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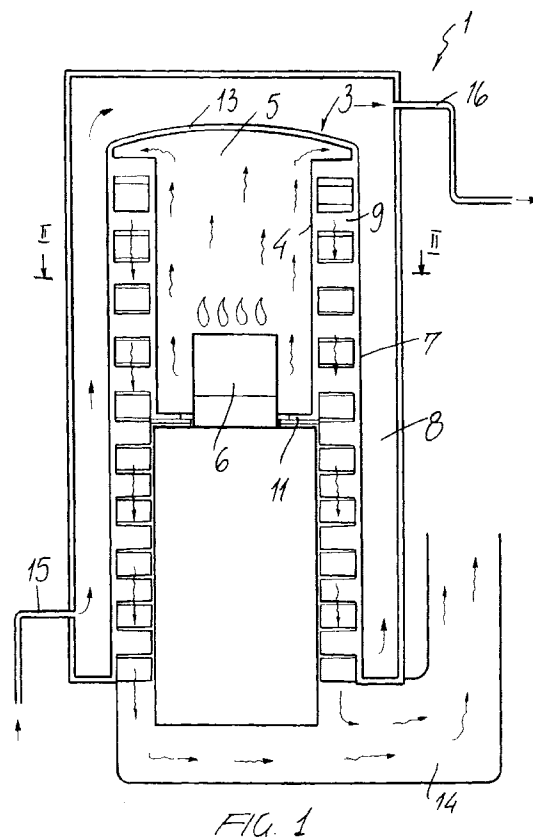
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AL LT LV RO SI(30) Priority: **02.08.1996 IT MI961697**(71) Applicant: **FERROLI S.p.A.****I-37047 San Bonifacio (Verona) (IT)**(72) Inventor: **Ferrolì, Dante****37047 San Bonifacio (Verona) (IT)**(74) Representative: **Cicogna, Franco****Ufficio Internazionale Brevetti****Dott.Prof. Franco Cicogna****Via Visconti di Modrone, 14/A****20122 Milano (IT)**(54) **High efficiency heat exchanger boiler**

(57) The present invention relates to a boiler (1) comprising a prismatic hollow heat exchanger (3). The heat exchanger (3) is vertically arranged and is provided with an inside shell (4) which laterally delimits a carrying fluid circulating chamber.

Between the outer and inner shells of the heat exchanger boiler a finned gap (9) is formed, which communicates, at the top end portion thereof, with the combustion chamber (5) and, at the bottom end portion thereof, with a fume collecting and removing duct (14).

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Description

BACKGROUND OF THE INVENTION

The present invention relates to a boiler including a high efficiency heat exchanger.

As is known, conventional boilers used in centralized heating systems for buildings in general usually comprise a combustion chamber or combustor and a heat exchanger, one side of which is in contact with the combustion products, and the other side of which is in contact with a carrying fluid, usually comprising water, and which is successively conveyed to heat radiating units provided in the rooms of the building to be heated.

One of the main problems related to a proper designing of heating system boilers is that of providing a thermal exchange efficiency between the combustion fumes and the heat carrying fluid.

Prior heat exchangers, conventionally used in heating system boilers have indeed a comparatively high thermal exchange efficiency.

However, the mentioned prior heat exchangers have a very complex construction and, accordingly, a very high making cost.

Moreover, because of their constructional complexity, prior heat exchangers require additional machining operations on the component parts thereof, and additional tests on said parts.

The above mentioned machining operations further add to the already high cost of prior heat exchangers for heating system boilers.

SUMMARY OF THE INVENTION

Accordingly, the aim of the present invention is to overcome the above mentioned drawbacks, by providing such a heating system boiler which comprises a high thermal exchange efficiency heat exchanger, which can be made at a very reduced cost.

Within the scope of the above mentioned aim, a main object of the present invention is to provide such a heat exchanger boiler which can be made by a simple melting operation in a conventional mold or in sand, while preserving those constructional features which are indispensable for providing a high thermal exchange efficiency.

Another object of the present invention is to provide such a heat exchanger boiler which can be assembled, at least with respect to the heat exchanger assembly thereof, in a very short time.

According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a high efficiency heat exchanger boiler, characterized in that said boiler comprises a vertically extending hollow prismatic heat exchanger including an inner shell laterally delimiting a combustion chamber and an outer shell arranged in a heat carrying

fluid circulating chamber, between said outer shell and inner shell a finned gap being provided, said finned gap communicating, at a top end portion thereof, with said combustion chamber and, at a bottom end portion thereof, with a fume collecting and removing duct.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the heating system boiler according to the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred, though not exclusive, embodiment thereof, which is illustrated, by way of an indicative, but not limitative, example, in the accompanying drawings, where:

Figure 1 is a schematic axial cross-sectioned view illustrating the heating system boiler according to the present invention;

Figure 2 is a horizontal cross-sectional view of Figure 1 substantially taken along the section line II-II.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the number references of the above mentioned figures, the heating system boiler according to the present invention, which has been generally indicated by the reference number 1, comprises an outer casing 2 or shell and a heat exchanger 3.

