June 10, 1930. E. SÖHR ET AL 1,762,426

HEAT EXCHANGER

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Fig. 1.

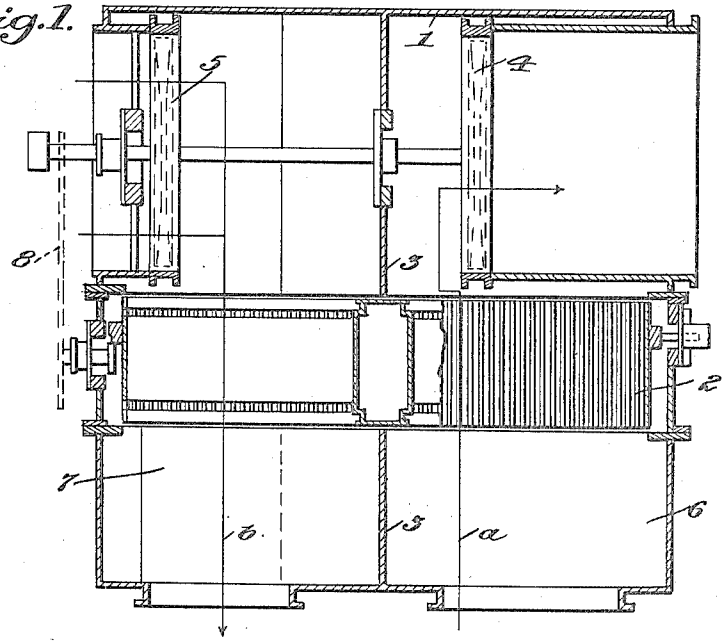
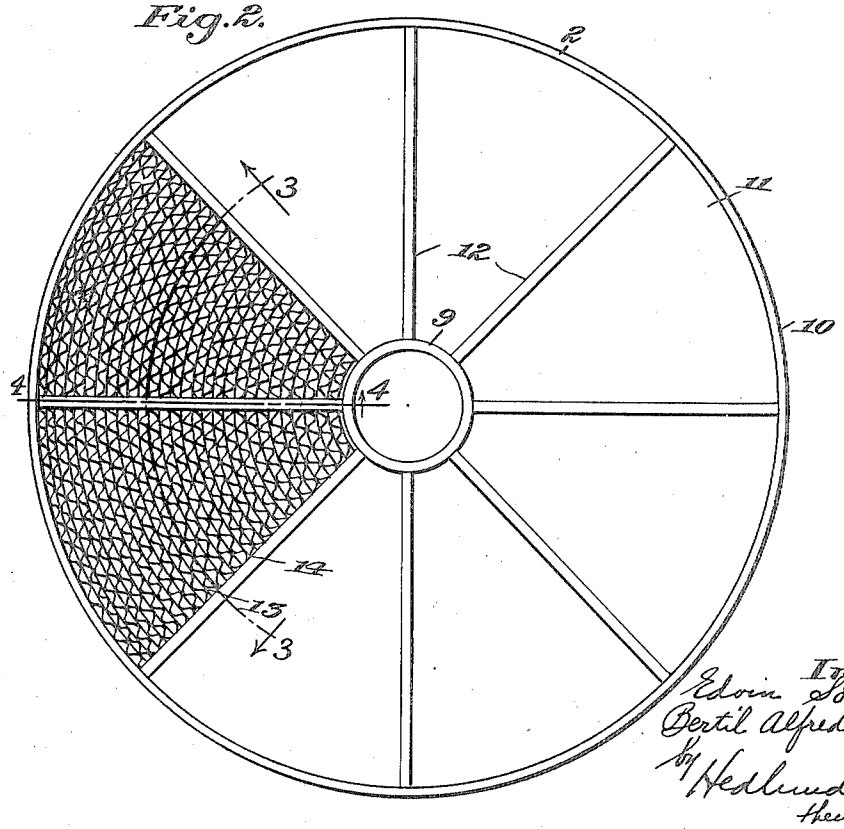


Fig. 2.



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Fig. 3.

