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(12) # EUROPEAN PATENT APPLICATION

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(54) **Heat exchanger.**

(57) The invention relates to a heat exchanger (1) provided with a feed opening (2) and a discharge opening (3) for a medium, which openings are mutually connected by a duct (4) substantially rectangular in cross section, through which duct transverse ducts (5) for a medium on the outside of the insert heat exchanger are arranged practically perpendicularly of the flow direction of the medium in the duct.

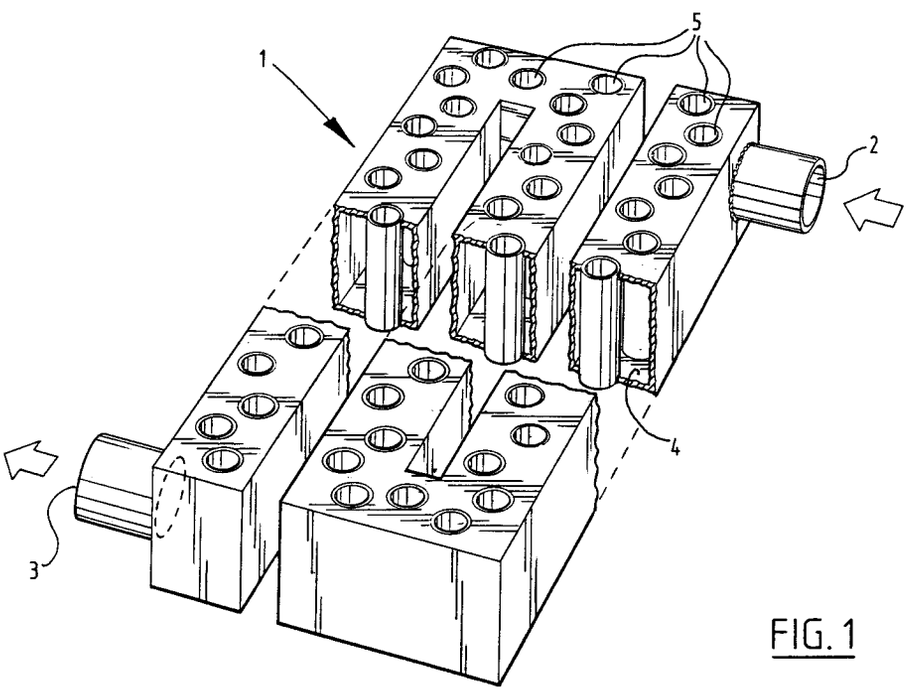

FIG. 1

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The invention relates to a heat exchanger. In the transfer of heat from a first medium to a second medium the efficiency of the transfer is of very great importance. Another important factor is the complexity of the construction of the heat exchanger. This is of particular relevance in the manufacture thereof and in the later servicing of the heat exchanger. The present invention has for its object to provide a structurally simple heat exchanger which is comparatively inexpensive to manufacture and which moreover produces a very high efficiency. The invention has the additional objective of combining a high heat exchanger efficiency with a limited volume of the heat exchanger.

This is achieved by the invention with a heat exchanger provided with a feed opening and a discharge opening for a medium, which openings are mutually connected by a duct substantially rectangular in cross section, through which duct transverse ducts for a medium on the outside of the insert heat exchanger are arranged practically perpendicularly of the flow direction of the medium in the duct. Such a heat exchanger combines a relatively high efficiency with a very simple and therefore inexpensive construction.

Cross sections through the transverse ducts are in preference practically circular. The heat exchanger is found in this case to produce a high efficiency.

The largest surface area of a cross section through a transverse duct perpendicular to the flow direction of the medium through the duct preferably amounts to about 40% of the surface area of the cross section through the duct. This ratio is found to produce an exceptionally favourable result.

The feed opening and the discharge opening are preferably both provided with a flange. This enables simple placing.

The feed opening and the discharge opening are preferably both placed in a common flange. It is possible in this case to place the heat exchanger as insert exchanger, for instance in a boiler.

The form of the duct is in preference substantially U-shaped. This shape enables a very compact construction of the heat exchanger.

The heat exchanger is preferably provided with a combustion chamber. In this case the heat exchanger is used as an element for producing as well as generating heat. The combustion chamber preferably has a substantially circular cross section and preferably connects onto an outlet duct for combustion gases as according to the already described heat exchanger. The substantially circular cross section of the combustion chamber has the advantage that the minimum distance from the wall of the combustion chamber to the burner, which will generally have a round shape, is maximal. If the combustion chamber connects onto the outlet duct for combustion gases no heat will be lost when combustion gases are transported from the combustion chamber to the outlet duct. It is further possible with such a heating element to place the whole device in a medium for heating.