The heat exchanger 3 has a prismatic configuration, preferably having a square base, and being of hollow construction.

Said heat exchanger 3 is vertically arranged inside said casing 2 and is provided with an inner shell 4 which laterally delimits a combustion chamber or combustor 5, in which a burner 6, of any suitable known types, is arranged.

The outer shell 7 of the heat exchanger 3 defines, together with the inner surface of the casing 2, a chamber 8 in which a heat carrying fluid is circulated, said fluid preferably comprising water.

Between the inner shell 4 and outer shell 7 of the heat exchanger 3, a gap 9 is defined, occupied by a plurality of fins 10 of said heat exchanger.

More specifically, the combustion chamber or combustor 5 is preferably formed in the top half of said heat exchanger 3 and is delimited, at the bottom thereof, by a sector 11, arranged in a middle region of the inner hollow of said heat exchanger 3.

The outer shell of the heat exchanger 3 is in turn provided with a plurality of fins 12, which have been specifically designed to increase the thermal exchange surface between the heat exchanger 3 and the heat carrying fluid, caused to circulate inside said chamber 8.

The finned gap 9 communicates with the combustion chamber 5 at the top end portion thereof.

More specifically, the combustion chamber 5 is closed, at the top thereof, by a top portion 13 which is

spaced by the top end portion of the gap 9 so that the fumes or combustion gases produced by the combustion inside said chamber 5, will be introduced into said gap 9 and will descend, along said gap, so as to contact the mentioned fins 10.

The bottom end portion of said finned gap 9 communicates, as shown, with a fume or combustion gas collecting and removing duct 14.

The chamber 8 communicates, near its bottom end portion, with a supplying duct 15, provided for introducing said heat carrying fluid into said chamber 8 and, near the bottom end portion thereof, with an outlet duct 16, for removing from said chamber 8 said fluid.

Thus, in the disclosed heat exchanger, a counter-current heat transmission occurs, i.e. from the combustion gases or fumes descending along said gap 7 and the heat carrying fluid driven upwardly along said chamber 8.

Owing to the disclosed construction, the heat exchanger 3 will provide a high efficiency heat transmission from said fumes to said fluid, and, moreover, said heat exchanger can be made at a very reduced cost.

In fact, said heat exchanger 3 is preferably made as a single piece by melting it into a conventional mold or in a sand mold arrangement.

The specifically designed hexagonal base prismatic configuration of said heat exchanger will allow to make it without omitting, as it would occur with a circular configuration, any portions of the fins, in order to provide an easy removal from the mold.

Thus, by a single melting operation, it will be possible to provide said heat exchanger which, being made as a single piece, can be easily machined, tested and installed.

In this connection it should be apparent that said heat exchanger 3 can be made, depending on requirements, either by a melting method or by a die casting method, starting from a cast iron or an aluminium material.

It should be also apparent that said heat exchanger defines said combustion chamber 4.

Moreover, the mentioned prismatic configuration will allow to produce the heat exchanger by casting its metal material into a single core and, accordingly, greatly reducing its making cost, with respect to prior art heat exchangers.

The combustion chamber 4, owing to its construction, provides the advantage that the walls of the combustion chamber may be easily cooled down through the fins 9.

Thus, by reducing the combustion chamber temperature, it will be possible to prevent polluting agents from being formed, i.e. a "cooler" combustion will be provided.

The prismatic configuration of the combustion chamber, as well as the easy and quick cooling thereof, will allow to use a radial burner of low cost and less polluting than conventional burners.

The top portion of the body contacting said combustion chamber will provide a primary thermal exchange function, like a conventional boiler.

In the bottom portion thereof, since no direct contact with said combustion chamber is provided herein, the combustion fumes or gases will be quickly condensated.

Owing to the sharp separation of the two operating regions, i.e. the primary exchange region and condensating region, it will be possible to obtain, from a same construction or a same tooling arrangement, a conventional boiler, provided with exclusively the top portion and a condensating boiler, provided with both portions.

From the above disclosure and the observations of the figures of the accompanying drawings it should be apparent that the invention fully achieves the intended aim and objects.

In particular, the fact is to be pointed out that a boiler has been provided which comprises a high thermal exchange heat exchanger, which can be made at a very low cost.

While the subject boiler has been disclosed by way of a merely indicative example, it should be apparent that it is susceptible to several modifications and variations all of which will come within the scope of the invention.

In practicing the invention, the used materials, provided that they are compatible to the intended application, as well as the contingent size and shapes, can be any, depending on requirements.

