

12

EUROPEAN PATENT APPLICATION

21 Application number: 87830182.9

51 Int. Cl.4: **H 05 B 3/50**
F 28 F 1/30

22 Date of filing: 14.05.87

30 Priority: 15.05.86 IT 2183186

43 Date of publication of application:
07.01.88 Bulletin 88/01

84 Designated Contracting States:
AT BE CH DE ES FR GB GR LI NL SE

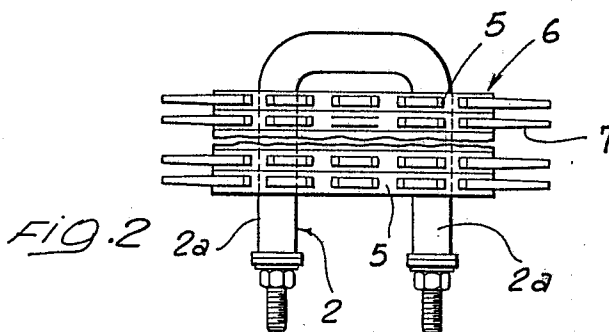
71 Applicant: **Piazzola, Gaetano**
Via Borri, 148
I-21100 Varese (IT)

72 Inventor: **Piazzola, Gaetano**
Via Borri, 148
I-21100 Varese (IT)

74 Representative: **Cicogna, Franco**
Ufficio Internazionale Brevetti Dott. Prof. Franco Cicogna
Via Visconti di Modrone, 14/A
I-20122 Milano (IT)

54 **Assemblable modular element heat exchanger.**

57 There is disclosed an assemblable modular element heat exchanger (1) which comprises a central heating element (2, 3), housed in at least a hollow (4) defined in the central portion (5) of a plurality of modular elements, adjoining one another, from the central portion (5) extending a plurality of fins (7) which are substantially coplanar with the central portion (5).



Description**ASSEMBLABLE MODULAR ELEMENT HEAT EXCHANGER****BACKGROUND OF THE INVENTION**

The present invention relates to an assemblable modular element heat exchanger structure.

As is known, in many industrial fields, are presently used heat exchangers the heating source of which generally consists of an electric resistance, immersed in air, which gives the heat produced thereby to the environment.

In order to improve the thermal exchange, structures have been already designed for application to the electric resistance so as to increase the thermal exchange surface and thereby improving the thermal exchange efficiency.

However, the known heat exchangers have not been found to be satisfactory both because of a rather complex structure and because they are not able of fully exploiting the heat exchanging capability of the used heating element.

Moreover, another drawback of known heat exchangers is that it is necessary to provide several types of structures depending on the heat exchanger size to be used.

SUMMARY OF THE INVENTION

Accordingly the task of the present invention is to overcome the above mentioned drawbacks, by providing such an assemblable modular element heat exchanger which affords the possibility of greatly increasing the thermal exchange surface as well increasing the air turbulence to optimize the heat exchanger efficiency.

Within the above task, it is a main object of the present invention to provide such an assemblable modular element heat exchanger which may be easily and quickly made with the most suitable size for the particular application without any constructional problems.

Another object of the present invention is to provide such a heat exchanger structure the several elements of which may be simply assembled so as to increase the thermal exchange surfaces without the need of remarkable constructional modifications.

Yet another object of the present invention is to provide such an assemblable modular element heat exchanger structure which may be easily made starting from easily commercially available elements and which is advantageous from a mere economic standpoint.

According to one aspect of the present invention, the above mentioned objects, as well as yet other objects, which will become more apparent thereafter, are achieved by an assemblable modular element heat exchanger structure characterized in that it comprises a central heating element housed in at least a hollow defined in the central portion of a plurality of modular elements adjoining one another.

In particular, from the mentioned central portion a plurality of fins extend which are substantially coplanar with said central portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the invention will become more apparent thereafter from the following detailed description of a modular element heat exchanger structure which is illustrated by way of an indicative example in the accompanying drawings, where:

Figure 1 is a cross-sectional view illustrating the subject heat exchanger and specifically showing the configuration of a modular element;

Figure 2 is a top plan view illustrating a possible embodiment of heat exchanger, provided with a U-shaped electric resistance;

Figure 3 is a side elevation view of that same heat exchanger; and

Figure 4 is a elevation view illustrating a heat exchanger provided with a substantially rectilinear electric resistance.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the Figures, the assemblable modular element heat exchanger structure according to the invention, which is generally indicated at the reference number 1, comprises a central heating element, which consists of an electric resistance 2, of substantially U-shape, as is shown in Figures 1 to 3, or which, possibly, may consist of an electric resistance 3 of substantially rectilinear shape and substantially rectangular cross-section.