The heat exchanger with combustion chamber is preferably arranged in a boiler which is connected to a solar collector. Particularly in this situation there will be a limited temperature difference between the heating waste gases and the already pre-heated medium for heating, so that particularly in this case a heat exchanger with a high efficiency is desired.

A plate is preferably arranged at a small distance beneath the heat exchanger for generating a desired flow pattern of the medium on the outside of the heat exchanger. The plate will be able to influence the natural convection pattern of the medium on the outside of the heat exchanger such that a strong upward flow through the transverse ducts of the heat exchanger will occur, thereby enabling an especially good heat transfer.

The present invention will be elucidated with reference to the non-limitative embodiments of a heat exchanger according to the present invention shown in the figures, wherein:

fig. 1 shows a partly cut away perspective view of a heat exchanger according to the invention, and

fig. 2 shows a partly cut away perspective view of a heat exchanger inserted in a vessel and provided with a combustion chamber.

Fig. 1 shows a meander-shaped heat exchanger 1 provided with a feed opening 2 and a discharge opening 3. Feed opening 2 and discharge opening 3 are mutually joined by a duct 4 substantially rectangular in cross section. The rectangular duct 4 can be manufactured from sheet metal material such as aluminium or stainless steel but also from steel of a lesser quality, and subsequently provided with a coating layer. Conceivable here for instance is a coat of enamel. Transverse ducts 5 are arranged practically perpendicular to the flow direction of the medium in the duct 4. The transverse ducts 5 shown in this figure all lie in the same direction. This does not however always have to be the case. The cross section through the transverse ducts 5 are practically circular, although this does not necessarily have to be the case either. They may for instance have another cross section. A possibility here is for instance a rectangular cross section.

Fig. 2 shows an insert heating element 6 which is placed in a vessel 7. The insert heating element 6 is provided with a feed opening 8 for fuel and oxygen-containing combustion gases. These gases are fed to a burner 10 situated in a combustion

chamber 9. The latter has a practically circular cross section to prevent the minimum distance between the wall of the combustion chamber 9 and the, in this case, round burner 10 being very small at a particular position. The combustion chamber 9 is connected to a rectangular outlet duct 11 for combustion gases. The transition from the combustion chamber 9 to the rectangular outlet duct 11 is a smooth one and can for instance be manufactured by forging a rectangular duct to a round shape at the position where the combustion chamber 9 is formed. The rectangular outlet duct 11 for combustion gases forms here the heat exchanger for generating the heat created by the combustion in the combustion chamber 9 to the medium in the vessel 7. The rectangular outlet duct 11 is provided for this purpose with transverse ducts 12 placed perpendicularly of the flow direction of the combustion gases in the rectangular duct 11. Through natural convection of the medium in vessel 7 a flow 13 will occur wherein the medium for heating will flow through the transverse ducts. The rectangular outlet duct 11 has substantially a U-shape and the discharge opening 14, where the cooled waste gases will leave the insert heating element 6, is joined like the feed openings to a flange 15. This flange 15 enables simple placing and removal of the insert heating element 6 into and out of the vessel 7. The insert heating element 6 described in this figure can be applied to particularly exceptional advantage in a solar boiler.

Claims

1. Heat exchanger provided with a feed opening and a discharge opening for a medium, which openings are mutually connected by a duct substantially rectangular in cross section, through which duct transverse ducts for a medium on the outside of the insert heat exchanger are arranged practically perpendicularly of the flow direction of the medium in the duct.

2. Heat exchanger as claimed in claim 1, **characterized in that** cross sections through the transverse ducts are practically circular.

3. Heat exchanger as claimed in claim 1 or 2, **characterized in that** the largest surface area of a cross section through a transverse duct perpendicular to the flow direction of the medium through the duct amounts to about 40% of the surface area of the cross section through the duct.

4. Heat exchanger as claimed in any of the claims 1-3, **characterized in that** the feed opening and the discharge opening are both provided with a flange.

5. Heat exchanger as claimed in any of the claims 1-3, **characterized in that** the feed opening and the discharge opening are preferably both placed in a common flange.

6. Heat exchanger as claimed in any of the claims 1-5, **characterized in that** the form of the duct is substantially U-shaped.

