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(54) Heat exchanger

(57) The invention relates to a heat exchanger comprising:
- a header;
- at least one substantially vertical first pipe hanging down from the header and said first pipe being sealed off at the bottom;
- a supply conduit connected to the header for supplying a heat exchanging fluid to the header; and
- a discharge conduit running from the header for discharging heated heat exchanger fluid from the header.

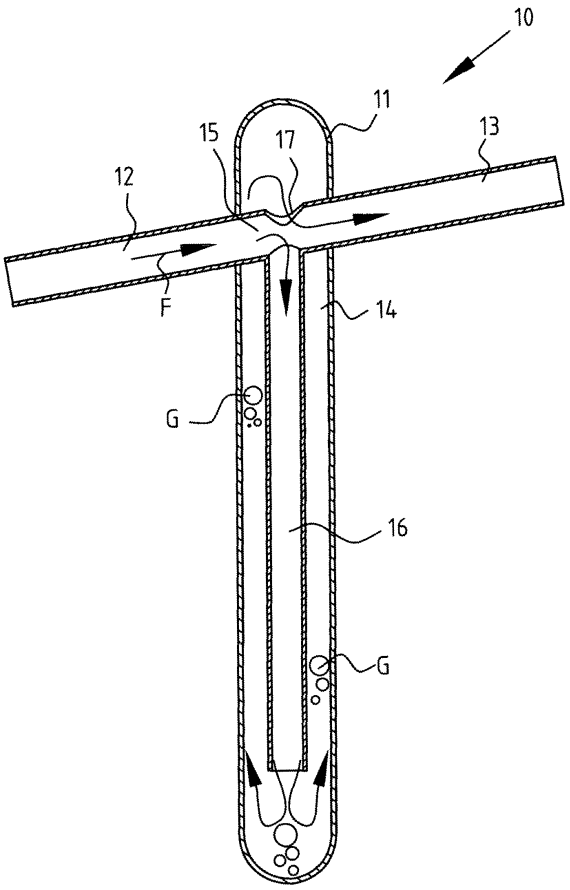

FIG. 2

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Description

[0001] Waste from households and companies are generally burned in an incinerator, which comprises a combustion chamber. The waste is put into the combustion chamber and burned. The heat from the gasses is partially converted in a heat exchanger. This heat exchanger is embodied in an incinerator by membrane walls. These walls, confining the combustion chamber, comprise a number of tubes through which a heat exchanging fluid, such as water, flows. The water is heated to temperatures in the range of the boiling temperature and the produced steam is used to drive a turbine and to generate energy.

[0002] Heat exchangers are also used in for example boilers for providing hot water in a house. Such a boiler generally comprises a heat exchanger with which the heat of heated gasses are converted into hot water.

[0003] It is the object of the invention to improve the heat exchanging capacity of heat exchangers comprising conduits through which a heat exchanging fluid flows.

[0004] This object is achieved by a heat exchanger comprising:

- a header;
- at least one substantially vertical first pipe hanging down from the header and said first pipe being sealed off at the bottom;
- a supply conduit connected to the header for supplying a heat exchanging fluid to the header; and
- a discharge conduit running from the header for discharging heated heat exchanger fluid from the header.

[0005] With such a heat exchanger according to the invention the flow within the conventional conduits, i.e. supply conduit and discharge conduit, are minimally disturbed, while additional heat exchanging capabilities are added. The vertical first pipe provides for the additional heat exchanging surface. Fluid present in this first pipe will be heated to the boiling temperature and the vapours generated will trust part of the fluid upwards and into the discharge conduit. This provides for a circulation of the heat exchanging fluid within the first pipe and accordingly transports the heat from the first pipe away along the discharge conduit.

[0006] In a preferred embodiment of the heat exchanger according to the invention deflecting means are arranged in the header for directing at least part of the supplied heat exchanging fluid into the first pipe. These deflecting means stimulate the circulation through the first pipe, as fluid from the supply conduit is deflected into the first pipe and displaces the fluid already present in the pipe, which is in turn urged into the discharged conduit.

