

May 25, 1937.

C. F. ROSENBLAD

2,081,678

HEAT EXCHANGER

Filed March 4, 1936

2 Sheets-Sheet 1

Fig. 1

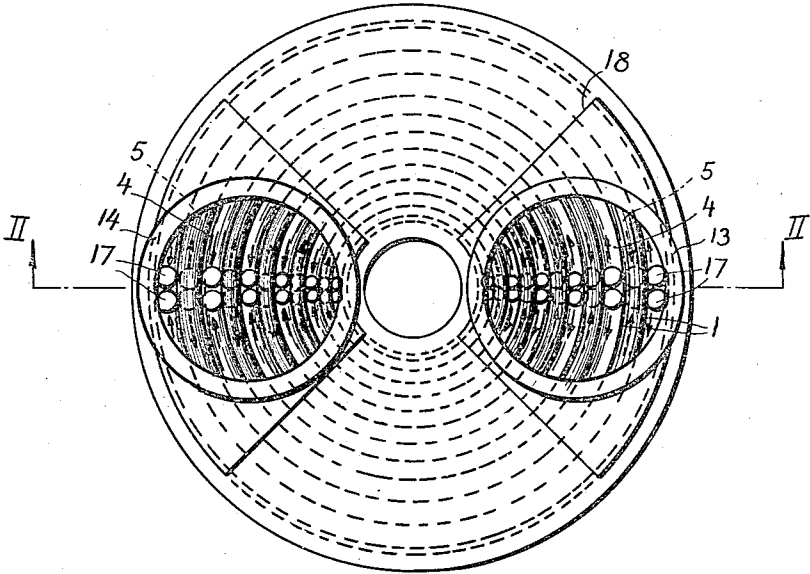


Fig. 2

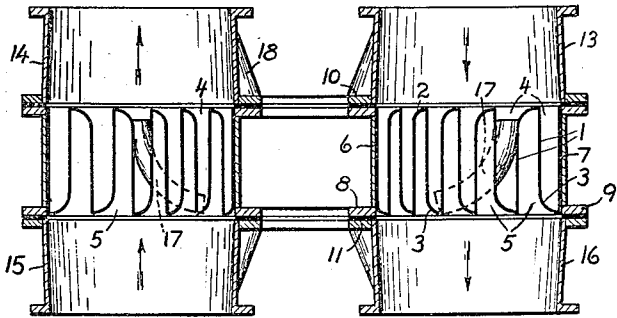
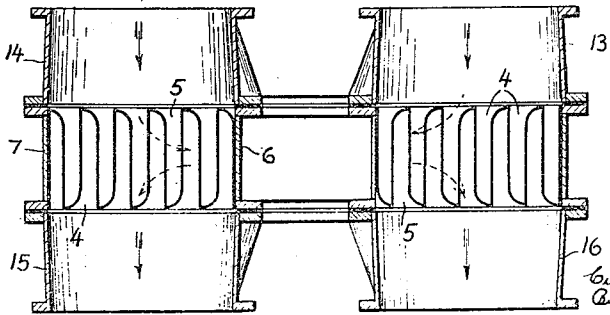