More specifically, the two branches or legs 2a of the electric resistance 2 are housed in hollows 4 defined in the central portion 5 of a modular element 6 which, advantageously, has a substantially plate-like shape.

The hollows 4 are so designed as to intimately contact the electric resistance 2 so as to provide a very good conduction heat transmission.

The modular elements 6 which, as mentioned, has a substantially plate-like shape, are adjoined to one another so as to define a modular element pack or set, to provide the heat exchanger with the desired size.

The modular elements 6 may be made by molding and are preferably made of aluminium or copper.

The central portion 5, as it has been mentioned, has a substantially plate-like shape and, from its edges, fins 7 extend which have preferably a less thickness than that of the central portion 5, so as to define air gaps, spaced from one another, adapted for increasing the thermal exchange surface.

The fins 7 are substantially coplanar with respect to the plate-like element 5.

The fins 7 are advantageously provided with throughgoing holes 8, formed through an intermediate portion thereof, which holes act to provide respective passages for the thermal exchange air flow.

This airflow is further increased, to provide a turbulence effect, which remarkably improves the

mentioned thermal exchange.

As is shown in Figure 4, the heat exchanger is provided with a central heating element consisting of a rectilinear heating electric resistance 3; in this case the modular element, also indicated at 6, is provided with a single central hollow housing the rectilinear electric resistance, which resistance is provided with end electrical connection portions 10.

From the above disclosure it should be apparent that the invention fully achieves the intended objects.

In particular it should be pointed out that a heat exchanger has been provided which may be easily made by simply locating in an adjoining relationship specifically shaped modular elements which, in addition to remarkably increasing the thermal exchange surface, also act to facilitate the thermal exchange air convection movements as well as air turbulence at the modular elements thereby preventing air from stagnating to thermally insulate the exchange elements.

Another important aspect of the invention is that the heat exchanger may be made with any sizes and shapes starting from standardized modular elements which may be coupled in any desired number thereby providing desired size heat exchangers.

In practicing the invention the used materials, provided that they are compatible to the intended use, as well as the size and specific shapes, may be any according to requirements.

Claims

1. An assemblable modular element heat exchanger, characterized in that it comprises a central heating element housed in at least a hollow defined in the central portion of a plurality of adjoining modular elements, from said central portion a plurality of fins extending which are substantially coplanar to said central portion.

2. An assemblable modular element heat exchanger, according to the preceding claim, characterized in that said modular elements have a substantially plate-like shape.

3. An assemblable modular element heat exchanger, according to the preceding claims, characterized in that said fins are provided with throughgoing holes.

4. An assemblable modular element heat exchanger, according to one or more of the preceding claims, characterized in that said fins have a less thickness than that of said central portion so as to define, between the fins of adjoining modular elements, regions to be traversed by the thermal exchange air flow.

