March 16, 1965 R. E. ALLENDER 3,173,482

QUADRANT BAFFLE FOR HEAT EXCHANGE HEADER

Filed Nov. 21, 1962 2 Sheets-Sheet 1

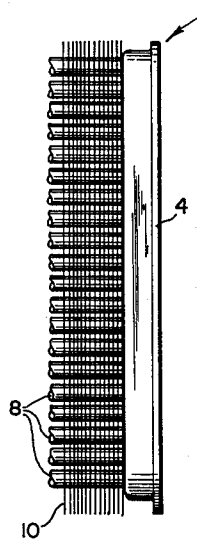


FIG. 2

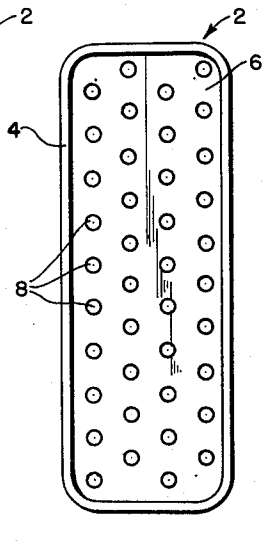


FIG. 1

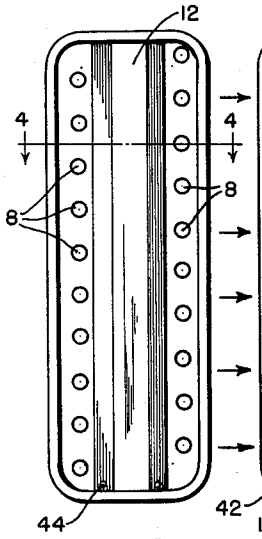


FIG. 3

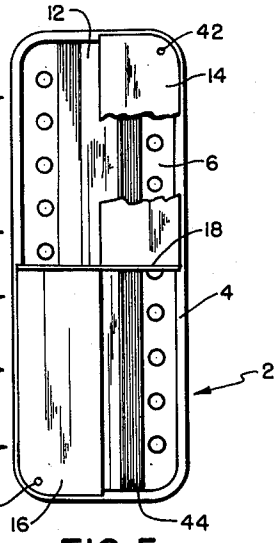


FIG. 5

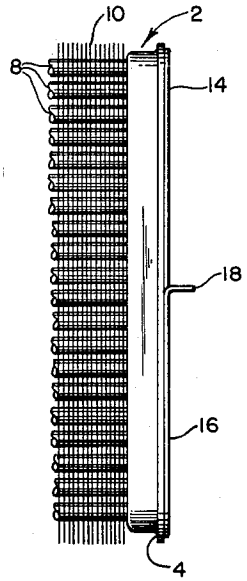


FIG. 6

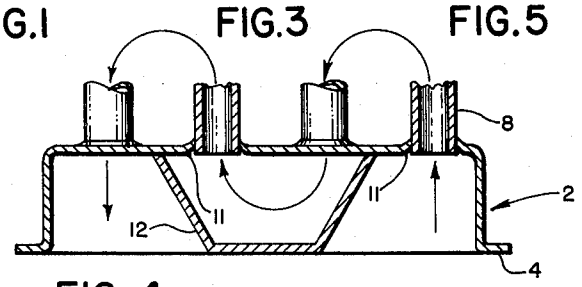


FIG. 4

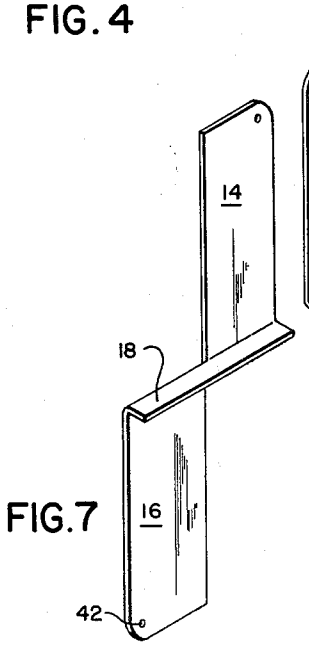


FIG. 7

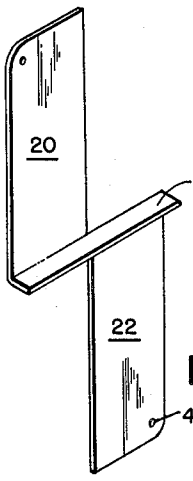


FIG. 8

INVENTOR.
RICHARD E. ALLENDER

BY Edward C. Grenz

ATTORNEY

March 16, 1965 R. E. ALLENDER 3,173,482

QUADRANT BAFFLE FOR HEAT EXCHANGE HEADER

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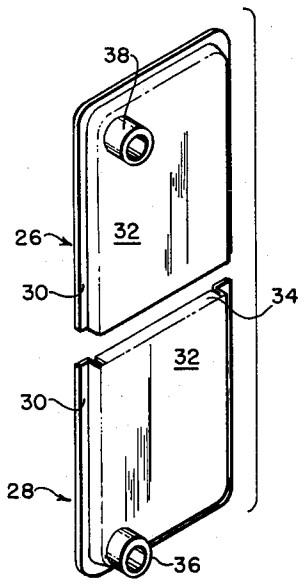