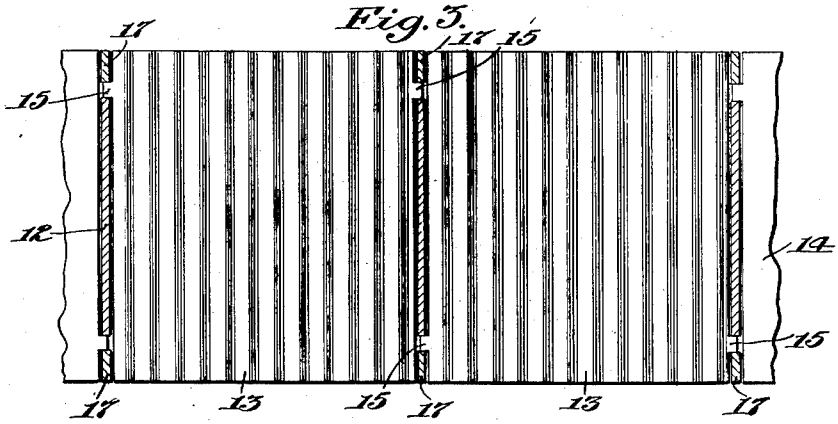


Fig. 4.

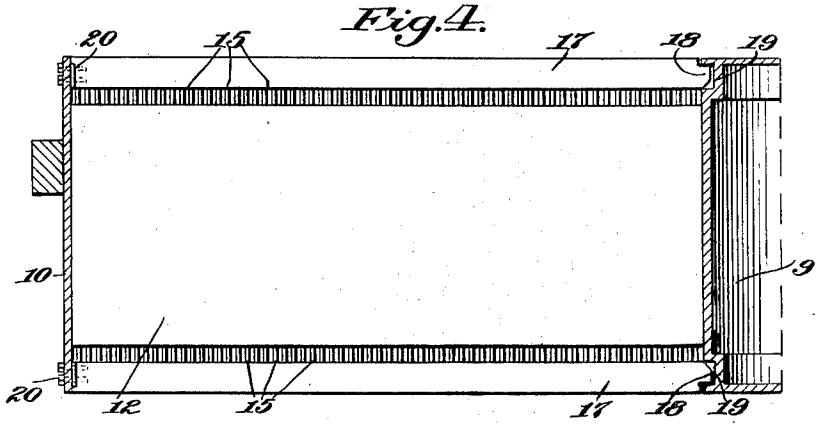
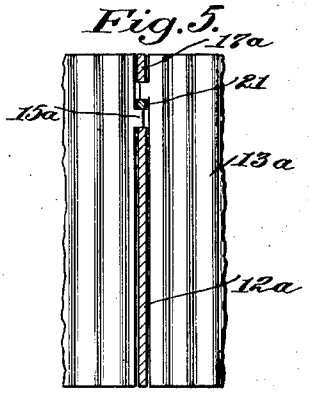


Fig. 5.



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Fig. 6.

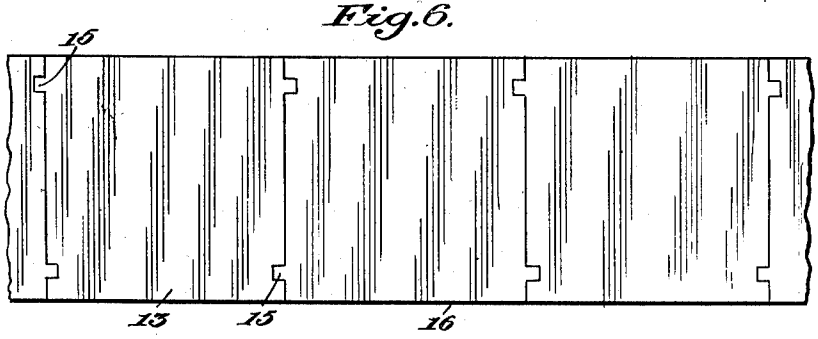


Fig. 7.

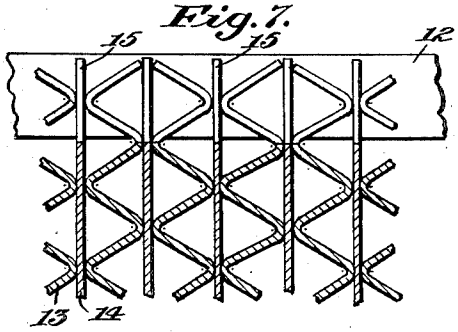
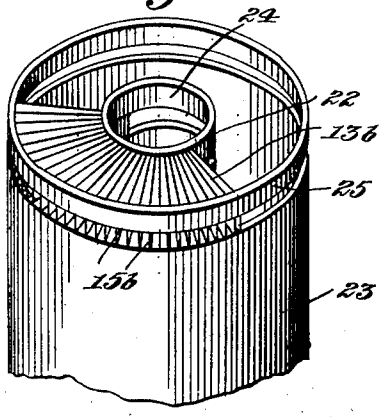


Fig. 8.



