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Schluter et al.

[11] **3,891,030**

[45] **June 24, 1975**

[54] **CYLINDRICAL HEATING-SURFACE SUPPORT STRUCTURE FOR REGENERATIVE AIR PREHEATERS**

[75] Inventors: **Siegfried Hans-Dietmar Schluter,** Wenden-Biggetal; **Erich Kraft,** Huttseifen, both of Germany

[73] Assignee: **Apparatebau Rothemuhle Brandt & Kritzler,** Rothemuhle, Germany

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[21] Appl. No.: **263,553**

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**....................................... **165/10;** 165/8

[51] **Int. Cl.**........................ **F28d 17/00;** F28d 19/04

[58] **Field of Search**.................................. 165/8, 10

[56] **References Cited**

UNITED STATES PATENTS

3,267,562	8/1966	Chiang et al.	165/8 X
3,361,193	1/1968	Kritzler	165/10
3,391,727	7/1968	Tapouzian	165/10
3,702,156	11/1972	Rohrs et al.	165/10

FOREIGN PATENTS OR APPLICATIONS

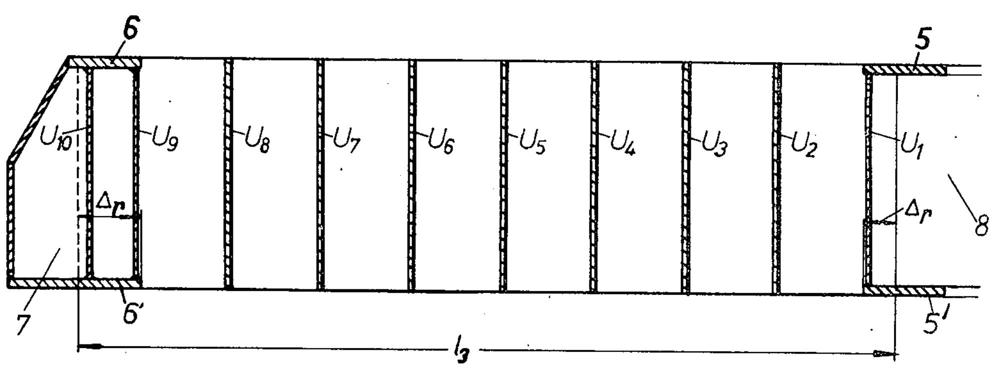
1,060,539	7/1959	Germany	165/8
1,209,319	3/1960	France	165/10

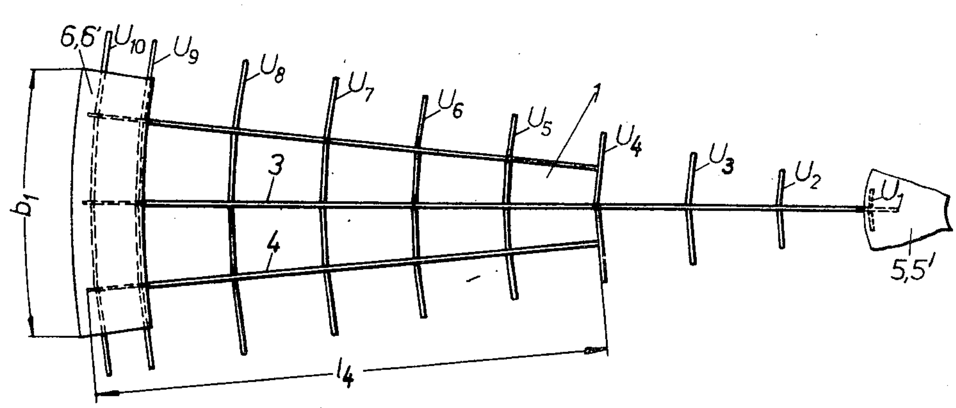
Primary Examiner—Albert W. Davis, Jr.
Assistant Examiner—S. J. Richter
Attorney, Agent, or Firm—Elliot A. Lackenbach

[57] **ABSTRACT**

An advantageous form of support structure for the heat storage mass of a rotary regenerative air preheater for at least partial prefabrication has two sorts of sector elements each secured at its radially inner and radially outer ends by welding between upper and lower parallel plates of a core and of an annular support structure. The radial extent of this weld is a fraction of the axial height of the structure. A first sort of element has only one full-length radial wall and chordal plates extend to its radial boundaries; the second sort has three full-length radial walls which form the radial boundaries of the elements.