Claims

1. A high efficiency heat exchanger boiler, characterized in that said boiler comprises a vertically extending hollow prismatic heat exchanger including an inner shell laterally delimiting a combustion chamber and an outer shell arranged in a heat carrying fluid circulating chamber, between said outer shell and inner shell a finned gap being provided, said finned gap communicating, at a top end portion thereof, with said combustion chamber and, at a bottom end portion thereof, with a fume collecting and removing duct.
2. A boiler, according to Claim 1, characterized in that said outer shell is finned.
3. A boiler, according to Claims 1 and 2, characterized in that said heat carrying fluid circulating chamber communicates, at the bottom thereof, with a heat carrying fluid inlet duct and, at a top end portion thereof, with a heat carrying fluid outlet duct, in order to provide a counter-current thermal exchange between the descending fumes, moving down through said gap, and the ascending heat carrying fluid, moving up along said chamber.

4. A boiler, according to one or more of the preceding claims, characterized in that said heat exchanger comprises a single piece body.
5. A boiler, according to one or more of the preceding claims, characterized in that said heat exchanger is made by casting. 5
6. A boiler, according to one or more of the preceding claims, characterized in that said heat exchanger is made by die-casting. 10
7. A boiler, according to one or more of the preceding claims, characterized in that said combustion chamber is delimited, at the bottom thereof, by a sector arranged at a middle region of the height of said heat exchanger. 15
8. A boiler, according to one or more of the preceding claims, characterized in that said heat exchanger has a hexagonal cross section configuration. 20

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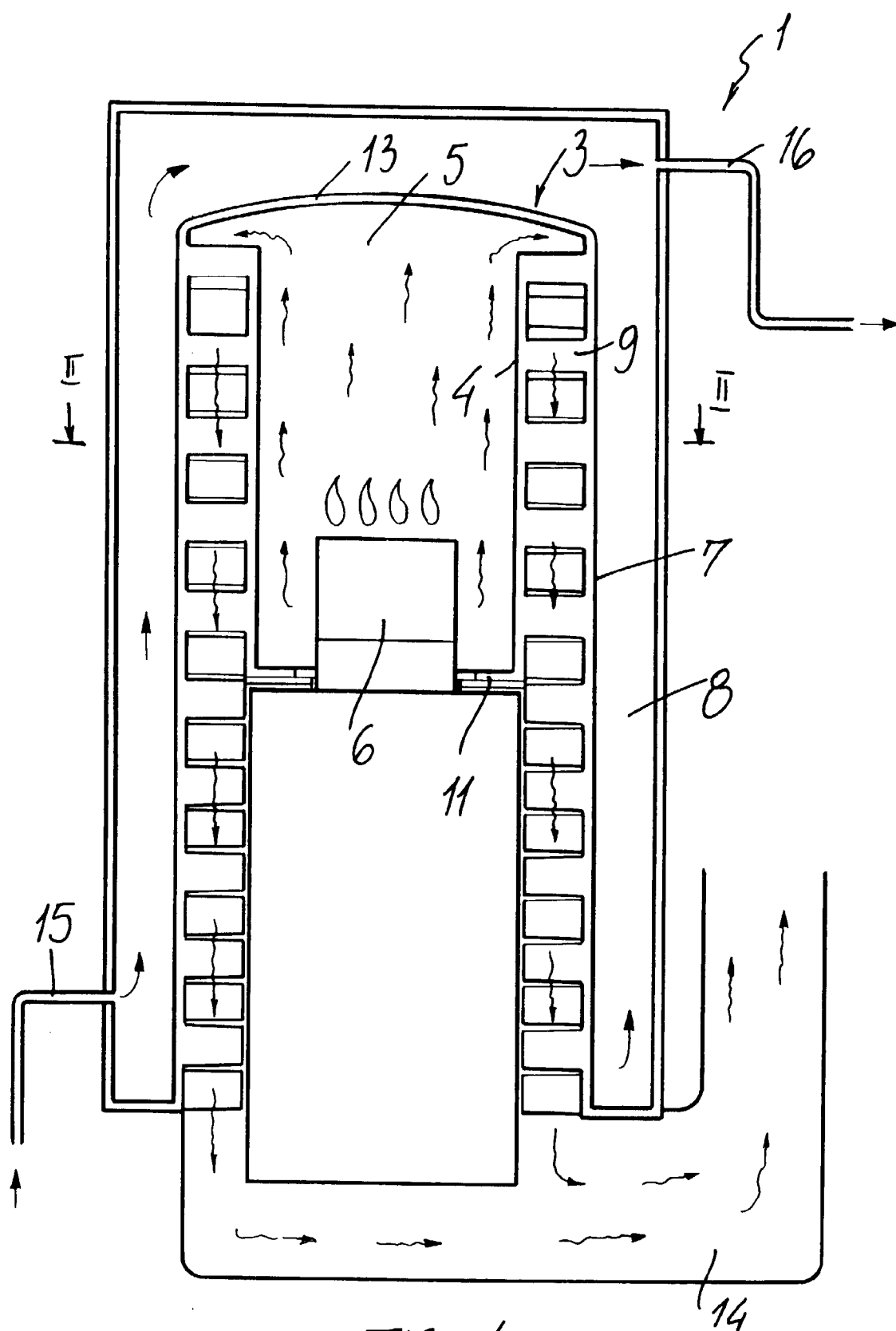