[0007] In a very preferred embodiment of the heat exchanger according to the invention, a second pipe is coaxially arranged inside the first pipe and connected to the header, wherein the second pipe debouches at the closed bottom of the first pipe. This second pipe provides for a downward conduit, while the space between the second pipe and the first pipe provides the upward passage within the first pipe. As the heat originates from the outside wall of the first pipe, the heat exchanging fluid will get to its boiling point at the inner surface of the first pipe and the generated bubbles will push the fluid upwardly within the space between the first and second pipe.

[0008] Preferably, the deflecting means direct the supplied fluid into the second pipe, while the heated fluid is directed from the first pipe into the discharge conduit.

[0009] In another embodiment of the heat exchanger according to the invention, the deflecting means comprise a connecting conduit arranged between the supply conduit and the discharge conduit, wherein the connecting conduit extends across the width of the first pipe and wherein the connecting conduit is provided with a bottom opening and a top opening, as seen in the vertical direction. Preferably the second pipe is connected to the bottom opening.

[0010] With these deflecting means the fluid flow from the supply conduits can flow easily to the discharge conduit, such that the primary flow is not substantially disrupted. When fluid within the first pipe is heated to its boiling temperature and the generated bubbles will force the fluid upwardly, a low pressure will arise within the second pipe, such that fluid from the supply conduit will be sucked through the bottom opening to the second pipe. Heated fluid flowing in upward direction will enter the header and flow through the top opening into the discharge conduits as a result of the venturi effect.

[0011] In yet another embodiment of the heat exchanger according to the invention, the top opening comprises a deflector plate arranged under a downward angle, such that heated fluid from the first pipe entering the top opening is directed towards the discharge conduit. Such a deflector plate further stimulates the venturi effect and provides for a good flow from both the supply conduit towards the discharge conduit and from the second pipe through the first pipe back to the header.

[0012] The invention also relates to a boiler of for instance an incinerator, which boiler has a combustion chamber defined by walls, wherein at least the ceiling wall comprises a plurality of conduits, through which a heat exchanging fluid flows, at least one of the conduits comprising a heat exchanger according to the invention. The heat exchanger according to the invention can easily be implemented in an available boiler by cutting out a portion of one of the conduits and inserting the header of a heat exchanger according to the invention.

[0013] Preferably, the boiler according to the invention has a plurality of conduits of the sealing wall which comprise a heat exchanger according to the invention and wherein the heat exchangers share a common header. With such an embodiment a curtain is provided for in the boiler, which curtain hangs down from the ceiling wall. An additional advantage of such a curtain is that the flow

of heated gasses is influenced, which could result in a better mixing of the gasses such that toxic components within the gasses are reduced.

[0014] These and other advantages of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a cross-sectional view of a first embodiment of a heat exchanger according to the invention.

Figure 2 shows a schematic cross-section view of a second embodiment of the invention.

Figure 3 shows schematically the top portion of a third embodiment.

Figure 4 shows schematically a fourth embodiment of a heat exchanger according to the invention.

Figure 5 shows the ceiling wall with integrated heat exchanger according to the invention of a boiler according to the invention.

[0015] Figure 1 shows a heat exchanger 1 according to the invention. This heat exchanger 1 has a header 2 onto which a supply conduit 3 a discharge conduit 4 and a vertical pipe 5 are arranged.

[0016] A heat exchanging fluid F is supplied by supply conduit 3 and flows into the header 2. Part of the fluid F directly flows to the discharge conduit 4 and part drops down into the vertical pipe 5.

[0017] The fluid in the vertical pipe 5 is heated from the outside through the wall such that the fluid F reaches its boiling point and vapour bubbles G develop. These vapour bubbles G trust part of the fluid F upward and into the discharge conduit 4.

[0018] Due to the development of vapour bubbles G circulation of the fluid F is created within the vertical pipe 5 such that heated fluid F is pushed to the discharge conduit 4.

[0019] Figure 2 shows a second embodiment 10 of a heat exchanger according to the invention. This heat exchanger 10 has a header 11 onto which a supply conduit 12, a discharge conduit 13 and a vertical pipe 14 are attached. Within the header 11 a connecting conduit 15 is arranged, which extends between the supply conduit 12 and the discharge conduit 13.

[0020] The connecting conduit 15 has a bottom opening onto which a second vertical pipe 16 is arranged. The connecting conduit 15 has furthermore a top opening 17.

[0021] When the fluid in the vertical pipe 14 is heated through the wall of the pipe 14, vapour bubbles G will be developed. This will trust part of fluid F upwardly, which flows through the top opening 17 into the discharge conduit 13. As a result of the development of vapour bubbles and the trusting of fluids F upwardly, a small under-pressure will be created, which promotes the flow of fluid F from the supply conduit 12 through the connecting conduit 15 into the bottom opening in the second vertical pipe 16. This vertical pipe 16 debouches at the bottom of the vertical pipe 14. As a result, a more controlled flow of the fluid F will occur and a better heat exchanging will be provided.

[0022] Figure 3 shows a third embodiment 20 of the heat exchanger according to the invention. This embodiment 20 has a header 21 to which a supply conduit 22 and a discharge conduit 23 is attached. Between the supply conduit 22 and discharge conduit 23 a connecting conduit 24 is arranged. This connecting conduit 24 has a bottom opening 25 to which a vertical pipe 26 is arranged. This vertical pipe 26 is coaxially arranged with the outer vertical pipe 27.

[0023] The connecting conduit 24 has a top opening 28 which is provided with a deflector plate 29. This deflector plate 29 urges the fluid F into the vertical pipe 26, which debouches at the bottom into the vertical pipe 27 accordingly the embodiment of figure 2. The deflector plate 29 also provides for a venturi effect at the top opening 28 such that heated fluid F is sucked into the top opening 28 and dragged along into the discharge conduit 23.

[0024] Figure 4 shows a fourth embodiment 30 of a heat exchanger according to the invention. This heat exchanger 30 has also a header 31 onto which a supply conduit 32, a discharge conduit 33 and a vertical pipe 34 are connected. The supply conduit 32 and discharge conduit 33 are interconnected by connecting conduit 35 which is provided with a top opening 36 a bottom opening 37 onto which a second vertical pipe 38 is arranged and side openings 39.

[0025] In figure 5 part of a ceiling wall 50 of a boiler according to the invention is shown. The ceiling wall 50 consists out of a number of conduits 51 which are connected to each other in order to provide a closed wall. Through these conduits 51 a heat exchanging fluid, in particular water, flows. These conduits 51 are interrupted by a common header 52 from which vertical pipes 53 drop down. These vertical pipes 53 are embodied as disclosed above according to the invention. Fluid F flows into the conduits 51 and arrives at the common header 52. In the header 52 part of the fluid drops down into the vertical pipe 53, where it is heated by hot gasses present in the combustion chamber of the boiler. After reaching the boiling temperature of the fluid F vapour bubbles will develop and push part of the fluid back out of the vertical pipes 53 into the header 52 where it can proceed with the travel through the conduits 51.

[0026] With such a heat exchanger according to the invention in a boiler it is possible to have an enlarged surface for exchanging heat between the combustion gasses and the fluid F, but it also provides for a curtain within the combustion chamber which enables one to guide the gasses in a desired direction.

[0027] Although figure 5 shows an embodiment with a common header 52, it is also possible to provide for a curtain of vertical pipes wherein each vertical pipe connects to a pipe in the ceiling wall via a separate header.

Claims

1. Heat exchanger comprising:

   - a header;
   - at least one substantially vertical first pipe hanging down from the header and said first pipe being sealed off at the bottom;
   - a supply conduit connected to the header for supplying a heat exchanging fluid to the header; and
   - a discharge conduit running from the header for discharging heated heat exchanger fluid from the header.

2. Heat exchanger according to claim 1, wherein deflecting means are arranged in the header for directing at least part of the supplied heat exchanging fluid into the first pipe.

3. Heat exchanger according to claim 2, comprising a second pipe arranged coaxially inside the first pipe and connected to the header, wherein the second pipe debouches at the closed bottom of the first pipe.

4. Heat exchanger according to claim 3, wherein the deflecting means direct the supplied fluid into the second pipe, while the heated fluid is directed from the first pipe into the discharge conduit.

5. Heat exchanger according to any of the claims 2 - 4, wherein the deflecting means comprising a connecting conduit arranged between the supply conduit and the discharge conduit, said connecting conduit extending across the width of the first pipe, wherein the connecting conduit is provided with a bottom opening and a top opening, as seen in the vertical direction.

6. Heat exchanger according to claim 5 and claims 3 or 4, wherein the second pipe is connected to the bottom opening.

7. Heat exchanger according to claim 5 or 6, wherein the top opening comprises a deflector plate arranged under a downward angle, such that heated fluid from the first pipe enters the top opening and is directed towards the discharge conduit.

8. Boiler of for instance an incinerator, which boiler has a combustion chamber defined by walls, wherein at least the ceiling wall comprises a plurality of conduits, through which a heat exchanging fluid flows, at least one of the conduits comprising a heat exchanger according to any of the preceding claims.

9. Boiler according to claim 8, wherein a plurality of the conduits of the ceiling wall comprise a heat exchanger according to any any of the claims 1 - 7 and wherein the heat exchangers share a common header.

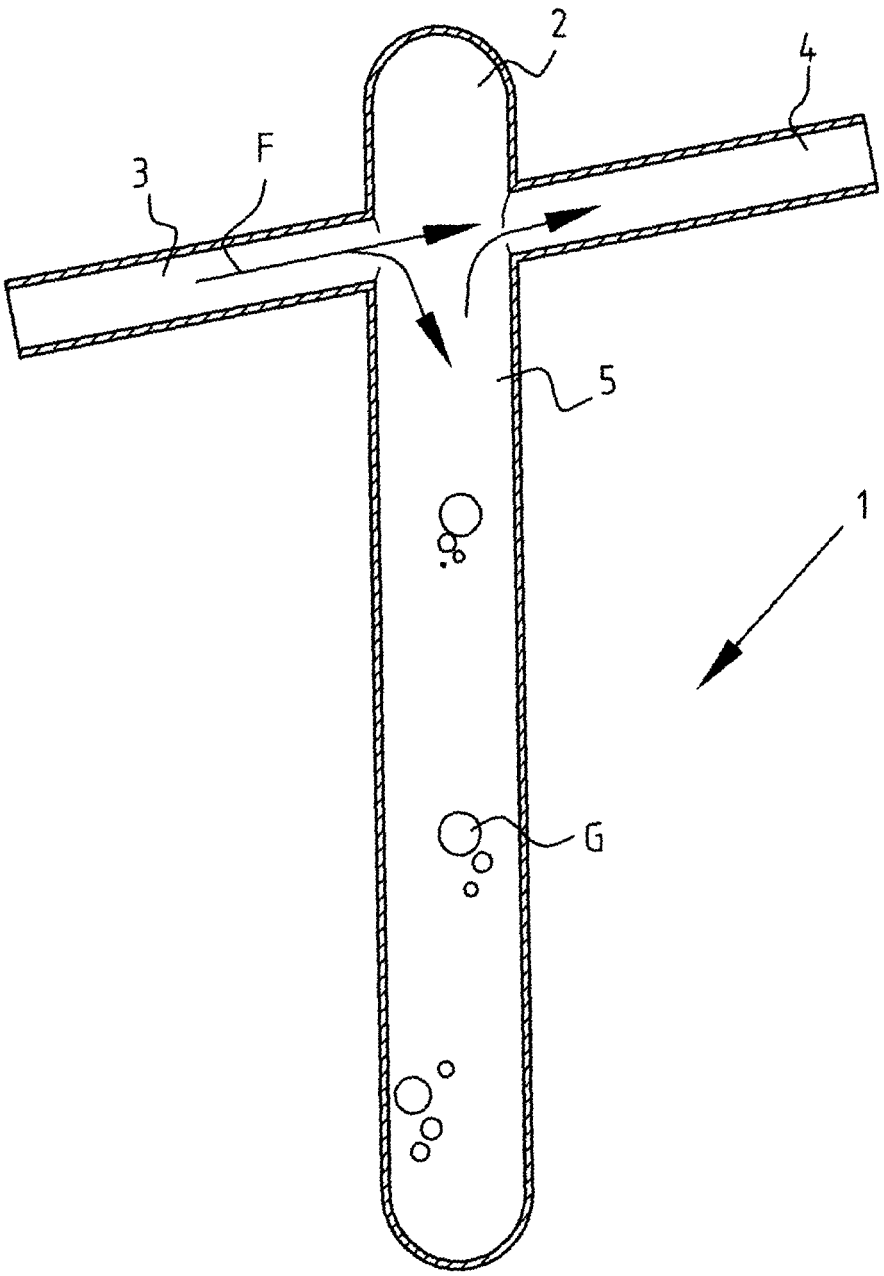

FIG. 1

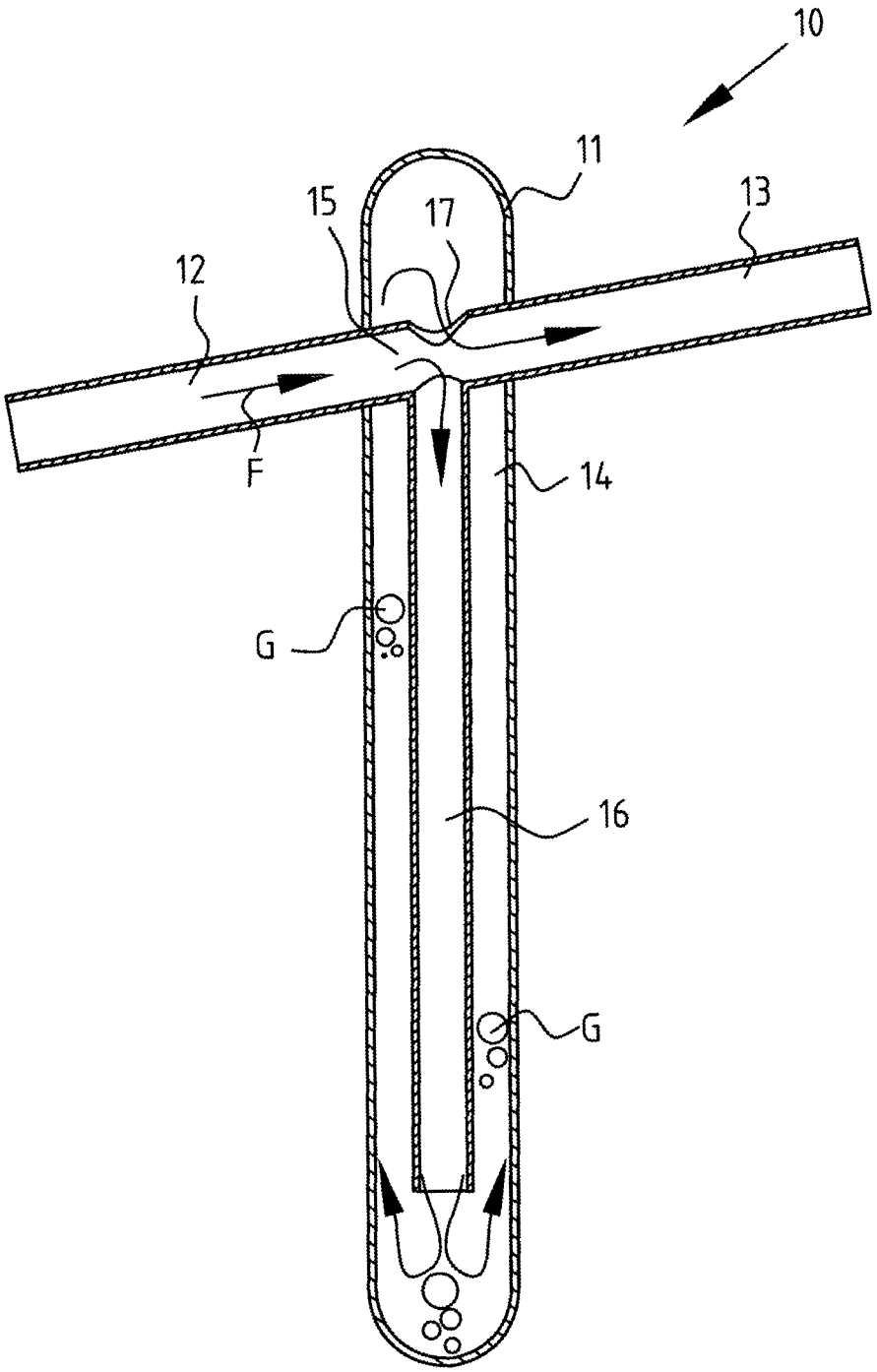

FIG. 2

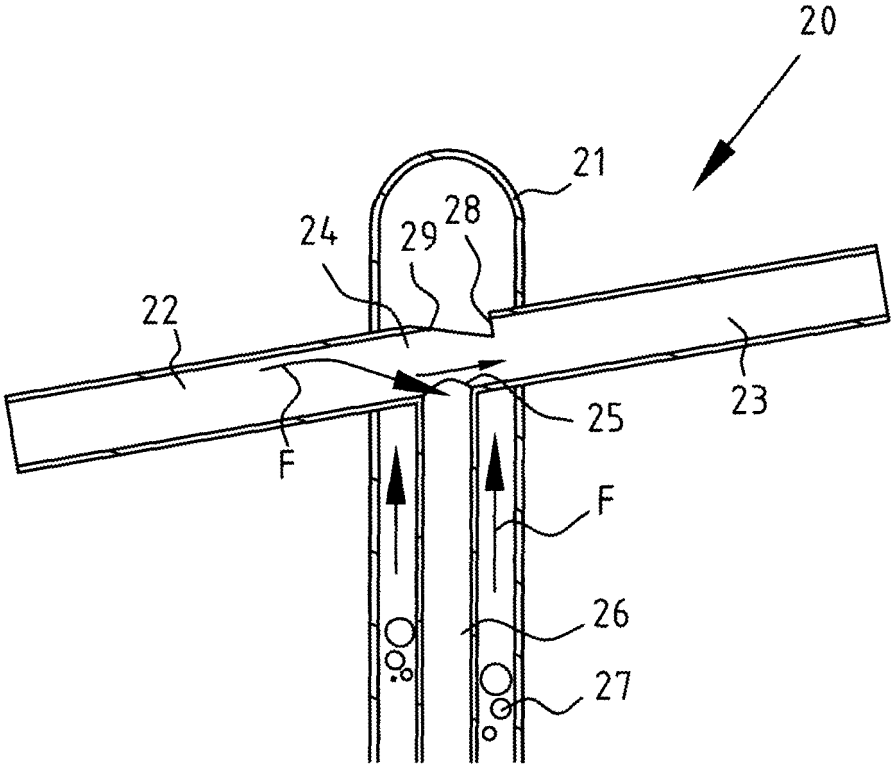

FIG. 3

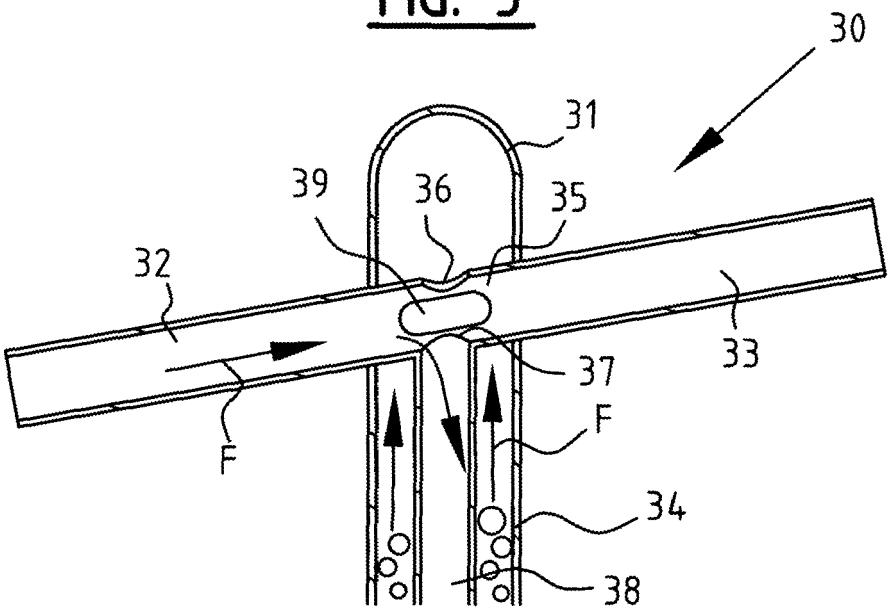

FIG. 4

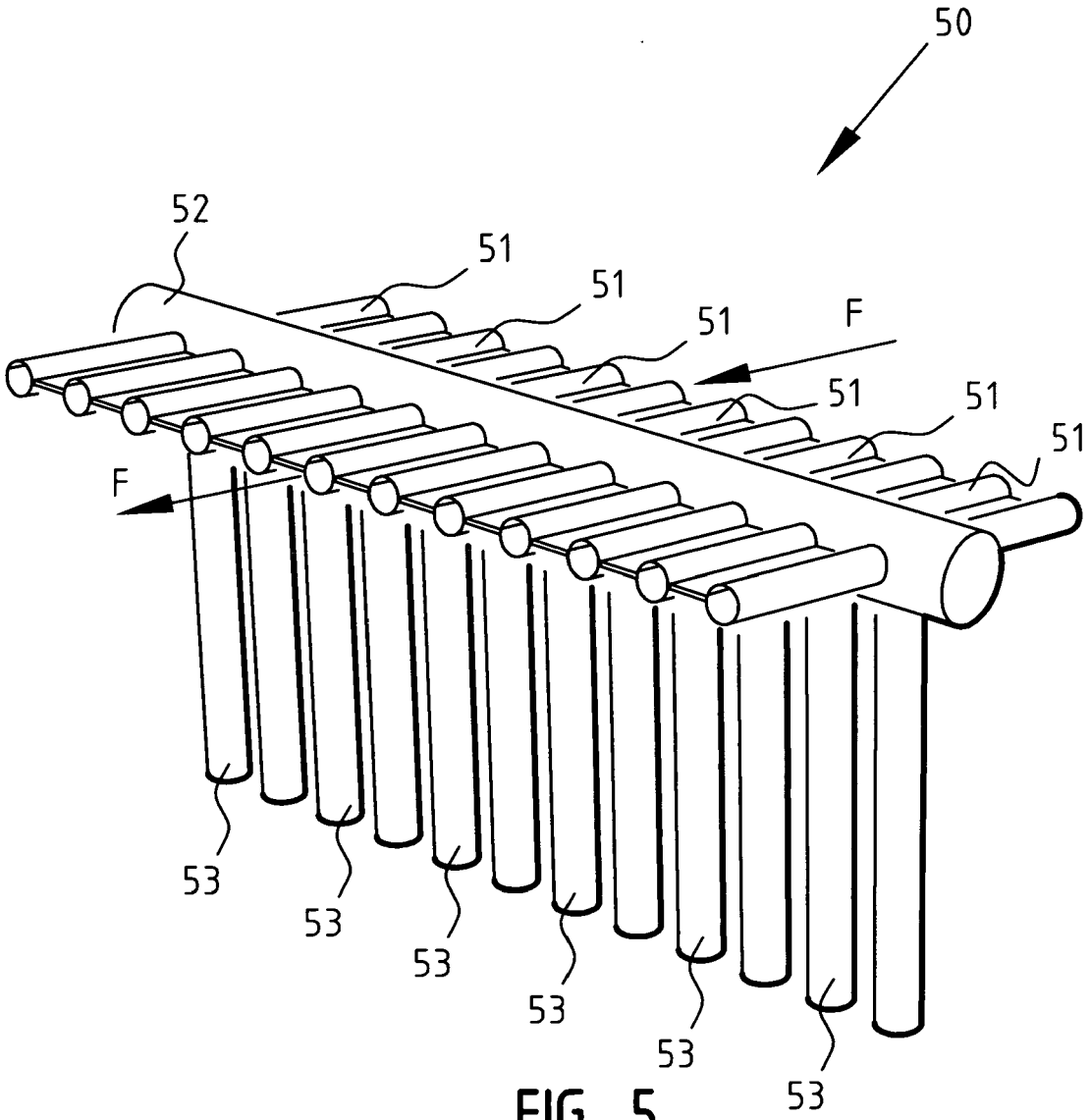

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 07 5741

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 443 188 A (BUEHLER KARL [CH]) 17 April 1984 (1984-04-17) * figure 6 * -----	1-4	INV. F24H1/40 F22B23/06 F28D7/12
A	DE 283 772 C (JUNKERS) 24 April 1915 (1915-04-24) * the whole document * -----	1,8	

TECHNICAL FIELDS SEARCHED (IPC)

F24H
F22B
F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 February 2009	van Gestel, Harrie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 07 5741

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-02-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4443188 A	17-04-1984	BR 8202869 A	26-04-1983
		DE 3265568 D1	26-09-1985
		EP 0065330 A1	24-11-1982
		JP 1469713 C	14-12-1988
		JP 57196079 A	01-12-1982
		JP 63019794 B	25-04-1988
DE 283772 C		NONE	

EPO FORM P0459

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