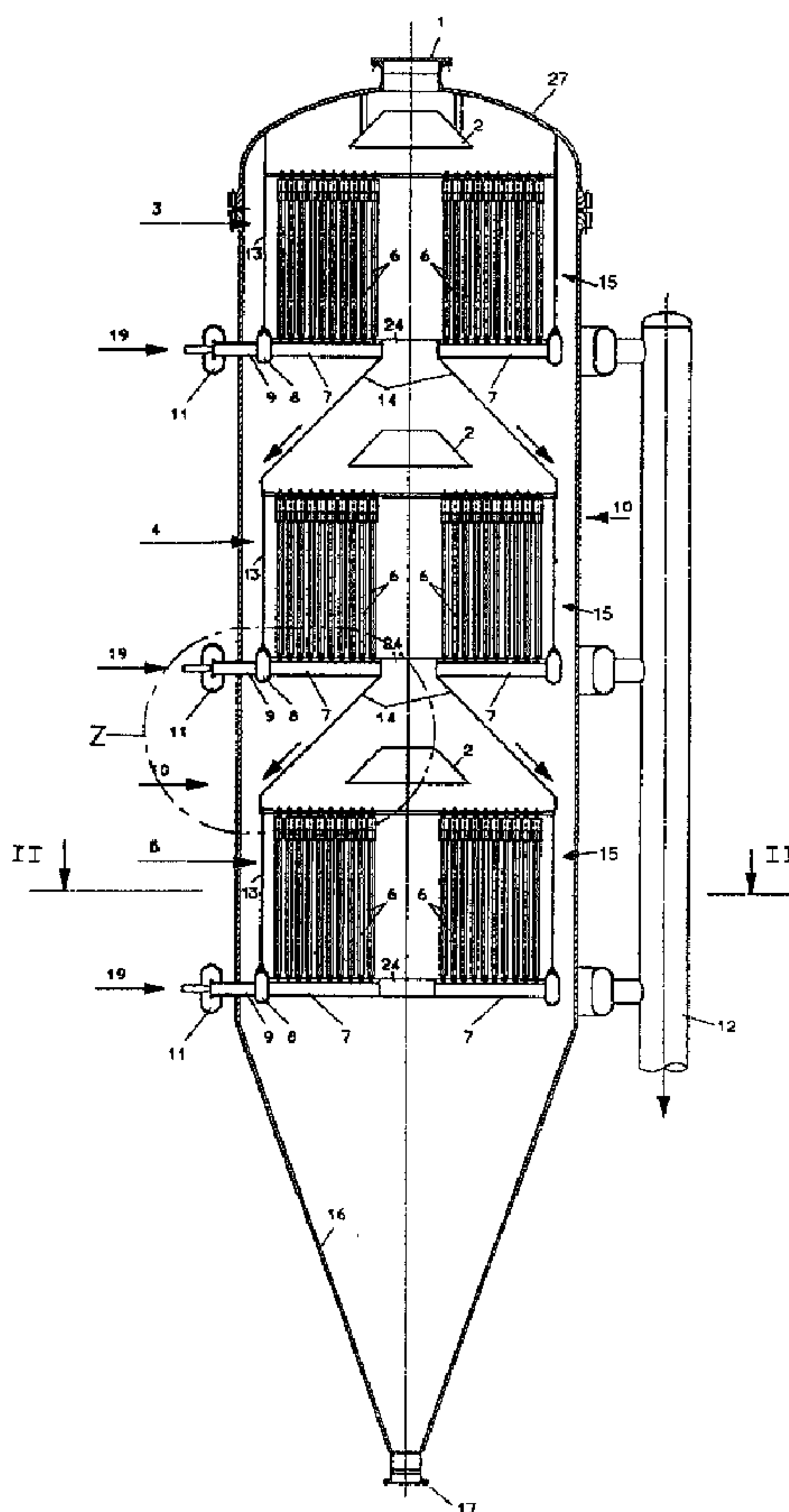




(22) Date de dépôt/Filing Date: 1996/06/21
 (41) Mise à la disp. pub./Open to Public Insp.: 1997/01/27
 (45) Date de délivrance/Issue Date: 2005/06/07
 (30) Priorité/Priority: 1995/07/26 (195 27 311.7) DE

(51) Cl.Int.⁶/Int.Cl.⁶ B01D 46/24
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(54) Titre : PROCÉDE ET APPAREIL DE NETTOYAGE DE GAZ CHARGES DE POUSSIÉRES
 (54) Title: PROCESS AND APPARATUS FOR THE CLEANING OF DUST LADEN GAS



(57) Abrégé/Abstract:

In a process for the cleaning of dust laden, preferably hot gas with the aid of ceramic filter candles which are open at one end stacked above one another in levels in a raw gas space, and connected to a clean gas space, these filter candles are cleaned by

(57) **Abrégé(suite)/Abstract(continued):**

way of pulsed gas, which is blown into the filter candles for a short period of time from the side of the clean gas space and against the direction of raw gas flow. In the raw gas space the gas to be cleaned and the dust loosened by the cleaning are guided separately so that the loosened dust is guided to the dust removal structure of the raw gas space without once again mixing with the gas to be cleaned. The process is advantageously carried out in a filter housing wherein the filter candles are connected to laterally spaced apart supporting collectors. The filter candles in one level are separated from the filter candles in the level thereabove by an ash removal mantle.

ABSTRACT

In a process for the cleaning of dust laden, preferably hot gas with the aid of ceramic filter candles which are open at one end stacked above one another in levels in a raw gas space, and connected to a clean gas space, these filter candles are cleaned by way of pulsed gas, which is blown into the filter candles for a short period of time from the side of the clean gas space and against the direction of raw gas flow. In the raw gas space the gas to be cleaned and the dust loosened by the cleaning are guided separately so that the loosened dust is guided to the dust removal structure of the raw gas space without once again mixing with the gas to be cleaned. The process is advantageously carried out in a filter housing wherein the filter candles are connected to laterally spaced apart supporting collectors. The filter candles in one level are separated from the filter candles in the level thereabove by an ash removal mantle.

PROCESS AND APPARATUS FOR THE CLEANING OF DUST LADEN GAS

The invention relates to an apparatus for the cleaning of dust laden gas. More particularly, the invention relates to an apparatus for the cleaning of hot gas by way of ceramic filter candles which are stacked in a filter housing.

A hot gas filter with ceramic filter candles is known from EP-PS 0 433 637, which filter candles stand on collector channels or are suspended therefrom. These collector channels are positioned spaced apart parallel and at multiple levels within the filter housing. The collector channels open into a clean gas collector chamber which is formed in the filter housing and to which an exit flange is connected. The filter candles are periodically cleaned by way of pulsed gas. The dust which is thereby detached from the filter candles can admix in the lower levels with the raw gas proceeding to the filter candles and will once again deposit on the these filter candles. This redepositing of the dust and the thereby necessary dual or triple removal of the same dust significantly increases the consumption of the pulsed cleaning gas which must be clean, and possibly especially processed, but always highly pressurized.

