

second slots, said screw means also being connected with the adjacent headers to hold said first and second sets of sealing surfaces together with a watertight fit and being releasable to permit said tubes with their associated sealing plates to be lifted individually from the exchanger.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,792,729

Dated February 19, 1974

Inventor(s) Richard C. Perry

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, line 67 of Column 4, erase "7" and insert ---, --- therefor;
Also in Claim 1, line 1 of Column 5 erase "of said channels side walls"
and insert ---side walls of said channels--- therefor.

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents