(19) DANMARK

(10) **DK/EP 3101340 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***F 22 B 37/48 (2006.01)*** ***F 23 J 3/02 (2006.01)*** ***F 28 G 1/16 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2022-08-01**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2022-06-01**

(86) Europæisk ansøgning nr.: **15170106.7**

(86) Europæisk indleveringsdag: **2015-06-01**

(87) Den europæiske ansøgnings publiceringsdag: **2016-12-07**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Alfa Laval Corporate AB, Box 73, 221 00 Lund, Sverige**

(72) Opfinder: **DAHL GIVERSEN, Mike, Jeppe Åkjaers vej 35, 9200 Ålborg SV, Danmark**

(74) Fuldmægtig i Danmark: **Marks & Clerk (Luxembourg) LLP, 44 rue de la Vallée, B.P. 1775, L-1017 Luxembourg, Luxembourg**

(54) Benævnelse: **VARMEVEKSLER**

(56) Fremdragne publikationer:
DE-A1- 10 144 304
US-A- 4 351 277

DESCRIPTION

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention refers to a heat exchanger generally for heating a fluid by flue gases. Such heat exchangers comprise apparatuses frequently referred to as boilers, economizers, superheaters etc. More specifically, the present invention refers to a heat exchanger comprising

a casing forming a channel for flue gases, wherein the channel has a longitudinal center axis,

a tube arrangement for a fluid to be heated by the flue gases, wherein the tube arrangement comprises a first tube provided in the channel and configured to convey the fluid, wherein the first tube comprises a helical coil having a longitudinal center axis, a plurality of turns and a default pitch, and wherein the first tube comprises a fluid inlet end and a fluid outlet end, and

a soot blowing device comprising a first ejection pipe having a plurality of nozzle openings in a pipe wall and being configured to permit ejection of a cleaning medium onto the first tube.

BACKGROUND OF THE INVENTION AND PRIOR ART

[0002] A boiler typically comprises a vessel and a tube arrangement inside the vessel through which a fluid to be heated flows. For heating the fluid, hot gases, such as flue gases resulting from combustion of fuel, may be fed through the vessel. The flue gases resulting from combustion of various oils, such as MDO, Marine Diesel Oil, and HFO, Heavy Fuel Oil, may contain a high amount of impurities. When such flue gases are fed through the vessel, the impurities in the flue gases tend to stick to the tubes inside the vessel. When the impurities build up on the tubes, the heat transfer from the flue gases to the fluid to be heated is deteriorated.

[0003] To overcome this problem, it is known to provide so-called soot blowers in the vessel in order to remove the impurities from the tubes, i.e. to clean the boiler.

[0004] DE-10144304 discloses a heat exchanger comprising a plurality of tubes arranged in a flue gas channel and a plurality of lance blowers arranged to be move in to and out of the flue gas channel to clean the tubes.

[0005] US-4,346,674 discloses an economizer for use in recovering heat from flue gases. The economizer comprises a housing with a flue gas passage therethrough and a helically wound heat transfer coil positioned in the flue gas passage for placing a heat transfer fluid in a heat

exchange relation with the flue gas passing through the flue gas passage where the heat transfer coil defines a generally vertically extending central opening therethrough. A soot blower assembly with an elongate soot blower lance is rotatably mounted in the coil central opening for directing a pressurized cleaning fluid over the heat transfer coil to periodically clean it.

[0006] A disadvantage of the solution of US-4,346,674 is that only the inner coil closest to the soot blower will be directly exposed to the soot blower. Furthermore, the outer side of the inner coil, will be protected from the soot blower, and thus harder to remove impurities from.

[0007] US-4,351,277 discloses an economizer of the type having a vertically extending cylindrical casing in which is mounted a plurality of spiral coils arranged in parallel to each other in concentric relation with respect to the central vertical axis of the cylindrical casing. The spiral coils are in the form of finned tubes. A heat exchange fluid is conducted through the spiral coils whereby the coils can extract heat from exhausted gases passing upwardly through the economizer from a boiler. A soot blower is mounted in the casing below the spiral coils. The soot blower includes a pair of horizontally disposed structural tubular members arranged across the casing adjacent to the bottom thereof.

[0008] A disadvantage of the economizer of US-4,351,277 is the difficulty to reach all the turns of the coils, especially the upper turns of the coils.

[0009] JP-9-287889 discloses a heat exchanger comprising a casing and two concentric helical coils for a fluid to be heated. The coils are provided in the casing, one within the other. The heat exchanger comprises a soot blower comprising three vertical pipes extending between the two coils and comprising nozzle openings.

[0010] A disadvantage of the heat exchanger of JP-9-287889 is that the arrangement of the vertical pipes in the tube arrangement requires a certain radial distance between the inner coil and the outer coil.

[0011] Thus, an efficient cleaning of heat exchangers having one or more tubes formed as helical coils is problematic. The problem becomes even larger if two or more helical coils are provided in the heat exchanger.

SUMMARY OF THE INVENTION

[0012] The object of the present invention is to provide a heat exchanger as defined above provided with an efficient and reliable soot blowing device, which is described in claim 1.

[0013] This object is achieved by the heat exchanger initially defined, wherein the first ejection pipe is provided at an intermediate position in the helical coil of the first tube between two adjacent turns of the helical coil of the first tube.

[0014] Such an ejection pipe will permit an efficient cleaning of the tube or tubes. By inserting the first ejection pipe of the soot blowing device between two adjacent turns of the helical coil of the first tube, the cleaning medium may be ejected in parallel with the flow direction of flue gases and in-line with the helical coil of the first tube. A large cleaning effect may be achieved for the whole helical coil and for all helical coils in the case of more than one helical coil.

[0015] The first ejection pipe may extend in parallel with a plane being transversal to the longitudinal center axis of the helical coil of the first tube, especially perpendicularly to the longitudinal center axis of the helical coil of the first tube.

[0016] The longitudinal center axis of the helical coil of the first tube may be parallel with the longitudinal center axis of the channel. Furthermore, the helical coil of the first tube may extend concentrically with the longitudinal center axis of the channel. Thus, the helical coil of the first tube may enclose the longitudinal center axis of the channel.

[0017] The helical coil of the first tube, or more tubes, may have a circular cylindrical shape. However, the helical coil may also have other shapes, such as an oval shape, a conical shape, a polygonal shape with rounded corners etc.

[0018] The intermediate position may be any position between two adjacent turns between the fluid inlet end and the fluid outlet end. For instance, the intermediate position may be in the middle of the helical coil of the first tube. However, the intermediate position may also be more closely to one of the fluid inlet and fluid outlet ends and thus more remote from the other of the fluid inlet and fluid outlet ends.

[0019] The first ejection pipe may comprise nozzle openings turned towards both the fluid inlet end and the fluid outlet end of the first tube. In such a way, all turns of the first tube may be efficiently cleaned by the soot blowing device.

[0020] The cleaning medium may be one or a combination of water, steam, pressurized gas, for instance air.

[0021] According to an embodiment of the invention, said two adjacent turns define an increased pitch being larger than the default pitch. Consequently, the distance between said two adjacent turns is longer than the distance between adjacent turns for the rest of the helical coil, or at least for the majority of the rest of the helical coil. For instance, the increased pitch may be about three times the default pitch.

[0022] By means of the increased pitch, sufficient space is created in the helical coil to house the first ejection pipe of the soot blowing device.

[0023] According to a further embodiment of the invention, the heat exchanger comprises a support device securing the position of at least one of the two adjacent turns. With such a

support device any possible weakening of the helical coil of the first tube at the position of the first ejection pipe may be avoided.

[0024] Moreover, the support device may secure the position of each of the two adjacent turns.

[0025] According to a further embodiment of the invention, the support device secures said increased pitch, i.e. the longer distance between said two adjacent turns of the helical coil of the first tube.

[0026] According to a further embodiment of the invention, the support device comprises a number of primary elements engaging the helical coil of the first tube between said adjacent two turns in order to secure said increased pitch.

[0027] According to a further embodiment of the invention, the support device comprises secondary elements engaging the helical coil of the first tube to secure the default pitch. Consequently, the secondary elements of the support device may engage the helical coil of the first tube at positions remote from said adjacent two turns of the helical coil.

[0028] According to a further embodiment of the invention, the support device comprises a number of elongated bars extending in parallel with the longitudinal center axis of the helical coil of the first tube, wherein each of the elongated bars comprises one of the primary elements being attached to and extending from the respective elongated bar. For example, the support device may comprise at least three such elongated bars, in particular three elongated bars for each tube. The elongated bars of the first tube may for example be provided equidistantly, e.g. at an angular distance of 120° from each other in the case of three bars for each tube.

[0029] The primary elements may extend radially inwardly from the respective elongated bar, which thus is provided outside the first tube. However, the primary elements may also extend radially outwardly from the respective elongated bar, which then is provided radially inside the first tube.

[0030] According to a further embodiment of the invention, each of the elongated bars comprises a plurality of the secondary elements being attached to and extending from the respective elongated bar to engage a respective turn of the helical coil of the first tube.

[0031] Preferably, the secondary elements extend in the same direction as the primary elements.

[0032] According to a further embodiment of the invention, the nozzle openings of the first ejection pipe are turned towards at least one of the fluid inlet end and the fluid outlet end of the first tube. The first ejection pipe may comprise nozzle openings turned both towards the fluid inlet end of the tube and towards the fluid outlet end of the first tube.

[0033] The first ejection pipe extends at least partly around the longitudinal center axis of the helical coil of the first tube and at least partly along said two adjacent turns of the helical coil of the first tube. The first ejection pipe may thus extend around the longitudinal center axis of the helical coil of the first tube, either a whole round, i.e. 360°, or as a part of a round, such as more than 180°, preferably more than 220°, more preferably more than 260°.

[0034] The first ejection pipe may also extend less than 180° around the longitudinal center axis of the helical coil of the first tube.

[0035] According to a further embodiment of the invention, the soot blowing device comprises a further ejection pipe having a plurality of nozzle openings in a pipe wall and being configured to permit ejection of a cleaning medium onto the first tube. With such a further ejection pipe, a first tube comprising a longer helical coil may be efficiently cleaned.

[0036] According to a further embodiment of the invention, the further ejection pipe is provided at one of the fluid inlet and fluid outlet ends of the first tube, wherein the nozzle openings of the further ejection pipe are directed towards the other of the fluid inlet and fluid outlet ends of the first tube.

[0037] The soot blowing device may also comprise a still further ejection pipe so that one ejection pipe may be provided at each of the fluid inlet and fluid outlet ends and one ejection pipe may be provided at an intermediate position in the coil as defined above.

[0038] It is also to be noted that more than one ejection pipe may be provided, each at a different intermediate position in the coil of the first tube, if so required due to, for instance, the length of the helical coil.

[0039] According to a further embodiment of the invention, the tube arrangement comprises a second tube provided in the channel and configured to convey the fluid, wherein the second tube comprises a helical coil having a plurality of turns and a default pitch, wherein the second tube comprises a fluid inlet end and a fluid outlet end, and wherein the first ejection pipe is provided between two adjacent turns of the helical coils.

[0040] The longitudinal center axis of the helical coil of the second tube may be parallel with the longitudinal center axis of the channel and with the longitudinal center axis of the helical coil of the first tube. Thus, the helical coil of the second tube may enclose the longitudinal center axis of the channel.

[0041] Thus, two or more tubes may be efficiently cleaned by means of one ejection pipe provided in an intermediate position as defined above.

[0042] According to a further embodiment of the invention, the helical coils of the first and second tubes extend concentrically with respect to the longitudinal center axis of the helical coil

of the first tube.

[0043] The support device may comprise three elongated bars for the helical coil of each of the tubes.

[0044] Alternatively, the primary elements and the secondary elements may be adapted to support the helical coil of all tubes. For instance, the primary element and the secondary element may then have a length across the radial distance of all tubes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] The present invention is now to be explained more closely through a description of different embodiments and with reference to the drawings attached hereto.

Fig 1
: discloses schematically a partly sectional side view of a heat exchanger according to a first embodiment of the invention.

Fig 2
: discloses schematically a cross sectional view along the line II-II in Fig 1.

Fig 3
: discloses schematically a side view of a tube arrangement in the heat exchanger in Fig 1.

Fig 4
: discloses schematically another side view of the tube arrangement in the heat exchanger in Fig 1.

DETAILED DESCRIPTION OF DIFFFERENT EMBODIMENTS

[0046] With reference to Figs 1-4, a heat exchanger according to a first embodiment of the invention is disclosed. The heat exchanger comprises a casing 1 forming a channel 2 for flue gases. The heat exchanger also comprises a tube arrangement 10 for a fluid to be heated by the flue gases. The tube arrangement 10 is provided in the channel 2 as can be seen in Figs 1 and 2.

[0047] In the first embodiment, the heat exchanger comprises or constitutes a boiler, economizer, superheater or the like. It is to be noted that the invention is not limited to these kinds of heat exchangers, but the invention may also be applied to other kinds of heat exchangers.

[0048] Furthermore, the heat exchanger comprises an outer shell 3 enclosing the casing 1. An

interspace is provided between the casing 1 and the outer shell 3. An insulation 4 is provided in the interspace.

[0049] The casing 1 comprises an inlet 5 for the flue gases to the channel 2, and an outlet 6 for the flue gases from the channel 2. The channel 2 has a longitudinal center axis x, which extends through the inlet 5 and the outlet 6. The flue gases may thus pass through the channel 2 via the inlet 5 and out through the outlet 6.

[0050] Furthermore, the heat exchanger comprises a first connection element 7 at the inlet 5 to permit attachment to further equipment, for instance a burner of a boiler. The heat exchanger also comprises a second connecting element 8 at the outlet 6 for connection to further equipment, for instance an economizer or an exhaust gas duct. In the embodiments disclosed, the first and second connecting elements 7 and 8 comprise a respective flange.

[0051] In the embodiments disclosed, the tube arrangement 10 comprises four tubes 11, 12, 13, 14 provided in the channel 2 and configured to convey the fluid, see in particular Fig 2.

[0052] The tubes 11-14 may optionally be provided with fins or other surface enlarging elements. Especially in Fig 4, it is indicated that the tubes 11-14 may be provided with fins or other surface enlarging elements. Fins are shown on the tubes 11-14 to the right in Fig 4 on the uppermost turn and on the lowermost turn of the tubes 11-14.

[0053] Each tube 11-14 of the tube arrangement 10 comprises, or is at least partly formed as, a helical coil having a plurality of turns and a default pitch P_D, or distance between adjacent turns. Each tube 11-14 has a longitudinal center axis x', see Figs 3 and 4, being concentric with the longitudinal center axis x. The tubes 11-14 are arranged one within the other as can be seen from Figs 1-4.

[0054] In the embodiments disclosed, the helical coils of the tubes 11-14 have a circular cylindrical shape. However, the helical coils may also have other shapes, such as an oval shape, a conical shape, a polygonal shape with rounded corners etc.

[0055] The tube arrangement 10 also comprises an inlet member 15 for the fluid to be heated and an outlet member 16 for the heated fluid, see especially Fig 4. The inlet member 15 is connected to a fluid inlet end of the tubes 11-14. The outlet member 16 is connected to a fluid outlet end of the tubes 11-14. The fluid to be heated is thus conveyed through the tubes 11-14, in via the inlet member 15 and out via the outlet member 16.

[0056] It is to be noted that the tube arrangement 10 could comprise another number of tubes than four, for instance only one tube, or two, three, five, six, seven, eight or even more tubes.

[0057] As can be seen in Figs 1, 3 and especially Fig 4, there is an increased pitch P_I, or increased distance, between two adjacent turns at an intermediate position in the helical coils of the tubes 11-14. The increased pitch P_I is greater, or significantly greater, than the default

pitch P_D.

[0058] The heat exchanger also comprises a support device 19 securing the position of the tubes 11-14. Especially, the support device 19 is provided to secure the increased pitch P_I at the intermediate position, i.e. to support at least one of the two adjacent turns of the helical coil of the tubes 11-14.

[0059] In the embodiments disclosed, the support device 19 comprises three elongated bars 20 for each of the tubes 11-14. Consequently, in the embodiments disclosed the support device 19 comprises 12 elongated bars 20 as can be clearly seen in Fig 2. Each elongated bar 20 comprises a primary element 21, which is attached to and extends from the respective elongated bar 20. The primary element 21 secures the increased pitch between the two adjacent turns of the helical coil of the respective tube 11-14. As can be seen in Figs 1 and 4, there is a small distance between the tubes 11-14 and the primary element 21. This is due to the fact that the fins are not shown in the figures at the two adjacent turns of the tubes 11-14. With the fins, one of the two adjacent turns of the helical coil of the tubes 11-14 rests on the primary element 21.

[0060] Furthermore, each of the elongated bars 20 comprises a plurality of secondary elements 22, which are attached to and extend from the respective elongated bar 20. Each secondary element 22 secures the default pitch P_D between adjacent turns of the rest of the helical coils of the tubes 11-14. As can be seen in Figs 1 and 4, there is a small distance also between the tubes 11-14 and the secondary elements 22 except for the uppermost turn and the lowermost turn of the tubes 11-14, where the fins are shown and where it thus can be seen that two of the secondary elements 22 engage a turn of the helical coil of the tubes 11-14.

[0061] Each elongated bar 20 comprises a flat bar extending in parallel with the longitudinal center axis x' of the helical coils of the tubes 11-14, see especially Fig 4. From the elongated bar 20, the primary element 21 and the secondary elements 22 extends radially inwardly. The primary element 21 and the secondary elements 22 of each elongated bar 20 are formed by a respective plate attached to the flat bar and extending perpendicularly, or substantially perpendicularly, from the bar 20 and to the longitudinal center axis x'.

[0062] Furthermore, the heat exchanger comprises a central casing 25 extending in parallel with the longitudinal center axis x from the inlet 5 to the outlet 6. The central casing 25 is disclosed in Fig 2 only. The central casing 25 encloses a bypass channel for the flue gases when they are to bypass the tubes 11-14. A valve 26 is provided in the central casing 25 for opening or closing the bypass channel.