In the hot gas filter known from EP-PS 0 129 053 the filter candles are suspended from multiple, stacked perforated plates which are respectively proceeded by a conical hood for the removal of the clean gas. The dust detached from the filter candles is intended to slide along the slope of the hood located respectively below. However, in this arrangement the detached dust is also carried along by the raw gas because of turbulence below the perforated plates and can deposit once again on the filter candles of the lower levels.

It is an object of the invention to modify the conventional process or apparatus so that redepositing on the filter candles of previously removed dust is substantially prevented.

This object is achieved in a process in accordance with the invention by separating the flow path of the raw gas to be cleaned from that of the loosened dust. This prevents that the already loosened dust admixes with the raw gas and redeposits on the filter candles. Repeated removal of the same dust, which would be associated with a higher consumption of pulsed cleaning gas, is thereby substantially avoided. In a filter apparatus with multiple levels of stacked filter candles connected to individual supporting collectors this separation of the flow paths is preferably achieved by way of an ash removal funnel.

Accordingly, the invention provides a method for the cleaning of dust laden gas including the steps of providing ceramic filter candles which are open at one end, stacked above one another in levels in a raw gas space, and connected to a clean gas space, cleaning of the filter candles by blowing a pulsed cleaning gas for a short period of time into the filter candles from the side of the clean gas space and against the direction of raw gas flow, separately guiding the raw gas to be cleaned and the loosened dust in such a manner that the loosened dust is guided to a dust removal structure connected to the raw gas space without once again mixing with the raw gas to be cleaned, and removing the loosened dust from the dust removal structure.

The invention further provides an apparatus including ceramic filter candles for the cleaning of dust laden gas, which candles are closed at one end, stacked in several levels within a filter housing and connected to laterally spaced apart candle supporting clean gas collectors, a central region at the center of each level of candles being free of collectors, and an ash removal mantle for separating the filter candles at one level from the filter candles in the level thereabove, the ash removal mantle including a cylindrical section and a conical section and extending from

the collectors at the one level to the collectors at the other level and being affixed thereto.

Several exemplary embodiments of the invention will be described in detail in the following with reference to the attached drawing, wherein

- Fig. 1 shows a longitudinal section through a preferred embodiment of an apparatus in accordance with the invention for the cleaning of dust laden gas;
- Fig. 2 is a section through Fig. 1 taken along line II-II;
- Fig. 3 is an enlargement of the detail Z of the apparatus shown in Fig. 1;
- Fig. 4 is a section through Fig. 3 taken along line IV-IV;
- Fig. 5 is a longitudinal section through another preferred apparatus for cleaning dust laden gas,
- Figs. 6-8 respectively illustrate a section through a further preferred embodiment of the apparatus shown in Fig. 1 and taken along line II-II;
- Fig. 9 is a longitudinal section through another apparatus in accordance with the invention for the cleaning of dust laden gas; and
- Fig. 10 is a longitudinal section through yet another apparatus in accordance with the invention for the cleaning of dust laden gas.

In a preferred embodiment, the apparatus in accordance with the invention includes a cylindrical, possibly pressurizable filter housing 10 closed by a cover 27. The cover 27 is provided with a centrally positioned inlet conduit 1 for the raw gas to be cleaned. The lower end of the filter housing 10 is shaped as a dust collector funnel 16 which is provided with an exit conduit 17 for removal of the dust loosened during cleaning. A distributor arrangement 2 with downwardly inclined deflector surfaces is positioned below the inlet conduit 1. The flow of raw gas which centrally enters through the inlet conduit 1 is deflected by the distributor

arrangement 2 downwardly and radially from the center outward to the filter candles 6.

The filter candles 6 are hollow ceramic bodies which are open at one end and stand upright with their open end on elongated tubular filter candle supporting collectors 7. The supporting collectors 7 are spaced apart and positioned side by side parallel. Multiple collectors 7 are connected, preferably at both ends to a common clean gas collecting channel 8. The collectors 7 and the clean gas collecting channel 8 together with the conduits connected in series thereto form the clean gas space of the filter apparatus. The clean gas collecting channel 8 and the collectors 7 are positioned in the same plane. The filter candles 6 can also be provided with a flange surrounding the open end and suspended thereby from the collectors 7 instead of being supported thereon.

Together the clean gas collector channels 8 and the associated collectors 7 and filter candles 6 positioned in the same plane in the filter housing form a filter module. Several of these filter modules are positioned one above the other in the filter housing 10. Fig. 1 shows three of these filter modules, namely an upper filter module 3, a central filter module 4 and a lower filter module 5 which respectively form one level of the whole filter unit. Each filter module 3, 4, 5 is divided into several filter segments 18 in the shape of a circular sector. On the clean gas side, the segments 18 are separated from each another. Each filter segment 18 includes one clean gas collecting channel 8 and the respectively associated collectors 7 and filter candles 6. A space remains in the center of each filter module 3, 4, 5 which is kept free of collectors 7 and forms a central opening 24. Six or more of those filter segments 18 of the same size can be provided in each module. Fig. 2 illustrates a filter module 5 which is divided into three filter segments 18.

The collectors 7 are symmetrically positioned about an axis extending through the center of the filter modules. According to Figs. 2 and 6, the clean gas collector channels 8 are of annular shape and surround the collectors 7 on the outside. In each segment 18, the collectors 7 can be positioned in the shape of a V symmetrical to the axis of symmetry of the segment or parallel thereto. The annular clean gas collecting channels 8 are connected with a clean gas exhaust conduit 9 which is centrally positioned in the axis of symmetry of the respective filter segment 18. This clean gas exhaust conduit 9 passes through the wall of the filter housing 10 to the outside.

According to Figs. 7 and 8, each clean gas collecting channel 8 is positioned along the axis of symmetry of the respective filter segment 18, whereby the collectors 7 open into the clean gas collecting channel 8 from both sides. Each of these clean gas collecting channels 8 is guided through the wall of the filter housing 10 to the outside. The flow-through cross-section of the clean gas collecting channels 8 increases in the direction of flow of the clean gas to the same extent as the flow volume increases. The increase in the flow-through cross-section can be achieved by an increase in the width or height of the respective clean gas collecting channel 8 or both.

The clean gas exhaust conduits 9 (Figs. 1, 2, 3, 6) which are guided to the outside, or the clean gas collecting channels 8 (Figs. 7, 8) open into an annular clean gas collector 11 positioned at the same level but outside the filter housing 10. The annular clean gas collectors 11 are connected to a common clean gas conduit 12. A cleaning lance 19 respectively protrudes into that end of each clean gas exhaust conduit 9 or clean gas collecting channel 8 which protrudes outward through the wall of the filter housing 10. A pulsed cleaning gas is blown through that lance and into the respectively associated

channel or conduit for the cleaning of the filter candles 6. Each filter segment 18 is individually cleaned.

As shown in Fig. 5, the wall, the cover 27 and the funnel 16 of the filter housing 10 as well as the annular clean gas collectors 11 and the clean gas conduit 12 are preferably provided with an internal fire proof coating 23 for the handling of hot dust laden gas.

