(54) Title: TUBE PLATE FOR TUBE BUNDLES FOR CHEMICAL REACTORS AND HEAT EXCHANGERS IN GENERAL

(57) Abstract:
A tube plate (10) for tube bundles for chemical reactors and heat exchangers in general, comprises a plurality of components (11, 12), with a shape which is complementary to one another, in order to form a complete plate (10), wherein the components (11, 12) are produced separately, and are connected to one another subsequently by means of mechanical joints, in order to form the tube plate (10). The components (11, 12) which form the tube plate (10) are joined to one another by means of a plurality of pins (15), or other mechanical connections, which are inserted in corresponding holes provided in the respective components, (11, 12). This joint can be completed by means of welded connections on the mechanical connection parts.
ABSTRACT

A tube plate (10) for tube bundles for chemical reactors and heat exchangers in general, comprises a plurality of components (11, 12), with a shape which is complementary to one another, in order to form a complete plate (10), wherein the components (11, 12) are produced separately, and are connected to one another subsequently by means of mechanical joints, in order to form the tube plate (10). The components (11, 12) which form the tube plate (10) are joined to one another by means of a plurality of pins (15), or other mechanical connections, which are inserted in corresponding holes provided in the respective components, (11, 12). This joint can be completed by means of welded connections on the mechanical connection parts.
TUBE PLATE FOR TUBE BUNDLES FOR CHEMICAL REACTORS AND HEAT EXCHANGERS IN GENERAL

The present invention relates to a tube plate for tube bundles for chemical reactors and heat exchangers in general.

The present invention can also be applied to petrochemical and refinery reactors.

As is known, chemical reactors consist of containers with large dimensions, inside which chemical reactions take place at a high temperature and a high pressure.

Inside their substantially cylindrical body, these chemical reactors generally have a plurality of tubes, or tube bundles, which can carry out various functions, including assisting heat exchange between the operating fluids.

These tube bundles are installed and kept in an operative position by means of use of tube plates, which in some cases can have large dimensions.

With particular reference to the state of the art, it can be noted that, at present, the tube plates are produced in a single piece, or alternatively in several pieces which are welded together and then finished, for example which are drilled and/or machined.
However, these processing operations cause some significant technical problems which must be faced satisfactorily.

Firstly, in order to carry out these processing operations, particular machine tools are necessary, which have large capacities, large useful dimensions, and high costs.

In addition, the operations to be carried out for these purposes are such that they require processing times which are often too lengthy for present requirements.

Other problems according to the known art are caused by deformations which are created in the tube plate, as a result of welding shrinkages, in particular in the case of joints which are fully welded.

The object of the present invention is thus to provide a tube plate for tube bundles for chemical reactors, which eliminates the above-described disadvantages.

A further object of the present invention is to provide a tube plate for tube bundles for chemical reactors, which can be produced quickly and economically.

A further object of the present invention is to provide a tube plate for tube bundles for chemical reactors, which is safe and reliable when it is installed.

These objects and others according to the invention are achieved by a tube plate for tube bundles for chemical reactors, characterised in that it comprises a plurality of components, with a shape which is complementary to one another, in order to form a
complete plate, wherein the said components are produced separately, and are connected to one another subsequently by means of mechanical joints, in order to form the said tube plate.

According to a preferred embodiment of the present invention, the components which form the said tube plate are joined to one another by means of a plurality of mechanical connections, which engage the respective components with one another.

Further characteristics of the tube plate for tube bundles for chemical reactors, according to the present invention, are defined in the other claims attached to the present application.

The characteristics and advantages of the tube plate for tube bundles for chemical reactors, according to the present invention, will become more apparent from the following description of a typical embodiment, provided by way of non-limiting example, with reference to the attached schematic drawings in which:

- figure 1 represents in plan view a tube plate for tube bundles for chemical reactors, according to the present invention; and

- figure 2 represents, partially in cross-section, a detail of the system for connection between components of the tube plate in the preceding figure, according to a preferred embodiment of the present invention.

With particular reference to the aforementioned figures, the tube plate for tube bundles with large sizes, according to the present invention, is indicated globally by the reference number 10.
In the embodiment illustrated by way of example in the attached figures, the tube plate 10 has two components, 11 and 12, with a substantially semi-circular shape, which have previously been machined.

It will be appreciated that, according to the present invention, perforated plates can be produced in several pieces or components, according to requirements and to the design dimensions, which are subsequently joined together by means of mechanical joints.

Thus, a perforated plate with large dimensions is produced in several parts which are connected to one another.

