

Nov. 13, 1962

E. J. GREENE ET AL
HEAT EXCHANGE UNIT
Filed Aug. 15, 1960

3,063,682

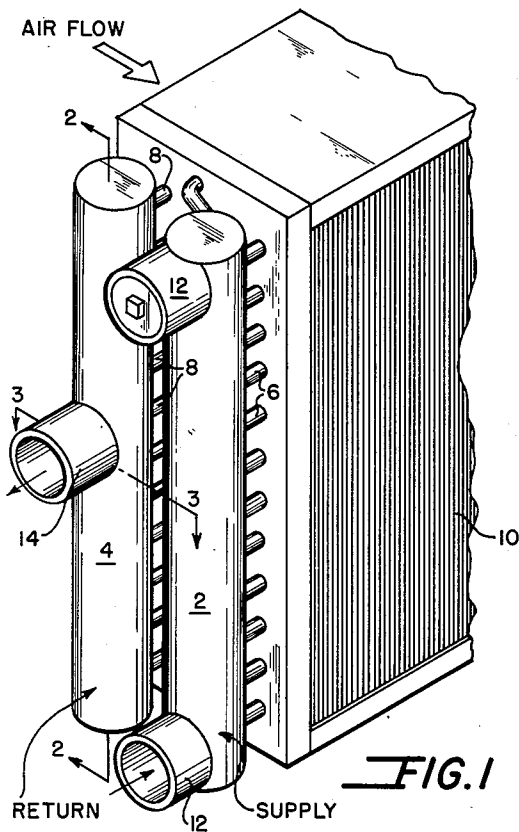


FIG. 1

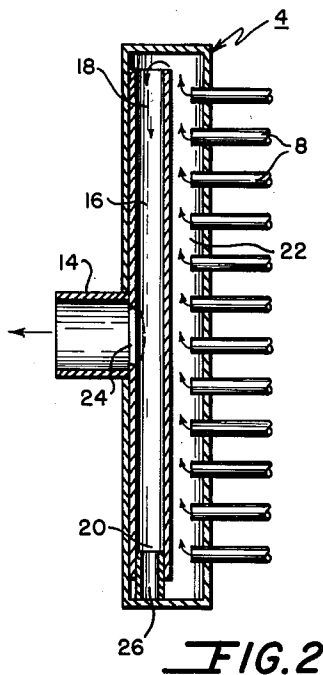


FIG. 2

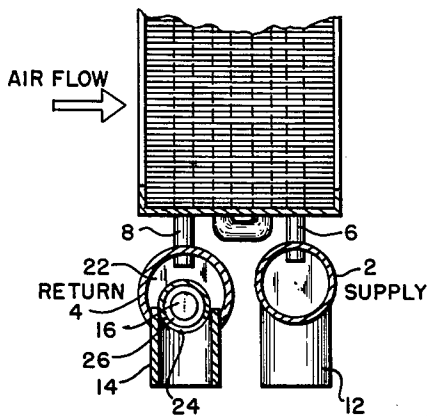


FIG. 3

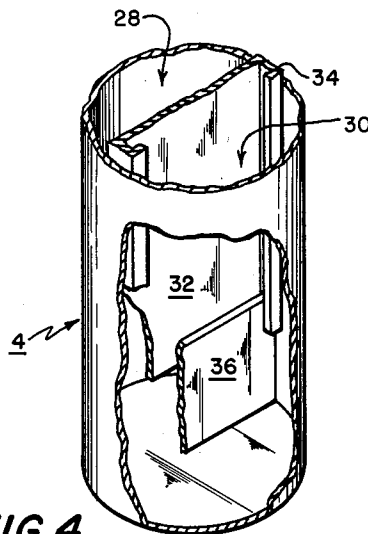


FIG. 4

INVENTORS
EARNEST J. GREENE
WILLIAM V. MILLMAN
BY

Edward C. Arney
ATTORNEY

1

3,063,682

HEAT EXCHANGE UNIT

Earnest J. Greene and William V. Millman, Moline, Ill.,
assignors to American Air Filter Company, Inc., Louis-
ville, Ky., a corporation of Delaware

Filed Aug. 15, 1960, Ser. No. 49,558

6 Claims. (Cl. 257-148)

This invention relates generally to air heating and cooling coils, and relates specifically to the header construction of such coils.