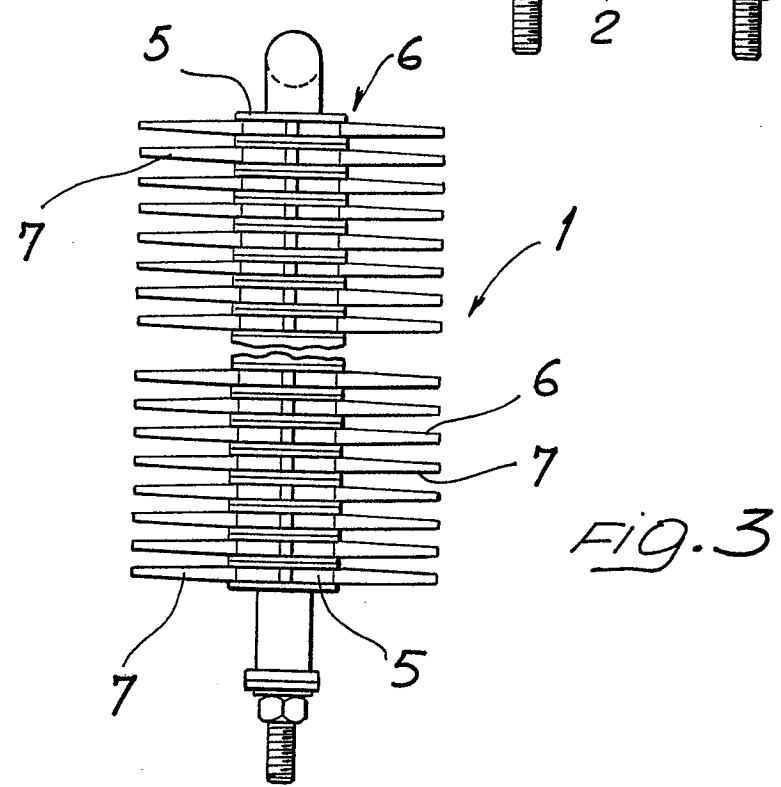
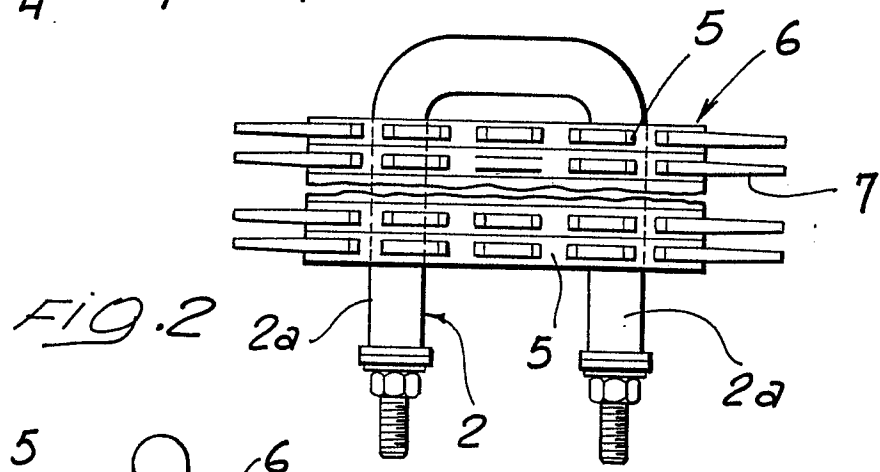
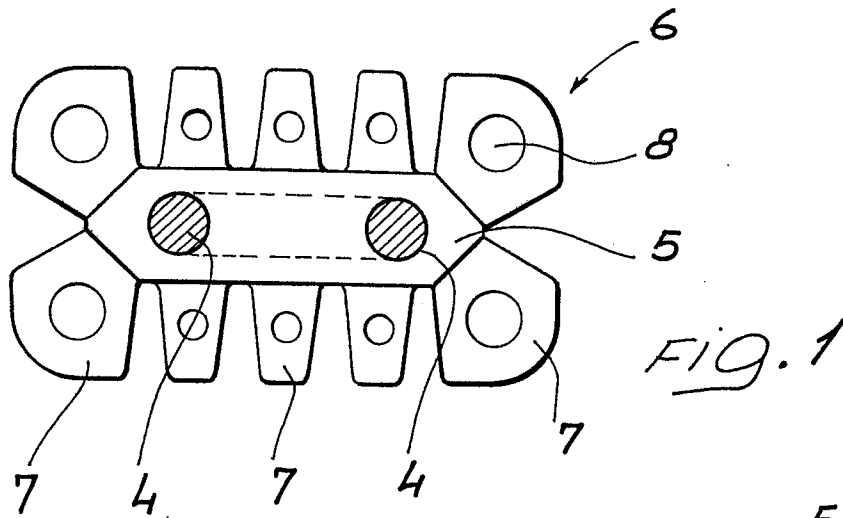
5. An assemblable modular element heat exchanger, according to one or more of the preceding claims, characterized in that the heating element consists of a substantially U-shaped electric resistance the legs of which are housed in two hollows defined in said central portion.

6. An assemblable modular element heat exchanger, according to one or more of the preceding claims, characterized in that the central heating element consists of a rectilinear electric resistance housed in a single hollow defined in the central portion.

7. An assemblable modular element heat exchanger, according to one or more of the preceding claims, characterized in that said hollow has a shape mating with the cross-section of the heating element contained therein, in order to intimately contact the central heating element surface.

8. An assemblable modular element heat exchanger, according to one or more of the preceding claims, and as substantially disclosed and illustrated for the intended objects.

