PATENT SPECIFICATION (11) 1 404 643

1 404 643

(21) Application No. 44099/72 (22) Filed 23 Sept. 1972
(23) Complete Specification filed 13 Sept. 1973
(44) Complete Specification published 3 Sept. 1975
(51) INT. CL.² F28F 9/00
F22B 37/20//1/06
(52) Index at acceptance
F4S 10A
F4A 36 8C
(72) Inventor JOHN CHARLES BENNETT

(19) THE PATENT OFFICE LONDON

(54) HEAT EXCHANGER

(71) We, CLARKE CHAPMAN LIMITED, formerly CLARKE CHAPMAN-JOHN THOMPSON LIMITED, a British Company of Victoria Works, Gateshead, County Durham NE8 3HS, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to heat exchangers.

A heat exchanger such as forms for example part of a power steam boiler is made up of numerous tube passes which may be arranged in many different ways and it is necessary to secure the tube passes so that they are properly supported.

The means by which the tube passes are secured need to be as simple as possible so as to facilitate construction of the heat exchanger and must be able to continue to function effectively under the varying operating conditions to which the heat exchanger is subjected.

It is an object of the invention to provide a heat exchanger in which tube passes are secured by means which meet those requirements in an improved way.

In a heat exchanger according to the invention, tube passes are secured to a member extending past several tube passes, abutment means being provided having faces in engagement with said tube passes, at least some of the abutment means each comprising two abutment pieces and a wedge which acts on said pieces to maintain said engagement, said wedge being secured to said member.

Preferably, said wedges are each secured to said member by a rivet.

Each of the other said abutment means is preferably an abutment element having two of said faces in engagement with respective tube passes.

Each of said other abutment means is preferably secured to the member by brazing or welding for example.

One form of heat exchanger according to the invention will now be described by way of example with reference to the drawings accompanying the provisional specification in which:—

Figure 1 is a diagrammatic vertical cross-section through part of the heat exchanger; and

Figure 2 is a view looking in the direction of the arrow 'A' in Figure 1.

The heat exchanger shown in the drawings is intended for use in nuclear reactor plant such as a fast breeder reactor power generation plant where hot liquid metal flows over the tube passes and water flows through the tubes.

The heat exchanger comprises tube passes 10, 12 which may respectively for example be turns of two helical tube coils, one located within another. Members, in the form of bars, 14, 16 pass adjacent the tube passes 10, 12 respectively, and the tube passes are secured to the members 14, 16 so as to be supported by the members 14, 16.

The tube passes are secured by abutment means some of which form a first series of abutment means 20 (shown in detail in Figure 1 only in relation to the member 14, those associated with the member 16 being similar) and others of which form a second series 22.

Each abutment means 20 comprises two abutment pieces 24 each having a part-circular recess providing a face 26 engageable with a tube pass 10.

Since the tube passes 10, 12 are turns of helical coils they do not cross the members 14, 16 exactly at right angles. Therefore, the recesses providing the faces 26 engageable with the tube passes must be formed accordingly.

That is, each recess is slightly angled

[Price 33p]

with respect to the remainder of the abutment pieces 24 in which it is formed and so is slightly angled with respect to the member 14 or 16 to which the abutment piece is secured.

Each piece 24 also has a frusto-conical surface 28. The surfaces 28 converge towards the member 14. A frusto-conical wedge 30 having a central longitudinal bore, through which extends a rivet 32, is positioned between the pieces 24 in each means 20 to engage the surfaces 28 to force the pieces 24 into engagement with adjacent tube passes.

The rivet 32 also extends through a hole in the member 14.

The rivet 32 is preferably of the kind known as a "pop" rivet and is designed to secure the wedge with respect to the member 14 and hence secure the two pieces 24 in place thus positioning the tube passes with respect to the member 14; the two pieces 24 being forced against their respective tube passes under a pre-determined loading (within limits).

Each abutment means of the series 22 is an element in the form of a solid block having two oppositely-directed, part-circular recesses 40 providing faces for engaging respective tube passes 10. The elements 22 are secured to the member 14 by brazing or welding or by other suitable means. The tube passes 10 are forced against the respective faces 40 of the elements 22 by the action of the wedges 30.

The arrangement of the abutment means 20, 22 in relation to the member 16 and the tube passes 12 is exactly similar to that just described.

In a first modification, the elements 22 could be replaced by abutment means similar to the abutment means 20.

In another modification, the elements 22 could be free to move longitudinally of the members 14, 16.

With such a modification fewer abutment means 20 could be used. For example two or more elements 22 could be used between successive abutment means 20.

Only part of the heat exchanger is shown in the drawings. Further helical coils could be nested within or without the two shown in part. There are several members 14 for the coil comprising tube passes 10, the members being angularly spaced about the axis of the coil, although only one member 14 is shown. The same applies to the coil having tube passes 12 and to other coils.

