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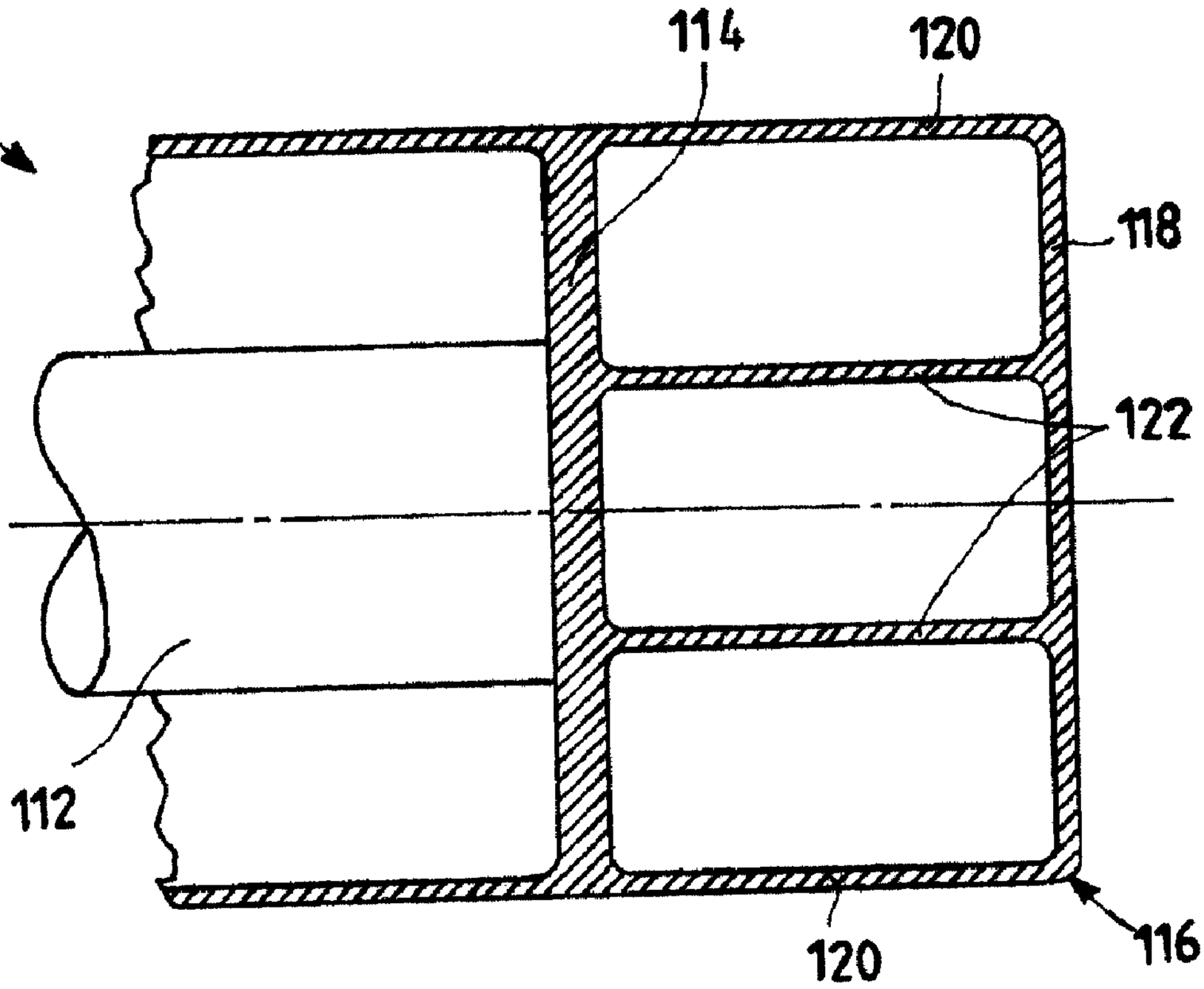
(54) Titre : DISPOSITIF UTILISE COMME REACTEUR CHIMIQUE OU COMME ECHANGEUR DE CHALEUR EN GENERAL, EQUIPE D'UNE PLAQUE TUBULAIRE MINCE

(54) Title: DEVICE USED AS A CHEMICAL REACTOR OR HEAT EXCHANGER IN GENERAL, WITH A THIN TUBE PLATE



(57) Abrégé/Abstract:
A device (110) used as a chemical reactor or heat exchanger in general, with a thin tube plate (114), of the type in which at least one pipe (112) is connected to a tube plate (114), this tube plate (114) being closed by a chamber (116) with a container function,

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(57) Abrégé(suite)/Abstract(continued):
wherein this chamber (116) is produced by means of a section with any shape, with a base (118) which is joined to the plate (114) by a lateral portion (120); connection elements (122) are also provided between the tube plate (114) and the base (118) of the chamber (116).