[0063] Furthermore, the heat exchanger comprises a soot blowing device 30 for cleaning the tubes 11-14, and the possible fins provided on the tubes 11-14. The soot blowing device 30 comprises a first ejection pipe 31, which is provided in the above mentioned intermediate position between said two adjacent turns of the helical coil of the tubes 11-14. The first ejection

pipe 31 comprises a plurality of nozzle openings 32 in a pipe wall of the first ejection pipe 31. The first ejection pipe 31 is configured to eject a cleaning medium onto the tubes 11-14 and the possible fins of the tubes 11-14.

[0064] In the embodiments disclosed, the nozzle openings 32 of the intermediate ejection pipe 31 are turned towards both the fluid inlet end and the fluid outlet end of the tubes 11-14.

[0065] The first ejection pipe 31 extends transversally to the longitudinal center axis x' along said two adjacent turns of the helical coil of the tubes 11-14, i.e. here along an essentially circular path. In particular, the first ejection pipe extends perpendicularly to the longitudinal center axis x'.

[0066] The first ejection pipe 31 extends around the longitudinal center axis x', as a part of a round, as can be seen in Fig 2. For instance, the part of the round may be more than 180°, preferably more than 220°, more preferably more than 260°.

[0067] The nozzle openings 32 are evenly distributed on the intermediate ejection pipe 31.

[0068] The soot blowing device 30 also comprises a further ejection pipe 33 provided between the fluid inlet end of the tubes 11-14 and the outlet 6, see Figs 1 and 2. Also the further ejection pipe 33 comprises nozzle openings 32 in a pipe wall of the further ejection pipe 33. The nozzle openings 32 are directed towards the tubes 11-14. The further ejection pipe 33 has no nozzle openings directed in an opposite direction. The nozzle openings 32 are also for the further ejection pipe 33 evenly distributed on the further ejection pipe 33 as can be seen in Fig 2.

[0069] Furthermore, the soot blowing device 30 comprises a further ejection pipe 34 provided between the fluid outlet end of the tubes 11-14 and the inlet 5. Also the further ejection pipe 34 comprises nozzle openings 32 in a pipe wall of the further ejection pipe 34. The nozzle openings 32 are directed towards the tubes 11-14. No nozzle openings are directed in the opposite direction.

[0070] The soot blowing device 30 comprises a source 35 containing the cleaning medium. The cleaning medium may be one or a combination of water, steam, pressurized gas, for instance air.

[0071] The soot blowing device 30 is configured to permit supply of the cleaning medium from the source 35 to the ejection pipes 31, 33 and 34 for being ejected through the nozzle openings 32 towards the tubes 11-14 and the possible fins provided on the tubes 11-14.

[0072] The three ejection pipes 31, 33 and 34 have similar configuration except for the direction of the nozzle openings 32 The three ejection pipes 31, 33 and 34 extend in parallel with plane being transversal to the longitudinal center axis x', especially being perpendicular to the longitudinal center axis x'.

[0073] In the embodiments disclosed three ejection pipes 31, 33 and 34 are thus disclosed. It should be noted, that depending on the circumstance, for instance the size of the heat exchanger and thus the length or height of the tube arrangement 10, the number of ejection pipes may vary. Especially only one intermediate ejection pipe 31 may be sufficient. Alternatively, the one intermediate ejection pipe 31 may be combined with one of the two further ejection pipes 33.

[0074] It is also possible to provide more than one intermediate ejection pipe 31 in the tube arrangement 10, wherein the tube arrangement may comprise a further intermediate position with an increased pitch P_I.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE10144304 **[0004]**
- US4346674A **[0005]** **[0006]**
- US4351277A **[0007]** **[0008]**
- JP9287889A **[0009]** **[0010]**

VARMEVEKSLER

PATENTKRAV

1. Varmeveksler omfattende

et hus (1), fer danner en kanal (2) til røggasser, hvor kanalen (2) har en langsgående midterakse (x),

en røranordning (10) til et fluid, der skal opvarmes af røggasserne, hvor røranordningen (10) omfatter et første rør (11-14), der er tilvejebragt i kanalen (2) og konfigureret til at lede fluidet, hvor det første rør (11-14) omfatter en spiralspole med en langsgående midterakse (x'), en flerhed af viklinger og en standardstigning (P_D), og hvor det første rør (11-14) omfatter en fluidindløbsende og en fluidudløbsende, og

en sodblæsningsanordning (30), der omfatter et første udstødningsrør (31), der har en flerhed af dyseåbninger (32) i en rørvæg og er konfigureret til at muliggøre udstødning af et rensemiddel på det første rør (11-14),

kendetegnet ved, at det første udstødningsrør (31) er tilvejebragt ved en mellemposition i det første rørs (11-14) spiralspole mellem to tilstødende viklinger af det første rørs (11-14) spiralspole, hvor det første udstødningsrør (31) strækker sig mindst delvist omkring den langsgående midterakse (x') af det første rørs (11-14) spiralspole og mindst delvist langs med de to tilstødende viklinger af det første rørs (11-14) spiralspole.