Fig. 3



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Fig. 4

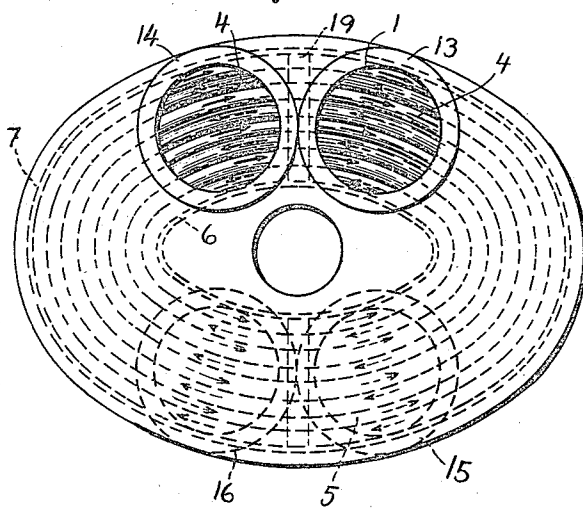


Fig. 5

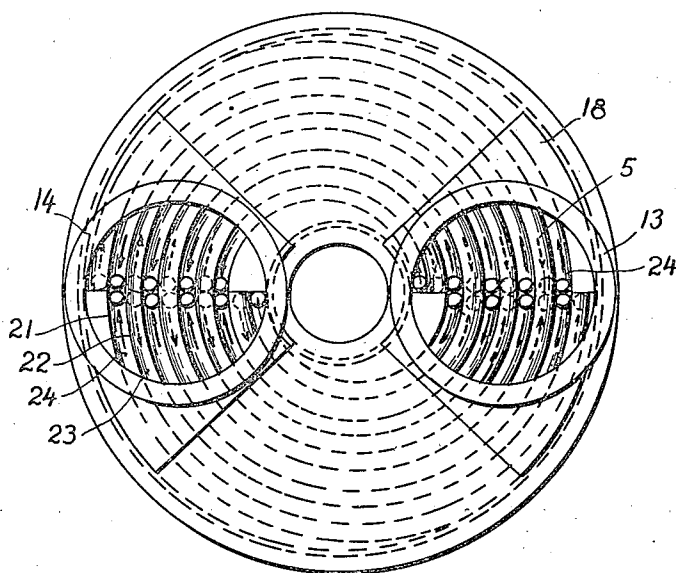
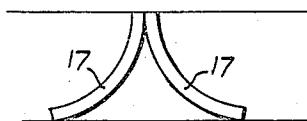


Fig. 6



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UNITED STATES PATENT OFFICE

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HEAT EXCHANGER

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In Sweden March 4, 1935

9 Claims. (Cl. 257—245)

This invention relates to heat exchangers of the regenerative type for indirect heat exchange between two fluids and especially for heat exchange between noncondensable gases. In such cases the volumes of the gases are generally very large and, therefore, the channels for the gases have to be relatively short, and these circumstances have until now made it difficult to construct a compact apparatus suitable for the purpose.

The main object of my invention is to provide an apparatus having a superior efficiency of heat transmission and yet being of smaller dimensions than any type of such apparatus heretofore used.

Another object of the invention is to provide a successive narrowing of the channels for the fluids towards the centre of the apparatus in order to effect the highest possible heat transmission efficiency, even though the diameter of the central part be small.

Some embodiments of my invention are shown in the annexed drawings.

Fig. 1 is a plan view of one embodiment of the apparatus;

Fig. 2 is a sectional view taken on the line II—II of Fig. 1;

Fig. 3 is a similar sectional view showing a modified embodiment of the apparatus;

Figs. 4 and 5 are plan views of other modified embodiments of the apparatus; and

Fig. 6 is a detail view.

According to Fig. 1 the heat transmitting surface is formed by a series of concentric circular cylinders 1, made of sheet metal. The cylinders are flanged at 2 and 3 alternately at opposite ends and the flanges are connected, for instance by welding or soldering, to the corresponding edges of adjacent cylinders. In this way there are formed two series of channels of which the channel series 4 is open at its upper end and closed at its bottom end and separated from the channel series 5 which is open at its bottom end and closed at its upper end. In its centre and around its periphery the apparatus is provided with an inner mantle 6 and an outer mantle 7, and these mantles are provided with flanges 8 and 9 for securing covers 10 and 11 to the upper and bottom ends of the apparatus. On said covers there are arranged pipe connections 13, 14, 15 and 16, for instance, as shown, two by two diametrically opposite to one another, and forming inlets and outlets for fluids. In order to decrease the loss of pressure of the fluids at the inlets and outlets the channels are at the same preferably

provided with guiding bars 17 (Fig. 6) of round or flat bar iron.