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DEVICE USED AS A CHEMICAL REACTOR OR HEAT EXCHANGER IN GENERAL, WITH A THIN TUBE PLATE

ABSTRACT

A device (110) used as a chemical reactor or heat exchanger in general, with a thin tube plate (114), of the type in which at least one pipe (112) is connected to a tube plate (114), this tube plate (114) being closed by a chamber (116) with a container function, wherein this chamber (116) is produced by means of a section with any shape, with a base (118) which is joined to the plate (114) by a lateral portion (120); connection elements (122) are also provided between the tube plate (114) and the base (118) of the chamber (116).

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DEVICE USED AS A CHEMICAL REACTOR OR HEAT EXCHANGER IN GENERAL, WITH A THIN TUBE PLATE

The present invention relates to a device used as a chemical reactor or heat exchanger in general, with a thin tube plate.

The present invention also applies to petrochemical and refinery reactors.

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

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

These tube bundles are installed and retained in the operative position by means of the use of tube plates, which in some cases can have a large surface area.

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 welded pieces, and are then finished, for example they are drilled and/or machined.

The tube plates are usually designed with a thickness which makes it possible to withstand the loads applicable.

Above all in the case of chemical reactors, the loads, whether caused by the weight, pressure or temperature of use, can generate high levels of stresses. Plates with substantial thicknesses are thus required, which are sometimes at the limit of technical feasibility.

In particular in these cases, these plates can alternatively be produced with a reduced thickness, but with the addition of elements which are used to strengthen the plates themselves.

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Various methods for strengthening tube plates are known according to the state of the art.

Design codes are also known which regulate the dimensional criteria for the plates and for strengthening the latter.

In general the known strengtheners consist of reinforcement ribs, which are welded to the thin plates such as to limit the deformations and stresses to which the plates are subjected.

These strengtheners are very costly and their size, by reducing considerably the useful space for insertion of the tubes on the plates, leads to a significant increase in the diameter of the plates themselves and consequently in the overall diameter of the equipment.

The object of the present invention is thus to eliminate the aforementioned disadvantages and in particular to provide a device which is used as a chemical reactor or heat exchanger in general, with a thin tube plate, which makes it possible to reduce the costs of construction of the device itself.

Another object of the present invention is to provide a device which is used as a chemical reactor or heat exchanger in general, with a thin tube plate, which makes it possible to lighten the device itself and facilitate its installation.

A further object of the present invention is to provide a device used as a chemical reactor or heat exchanger in general, with a thin tube plate, which is safe and reliable when it is installed.

Another object of the present invention is to provide a device used as a chemical reactor or heat exchanger in general, with a thin tube plate, which is particularly simple and functional.

This object and others according to the invention are achieved by providing a device used as a chemical reactor or heat exchanger in general, with a thin tube plate, of the type in which at least one pipe is connected to a tube plate. The said tube plate being connected to a chamber, wherein this chamber is produced by means of a section, with a base which is joined to the plate by a lateral portion. Connection elements are provided between the said tube plate and the said base of the said chamber.

The characteristics and advantages of a device used as a chemical reactor or heat exchanger in general, with a thin tube plate, according to the present invention, will become clearer and more apparent from the following description provided by way of non-limiting example with reference to the attached schematic drawings, in which:

figure 1 is a cross-section of a device used as a chemical reactor or heat exchanger in general, which shows a pipe connected to a plate, the plate being produced according to the known art; and

figure 2 is a cross-section of a device used as a chemical reactor or heat exchanger in general, which shows the pipe in figure 1 connected to a thin plate, the plate being provided with a system for transfer of the loads according to the teaching of the present invention.