5 Claims, 5 Drawing Figures





PATENTED JUN 24 1975 3,891,030

SHEET 1

Fig.1

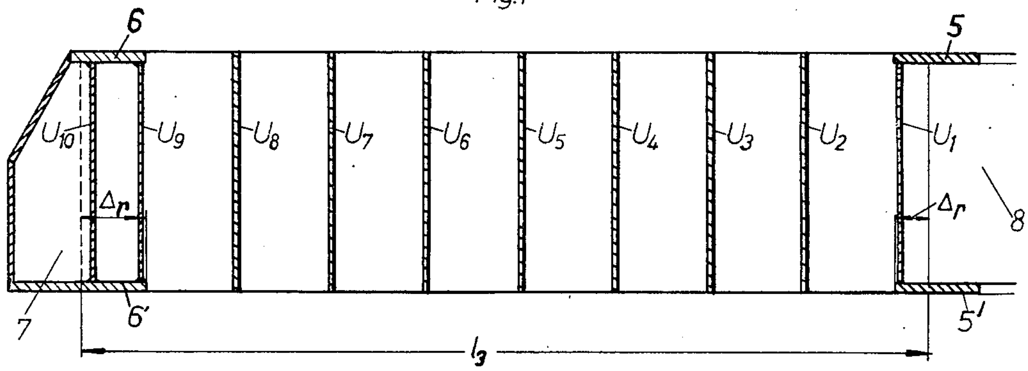


Fig.2

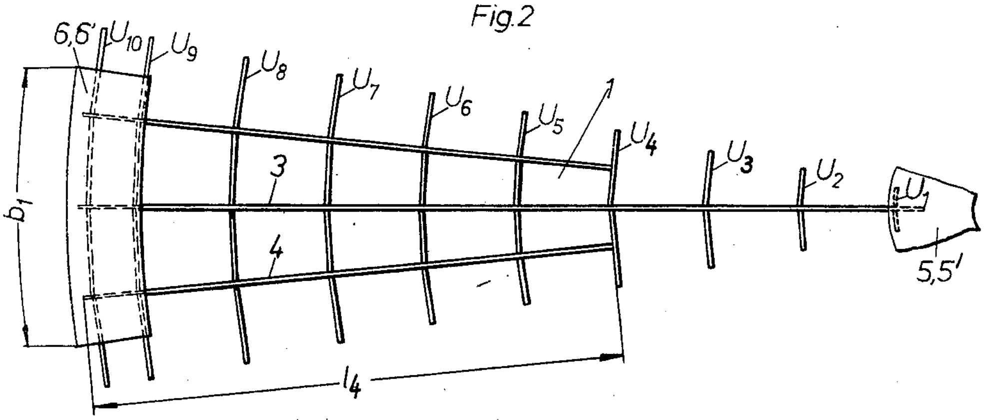


Fig.3

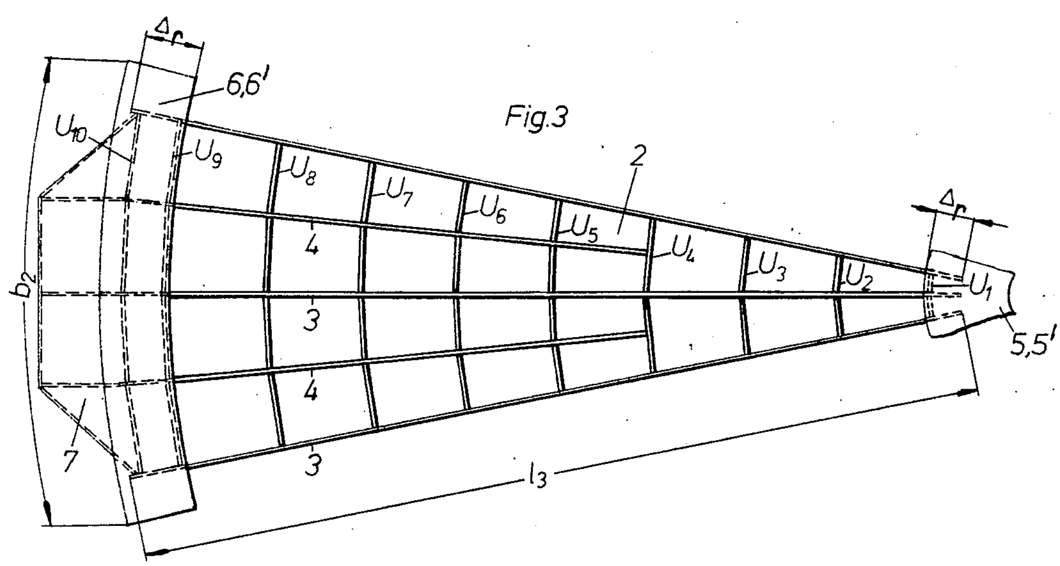


Fig. 4.

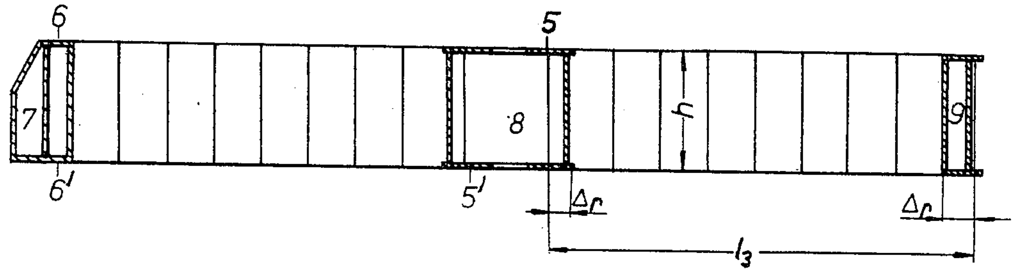
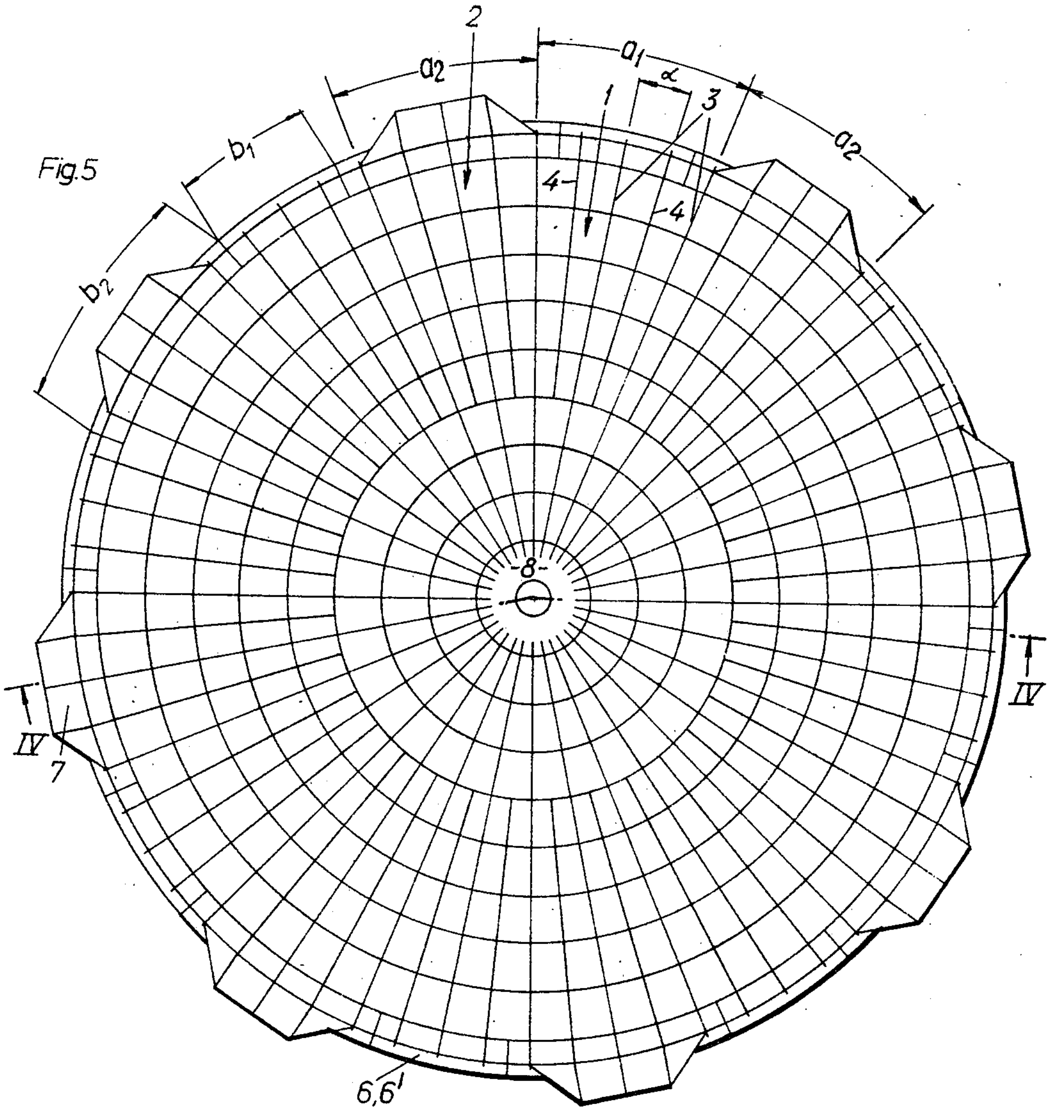

