

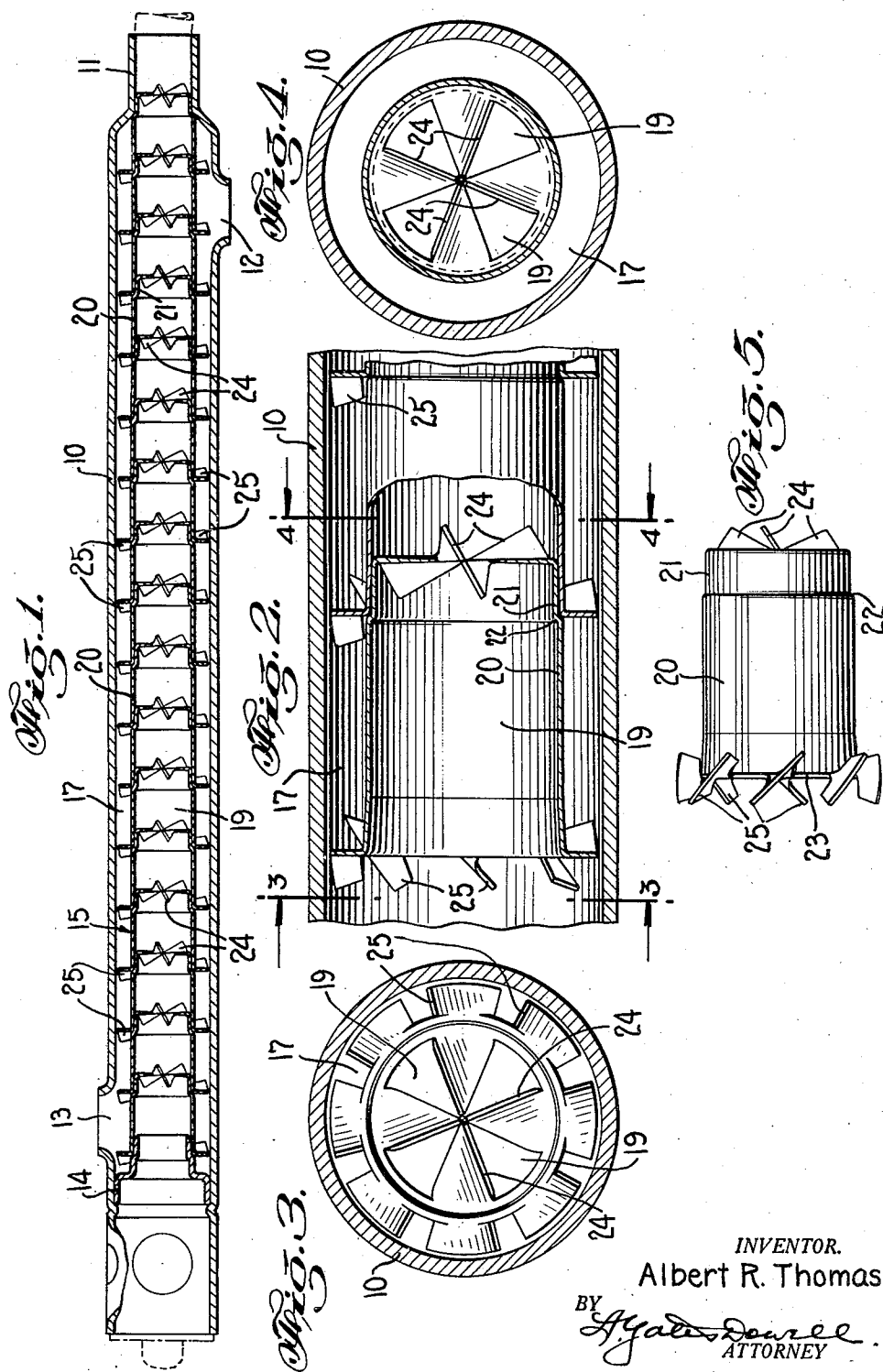
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HEAT EXCHANGER

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UNITED STATES PATENT OFFICE

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HEAT EXCHANGER

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This invention relates to the art of heat transfer and more particularly to apparatus for the transfer of heat from high temperature fluids to lower temperature fluids flowing in separate passages.

Heat transfer between gas and a solid wall is very poor and depends, with a given temperature gradient, on the velocity of the gas flow, turbulence, which is a function of the flow resistance, contact surface area, and physical properties of the gas. In gas heat exchangers it has been suggested to provide fins in the path of the gases in the channels of flow to increase heat transfer between the gases through the separating wall. This has been done by securing fins or vanes to the metal shells. This not only necessitates an undue amount of labor and expense in fabricating such gas heat exchangers but also fails to achieve the greatest efficiency for there are two joints in the heat conducting path from each inner vane through the separating wall to each outer vane.