Each filter segment 18 of each filter module 3, 4, 5 is supported on the wall of the filter housing 10 by way of one or more support structures. The support structure is preferably in the form of a wall console including one or more angled pipe elements 21 as shown in Figs. 3 and 4. When the apparatus is used as a hot gas filter, a cooling medium is preferably pumped through the pipe elements 21. The support structure can also be provided with a double wall to allow the cooling medium to flow therethrough. A support 22 is provided on the pipe elements 21 of each support structure which support consists of a vertical web that carries two lateral webs. The collectors 7 of two adjacent filter segments 18 slidably rest on the webs of this support 22. The fixed point of a filter segment 18 is located at the point where the respectively associated clean gas exhaust conduit 9 or clean gas collecting channel 8 penetrates the filter housing. The individual filter segment 18 can thereby slidably expand upon an increase in temperature on the supports 22 towards the housing center without the need for a special compensator which can create problems at high temperatures or pressure differentials. Thus, when the filter is operated with hot gases of up to 1000°C the material expansion upon an increase in temperature affects only the individual filter segment 18.

Fig. 10 shows a filter apparatus wherein four filter modules of the above principle construction are positioned one above the other. Each filter module 4, 5 is separated from the filter module 3, 4 thereabove by an ash guide mantle 15 made

of sheet steel. The ash guide mantle 15 includes a cylindrical section 13 and a conical section 14 and bridges the interior of the filter housing 10 between two filter modules 3, 4, 5 located above one another. In the embodiment according to Figs. 1 and 2 the cylindrical section 13 of the ash guide mantle 15 surrounds the filter candles 6 of the respective filter module 3, 4, 5 on the outside and extends at least to the upper edge of the filter candles 6. The lower edge of the ash guide mantle 15 is sealingly welded onto the clean gas collecting channel 8. If the collectors 7 are positioned as shown in Figs. 7 and 8, the cylindrical section 13 is connected to the outer collectors 7. The conical section 14 tapers upwardly and merges with the central collector-free opening 24 of the filter module 4, 3 thereabove. It is connected to the support structure formed by the pipe elements 21. The juncture 20 between the cylindrical section 13 and the conical section 14 is overlapped and constructed as a sliding connection. The conical section 14 is omitted from that ash guide mantle 15 which surrounds the upper filter module 3. Instead, the cylindrical section 13 is connected at the upper edge with the cover 27 or the wall of the filter housing 10 and that connection also can be constructed as a sliding connection.

The dust deposited on the filter candles 6 is periodically removed from the surface of the candles by way of pulsed cleaning gas which is injected through the cleaning lances 19 for a short period of time. The loosened dust is guided by the ash guide mantle 15 through the gap between the ash guide mantle 15 and the wall of the filter housing 10 and eventually enters the funnel 16. The loosened dust thereby no longer comes into contact with the raw gas, since the latter flows along the interior of the ash guide mantle 15 to the filter candles 6 of the filter module 4, 5 respectively below. A mixing of already removed dust with the raw gas on its way to the filter candles 6 and a redepositing of the same dust is no longer possible. In this way a large amount of pulsed

cleaning gas required for the cleaning of the filter candles 6 is saved which is advantageous since the cleaning gas must be clean, possibly especially processed, but always highly pressurized.

The annular dust removal gap between the wall of the filter housing 10 and the ash guide mantle 15 can be made small. The danger of bridging is reduced. The ash guide mantle 15 need only have a small wall thickness since the same pressure is present on both sides of the ash removal mantle 15.

Symmetrical flow characteristics of the raw gas stream are achieved, since the raw gas stream comes centrally from above and the clean gas is immediately removed at each level of the filter module 3, 4, 5. This leads to a relatively even loading of all filter candles 6 with dust and thereby to a further reduction in the pulsed cleaning gas required.

A variant of the ash guide mantle 15 is shown in Fig. 9. The cylindrical section 13 of the ash guide mantle 15 is therein positioned in the space free of collectors 7 which forms the central opening 24. The cylindrical section 13 is positioned inward of and adjacent to the filter candles 6 of one filter module 3, 4, 5 and is affixed to the collectors 7. The inverted conical section 14 which is directly adjacent the cylindrical section 13 is upwardly flared and according to Fig. 9 is attached to the clean gas collecting channels 8 of the filter module 4, 5 respectively positioned thereabove. The central, collector-free space of the uppermost filter module 3 is closed by a plate 26. The filter candles 6 of each filter module 3, 4, 5 are outwardly surrounded by a guide wall 25. The operation of the ash guide mantle 15 in this variant corresponds in principle to the one of the aforescribed ash guide mantle 15. The raw gas to be cleaned enters through the entry flange 1 and vertically impinges on the filter candles 6 of the upper filter module 3 from above. A further portion of the raw gas flows downward and between

the ash guide mantle 15 and the wall of the filter housing 10 towards the filter modules 4, 5 below. There the raw gas guided between the guide wall 25 and the cylindrical section 13 of the ash guide mantle 15 impinges vertically from above onto the filter candles of the respective filter module 4, 5. The dust loosened from the filter candles 6 by the cleaning operation is guided along the inside of the ash guide mantle 15 and past the filter candles 6 of the filter module respectively below without once again coming into contact with the raw gas.

The process of the invention of separately guiding the loosened dust and the raw gas to be cleaned can also be carried out with the filter apparatus illustrated in Fig. 10. In that filter apparatus, the filter candles 6 are suspended from the collectors 7. The ash removal mantle 15 which separates the filter candles 6 of one filter module from the filter candles 6 of a filter module thereabove consists of a cylindrical section 13 and a frusto-conical, upwardly flared section 14, which is connected to the respective clean gas collecting channel or channels 8. The filter apparatus shown in Fig. 10 furthermore has the peculiar feature that more than three filter modules are stacked one above the other. A solution for a filter arrangement is also conceivable wherein the supporting collectors which are stacked above one another and to which the filter candles are connected are together suspended or supported in the filter housing by way of supporting elements.

Changes and modifications in the specifically described embodiments can be carried out without departing from the scope of the invention which is intended to be limited only by the scope of the appended claims.

CLAIMS:

1. Apparatus for cleaning dust-laden gas with the aid of ceramic filter candles which are closed at one end and which are stacked one above the other in several levels within a filter housing and connected with supporting clean gas collectors arranged at a lateral spacing from one another, wherein the filter candles of one level are separated from the filter candles of the level arranged thereabove by an ash guide mantle which consists of a cylindrical section and a conical section and surrounds the filter candles from one side, characterized in that the ash guide mantle extends from the supporting clean gas collectors of the one level to the supporting clean gas collectors of the other level and is connected with these, that in the center of each level a space is left free of supporting clean gas collectors and that the conical section of the ash guide mantle merges with said space free of supporting clean gas collectors.
2. Apparatus according to claim 1, wherein the cylindrical section of the ash guide mantle radially outwardly surrounds the filter candles at one level and the conical section thereof is upwardly tapered and extends into the central collector-free opening of the level thereabove.
3. Apparatus according to claim 1, wherein the cylindrical section of the ash guide mantle is positioned radially inwardly of the filter candles at one level and the conical section thereof is upwardly flared and extends to the outer edge of the collectors at the level thereabove.
4. Apparatus according to any one of claims 1 to 3, wherein the cylindrical section and the conical section of the ash guide mantle are interconnected by way of a sliding connection.
5. Apparatus according to any one of claims 1 to 4, wherein the cylindrical section of the uppermost level is attached to the wall or the cover of the filter housing.