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1,762,426

UNITED STATES PATENT OFFICE

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HEAT EXCHANGER

Application filed February 4, 1927, Serial No. 165,884, and in Sweden January 20, 1926.

The present invention relates to regenerative pre-heaters and more particularly to pre-heaters of the rotary type. In pre-heaters of this type there is usually provided a rotary heat exchange element including a plurality of heat exchange plates.

One of the objects of this invention is the assembly of the heat exchange plates in such manner so as to improve the operation of the pre-heater, eliminating obstructions to the flow of gases.

Another object of the invention is the provision of improved means for fastening the plates to the supporting frame of the heat exchange element.

Another object of the invention is the provision of a heat exchange element that may be readily dismantled for inspection or repair.

A further object of the invention is to simplify the construction of the heat exchange plates and to eliminate waste of material in their manufacture.

With these and other objects in view, as will hereinafter appear, the invention consists in certain novel features of construction hereinafter shown and described and pointed out in the claims.

For a complete understanding of the invention reference is to be had to the following description and to the accompanying drawings forming a part of this specification.

In the drawings:

Figure 1 is a longitudinal sectional view of a regenerative pre-heater of the Ljungstrom type;

Figure 2 is a plan view of the rotary heat exchange element showing the division of this element into sectors, only two of the sectors being shown with the heat exchange or regenerative material therein;

Figure 3 is a sectional view on the line 3—3 of Figure 2;

Figure 4 is a sectional view on the line 4—4 of Figure 2;

Figure 5 is a view similar to Figure 3, showing a modification of our invention;

Figure 6 is a plan view illustrating one method for manufacture of the heat exchange plates;

Figure 7 is an enlarged sectional plan view of a portion of the heat exchange element showing the engagement of the heat exchange plates with the sector plates; and

Figure 8 is a perspective view showing the arrangement of the heat exchange plates between cylindrical walls, the plates being radially disposed.

Referring to the drawings in detail and more particularly to Figure 1, the regenerative preheater is designated by the reference character 1. This pre-heater is of the Ljungstrom type and comprises a casing in which the heat exchange element in the form of a rotor 2 operates. The casing is divided into two sections by the vertical partitions 3 to form separate air and gas passage-ways. A fan 4 induces the flow of heating medium through the passage-way 6 as shown by the directional line *a*. A fan 5 induces the flow of air through the passageway 7 as shown by the directional line *b*. A driving mechanism 8 of any well-known type actuates the fans 4 and 5 and also operates the rotor 2.

The rotor 2 comprises a hub portion 9 and a rim portion 10 and is divided into sectors 11 by radially extending sector plates or partition walls 12. Heat exchange plates 13 and 14 in substantial contiguous relation extend between successive partition walls or sector plates 12, as shown more clearly in Figures 2 and 7. The rotor 2 is actuated by the driving mechanism 8 to successively present sectors 11 in the passage-ways 6 and 7 so that the heat exchange material is alternately subjected to the heating action of the heating medium flowing through the passageway 6 and to the cooling action of the air to be preheated, thereby absorbing and releasing heat alternately.

The regenerative material comprises heat exchange plates which are alternately corrugated, as plates 13, and flat, as plates 14. Each of these plates is provided with end projections 15 preferably formed integral therewith. As shown in Fig. 6, the plates are blanked out from a length of material with the end projections cut from each section so as to result in the maximum use of material of the strip.