Figure 1 shows a device used as a chemical reactor or heat exchanger in general, indicated as 10 as a whole, according to the known art.

In the example illustrated, the device 10 comprises a pipe system 12. This system, in preferred embodiments described by way of non-limiting example, comprises pipes which are superimposed and is secured to a tube plate 14 disposed perpendicularly to the axis of the pipes.

A chamber 16 which acts as a fluid distributor is connected to the tube plate 14. In the example illustrated, this chamber 16 is produced by means of a section in the shape of a "U", with a base 18 which is joined to the plate 14 by a cylindrical portion 20, with generatrices parallel to the axis of the pipes.

On the other hand figure 2 shows a device used as a chemical reactor or heat exchanger in general, indicated as 110 as a whole, according to the present invention.

In this figure the components which are the same as and/or equivalent to those illustrated in figure 1 have the same reference numbers increased by 100.

More specifically, in the example illustrated, the device 110 comprises a pipe system 112 which is shown schematically in the figure. In preferred embodiments described by way of non-limiting example, this system 112 comprises pipes which are superimposed and is secured to a tube plate 114 disposed perpendicularly to the axis of the pipes.

A chamber 116 which acts as a fluid distributor is connected to the tube plate 114. In the example, the chamber 116 is produced by means of a section in the shape of a "U", with a base 118 which is joined to the plate 114 by a cylindrical or lateral portion 120, with generatrices parallel to the axis of the pipes.

In addition, in comparison with the device 10 according to the known art, the plate 114 of the device 110 according to the invention is connected at the base 118 of the chamber 116 both by means of the cylindrical portion 120 and by means of connection elements 122 which are disposed inside the cylindrical portion 120.

In figure 2 these connection elements 122 are cylindrical or flat portions with a shape similar to the lateral portion 120. The example shows one of these elements 122, disposed axially symmetrically relative to the axis of the pipe 112, although other configurations are not excluded.

The functioning of the device 110 used as a chemical reactor or heat exchanger in general, according to the invention, is apparent from the foregoing description provided with reference to the figures, and briefly is as follows.

In the case of the known art, the loads are transmitted entirely by the device 10 through the plate 14 to the cylindrical portion 20 of the chamber 16.

In the case in figure 2 however, there is more efficient distribution of the loads.

In fact, according to the present invention, the loads are transmitted by the device 110 through the plate 114, both to the cylindrical portion 120 and to the connection elements 122.

It is thus possible to use thinner tube plates 114.

The description provided makes apparent the characteristics of the device used as a chemical reactor or heat exchanger in general, with a thin tube plate, which is the subject of the present invention, as well as the corresponding advantages, which, it will be remembered, include:

-lower overall weights;

-simplification of the installation and of retention of the tube bundle;

-lower overall costs and shorter construction times than in the known art; and

-simple, reliable and safe use.

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

Finally it is apparent that many modifications and variations, all of which come within the scope of the invention, can be made to the device thus designed, used as a chemical reactor or heat exchanger in general, with a thin tube plate; in addition all the details can be replaced by technically equivalent elements.

In practice any materials, forms and dimensions can be used according to the technical requirements.

The scope of the invention is thus delimited by the attached claims.

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WHAT IS CLAIMED IS:

1. A chemical reactor or heat exchanger comprising:

at least one pipe having a pipe axis;

a thin tube plate having a first side attached to the pipe, wherein said plate is perpendicular to the pipe and an open end of the at least one pipe terminates and is sealed off by the first side of the thin tube plate;

a chamber defined by the thin tube plate and a base opposite and parallel to a second side of the plate and by a lateral section connecting the plate and base, wherein said lateral section includes walls parallel to a pipe wall, and

a connection element directly connected to and extending between said base and said tube plate, wherein said connection element is parallel to and aligned with the pipe axis and the connection element is at least partially radially inward of said pipe wall.

2. A device as in claim 1 wherein said connection element is a flat portion.

3. A device as in claim 1 wherein said connection elements is cylindrical.

4. A device as in claim 1 wherein said connection element is within said lateral section of the chamber and is symmetrical about an axis of the pipe, wherein said axis of the pipe is perpendicular to the plate.

5. A device as in claim 4 wherein the connection element is a cylinder and is axially symmetrical about the axis of the pipe.