7. Heat exchanger as claimed in any of the claims 1-6, **characterized in that** the heat exchanger is provided with a combustion chamber.

8. Heat exchanger as claimed in claim 7, **characterized in that** the combustion chamber has a substantially circular cross section and connects onto an outlet duct for combustion gases similarly to the duct.

9. Heat exchanger as claimed in claim 7 or 8, **characterized in that** the heat exchanger with combustion chamber is arranged in a boiler which is connected to a solar collector.

10. Heat exchanger as claimed in any of the claims 1-9, **characterized in that** a plate is arranged at a small distance beneath the heat exchanger for generating a desired flow pattern of the medium on the outside of the heat exchanger.

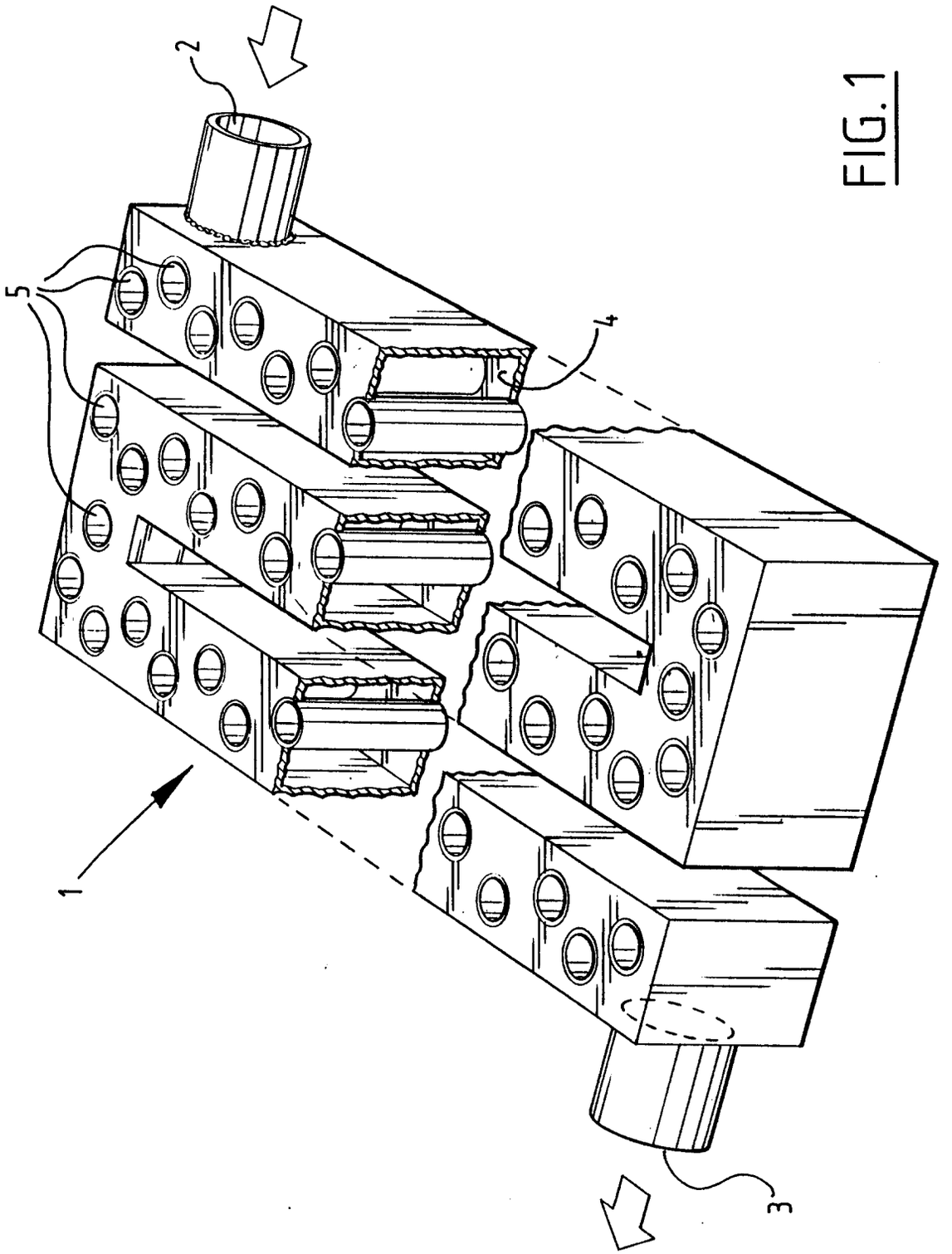

FIG.1

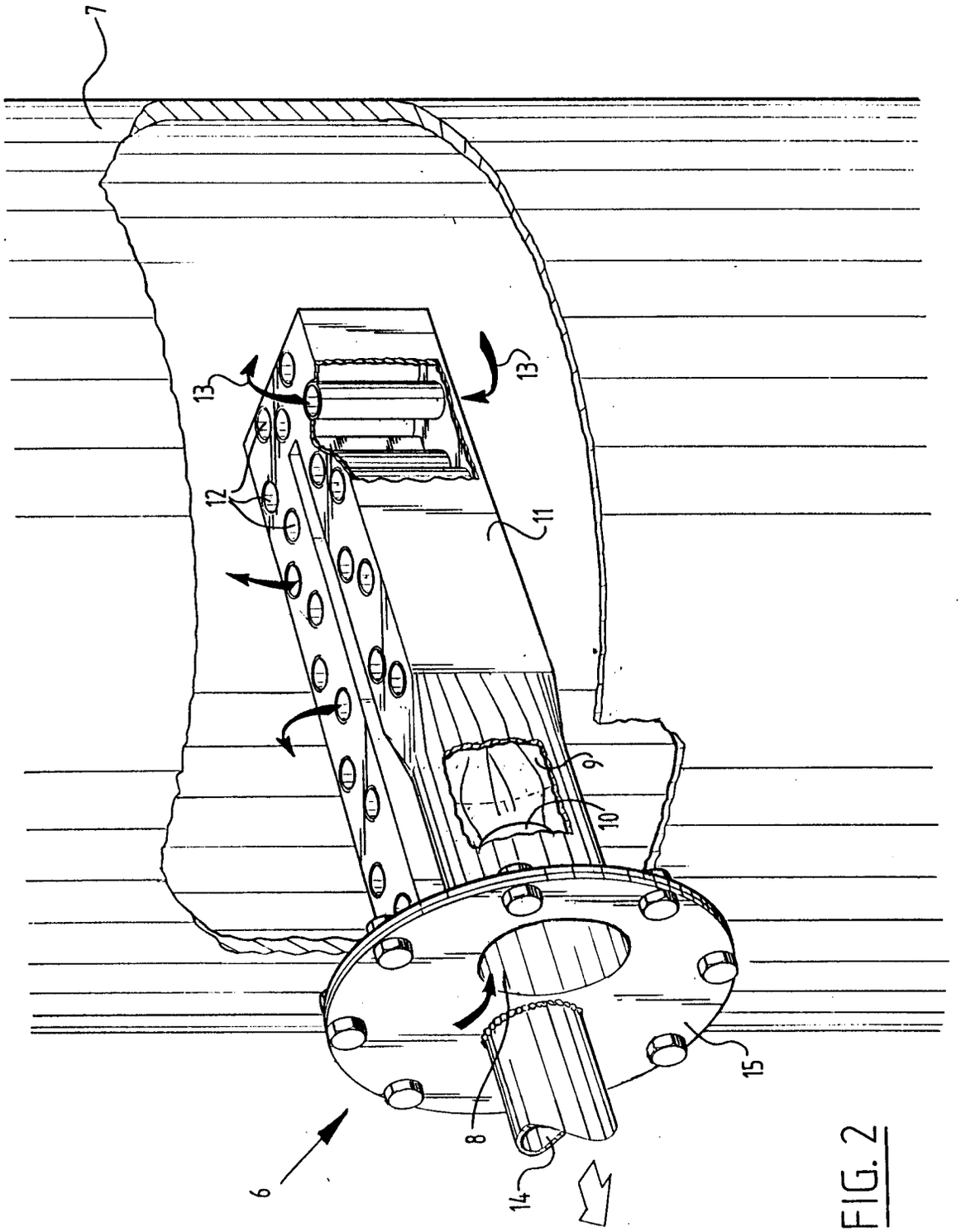

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number EP 94202587.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
X	EP - A - 0 291 322 (DU PONT) * Fig. 5; abstract *	1-3	F 28 D 1/053 F 28 F 1/04
A		4-10	
A	EP - A - 0 023 317 (PREE) * Fig. 1, 1a *	1-10	
A	US - A - 4 034 803 (REED et al.) * Fig. 1,4; abstract *	1-10	

TECHNICAL FIELDS SEARCHED (Int. Cl. 6)

F 28 D
F 28 F
F 23 J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	15-11-1994	HUBER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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