FIG.9

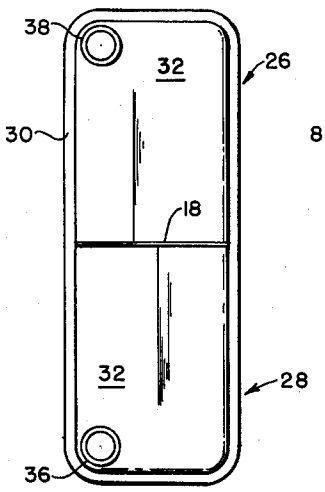


FIG.10

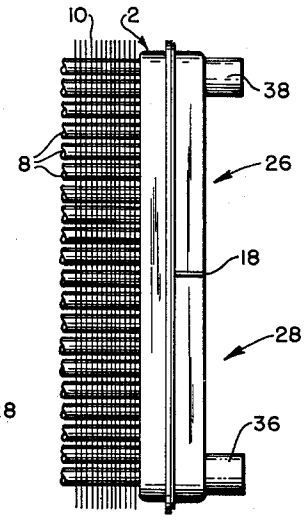


FIG.11

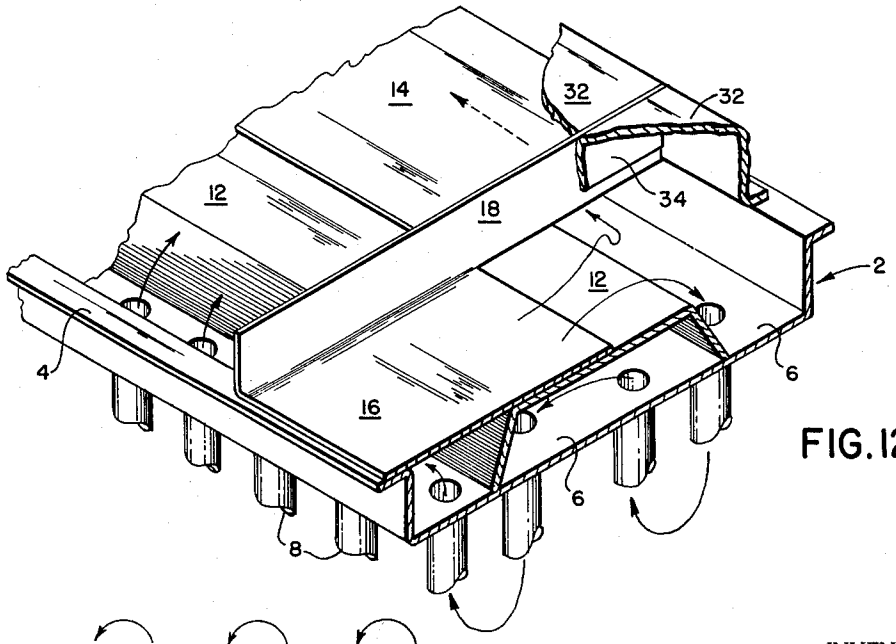


FIG.12

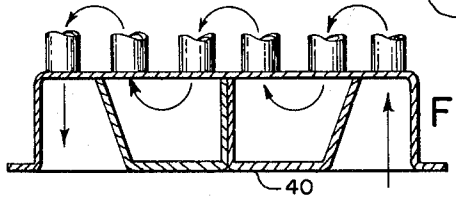


FIG.13

INVENTOR.
RICHARD E. ALLENDER

BY Edward C. Gregg

ATTORNEY

United States Patent Office 3,173,482 Patented Mar. 16, 1965

3,173,482

QUADRANT BAFFLE FOR HEAT EXCHANGE HEADER

Richard E. Allender, Davenport, Iowa, assignor to American Air Filter Company, Inc., Louisville, Ky., a corporation of Delaware

Filed Nov. 21, 1962, Ser. No. 239,227
11 Claims. (Cl. 165—174)

This invention relates to an improved header construction for a heat exchange coil of the type arranged for serpentine flow and where the supply and return connections are on the same end of the coil.

The header construction according to the invention is comprised of thin wall members, such as sheet copper for example, assembled to form a hollow structure having interior partition means dividing the interior space into separate chambers. A supply chamber is formed which communicates with the row of tubes on one face of the coil; a return chamber is formed which communicates with the row of tubes on the opposite face of the coil; and one or more flow reversing chambers are formed to place each even numbered row of tubes in communication with the next adjacent odd numbered row of tubes, save for the first and last row of tubes.

The header, in one presently preferred embodiment for a four row coil, includes a shallow pan-shaped member receiving the open ends of the tubes, a channel secured with its open side over the two middle rows of tube ends to direct the flow out of one of these rows into the other of these rows, baffle means including opposite quadrant portions secured to the open face of the pan-shaped member and overlapping the channel, the baffle means further including an intermediate outwardly projecting flange in a plane normal to the quadrant portions and extending transverse to the direction in which the channel extends, and a pair of shallow pan-shaped cover members secured over the