6
5
7
8
h
9
6'
5'
Δr
Δr
l_3

Fig. 5


2
a_2
a_1
α
3
a_2
b_1
4
1
4
b_2
8
IV
IV
7
6,6'

CYLINDRICAL HEATING-SURFACE SUPPORT STRUCTURE FOR REGENERATIVE AIR PREHEATERS

FIELD OF THE INVENTION

The invention relates to a cylindrical heating-surface support structure for regenerative air preheaters which is fabricated in parts and completely assembled only on the building site.

BACKGROUND OF THE INVENTION

Such sub-division of the cylindrical heating-surface support structure is absolutely necessary for transport and installation of large preheaters and also for simpler production, since diameters of the large preheaters used today already exceed 15 metres.

It is known to sub-divide such a heating-surface support structure into a number of independent individual sectors which are assembled only on the building site to the complete cylindrical support structure. By way of example, reference is made to the construction of the rotating heating surface support in German Pat. No. 1,060,539, which has a rotating regenerative mass but the construction of which can be used in a similar version for stationary cylindrical heating-surface support structures.

Meanwhile regenerative air preheaters with diameters of 20 metres have already been planned for larger power station units, and the weight of individual sectors of the heating-surface support structure is becoming so high that, in order to facilitate transport and installation, eventually also the assembly and the production of these sectors from radial walls and connecting metal sheets will have largely to take place on the building site.

Separate prefabrication of the individual sectors offers even for the dimensions of such heating-surface support structures which exist at present the advantages of easier transport and simpler installation. However, it has the disadvantage that double sector walls are arranged between the sectors; consequently, it requires a higher expenditure of material and higher production costs, since these individual sectors produced from separate units must be completely machined for exact assembly.