6. A chemical reactor or heat exchanger comprising:

a pipe having a pipe axis and a pipe wall;

a thin tube plate having a first side attached to the pipe, wherein the plate is in a plane perpendicular to the pipe axis and an open end of the at least one pipe terminates and is sealed off by the first side of the thin tube plate;

a chamber defined by a second side of the thin tube plate and a base plate opposite to the thin tube plate and by a lateral cylindrical section connecting the plate and base, wherein said chamber distributes fluid and said lateral cylindrical section is coaxial with the pipe axis, and

a connection element within the chamber and directly connected to and extending between said base plate and said tube plate, said connection element being parallel to and symmetrical about the pipe axis, said connection element structurally supporting the base plate and lateral cylindrical section, wherein the connection element is radially inward of a pipe wall.

Fig.1

PRIOR ART

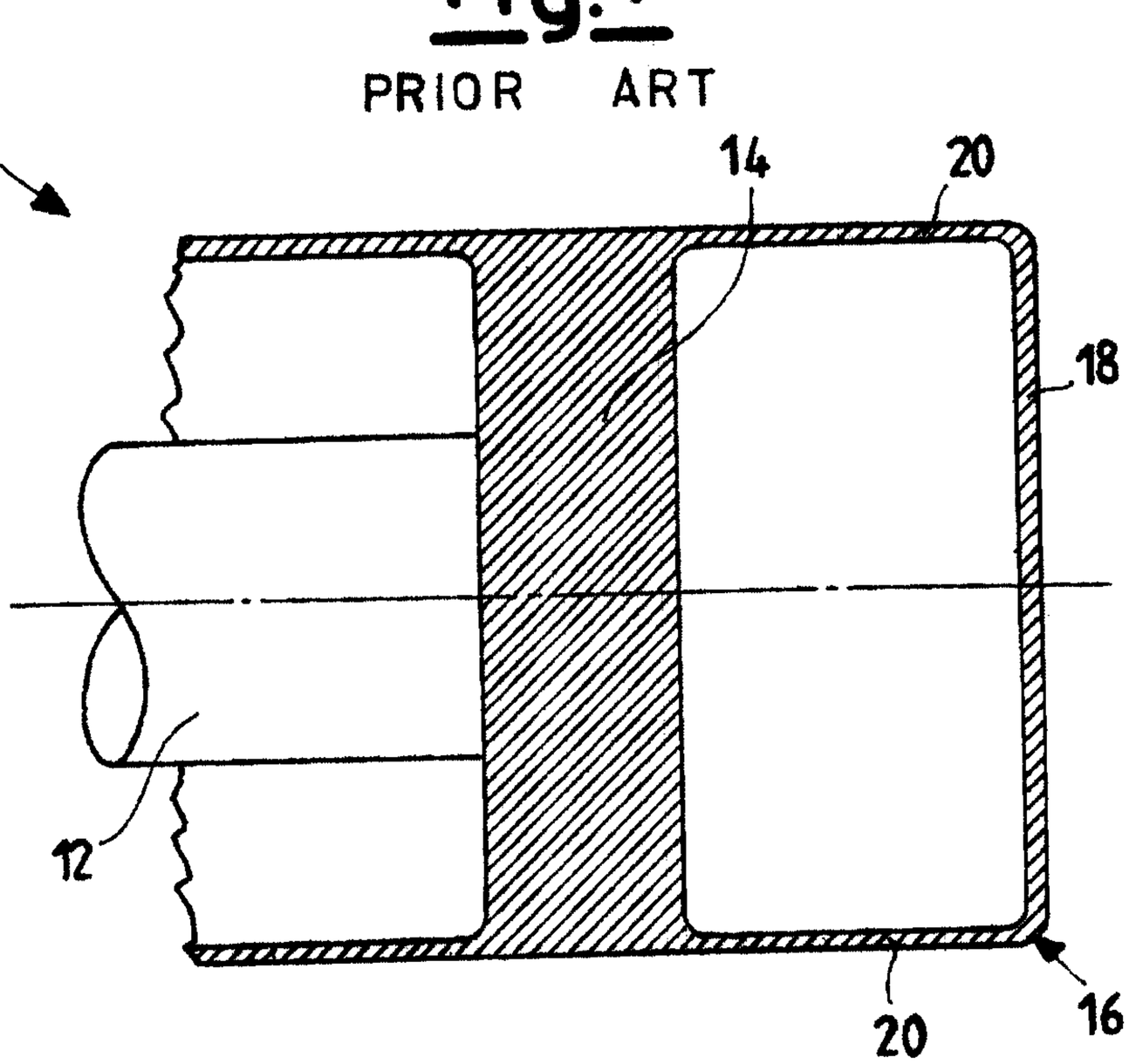
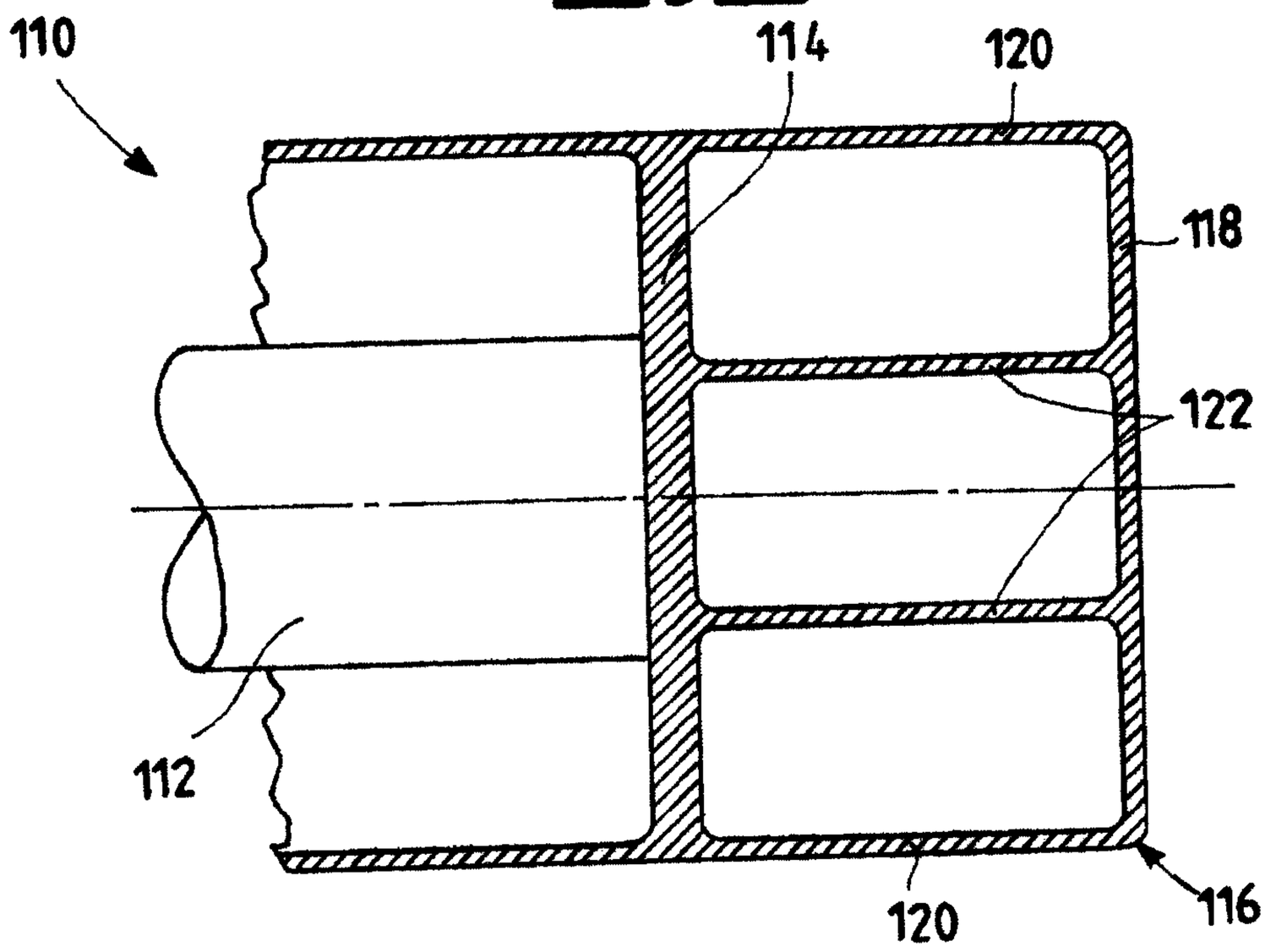
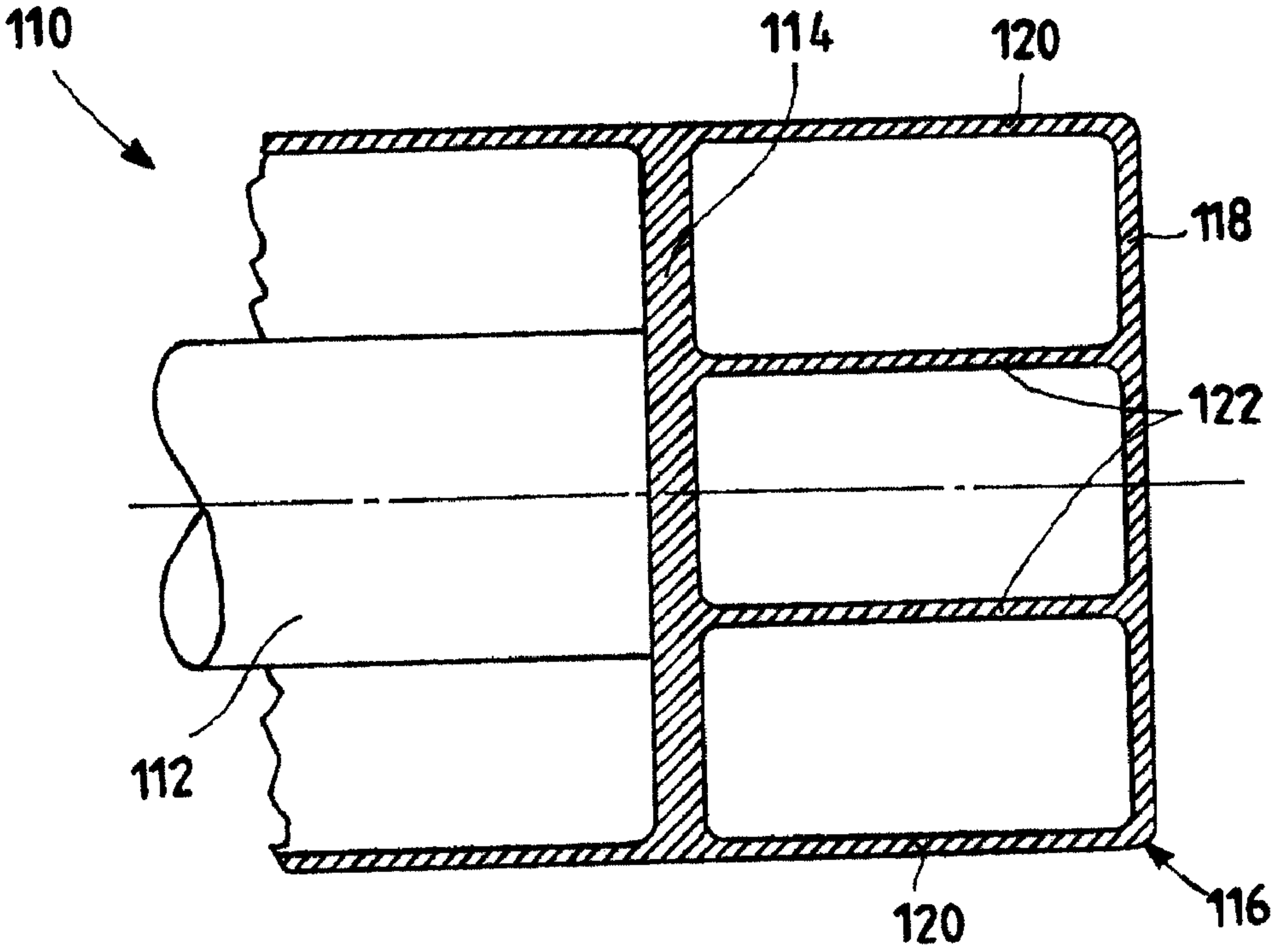


Fig.2

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