The invention is not limited to any particular form of tube array. For example it may be applied to heat exchangers in which the tube passes are planar, being of the so-called platen type, or formed as curved panels, for example panels having involute shape, or where each tube is a U-tube and several U-tubes are nested one in another so that the tube passes lie adjacent one another. Such U-tube assemblies may be planar or curved, for example involute (i.e. each U-tube of the assembly lies within a notional envelope of involute shape).

The invention may be applied to heat-exchangers which are designed for the flow of different media over and within the tubes or to heat-exchangers intended to have the same medium both flowing over the tubes and within the tubes. For example, in addition to heat-exchangers designed to have water or steam flowing through the tubes, the invention is applicable to intermediate heat-exchangers for use in liquid metal cooled nuclear plant which are designed to have liquid metal flowing both over the tubes and within them. The invention is applicable to steam power plant other than nuclear plant. For example, the heat-exchanger may be designed to have gas flowing over the tubes and water or steam flowing within them.

WHAT WE CLAIM IS:—

1. A heat exchanger in which tube passes are secured to a member extending past several tube passes, abutment means being provided having faces in engagement with said tube passes, at least some of the abutment means each comprising two abutment pieces and a wedge which acts on said pieces to maintain said engagement, said wedge being secured to said member.

2. A heat exchanger according to claim 1, in which said wedges are each secured to said member by a rivet.

3. A heat exchanger according to claim 2, in which the rivet in each case secures the corresponding wedge such that its associated abutment pieces are forced against a tube pass under a pre-determined load.

4. A heat exchanger according to claim 2 or claim 3, in which the rivet is a "pop" rivet.

5. A heat exchanger according to any preceding claim, in which some of said abutment means comprise a single abutment element having at least one face in engagement with a respective tube pass.

6. A heat exchanger according to any preceding claim, in which some of said abutment means comprise a single abutment element having at least one face in engagement with a respective tube pass and being secured to the member.

7. A heat exchanger according to claim 6, in which said abutment means is secured to the member by brazing or welding.

8. A heat exchanger according to any

preceding claim, in which the wedge is frusto-conical.

9. A heat exchanger substantially as hereinbefore described with reference to the drawings accompanying the provisional specification.

ROBERT J. CUMMINGS,

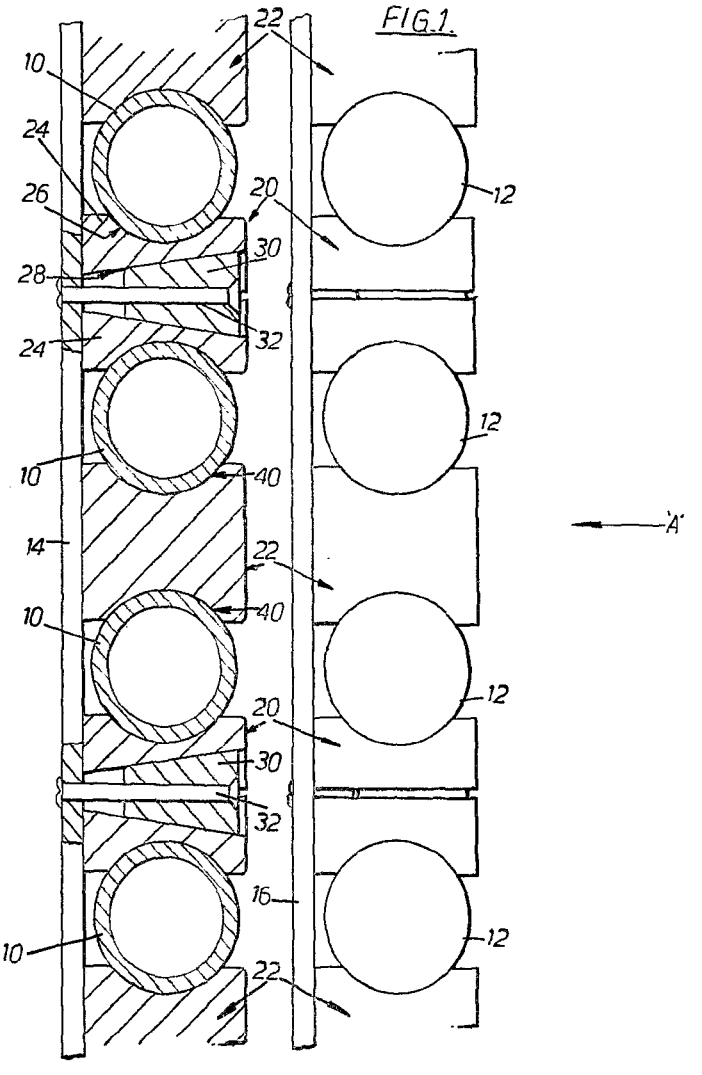
Chartered Patent Agent.

Agent for the Applicants.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1975.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1404643 PROVISIONAL SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG.1.



1404643 PROVISIONAL SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

FIG.2.