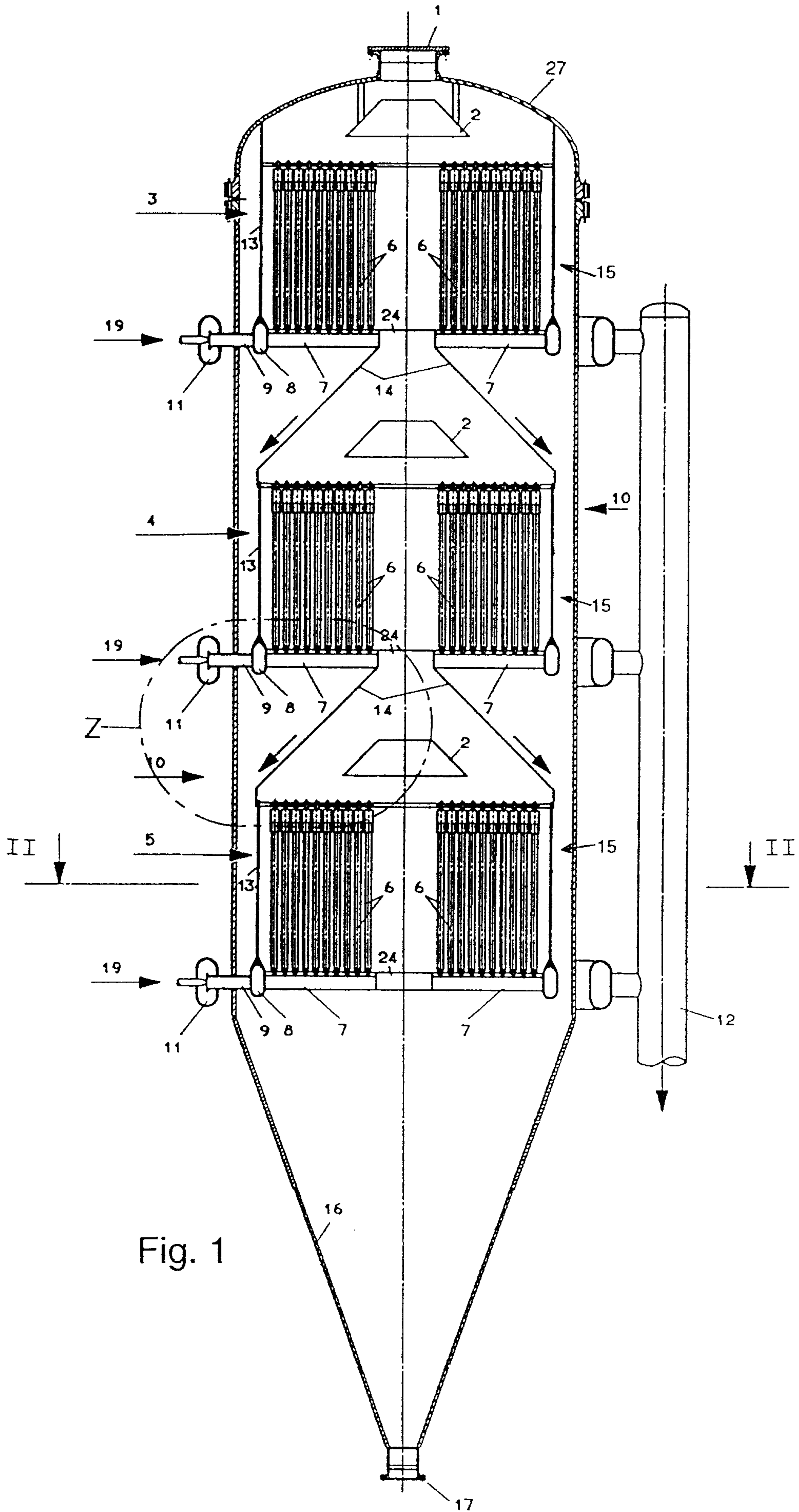
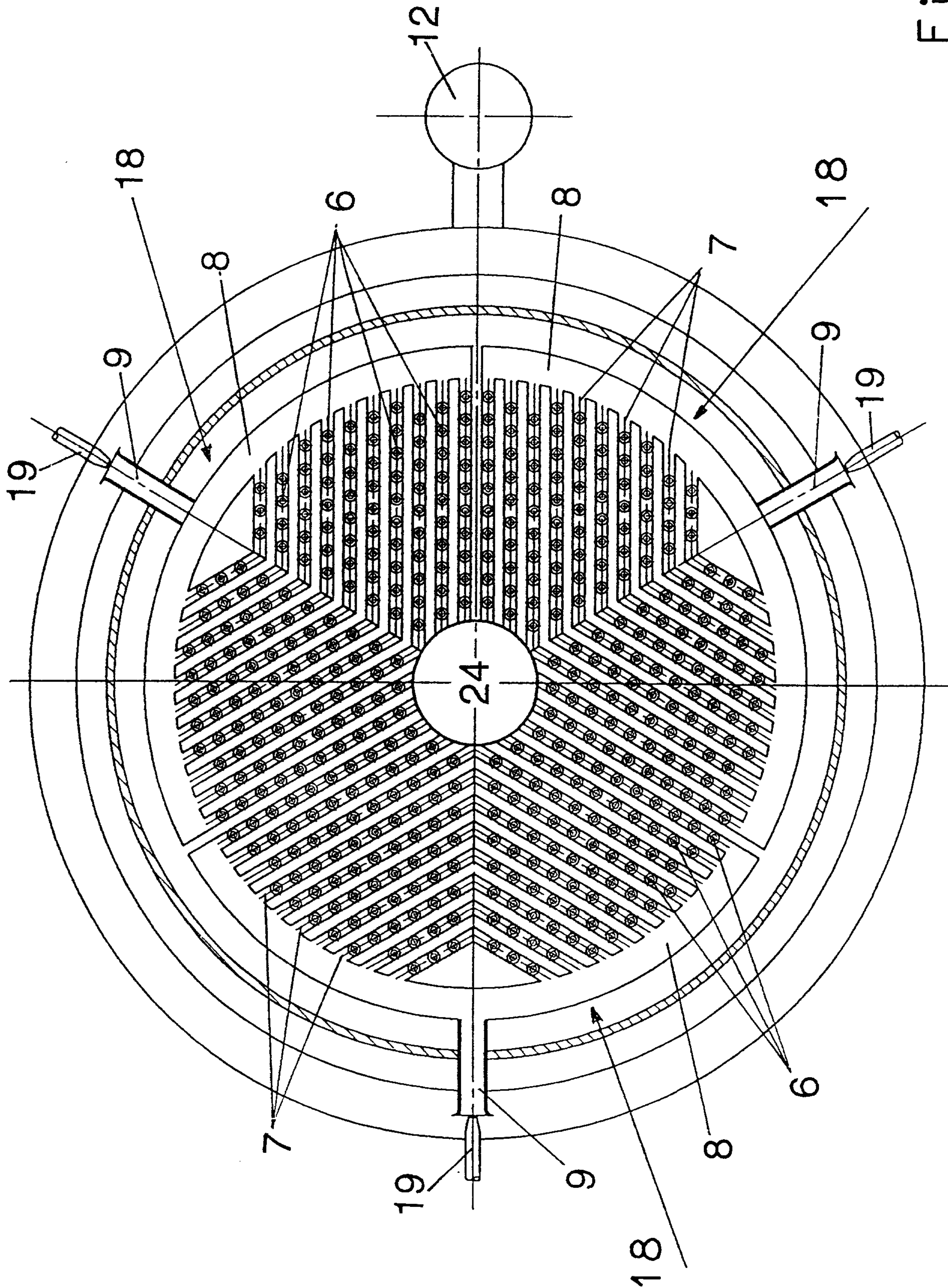