As described briefly hereinafter, the components of the tube plate, the number of which depends on the dimensions and the structural requirements, are processed until they are completed, and are then connected mechanically. In the example illustrated in the attached figures, the semi-circular components 11 and 12 are joined to one another by means of a plurality of pins 15.

The pins 15 are inserted in holes provided respectively in the component 12 and in a projecting portion 13 of the component 11.

In fact, the component 11 has a projection 13 which is inserted in a corresponding cavity 14 in the component 12.
The connection of these components 11 and 12 is completed by means of welded connections 16, between the head of the pin 15 and the component 12, and by means of further welded connections 16’ between the components 11 and 12.

However, in addition to the example described, in order to guarantee sealing, seals of any type can be used, or, alternatively, a welding seal can be produced on the mechanical connection parts (which can consist of braces, screws, wedges, cams etc.).

As a result, the invention makes it possible to process separately and in parallel components with smaller dimensions, on machines with smaller dimensions and capacities.

The description provided makes apparent the characteristics and technical advantages of the tube plate for tube bundles for chemical reactors, according to the present invention.

The following considerations and concluding comments are now made, in order to define the said advantages more clearly and accurately.

The invention avoids the need to use machine tools with large capacities and large useful dimensions, and the time for construction of the manufactured product is reduced.
In addition, there is a drastic reduction in the problems of deformation caused by welding shrinkages, in the case of fully welded joints.

The invention can be applied to chemical reactors, heat exchangers, and in general to tube-bundle type pressure devices.

Finally, it is apparent that many other variations can be made to the tube plate or tube bundles for chemical reactors which is the subject of the present invention, without departing from the principles of novelty which are inherent in the inventive concept.

It is also apparent that, in the practical implementation of the invention, any materials, dimensions and forms can be used according to requirements, and can be replaced by others which are technically equivalent.

In fact, the same results could be obtained with different connection technologies, provided that the novelty of the inventive concepts contained in the present description is applied.

The scope of the present invention is defined by the attached claims.
CLAIMS

1. Tube plate (10) for tube bundles for chemical reactors or heat exchangers, characterised in that it comprises
   a first plate component (11) perforated to receive a first plurality of tubes of the bundle and having a first facing edge thereof;
   a second plate component (12) perforated to receive a second plurality of tubes of the bundle and having a second facing edge thereof, said facing edges having mating complimentary surfaces that enable the first and second perforated components (11, 12) to be joined so as to form a smooth interface therebetween, wherein the said components (11, 12) are produced separately; and
   a plurality of mechanical connections, which join the respective components (11, 12) to one another in order to form the said tube plate (10).

2. Tube plate (10) according to claim 1, characterised in that the plurality of mechanical connections includes a plurality of pin fasteners (15) extending through said complimentary surfaces of said first and second perforated components (11, 12) to thereby form a connection between said first and second perforated components (11, 12).

3. Tube plate (10) according to claim 2, characterised in that the plurality of pin fasteners (15) are inserted in corresponding holes provided in the respective components (11, 12).

4. Tube plate (10) according to claim 3, characterised in that at least one of the said components (11, 12), has a series of projections (13), which are inserted in corresponding cavities (14) in the respective component, such as to enable the pins (15) to complete the connection between the said components (11, 12).

5. Tube plate (10) according to claim 4, characterised in that the connection of the said components (11, 12) is completed by means of welded connections (16) between the head of the pins (15) and at least one of the components (11, 12).
6. Tube plate (10) according to claim 4, characterised in that the connection of the components (11, 12) is completed by means of welded connections (16) between the components (11, 12).

7. Tube plate (10) according to claims 1 to 6, characterised in that it is constituted by means of a pair of semi-circular components (11, 12), which are joined to one another along a median line.

8. Tube plate (10) according to claims 1 to 7, characterised in that, a seal is used to guarantee the sealing between the components (11, 12).

9. Tube plate (10) according to claim 1, characterised in that the plurality of mechanical connections between the components (11, 12) of the plate (10) can be selected from amongst braces, screws, wedges pins, and cams.

10. Tube plate for tube bundles for chemical reactors, petrochemical reactors, refinery reactors and heat exchangers characterised in that it comprises

    first and second semi-circular plate components (11, 12) joined together mechanically long a pair of facing straight edges, respectively, of said first and second semi-circular components (11, 12), each of said semi-circular components having a plurality of perforations for receiving individual ones of said tubes;

    said first semi-circular component (11) provided with a projection along one of said pair of facing straight edges and said second semi-circular component provided with a cavity along the other of said pair of facing straight edges, said projection received within said cavity so as to form a smooth connecting interface between said first and second semi-circular components (11, 12).