Referring to Figs. 3 and 4 of the drawings, the assembly of the plates will be understood. The plates 13 and 14 extend between partition walls 12, the projections 15 engaging the edges of these walls 12. The walls 12 are narrower than the hub 9 and rim 10 of the rotor 2 and are positioned mediately of the sides of the rotor so that with the plates engaging the edges of the walls 12, said plates do not extend beyond the rotor sides. Bars 17 engage the projections 15 and secure the heat exchange plates removably in position. These bars extend from the rim 10 to the hub 9 of the rotor 2 and are preferably in alignment with the partition walls or sector plates 12, as shown more clearly in Fig. 3. Bars 17 have reduced end extensions 18 which are received in the annular groove 19 of the hub 9. Suitable fastening means such as bolts 20 secure the bars 17 to the rim 10, as shown more clearly in Fig. 4. In this construction, the plates of one sector are inserted from one side of the rotor and the plates of an adjacent sector are inserted from the opposite sides of the rotor.

Fig. 5 shows a modified construction and assembly of heat exchange plates. In this construction, partition walls or sector plates 12^a are preferably flush with one side of the rotor but are of less height than the rotor so that the upper edges are spaced from the other side of the rotor. All the plates are inserted from one side of the rotor as shown in the figure. The projection 15^a of the plates of one sector contact with the upper edges of plates 12^a, and are secured in position by a bar 21; projections 15^a of the plates in an adjacent sector engage the bar 21 and are held in place by a bar 17^a, removably secured to the rim 10 and the hub 9 in a manner similar to the securing of bar 17 in Fig. 4. In this construction, the plates have an extension similar to the extension at the end of bars 17, for engaging the lower groove 19 of hub 9, bolts 20 securing the plates to the rim 10.

Fig. 8 shows a further modification. In this construction, the supporting frame comprises the inner cylinder 22 and the outer cylinder 23. Heat exchange plates 13^b are radially disposed between the cylinders 22 and 23 and are provided with projections 15^b which engage the edges of these cylinders. Cylindrical bands 24 and 25 secure the heat exchange plates 13^b in position on the supporting frame. The cylinders are connected together in any well-known way to provide a rigid structure.

Although the end projections of the corrugated plates are also corrugated, Fig. 7 clearly discloses that there is no resultant leakage, the corrugated and flat plates cooperating together to form a plurality of separate unobstructed channels of small cross section, thus resulting in high efficiency of heat transfer. The preferred method of manufacture is to blank out the plates as shown in Fig. 6, thus eliminating waste, the corrugated plates having their corrugations formed either before or after, or simultaneously with the blanking out, as desired.

In view of the above description the advantages of the present construction will be apparent. The provision of end projections on the heat exchange plates and the retaining bars for holding the projections in engagement with the partition walls or sector plates or similar parts of the supporting frame of the heat exchange permits convenient assembly of the heat exchange element and ready dismantling thereof for inspection or repair. An important feature of the construction is the provision of the retaining bars or similar means and the alignment thereof with the partition walls or sector plates, thus permitting unhindered passage of gases between the heat exchange plates, and increasing the number of available heat exchange elements.

Having thus described the invention, what is claimed is:

1. In a heat exchange apparatus, a supporting frame, heat exchange plates having end projections, and detachable means cooperating with said end projections for removably securing said plates in said supporting frame.

2. In a heat exchange apparatus, a supporting frame comprising a plurality of partition walls, heat exchange plates mounted between and having end projections engaging said walls, and detachable means maintaining said projections in engagement with said walls to removably hold said plates within said supporting frame.

3. In a heat exchange apparatus, a plurality of heat exchange plates, supporting walls for said plates, said plates having projections engaging the edges of said walls, and detachable means in alignment with said walls and engaging said plate projections for removably securing said plates in position.

4. In a heat exchange apparatus, a supporting frame comprising a plurality of partition walls, heat exchange plates mounted between and having end projections engaging said walls, and detachable bars maintaining said projections in engagement with said walls to removably hold said plates within said supporting frame.

5. In heat exchange apparatus, a supporting frame comprising a plurality of partition walls, heat exchange plates, means associated with said plates to position said plates between adjacent partition walls, and detachable means cooperating with said first named means to removably secure said plates in position.

6. In a regenerative heat exchanger of the rotating rotor type, said rotor constituting a supporting frame, a plurality of partition walls in said rotor, heat exchange plates,

means positioning said plates between said partition walls, and means releasably locking said plates in position.

7. In a regenerative heat exchanger, a member constituting a supporting frame, a plurality of partition walls in said member, heat exchange plates, means positioning said plates between said partition walls, and means releasably locking said plates in position.

In testimony whereof we affix our signatures.

EDVIN SÖHR.

BERTIL ALFRED LJUNGSTRÖM.