It is conventional and recommended practice in connection with hot (and chilled) water systems to use an air vent valve in each water coil which can act as an air trap. Manual or automatic air vent valves are commonly provided at the top of return headers of the coils to permit elimination of air and gases from the system. Water coils are also commonly constructed so that water enters the supply header at the bottom thereof, flows upwardly to facilitate self-purging, and leaves the return header at the top thereof. Where such a coil is intended for installation immediately below a ceiling, or immediately below the top wall of an enclosing cabinet, space limitations pose certain problems. For example, while there may be space to install an air vent valve, it may be nearly inaccessible after the coil is installed. And if it is desirable to provide thermal insulation on the return pipe, there may be insufficient room for an adequate thickness of insulation.

These problems may be avoided to some extent by locating the return piping stub connection at an intermediate location on the return header and providing a baffle, within the return header, extending from immediately below the junction of return stub and return header diagonally inward and upwardly to the central part of the return header, and then upwardly to slightly below the top end of the return header, so as to divide the return header into two chambers which are in communication only at the top. Consequently, the water passing to the return header fills the chamber adjacent the outlet ends of the water tubes, and must overflow the top edge of the baffle to reach the chamber to which the return stub is directly connected. Consequently, air accumulating at the top of the return header is purged or forced out of the coil and may be eliminated from a larger air vent valve installed in a convenient location to serve a plurality of coils.

A coil having such a header construction may be turned end-for-end to permit connecting the coil to the piping system at either end. However, it cannot be turned top-for-bottom and thus has the disadvantage of providing air-to-water counterflow circuiting in only one of the alternate positions.

In a coil constructed in accordance with the present invention, the self-purging and intermediate return connection features are available with counterflow circuiting regardless of whether the coil supply is to be from the right or left hand end of the coil since the coil may be turned top-for-bottom as well as end-for-end. To obtain this desirable result we provide, in one embodiment of the invention for example, a coil which includes: a supply header with supply piping connections near both its ends so that, in accordance with the coil disposition, the lower connection may be connected to the supply piping and the upper one plugged; a return header having a return piping connection at an intermediate location on the return header; partition means dividing the return header into two chambers except at the opposite ends of the return header where they are open to each other; and an auxiliary baffle element slidably arranged in the return header to be gravity actuated to block off the lower of the openings between the two

2

return header chambers. Consequently, the coil may be installed in a position to be supplied from either the right or left hand, and may be turned top-for-bottom if desired to provide counterflow circuiting.

The invention will be explained in some detail in connection with the accompanying drawing illustrating apparatus incorporating the principles of the invention in several alternative embodiments by way of example, and wherein:

FIGURE 1 is a fragmentary isometric view of a coil of the invention with the supply and return connections on the same end of the coil;

FIGURE 2 is a vertical sectional view taken along the line 2-2 of FIGURE 1;

FIGURE 3 is a horizontal sectional view taken along the line 3-3 of FIGURE 1;

FIGURE 4 is a fragmentary isometric view of the lower end of a return header with parts broken away to illustrate the construction of an alternative embodiment of the invention.

A finned or extended-surface coil having a supply header 2 and a return header 4 at the same end of the coil is shown in FIGURE 1. The coil includes a plurality of vertically-spaced, serpentine tubes which have inlet ends 6 in communication with the interior of the supply header 2 and the outlet ends 8 in communication with the interior of the return header 4. A plurality of horizontally spaced, vertically disposed fin elements are bonded to the tubes to provide the extended heat transfer surface as is conventional in such coils.

The supply header 2 has a supply piping stub connection 12 at each end thereof so that, in accordance with the particular disposition of the coil as installed, the lower of the stub connections may be connected to the source of the liquid medium being used to heat or cool, and the upper stub may be plugged with a conventional fitting. The return header 4 has a return piping stub connection 14 midway between its opposite ends.