Fig. 1

Fig. 2



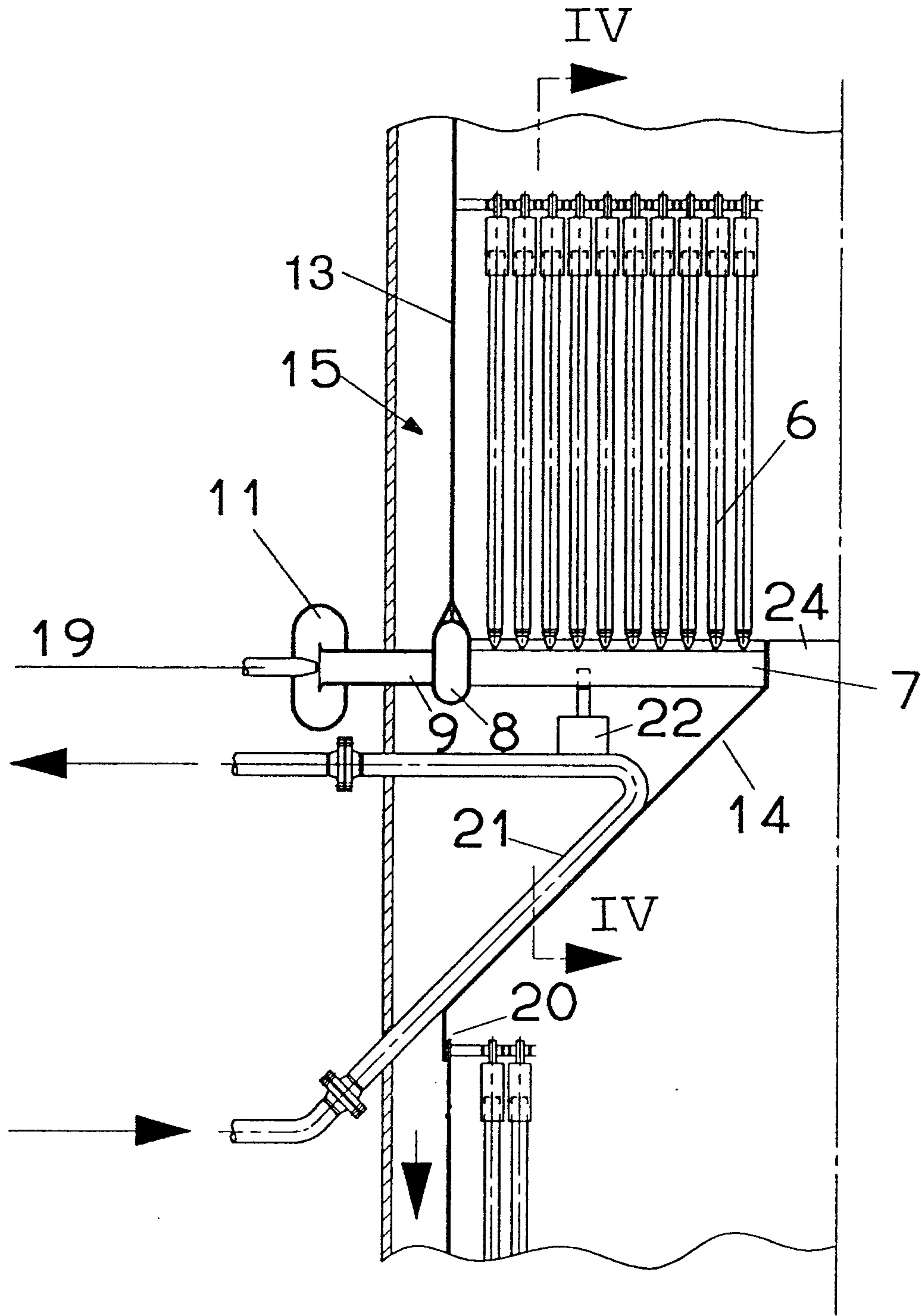


Fig. 3

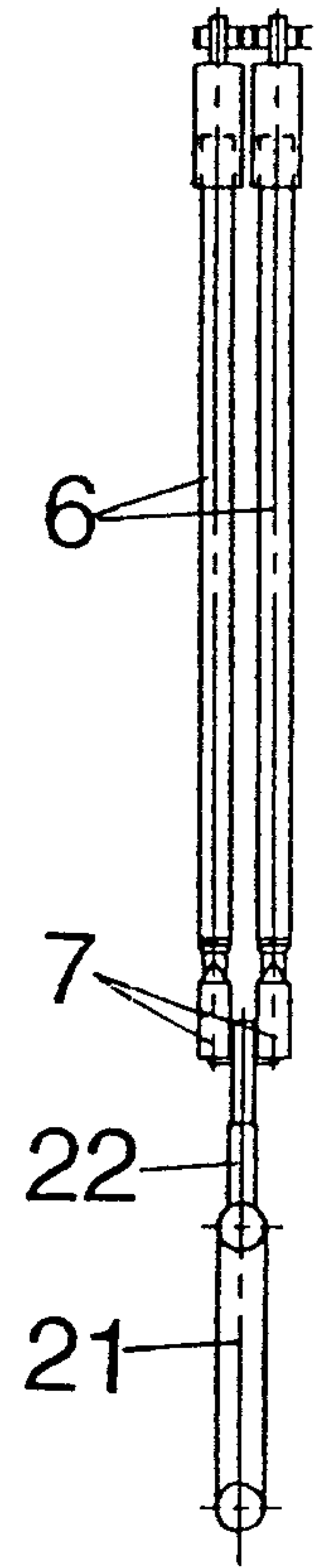