quadrant portions and remaining open face portions of the first pan-shaped member. In this preferred embodiment, and considering the coil as disposed with the tube rows being in a vertical plane and the tubes running in a horizontal direction, the intermediate flange serves as a partition which divides the header outer half (with respect to its depth or thickness) into a lower supply chamber, and an upper return chamber. The channel and one quadrant baffle prevents the flow of water (or other tempering medium used) which enters the supply or lower chamber from entering the tube ends of any row of tubes except the row along one face of the coil, and the channel and opposite quadrant baffle in the upper chamber prevent flow leaving the row along the opposite face of the coil from passing anywhere other than out of the return tapping. The channel over the two inner tube row ends directs flow from the one to the other row of tubes.

One feature of the outlined header construction is that the supply and return connections to the header may be positioned anywhere on the respective opposite portions of the outer half. When the coil is to be installed under conditions where the piping location is restricted, this feature is distinctly advantageous since the restricted location does not preclude installing the coil to obtain a counterflow passage of water. Other advantages will be noted in connection with the following description, which is to be taken in connection with the drawing wherein the figures generally follow the sequence of assembly of the header and wherein:

FIGURE 1 is a face view of the inner shell which receives the tube ends;

FIGURE 2 is a side view, with fragments of the tubes being shown, of the inner shell of FIGURE 1;

FIGURE 3 is a view corresponding to FIGURE 1 but with the return channel installed to place the two center rows of tubes in communication with each other;

FIGURE 4 is an enlarged horizontal section corresponding to one taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a view corresponding to FIGURE 3 but with baffle means added;