2. Varmeveksler ifølge krav 1, hvor de to tilstødende viklinger definerer en øget stigning (P_I), der er større end standardstigningen (P_D).

3. Varmeveksler ifølge et hvilket som helst af kravene 1 og 2, hvor varmeveksleren omfatter en støtteanordning (19), der sikrer positionen af mindst én af de to tilstødende viklinger.

4. Varmeveksler ifølge kravene 2 og 3, hvor støtteanordningen (19) sikrer den øgede stigning (P_I).

5. Varmeveksler ifølge krav 4, hvor støtteanordningen (19) omfatter et antal af primære elementer (21), der er i indgreb med det første rørs (11-14) spiralspole mellem de tilstødende to viklinger for at sikre den øgede stigning (P_I).

6. Varmeveksler ifølge krav 5, hvor støtteanordningen (19) omfatter sekundære elementer (22), der går i indgreb med det første rørs (11-14) spiralspole for at sikre standardstigningen (P_D).

7. Varmeveksler ifølge krav 6, hvor støtteanordningen (19) omfatter et antal af aflange stænger (20), der strækker sig parallelt med den langsgående midterakse (x') af det første rørs (11-14) spiralspole, og hvor hver af de aflange stænger (20) omfatter ét af de primære elementer (21), der er fastgjort til og strækker sig fra den tilsvarende aflange stang (20).

8. Varmeveksler ifølge krav 7, hvor hver af de aflange stænger (20) omfatter en flerhed af sekundære elementer (22), der er fastgjort til og strækker sig fra den tilsvarende aflange stang (20) for at gå i indgreb med en tilsvarende vikling af det første rørs (11-14) spiralspole.

9. Varmeveksler ifølge et hvilket som helst af de foregående krav, hvor det første udstødningsrørs (31) dyseåbninger (32) er vendt mod mindst én af det første rørs (11-14) fluidindløbsende og fluidudløbsende.

10. Varmeveksler ifølge et hvilket som helst af de foregående krav, hvor sodblæsningsanordningen (30) omfatter et yderligere udstødningsrør (33, 34), der har en flerhed af dyseåbninger (32) i en rørvæg og er konfigureret til at muliggøre udstødning af et rensemiddel på det første rør (11-14).

11. Varmeveksler ifølge krav 10, hvor det yderligere udstødningsrør (33, 34) er tilvejebragt ved én af det første rørs (11-14) fluidindløbs- og fluidudløbsende, og hvor det yderligere udstødningsrørs (33, 34) dyseåbninger (32) er rettet mod den anden af det første rørs (11-14) fluidindløbs- og fluidudløbsende.

12. Varmeveksler ifølge et hvilket som helst af de foregående krav,

hvor røranordningen omfatter et andet rør (11-14), der er tilvejebragt i kanalen (2) og konfigureret til at lede fluidet, hvor det andet rør (11-14) omfatter en spiralspole med en flerhed af viklinger og en standardstigning (P_D), og hvor det andet rør (11-14) omfatter en fluidindløbsende og en fluidudløbsende, og

hvor det første udstødningsrør (31) er tilvejebragt mellem to tilstødende viklinger af det andet rørs (11-14) spiralspole.

13. Varmeveksler ifølge krav 12, hvor det første og andet rørs (11-14) spiralspoler strækker sig koncentrisk i forhold til den langsgående midterakse (x') af det første rørs (11-14) spiralspole.