Fig. 4

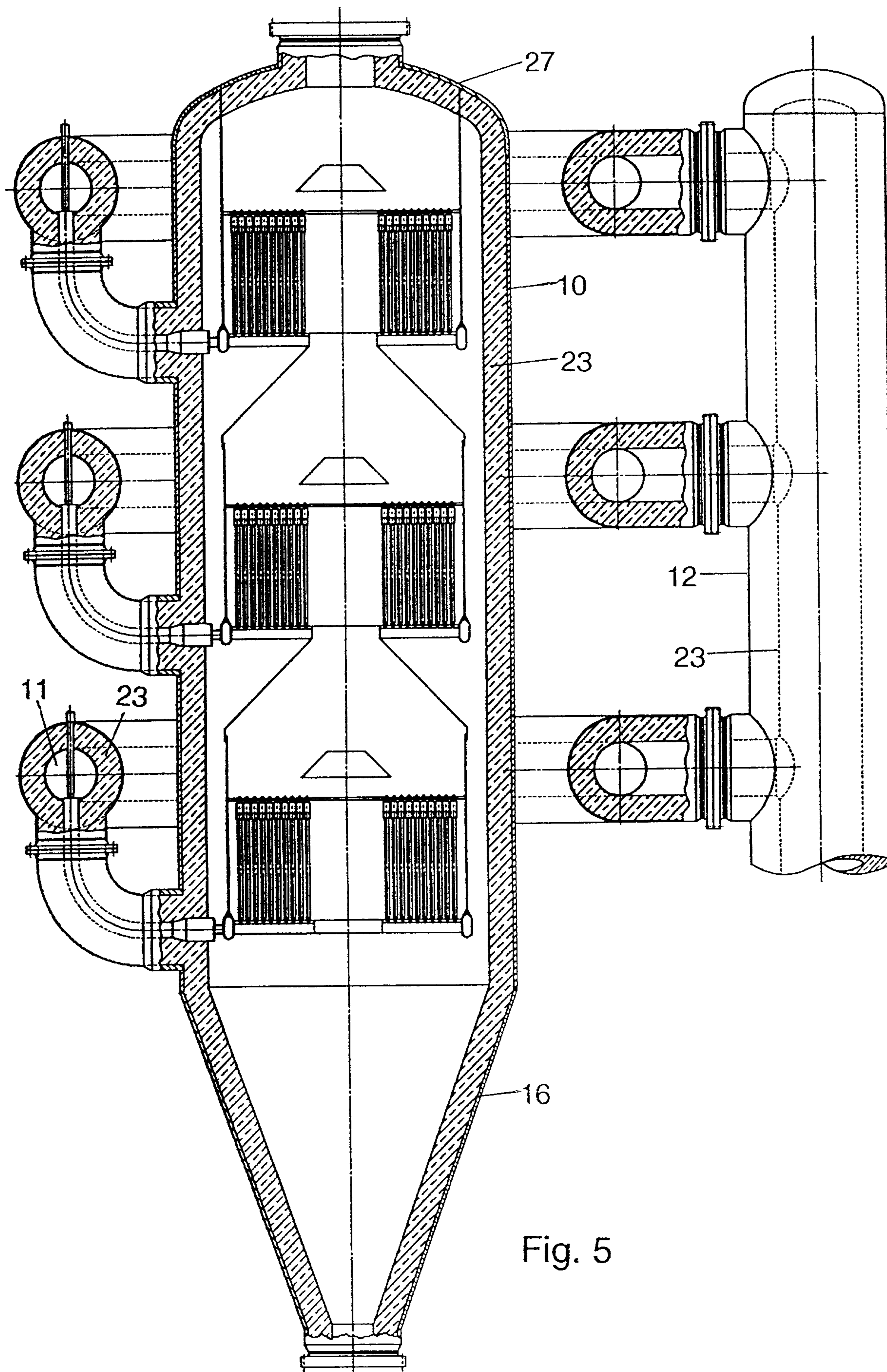


Fig. 5

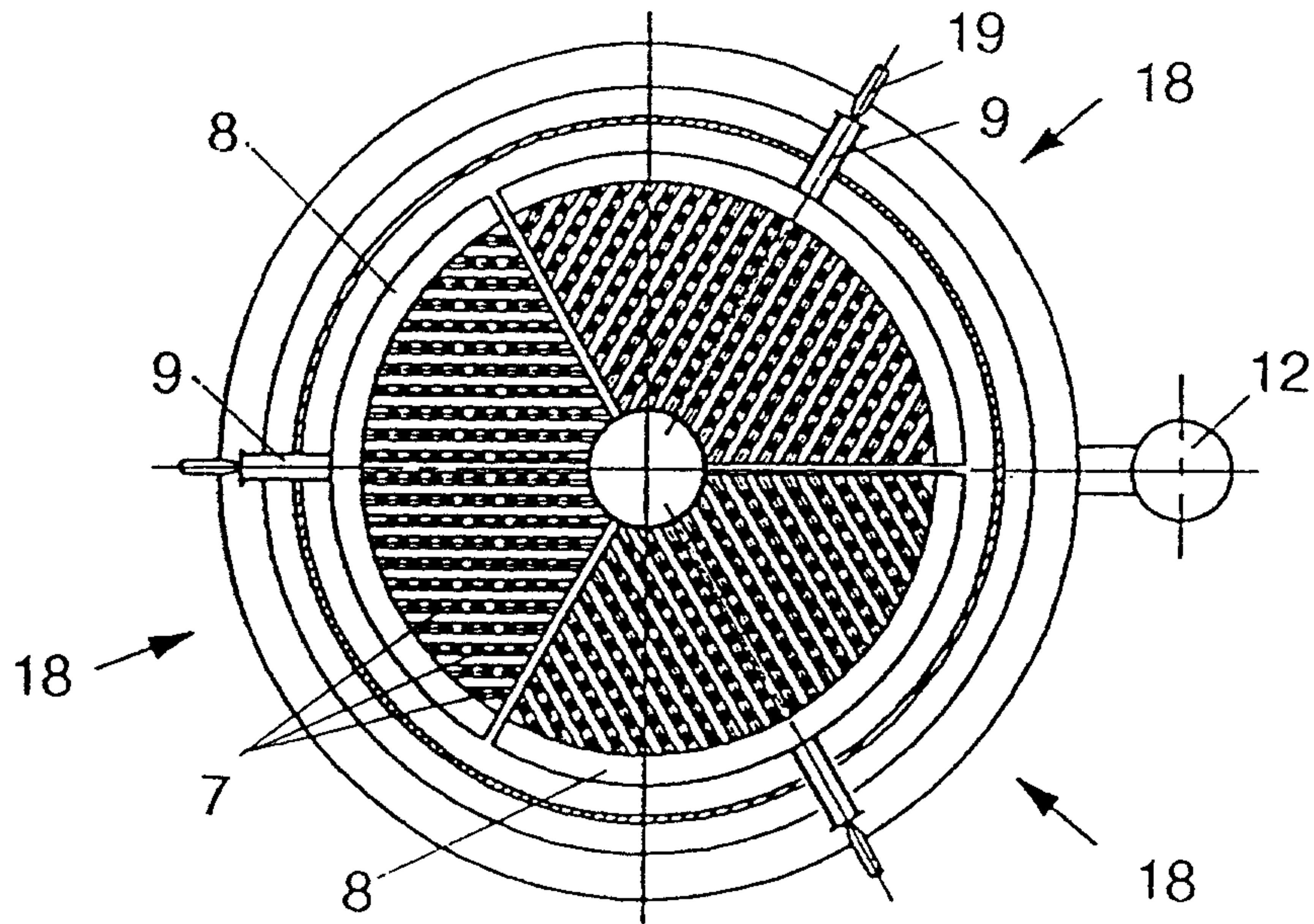