FIGURE 6 is a side view of the assembly of FIGURE 5;

FIGURES 7 and 8 are isometric views of the baffle means used for a right-hand and left-hand coil respectively;

FIGURE 9 is an isometric view of cover means carrying the supply and return tappings, and adapted to be secured against the face of the FIGURE 5 assembly;

FIGURE 10 is an outer face view of the header in completed form;

FIGURE 11 is a side view of the completed header of FIGURE 10;

FIGURE 12 is a fragmentary isometric view of the header, with parts broken away to illustrate the tempering fluid flow through the header and tubes;

FIGURE 13 is a sectional view illustrating the return channel arrangement in a six row coil header.

Only the header end of the coil is shown in the drawing. The remainder of the coil may be assumed to be conventional. Thus at the end of the coil opposite the header, the usual return bends are provided so that the tempering medium flow from the header down one row of tubes is directed into the adjacent row of tubes for reverse flow back to the header. While water will be used as the tempering medium example, it is to be understood that other media such as steam could be used so long as conventional practices are followed in regard to the varying characteristics of the different media.

FIGURES 1, 2, 4—Inner section and tube assembly

The inner or tube receiving section 2 of the header has the general shape of a rectangular shallow pan and includes a perimetric flange 4 and a sunken or recessed wall 6 in which rows of extruded holes are provided to receive the ends of the corresponding rows of tubes 8. In most cases conventional fins 10 are assembled on the tubes in spaced relation, and a support plate (not shown) may be provided between the wall 6 and first fin. The tube ends are brazed to the wall 6 by directing the brazing flame or other heating means toward the open ends of the tubes (i.e., the brazing is done from the open or right side of the wall 6 with respect to FIGURE 2). The open access thus afforded is considerably more convenient for brazing than in the case of brazing multiple rows to the exterior face of a closed header. Also, since no brazing access to the exterior face of the wall 6 is required the fins or support plate may be positioned closely adjacent that exterior face.

It is also noted that the extruded holes in wall 6 which receive the tube ends are formed with the material around the holes displaced outwardly so that an annular "well" 11 (shown in FIGURE 4 only) is formed with the tube end wall to facilitate the brazing operation.

FIGURES 3 and 4—Return channel installation

A return channel 12 is placed in the pan-shaped section 2 to straddle the two center rows of tube ends, and is brazed along all edges to the section 2 to isolate the tube ends of the two center rows from the rest of the header interior. The channel extends the length of the sunken wall 6 and the legs of the channel are dimensioned and inclined so that the outer face of the channel bight lies in the same plane as the outer face of perimetric flange 4 of section 2. The oblique disposition of the legs of the channel relative to the bight is preferred to promote smooth flow of the water within the header.

FIGURES 5–8—Baffle means installation

At that stage of assembly when only the return channel **12** has been installed, the coil may be considered to still be universal from the standpoint of the coil may ultimately be disposed with its supply and return connections on either the right-hand end of the left-hand end of the coil. However, before installation of the baffle means illustrated in FIGURES 7 and 8, it must be known whether the supply and return connections are to be on the right-hand or left-hand end. Assuming that the flow of tempering medium in the coil is to be counterflow to the air through the coil, then the FIGURE 7 baffle means is used for a right-hand coil, and the FIGURE 8 baffle means is used for a left-hand coil. If for some reason parallel flow were desired then the FIGURE 7 baffle means would be used for a left-hand coil, and the FIGURE 8 baffle means for a right-hand coil. It is usually preferable that the flow of tempering medium in relation to the direction of air flow be what is called counterflow, i.e., the medium flows through the row of tubes on the air leaving face first and then bows through rows of tubes successively closer to the air entering face, since this promotes heat exchange. In FIGURE 5 the arrows along the left-hand edge of the coil indicate the direction of air flow for purposes of explanation herein, and since one facing in the direction of air flow would see that the header is on the right end of the coil, the coil of the present example may be considered as a right-hand coil.