Referring now to FIGURES 2 and 3, in one embodiment of the invention an inner cylinder or tube 16 of reduced height and diameter relative to the return header cylinder, and having open ends 18 and 20 respectively at the top and bottom as shown in FIGURE 2, is eccentrically positioned within the return header cylinder so that the line of tangency of the two cylinder walls intersects the axis of the return piping stub connection 14. The inner tube 16 is fixed in this position, with its open upper and lower ends spaced from the respective end caps of the return header, by welding the top and bottom edges of the inner tube at the upper and lower points of tangency to the return header wall. With the inner tube 16 installed as described, the return header is divided into two vertical chambers: the inner chamber (generally defined by the wall of the inner tube 16 and consequently herein identified by the same number 16) being of a circular cross-section, and the outer chamber designated 22 being substantially in the form of a crescent as illustrated in FIGURE 3. The inner chamber 16 is in communication with the return stub connection 14 by providing an aperture 24 in its wall at the location where the return stub connection is affixed to the return header.

A relatively short sleeve element 26 of slightly reduced outer cross-section relative to the inner cross section of the tube 16 is slidably fitted within the tube so that it can be gravity actuated and slide within the tube between the opposite ends of the return header in accordance with whichever end of the return header is up. This cylindrical sleeve 26 is of slightly greater height than the spacing between the ends of the inner tube 16 and the corresponding cap on the ends of the return header. Consequently, when the coil is in the vertical disposition as shown in FIGURE

3

2, the sleeve 26 slides to the bottom end 20 of the tube 16 and serves as an auxiliary baffle member to divide the return header into the noted two vertical chambers 16 and 22 in communication at the top only.

In installing the coil, assuming that the air flow through the coil is to be from rear to front as indicated by the arrow in FIGURE 1, and the return and supply connections are both to be on the same end as shown, the supply piping of the systems will be connected to the lower supply piping stub connection 12 and the return piping connected to the return stub 14. As noted, the upper supply stub 12 is plugged. Since the supply water is introduced into the coil from the bottom and at the supply end, any air moves and is carried towards the return end and upwardly so that it tends to accumulate at the top end of the return header. Without the return header partition arrangement of the invention it would be possible that air accumulating at the top end of the return header could "lock out" flow of water through one or more of the upper serpentine tubes. However with the subject arrangement, to reach the return piping the water flowing out of the outlet ends 8 of the tubes and into the vertical chamber 22 must rise and overflow the top edge 18 of the inner tube 16, thereby carrying any accumulated or contained air into the vertical chamber 16 connected to the return piping. While a relatively small amount of water may seep into the bottom of vertical chamber 16 by flowing between the walls of sleeve element 26 and the wall of the lower end 20, under normal flow conditions this seepage rate is negligible relative to the rate at which water is delivered to the return header and overflows the top end 18 of the inner tube. It is also noted that while a small amount of air may from time to time accumulate at the very top of the return header, so long as the air pocket does not extend below the top serpentine tube it will not block water flow through it. Such air also tends to be picked up and carried to the return piping by water flow into the tube 16.

In FIGURE 4, the lower end of an alternative embodiment of the return header is shown with header 4 being divided into semi-cylindrical vertical chambers 28 and 30 by a plate 32 having its width extending diametrically across the header and in a lengthwise direction terminating short of the ends of the header. Along both longitudinal edges an inwardly projecting flange 34 serves as a guide for a relatively short gate 36 adapted to be gravity actuated and slide to whichever end of the header is lower. Since other arrangements to carry out the inventive concepts can also be devised within the spirit of the invention by those skilled in the art, it is not intended that the scope of the appended claims be limited to the precise structure illustrated in the drawing.

If the air flow with the coil of FIGURE 1 were to be in the opposite direction, and with the supply and the return connections to be to the coil from the same direction as shown in FIGURE 1, the coil would simply be turned top-for-bottom and the plug be placed in the other supply stub connection. In this case, the return header shown in FIGURE 2 is inverted and the sleeve 26 will slide to the now bottom end 18 of the inner tube 16. Consequently, counter flow circuiting of the water relative to the air flow is still available.

It will also be apparent that the coil may be turned end-for-end and then top-for-bottom to accommodate air flow in either direction if the supply and return headers are to be connected to the piping system at the opposite end from that shown in FIGURE 1.