The function of the apparatus is as follows:

Hot gas enters through the inlet connection 13 of the upper cover and is in the channels 4 distributed in opposite directions, flowing through said channels and escaping through the opposite outlet connection 14. Simultaneously, the gas to be heated enters through the connection 15 of the bottom cover and is in the channels 5 distributed in opposite directions, flowing through the same and escaping through the opposite outlet connection 16. In order to provide a uniform flow of the gas, the connections 13, 14, 15 and 16 are suitably fastened to the covers by means of sector shaped connecting parts 18. As the distance to be covered by the gas is much longer in the outer channels than in the inner ones the space between the plates is conveniently successively increased from the centre towards the periphery of the apparatus. By this arrangement such apparatus can be built with a rather small inner diameter and consequently less spacious, nevertheless having the best efficiency possible.

In the apparatus now described, the distance to be covered by the gas is half the circumference of the apparatus. However, it is possible to make said distance almost equal to the entire circumference by arranging the corresponding inlet and outlet connections adjacent to one another and providing necessary vertical partitions 19 in the channels. Such arrangement is illustrated in Fig. 4, according to which the cylinders 1 are by way of example oval.

Instead of concentric cylinder plates there can also be used two or more spirally wound plates, forming two or more parallel spiral channels, of which juxtaposed channels are closed, e. g. by welding, at different face ends, i. e. one of said juxtaposed channels is closed at the face end at which the other one is open.

Such an apparatus is illustrated in Fig. 5. The sheet metals 21 and 22 are bent spirally to form parallel spiral channels 23 and 24 for gases exchanging heat.

Possibly, as shown in Fig. 3, one half of every channel system can be closed at the upper end and the other half at the bottom end, in which case the connections 13 and 14 may, for instance, serve as inlets and the connections 15 and 16 as outlets for the gases. Thus the gas entering at 13 will be discharged at 15 and the gas entering at 14 will be discharged at 16. Possibly, however, the connections 13 and 16 may serve as inlets and the connections 14 and 15 as outlets.

Moreover, the plates may be formed in any desired manner within the scope of the invention, as heretofore set forth, provided they are arranged edgewise and mainly parallel and that their edges are alternately connected to one another.

I claim:

1. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel systems being connected each to one of said inlet connections and one of said outlet connections.

2. In an apparatus for exchanging heat between fluids, a series of sheet metal cylinders one arranged within another, covers on the edges of said cylinders, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel system being connected each to one of said inlet connections and one of said outlet connections.

3. In an apparatus for exchanging heat between fluids, a series of oval sheet metal cylinders, one arranged within another, covers on the edges of said cylinders, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel systems being connected each to one of said inlet connections and one of said outlet connections.

4. In an apparatus for exchanging heat between fluids, a series of spirally shaped heat transmitting plates arranged edgewise and extending alongside one another, covers on the spiral edges of said plates, inlet connections and outlet connections on said covers, said spiral edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel systems being connected each to one of said inlet connections and one of said outlet connections.

5. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end,

said channel systems being connected each to one of said inlet connections and one of said outlet connections, the outlet connection and the inlet connection of a channel system being disposed on opposite sides of the centre of one cover.

6. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel systems being connected each to one of said inlet connections and one of said outlet connections, the outlet connection and inlet connection of a channel system being arranged on one cover adjacent to one another.

7. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end and comprises a plurality of channels, said channel systems being connected each to one of said inlet connections and one of said outlet connections, the width of said channels increasing towards the periphery of the apparatus.

8. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face end, said channel systems being connected each to one of said inlet connections and one of said outlet connections, said edges being bent towards one another to alternately close opposite ends of said channel systems.

9. In an apparatus for exchanging heat between fluids, curved heat transmitting plates arranged edgewise and extending alongside one another, face covers on edges of said plates, inlet connections and outlet connections on said covers, said edges being alternately connected by pairs to one another so as to form separate channel systems each of which is open towards one cover and closed at an opposite face, and said channel systems being connected each to one of said inlet connections and one of said outlet connections, and curved guides for the fluids being arranged in the channel systems at the inlets and outlets.

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