In FIGURES 5 and 6 the baffle means of FIGURE 7 is shown in installed position on the open face of inner section **2** and on the bight of the channel **12**. The FIGURE 7 baffle means includes a first quadrant portion **14**, a third quadrant portion **16** and an intermediate outwardly projecting flange **18**. The flange **18** separates the outer half of the header into a top half and a bottom half. The first quadrant **14** overlies the corresponding first quadrant of the section **2** and thus bridges the space between the return channel **12** and the perimetric flange **4**. The third quadrant portion **16** correspondingly overlies the third quadrant of the section **2**. At this point in the assembly of the header, those edges of the first and third quadrant baffles which lie on the bight of the return channel **12** are brazed to it, and the central portion of the lower edge of the intermediate flange **18** is brazed to the adjacent bight surface. It is not necessary to braze along the perimetric flange **4** of the section **2** at this time.

If the coil were to have the supply and return on the left end and be counterflow, the baffle means shown in FIG. 8 would be used instead of the FIG. 7 baffle means. In such a case, the baffle portions **20** and **22** would be in the second and fourth quadrants respectively of FIG. 5, with the intermediate flange **24** projecting outwardly the same as with the FIG. 7 part. Either a right-hand or a left-hand baffle means may be formed from any one blank, the only difference being the direction in which the quadrant baffle portions are rotated relative to the flange during breaking.

FIGURES 9–11—End cap means installation

After the baffle means has been installed and secured by brazing, the outer half of the header is closed by the addition of an upper and a lower end cap **26** and **28** respectively. They are like section **2**, with which they mate in assembled form, in that they are relatively shallow and pan-shaped. Each includes a perimetric flange **30** along three edges, a main wall portion **32**, and an inwardly-directed stub flange **34** along the fourth edge. While the construction of both caps is the same, they may well differ in the location of the tapping provided on each. In the illustrated coil for example, both the supply tapping **36** on the lower end cap **28** and the return tapping **38** on the upper end cap **26** are disposed toward the front face (i.e., air entering face) of the coil. The exact location of the tappings on the walls is dictated by the supply and return piping location of the installation where the coil is to be used.

The end caps **26** and **28** are placed against the inner section **2** and baffle means with the stub flanges **34** abutting and separated by the intermediate flange **18**. The end caps are secured by brazing the perimetric flange **30** of each end cap to the perimetric flange **4** of the inner section, and by also brazing the stub flanges **34** to the intermediate flange **18**. Of course, at the same time that the perimetric flanges are brazed, the edges of the opposite quadrant baffle portions sandwiched between these flanges are brazed so that the perimeter of the header is completely sealed.

In its finally assembled form the plane in which the opposite quadrant baffle portions **14** and **16** lie may be considered as splitting the depth of the header into an inner half and an outer half. The channel **12** splits the inner half into separate spaces extending for the height of the tube rows, and the flange **18** splits the outer half in the opposite direction into the lower supply space **28** and upper return space **26**. The space in communication with the supply tapping **36** thus includes that part of the outer half below flange **18**, and that part of the inner half on the right side of the return channel **12**. Correspondingly, the space in communication with the return tapping **38** includes that part of the outer half above flange **18**, and that part of the inner half on the left side of the return channel **12**. The right row of tubes (last row with respect to the direction of air flow) is open to the inner half space on the right of channel **12**, and the left row of tubes (first row with respect to air flow) is open to the inner half space on the left of the channel.