FIG. 1

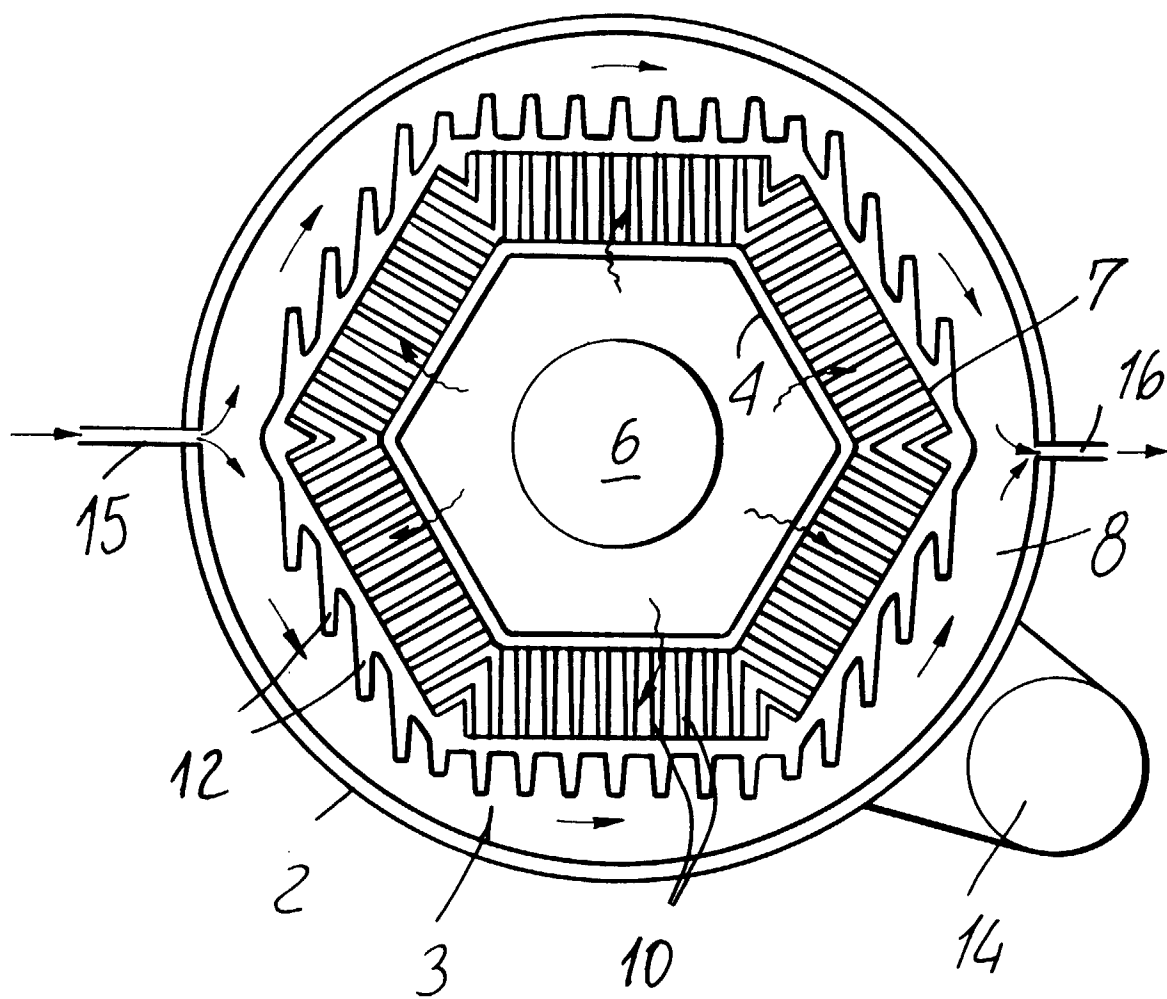


FIG. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0392

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)
A	FR 2 054 907 A (S.A.G.E.M.) * the whole document *	1	B61F5/22
A	EP 0 615 890 A (FIAT FERROVIARIA) * the whole document *	1	
A	EP 0 557 893 A (FIAT FERROVIARIA) * the whole document *	1	
A	EP 0 040 105 A (DOFASCO) * the whole document *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B61F
Place of search		Date of completion of the search	Examiner
THE HAGUE		10 December 1997	Kusardy, R
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 O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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