Fig. 6

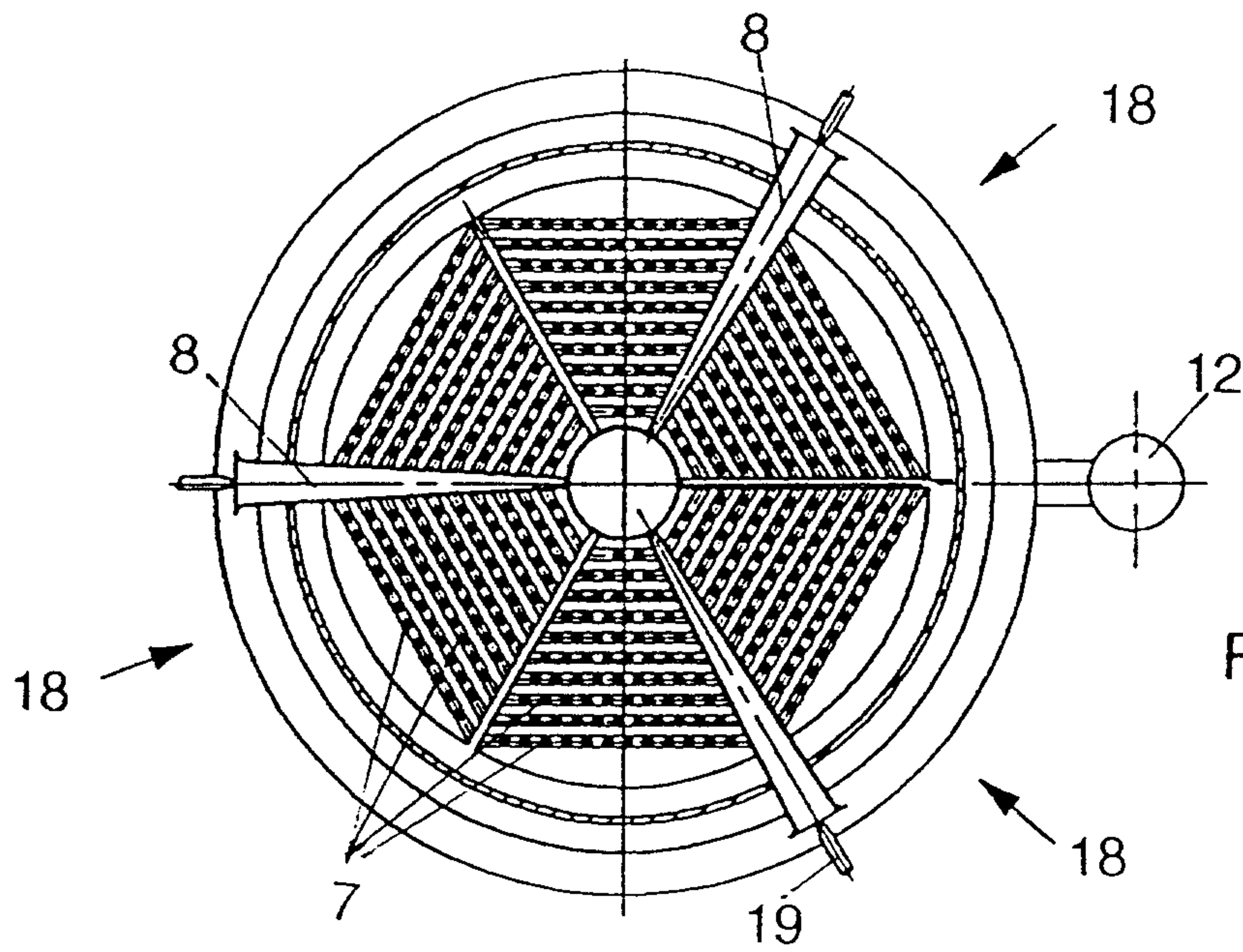


Fig. 7

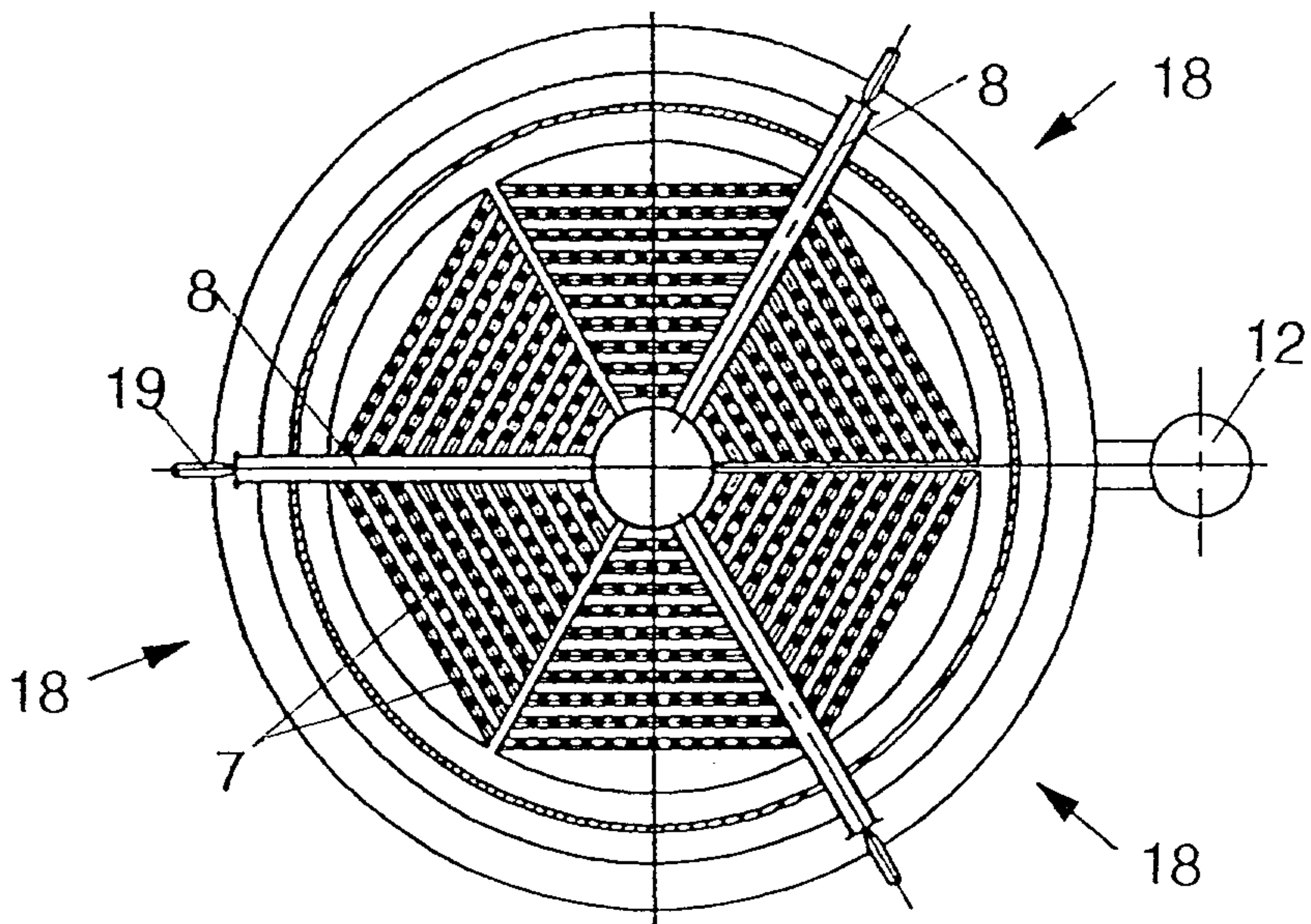


Fig. 8