FIGURE 12—Flow paths

The flow path is perhaps best perceived from the FIGURE 12 illustration. As illustrated, the supply water enters the supply chamber **28** through the supply tapping **36** (not shown in FIG. 12) and flows over the third quadrant baffle portion **16** and over the bight of the return channel **12** to the tube ends of the last row of tubes. The supply water also flows underneath the edge of intermediate flange **18** and under the first quadrant baffle portion **14** so that the entire last row of tubes is supplied with water. The water flows down through all of the tubes of the last row to the opposite end return bends connecting each fourth row tube to the corresponding third row tube (bends not shown), and then back up through all of the third row of tubes into the space formed between the return channel **12** and the inner section **2**. Here the water reverses its direction again and flows back down through all of the tubes of the second row, through the return bends (not shown) connecting the second and first rows and back up all of the tubes of the first row to the space on the left side of the channel. That water coming into the space in the inner half between the third quadrant baffle portion **16** and the inner section **2** flows underneath the edge of the intermediate flange **18** into the second quadrant of the header, into the return chamber **26** and out of the return tapping along with the water returning directly to the second quadrant space.

FIGURE 13—Six row coil

The principles of the invention may be applied to any same end supply and return coil which has an even number of rows of tubes. As shown in FIGURE 13, if the coil has six rows of tubes the return channel means **40** is designed to form a double chamber to place the tube ends of the second and third rows, and fourth and fifth rows, in isolated communication. The first and sixth row tube ends are of course in communication with the return and supply chamber respectively as set forth in connection with the four row coil.

Miscellaneous

With a coil header constructed in accordance with the principles set forth herein, it will be appreciated that

a good deal of flexibility is permitted in locating the supply and return tappings on the outer face of the header without requiring a change in the flow sequence through the rows. One example of the advantages of this flexibility is found in the use of the described coil in an air conditioning unit ventilator in which it is desirable to have both the supply and return tappings toward the front face of the coil because of available piping space, and still obtain a counterflow path of the tempering medium. A coil with a header incorporating the principles of the invention may be disposed in various ways so long as recognized piping practices regarding drains, air vents, etc., are followed. Thus, if the return tapping is not provided at the highest point of the return chamber, an air vent should be provided. Small weep holes are preferably provided in the interior partitions to permit draining of the entire coil. For a coil which is to be installed in an inclined position, the holes **42** in the opposite quadrant baffles (FIGS. 7 and 8), and holes 44 in the lower end of the return channel (FIGS. 3 and 5), will permit complete draining into supply chamber **28**.

While the invention has been described as embodied in one preferred construction, various departures in detail may be made without departing from the scope of the invention. For example, the respective quadrant baffle portions are shown as being of equal size and as being an integral part of a single piece bent to form both of the baffle quadrants and the intermediate flange. Such an arrangement is presently preferred because of manufacturing economies effected thereby. Of course, these pieces could be separate. As a further example of a change within the scope of the invention, one quadrant portion could be of greater area than another if it were desirable to divide the outer half of the header into spaces of unequal size in connection with piping location limitations.

The invention claimed is:

1. A header construction for a same end supply and return serpentine coil having an even number of rows of tubes, comprising:

(*a*) a header plate having apertures receiving the open ends of said tubes;

(*b*) channel means forming successive chambers with said header plate over the tube ends of each two successive adjacent rows of tubes, exclusive of the first and last rows of said tubes, so that said each two successive adjacent rows of tubes are in communication but isolated from other rows; and

(*c*) cover means, and interior opposite quadrant baffle means lying in a plane splitting the thickness of said header, sealed to said header plate and channel means to form an outer supply chamber in communication with said first row, and a separate outer return chamber in communication with said last row.

2. A header construction for a same end supply and return serpentine coil having an even number of rows of tubes, comprising:

(*a*) a shallow pan-shaped member having apertures receiving the open ends of said tubes;

(*b*) return channel means disposed to straddle the tube ends of each two successive adjacent rows of tubes, except the first and last of said rows, to place said tube ends of each two successive adjacent rows in communication;

(*c*) baffle means overlapping said return channel means and covering opposite quadrant portions only of said pan-shaped member;

(*d*) partition means projecting outwardly in a plane separating said baffle means and extending in a direction generally transverse to said return channel means; and

(*e*) cover means enclosing the outer part of said header and sealed to the perimeter of said pan-shaped member and said partition means to form a supply chamber on one side of said partition means in communication with said first row of tubes, and a return chamber on the opposite side of said partition means in communication with said last row of tubes.