DRAWINGS

Fig 1

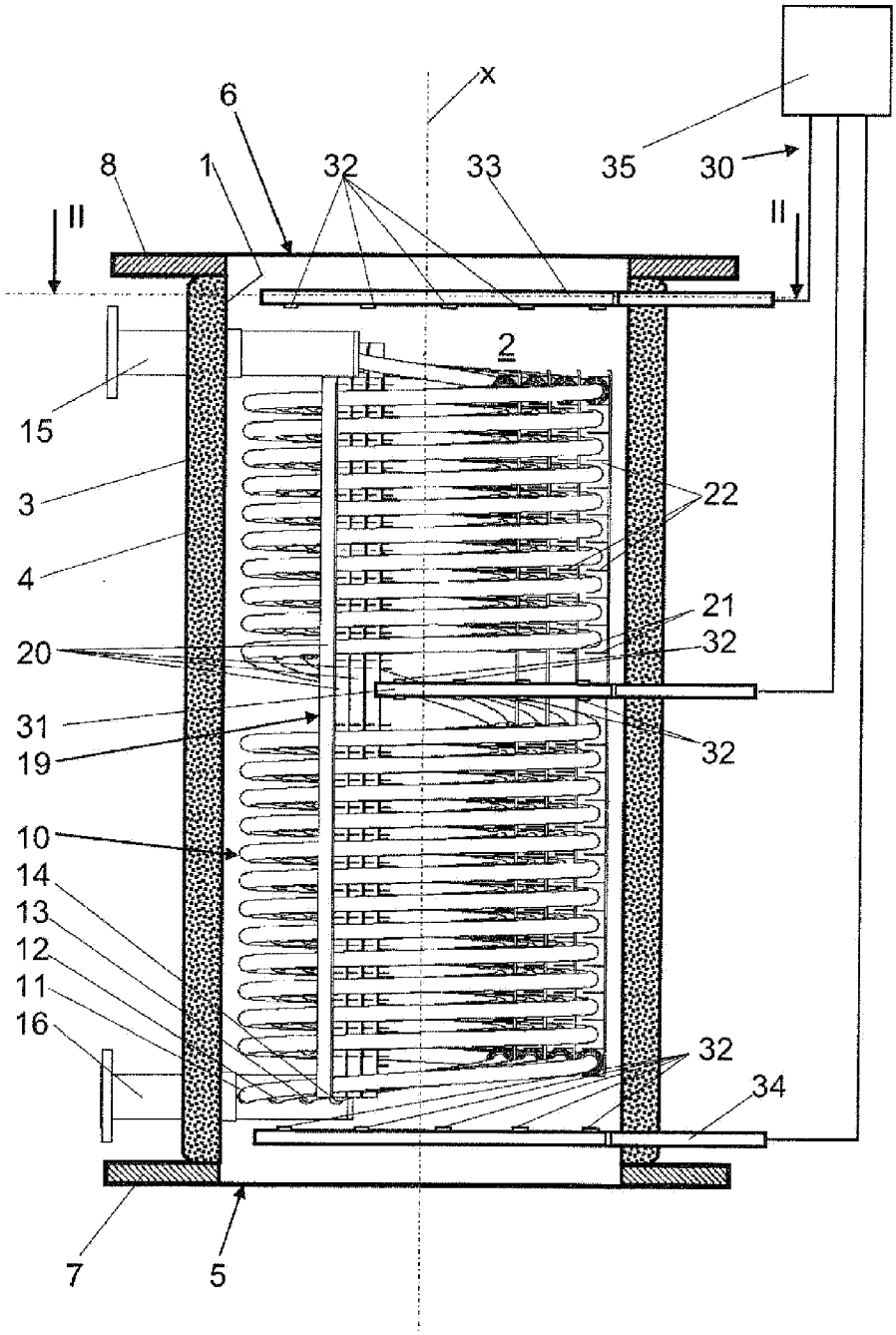

Fig 2