The greatest disadvantage of this version of welded heating-surface support structure, however, is that, with the prospect of ever increasing diameters of the regenerative air preheaters, the present type of welded connections between the radial sector walls and the parts of the supporting cylindrical peripheral walls will no longer be able to withstand the increasing stresses and deforming forces.

A particular disadvantage of this present type is the use of axially parallel welded connections the outer ends of which are subjected to high peak stresses in tension, compression or shear; with increasing diameters of the support structures and increasing deforming forces, this may lead to a breaking of the welded seams.

SUMMARY OF THE INVENTION

The present invention is therefore based on the task of increasing the stability of the structure with the lowest possible material and production costs, chiefly by a more advantageous arrangement and design of the supporting parts and their welded connections.

According to the invention, the supporting structure consists of cellular sector elements which consist of radial walls equally angularly displaced from each other of at least one connecting sheet in the direction of a chord to a circle centred on the centre of the structure, the radial walls being inserted and welded between at least one of central core plates and segments of coaxial outer ring flanges perpendicular to the axis of the regenerator, within a radial length which amounts approximately to 0.15 to 0.3 times the axial height of the regenerative chamber.

The heating-surface support structure may consist of equal or different numbers of two different sorts of prefabricated sector elements which are arranged alternatively.

DESCRIPTION OF THE DRAWINGS AND OF A PREFERRED EMBODIMENT

An embodiment of the invention is diagrammatically illustrated in the accompanying drawings, wherein:

FIG. 1 shows an elevation of a sector element,

FIGS. 2 and 3 show horizontal plans of different sorts of assembled sector elements,

FIG. 4 shows a sectional elevation of the whole heating-surface support structure on a smaller scale, and on the section line IV—IV, FIG. 5, and

FIG. 5 shows the corresponding plan view on the line V—V, FIG. 4.

In the illustrated example the cylindrical heating-surface support structure for a rotary regenerative air preheater is sub-divided into sixteen cellular sector elements of two different sorts, **1** and **2** respectively, which follow each other alternatingly around the circle, each sector element **2** being provided with a support claw **7.**

It can clearly be seen from FIGS. **2** and **3** that each sector element **1** has the basic form of the sector element **2** and has a central radial wall **3** of radial length l_3 and extending from inner core plates **5, 5'** of a hub body **8** to outer ring flanges **6, 6'** of an annular support body **9**; the core plates and ring flanges both lie in planes perpendicular to the axis of the cylindrical body, and are respectively coplanar. Shorter sector walls **4** of a length l_4 are arranged symmetrically at equal angular distances from the radial sector wall **3.** The element **2** also has four of the connecting sheets U_5 to U_{10} arranged between the radial walls **4** and **3** parallel to the regenerator axis and as a chord to circles centred on the axis of the cylindrical body and extend over the sector angle α; as well as two of the connecting sheets U_1 and U_4 which extend over the angular distance 2α.

The second sort of element, shown by element **2,** has three radial walls **3** two of which lie at the sector boundaries of the element, and the centre one of which has a slightly greater radial length to extend into the support claw **7.** As shown in FIG. **5,** elements **2** subtend an angle $\alpha 2$ while elements **1** subtend an angle $\alpha 1$ at the centre of the cylindrical body.

The flange rings **6, 6'** are made up of segments of arcuate length b_1 and b_2, according to whether they are to form part of elements **1** or elements **2.** As is best seen from FIGS. **2** and **3,** and from FIG. **5,** the ends of the sectors do not correspond with the radii lying at the edges of the sector elements **1,2.**

The connecting sheets need not all be arranged at equal radial distance from each other — sheets U_9 and U_{10} for example, are set closer together than sheets U_1

. . . U_9 and form a double shelled outer annular support structure together with the flanges **6,6'**.