3. A header construction for a same end supply and return serpentine coil having an even number of rows of tubes, comprising:

(*a*) a header plate having apertures receiving the open ends of said tubes;

(*b*) channel means isolating the ends of successive adjacent rows of tubes into communicating pairs which are out of communication with the ends of the first and last row of tubes;

(*c*) flow baffle means including opposite quadrant baffle portions and an intermediate outwardly projecting flange, one of said baffle portions overlying part of the tube ends of said first row and the other of said baffle portions overlying part of the tube ends of said last row; and

(*d*) end cap means sealed to the perimeter of said header plate and to said flange to provide separate supply and return chambers on opposite sides of said flange respectively in communication with the ends of said first and said last tube rows.

4. A header construction for a same end supply and return serpentine coil having an even number of tube rows, comprising:

(*a*) a hollow structure formed of a tube end receiving inner shell having apertures receiving the open ends of said tubes and mating outer shell means;

(*b*) return channel means secured to the inner face of said inner shell connecting each even numbered tube row to the adjacent odd numbered tube row, save for the first and last tube rows; and,

(*c*) baffle means in said structure dividing the remainder of the interior space into a supply chamber and a return chamber in communication with said first and last tube rows respectively, said baffle means including opposite quadrant baffle portions lying in the plane dividing said inner shell and said outer shell means, and cross partition means projecting outwardly from said plane to separate said outer shell means into opposite spaces respectively in communication with said first and said last tube rows.

5. The header construction of claim 4 wherein the interior space between each quadrant baffle portion and its facing inner shell surface is in communication with the interior space between the other quadrant baffle portion and its facing outer shell means surface.

6. A header construction for a same end supply and return serpentine coil having an even number of tube rows, comprising:

(*a*) means forming a hollow, relatively shallow, generally rectangular header having said tubes received in apertures in one face, and supply and return openings in the opposite face;

(*b*) return channel means positioned against the inner surface of said tube receiving face to place each even numbered tube row in communication with the adjacent odd numbered tube row, save for the first and last tube row;

(*c*) opposite quadrant baffles lying in a plane dividing the depth of said header, said baffles overlapping said return channel means; and

(*d*) an intermediate flange, in a plane normal to said plane dividing the depth of said header, extending generally transverse to said return channel means, and projecting outwardly to said opposite face of said header between said supply and return openings.

7. The header construction of claim 6 wherein:

(*a*) said baffles and said intermediate flange comprise a single sheet member with said opposite quadrant baffles broken in one direction from said flange for a right hand coil, and in an opposite direction for a left hand coil.

8. A header construction for a same end supply and re-

turn serpentine coil having an even number of rows of tubes, comprising:

(*a*) an inner pan-shaped section, and a pair of outer pan-shaped sections, secured together in opposing relation to form a hollow header, the wall of said inner section having apertures receiving the open ends of said tubes in parallel rows, and the opposite walls of said outer sections including a supply and a return opening;

(*b*) return channel means overlying the open ends of said rows of tubes, save for the first and last rows, to place each even numbered tube row in communication with the adjacent odd numbered tube row;

(*c*) a pair of opposite quadrant baffles disposed in the plane between said inner section and said outer section, each of said baffles having its edge parallel to said return channel means overlapping said return channel means; and

(*d*) an intermediate flange extending transverse to said return channel means and projecting outwardly from the plane in which said baffles lie to divide said outer

sections into separate chambers, one of which contains said supply opening and communicates with said first row of tubes, and the other of which contains said return opening and communicates with said last row of tubes.

9. The header construction of claim 8 wherein:

(*a*) the depth of said return channel means corresponds generally with the interior depth of said inner section.

10. The header construction of claim 8 wherein:

(*a*) the legs of said return channel means lie in planes forming an opening angle.

11. The header construction of claim 8 wherein:

(*a*) said opposite quadrant baffles and said flange comprise an integral member.

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CHARLES SUKALO, *Primary Examiner.*