A gas heat exchanger constructed in accordance with this invention provides effective heat transfer from the gas contacting one set of vanes to the gas flowing past the other set of vanes through a continuous heat conducting path and is inexpensive and simple in construction.

Other objects and advantages will be apparent from the following description taken in connection with the accompanying drawing, in which,

Fig. 1 is a vertical section through a gas heat exchanger contemplated by this invention;

Fig. 2, an enlarged detail of a section of the heat exchanger shown in Fig. 1;

Fig. 3, a view taken on line 3—3 in Fig. 2;

Fig. 4, a view taken on line 4—4 in Fig. 2; and

Fig. 5 shows one of the elements of which the inner tube or separating wall is fabricated.

Referring to the drawing, an outer casing or tube 10 is formed with a reduced end 11 and provided with an opening 12 adjacent one end thereof and an opening 13 adjacent the other end thereof for the circulation of

gas therethrough from one end to the other. In the end of the tube 10 opposite its reduced end 11 there is secured as by welding a reducing nipple 14. Between the reducing nipple and the reduced end 11 of the outer tube 10 there is secured a separating wall or inner tube 15 provided with integral vanes 25 extending into the annular chamber 17 formed between the inner and outer tube and integral vanes 24 extending across the tubular chamber 19 within the gas separating wall or inner tube 15.

The inner tube 15 is fabricated, as best shown in Fig. 2, of a plurality of nested cup-like members 20 shown in Fig. 5. Since there are no fins to be welded to the inner tube these cups may be of comparatively thin sheet metal. Each cup 20 is formed with a bottom portion 21 of reduced diameter, preferably reduced by twice the thickness of the metal, thereby forming a shoulder 22, and the rim of the cup is formed with an outwardly extending flange 23. The bottom of each cup is cut along two or more diameters and the resulting segments are twisted at an angle, as shown, forming vanes 24. The flange 23 on the rim of the cup 20 is cut into a plurality of segments which are bent at an angle to form a set of outwardly extending vanes 25. A plurality of these cups 20 are nested together, the reduced bottom portion 21 of each cup fitting within the open end of the succeeding cup, and secured in any desired manner such as welding or brazing. The stack of cups is then inserted within the outer casing or tube 10 so that the reduced bottom portion of the last cup fits within the reduced end 11 of the outer tube 10 and the reducing nipple 14 is secured within the other end of the outer tube 10 with its reduced portion fitting within the open end of the cup at this end of the stack.

As thus assembled, the nested cups 20 form the inner tube or separating wall 15, the vanes 25 extending into the annular channel of flow 17 and the vanes 24 extending into the tubular channel of flow 19. In forming the vanes 24 and 25 the segments are all twisted in corresponding directions so that the gases passing through their respective channels of

flow are deflected in a circular path, thus promoting turbulence. With this construction the heat conduction from one gas to the other is through an uninterrupted metallic path from one set of vanes to the other.

It will be obvious to those skilled in the art that various other changes may be made in the construction and arrangement without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawing and described in the specification but only as indicated in the appended claims.

I claim:

1. A gas heat exchanger comprising an outer tubular shell having an opening adjacent each end thereof for the circulation of gas therethrough, and an inner tubular shell within said outer shell and forming therewith an outer annular passage closed at each end and an inner tubular passage, said inner shell being formed of a plurality of nested metal cups, each cup formed with integral vanes extending outwardly around its rim into the said annular passage and having its bottom cut and bent to form vanes extending into said tubular passage.

2. A fluid heat exchanger comprising inner and outer shells forming two fluid passages separated by said inner shell, the latter being formed of a plurality of nested cup-like members having integral vanes extending outwardly around their rims and their bottoms cut and bent to form inner vanes.

3. A fluid heat exchanger comprising inner and outer shells forming two fluid passages separated by said inner shell, the latter being formed of a plurality of nested cup-like members having integral vanes flanging outwardly around their rims and having their bottoms formed by integral vanes.

4. In a fluid heat exchanger, a separating and heat transfer wall formed of a plurality of nested cups having outwardly flanged rims, the flanged rims and bottoms being cut and bent to form vanes.

5. In a fluid heat exchanger, a heat transfer partition comprising a plurality of nested cup-like members having their bottoms formed of integral vanes and their rims provided with integral outwardly extending vanes.

6. In a fluid heat exchanger, a separating and heat transfer wall formed of a plurality of cups having outwardly flanged rims, the flanged rims and bottoms being cut and bent to form vanes.

In testimony whereof, I affix my signature.

ALBERT R. THOMAS.