On assembly the radial walls **3, 4** of the sector elements **1, 2** are inserted and welded between the plate and ring surfaces **5, 5'** or **6, 6'** within a radial length Δ_r amounting approximately to 0.15 – 0.3 times the height h of the regenerative chamber formed by the assembly. Heat-storage elements are inserted within the trapezoidal sectors formed by the radial walls and the connecting sheets and supported therein.

The most important advantage achieved with the aid of this construction for the stability of the welded structure results from the higher load capacity of the welded connections, which absorb all main stresses and deformation forces, between the radial sector walls **3, 4** and the inner and outer annular supporting bodies **8, 9** which extend in radial direction and absorb only stresses in shear, their length being made sufficient to prevent the occurrence of excessive stresses.

Another advantage is the substantial saving of material and of processing costs, particularly in view of the present method of carrying out the connection between the radial walls and an inner cylindrical core part of the heating-surface support. This dimensionally stable cylindrical core part had previously to be precisely machined on all sides and this resulted in very high additional production costs.

It is also advantageous that a structural element which is resistant to bending and torsion is created by providing a double shell at the radially outer side with frontal limiting flanges, and radial walls arranged between the latter. By this way of clamping and supporting the radial walls (which occurs also similarly between the central core plates) of the heating surface support, it is achieved that under the load of static weight, the radial walls are not deformed like a freely resting support but like a support which is firmly clamped on both sides.

We claim:

1. Regenerative heat exchange support structure for supporting a plurality of heat exchange element packs in a generally cylindrical cellular arrangement comprising, in combination, a pair of core plates extending in respective planes perpendicular to the axis of the cylindrical structure, a pair of annular ring flanges extending in the same respective planes, the core plates being at a radially inner peripheral region of the structure and the ring flanges at a radially outer peripheral region of the structure, a plurality of pairs of prefabricated sector units, each of said units comprising a full length radial supporting wall extending from radially within an outer periphery of the core plates to radially beyond an inner periphery of the ring flanges and a plurality of chordal connecting sheets carried on the wall, one unit of each of said pairs comprising only one full length radial wall, the plurality of chordal connecting sheets attached thereto defining laterally open-ended volumes and the other unit of each of said pairs comprising an additional full length radial wall extending along each sector edge defining a dividing wall between the units of said pair of units and closing the said lateral open ends of said volumes, the said full length walls being welded between the core plates at their inner ends and the ring flanges at their outer ends, by welds extending radially of the axis.

2. Heat exchange support structure defined in claim **1** wherein the annular ring flanges extend peripherally around said units at each of the top and bottom surfaces thereof and each of said flanges comprises a plurality of sector pairs, one sector of each pair being associated with one of said sector units, the flange sector associated with the sector unit lacking sector edge radial walls terminating angularly inwardly of the sector edge and the flange sector associated with the sector unit having a full length radial edge walls extending therepast and overlapping the juncture between said sector edge full length walls and said chordal connecting sheet.

3. Heat exchange support structure defined in claim **2** comprising unitary core plates of one-piece construction overlapping and joining all of said units generally axially thereof.

4. A regenerative preheater support structure according to claim **3** wherein the radial extent of the said radially extending welds on the inner and outer ends of said full length radial supporting walls amounts to approximately 0.15 to 0.3 times the axial height of the support structure.

5. Cylindrical supporting structure for supporting heat storage masses of rotary regenerative air preheaters, the structure being completely assembled only on site from two types of prefabricated elements, the structure comprising, in combination cellular sector cells comprising radial walls extending in respective planes including the axis of the cylindrical structure and arranged at equal angular distances from each other and connecting sheets secured to at least one of said radial walls and arranged as chords to circles centered on the axis of the cylinder, the radial walls being inserted between and welded to upper and lower central core plates extending in planes perpendicular to the regenerator axis and to segments of upper and lower co-axial outer ring flanges extending in planes perpendicular to the axis of the cylinder along welds extending radially of the axis of the cylinder, said welds between said walls and said flanges and core plates, respectively, extending along a radial length amounting to approximately 0.15 to 0.3 times the axial height of the support structure.

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