If a coil requires supply and return connections to be at opposite ends, the respective supply and return header must be so located when the coil is built. However, such a coil may also be turned end-for-end and top-for-bottom as required in accordance with installation requirements so as to obtain counterflow circuiting.

The invention claimed is:

1. In a heat exchange unit adapted to receive a liquid

4

tempering medium: a supply header adapted to be vertically disposed and including liquid inlet means for admitting said medium to said header at the lower end thereof; a return header adapted to be vertically disposed and including liquid outlet means located approximately midway between the ends of said return header; a plurality of vertically spaced tubes connecting said headers to each other; fixed vertical partition means dividing said return header into adjacent vertical chambers, said partition means having opposite ends terminating short of the corresponding ends of said return header but extending at least as high and as low as the respective upper and lower tubes; and slidable auxiliary partition means disposed within said return header for gravity actuation thereof in response to the selected disposition of said unit to substantially block off liquid flow between said vertical chambers at their bottom ends.

2. In a heat exchange unit adapted to receive a liquid tempering medium: a supply header adapted for vertical disposition with either of its ends at the top, said supply header including supply piping connection means at both ends and means for blocking the upper of said connection means; a return header adapted for vertical disposition with either of its ends at the top, said return header including return piping connection means intermediate its ends; a plurality of tubes having inlet ends connected to said supply header in vertically spaced relation and having outlet ends connected to said return header in corresponding vertically spaced relation; fixed partition means generally dividing said return header into one vertical chamber in direct communication with said tube outlet ends and an adjacent vertical chamber in direct communication with said return piping connection means, the upper and lower ends of said partition means extending beyond the respective extreme upper and lower outlet ends but terminating short of the interior ends of said return header; and slidable auxiliary partition means adapted to be gravity actuated to the lower end of said return header in accordance with the selected disposition of said unit to substantially block off flow from said one to said adjacent vertical chamber at the bottom end of said return header.

3. In the unit of claim 2: said fixed partition means is in the form of an open-ended cylindrical tube generally defining said adjacent vertical chamber; and said auxiliary partition is in the form of a relatively short cylindrical member slidably disposed within said cylindrical tube.

4. In the unit of claim 2: said fixed partition means is a relatively long plate-like member diametrically disposed between opposed walls of said return header; and said auxiliary partition is a relatively short plate-like member disposed for sliding movement adjacent one face of said relatively long member.

5. In a heat exchange unit adapted to be placed in a vertical disposition and to receive a liquid tempering medium: a vertical supply header including supply piping connector means adjacent each end thereof to permit connecting said header to a supply of said medium at whichever end of said supply header is lower; means for plugging the upper of said connector means; a vertical return header including return piping connector means; a plurality of vertically spaced tubes having inlet ends connected to said supply header and outlet ends connected to said return header to carry said liquid in parallel paths from said supply to return header; partition means extending from near the bottom end to near the top end of said return header for dividing said return header into vertical chambers open to each other at said ends; and auxiliary partition means slidably arranged within said return header for displacement to block off the lower of said end openings between said vertical chambers in accordance with the selected disposition of said heat exchange unit as installed for service.

6. In a heat exchange unit adapted to receive a liquid tempering medium: a supply header adapted for vertical

5

disposition with either of its ends at the top, said supply header including supply piping connecting means at both ends and means for blocking the upper of said connection means; a return header adapted for vertical disposition with either of its ends at the top, said return header including return piping connection means intermediate its ends; a plurality of tubes having inlet ends connected to said supply header in vertically spaced relation and having outlet ends connected to said return header in corresponding vertically spaced relation; means in and dividing said return header into a first chamber in direct communication with said outlet ends and a second chamber in direct communication with said return piping connection

6

means, with alternate interconnecting passageways formed between the opposite extreme ends of said chambers; and means for substantially closing the lower of said alternate interconnecting passageways by gravity actuation in accordance with the selected disposition of said unit as installed for service.

References Cited in the file of this patent

UNITED STATES PATENTS

2,577,832	Weiks	Dec. 11, 1951
2,831,490	Simcock	Apr. 22, 1958
3,004,545	Siemer	Oct. 17, 1961