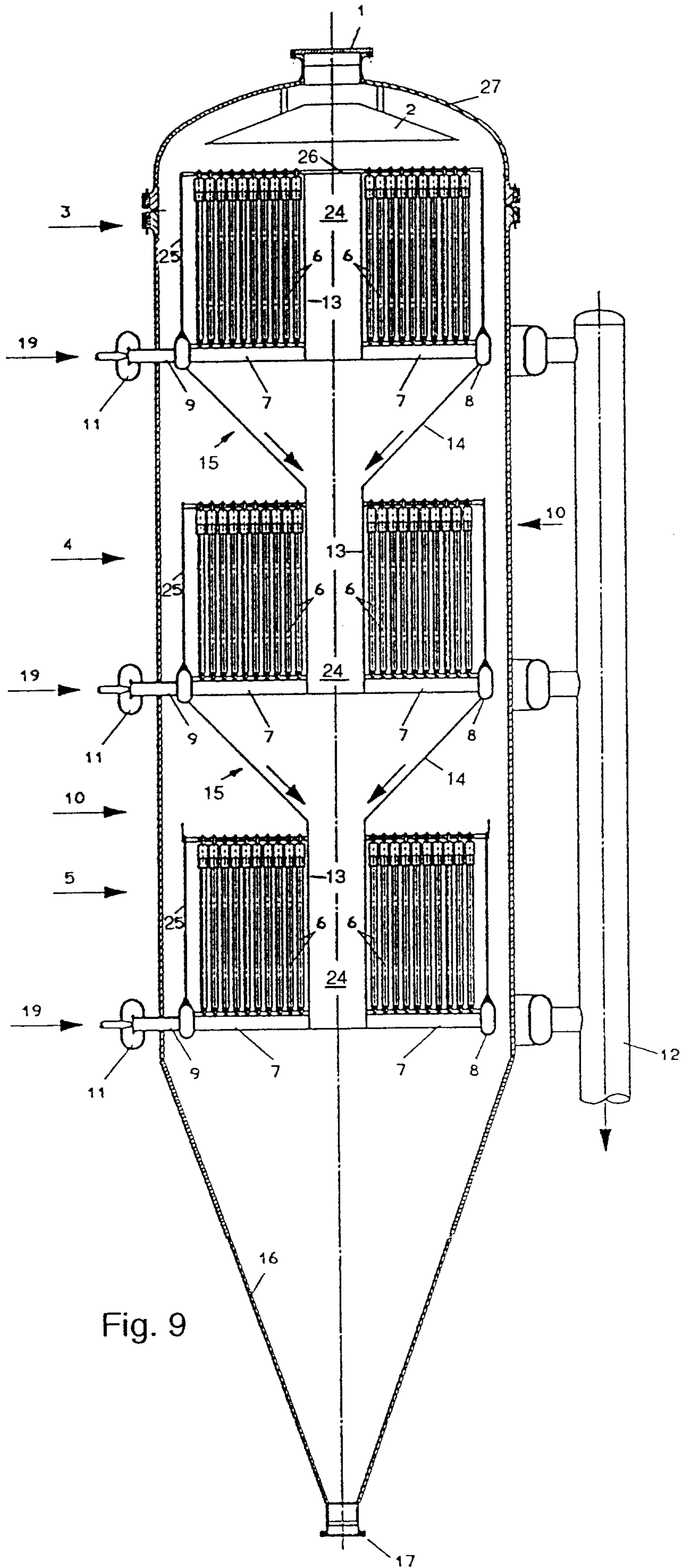


Fig. 9

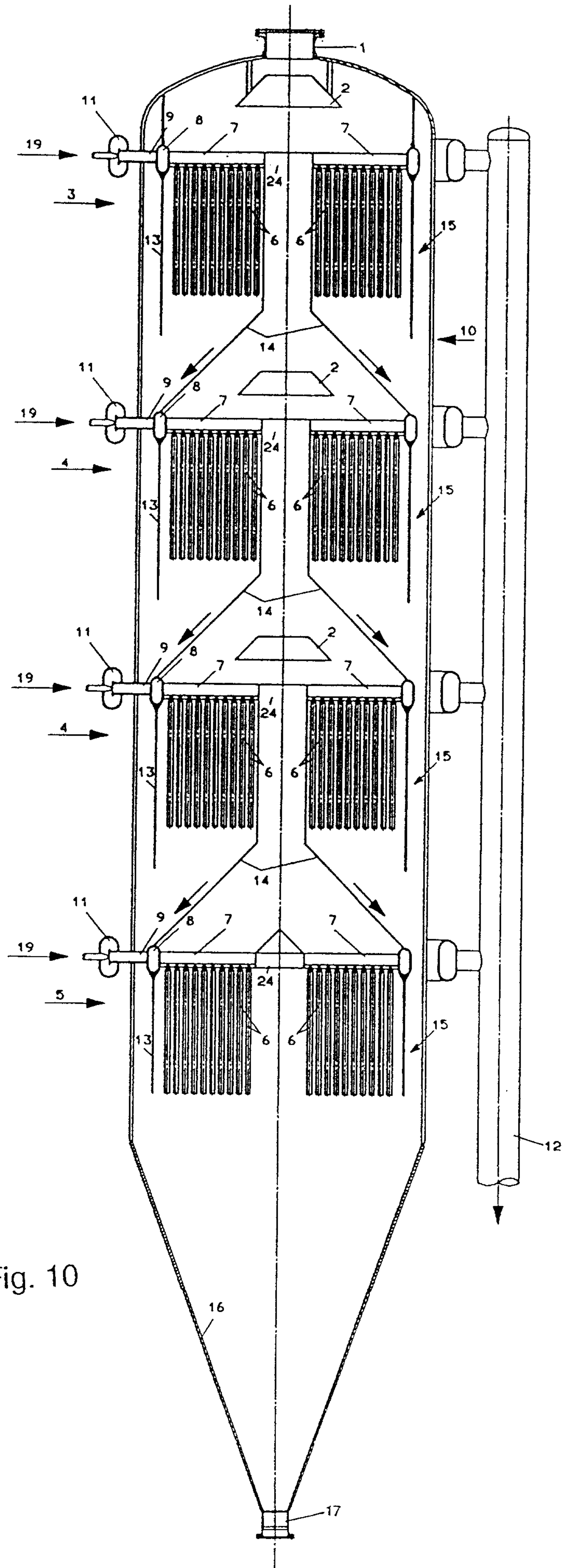


Fig. 10