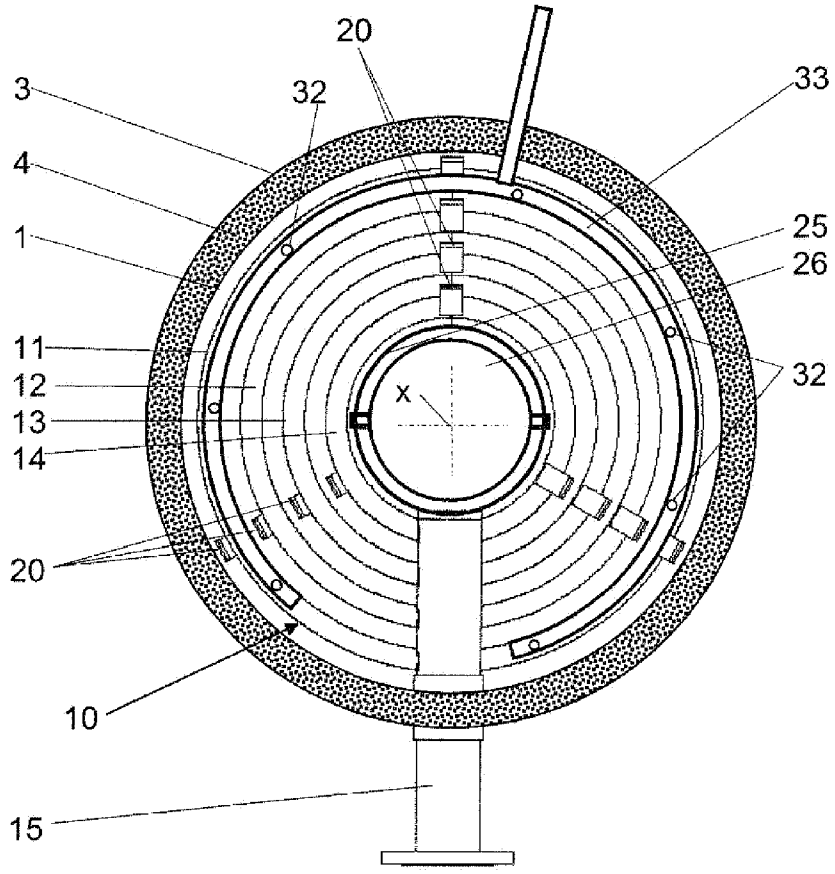

Fig 3

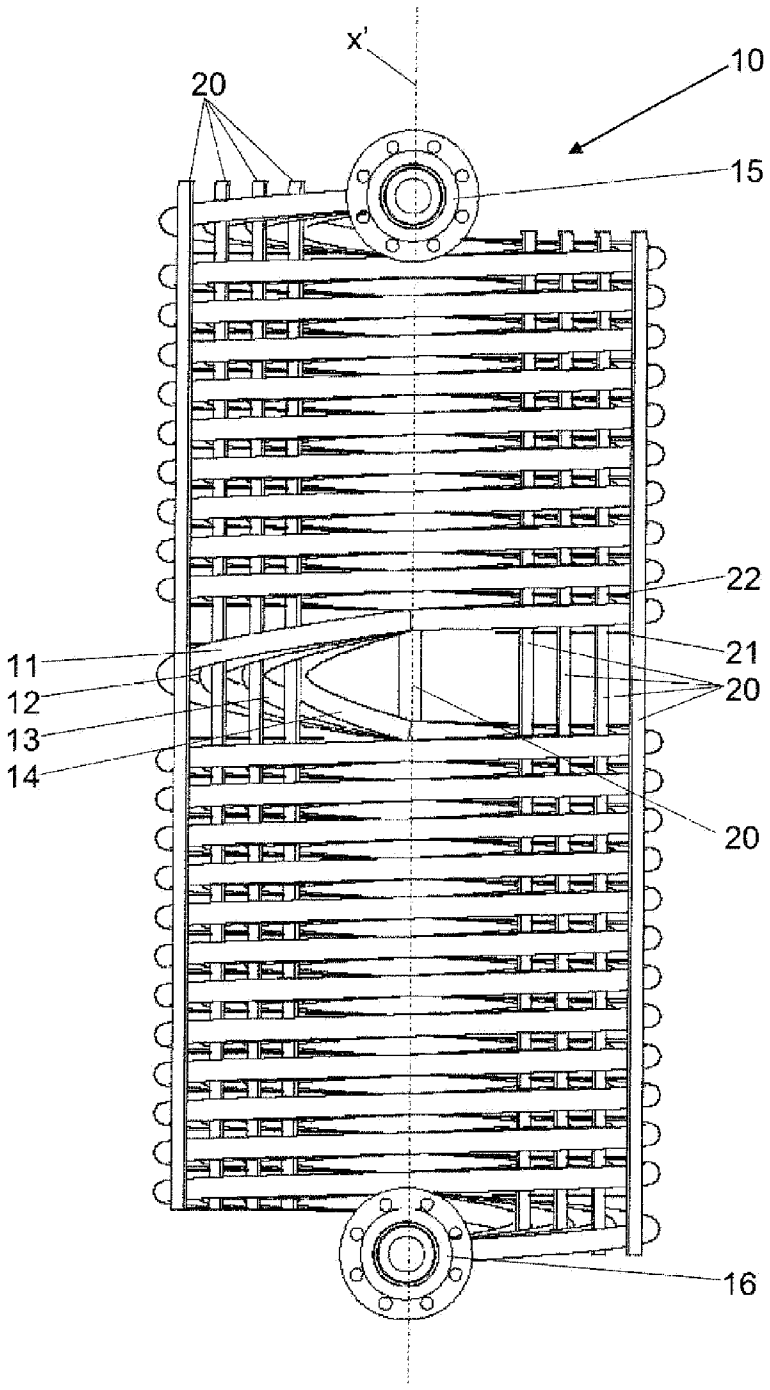

Fig 4