5
10
15
20
25
30
35
40
45
50
55
60
65



0252019

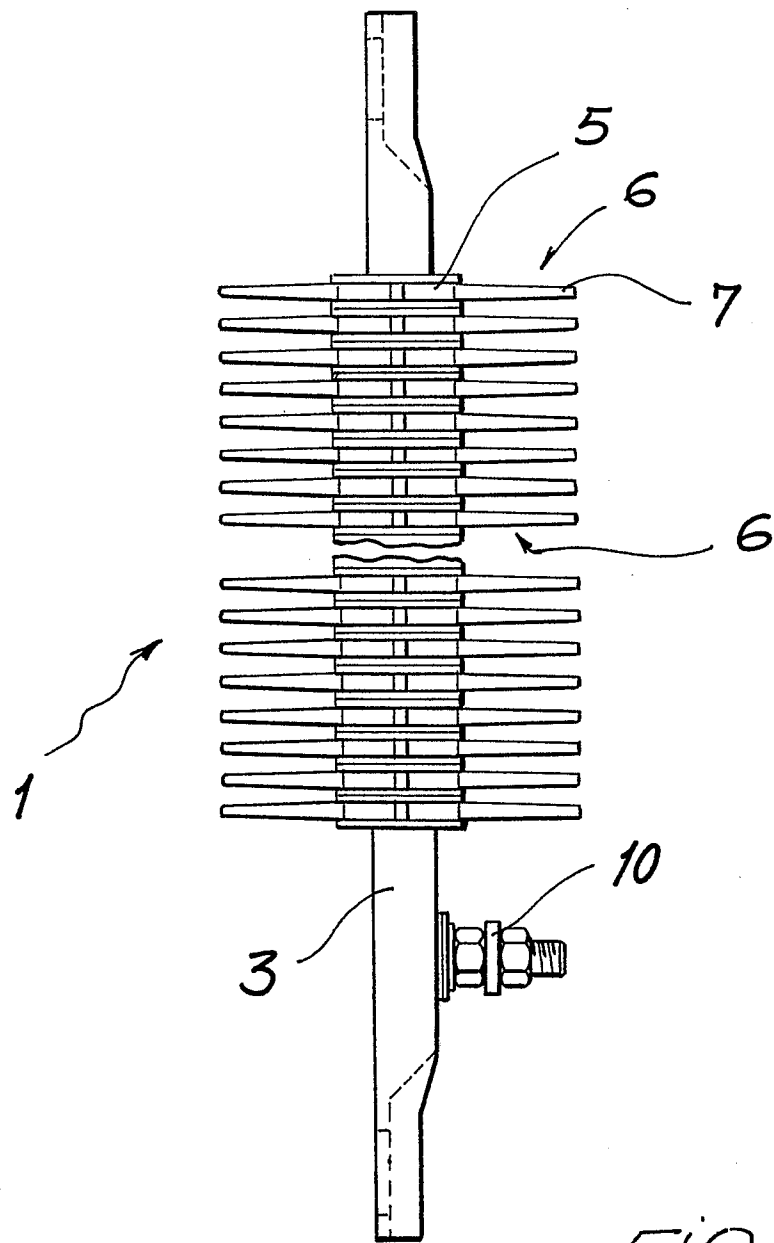


FIG. 4



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.4)
X	US-A-2 216 778 (HOUDRY) * Page 1, column 1, lines 9-20,36-53; figures 1-3 *	1,2,4,7,8	H 05 B 3/50 F 28 F 1/30
X	US-A-2 537 984 (FRISCH) * Column 2, lines 29-55; figures 3,4 *	1,2,4,7,8	
Y		3,5,6	
Y	CH-A- 414 705 (BROWN, BOVERI & CO.) * Page 1, lines 61-69; figure 4 *	3	
Y	FR-A-2 348 617 (FINIMETAL S.A.R.L.) * Claim 1; figures 1,2 *	5	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 05 B F 28 F
Y	US-A-2 051 930 (YOUNG et al.) * Figures 2,3,4 *	6	
A	US-A-3 550 680 (ORBIT MANUFACTURING) * Abstract; figures 7-9 *	1,2,5-8	
--- -/-			
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23-09-1987	Examiner HOERNELL, L.H.

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



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.4)
A	DE-A-2 643 817 (FRITZ EICHENAUER) * Claim 1; figure 6 *	5-8	
A	FR-A- 958 125 (POOLE) * Figure 1 *	1-3	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
Place of search THE HAGUE		Date of completion of the search 23-09-1987	Examiner HOERNELL, L.H.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p> <p>& : member of the same patent family, corresponding document</p>			