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HEADER CONSTRUCTION FOR UNIT HEATER COIL

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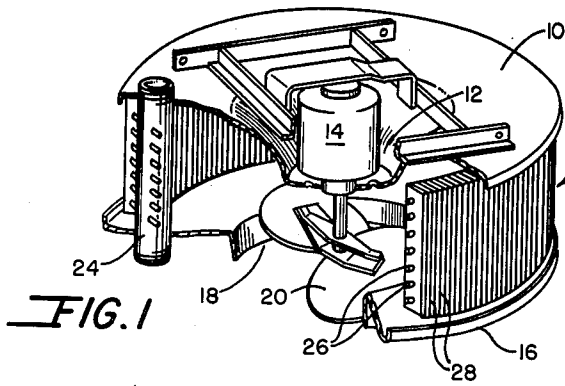
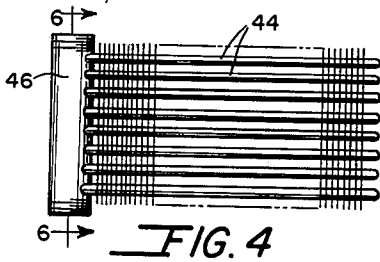
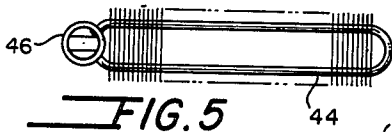
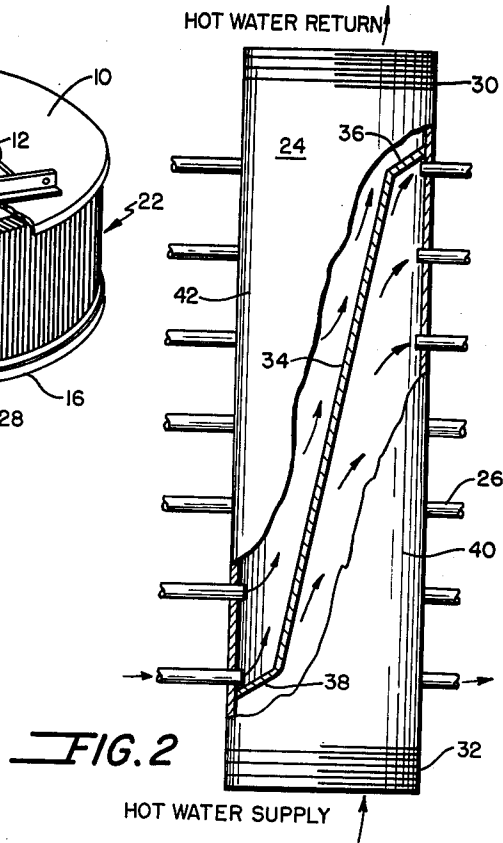
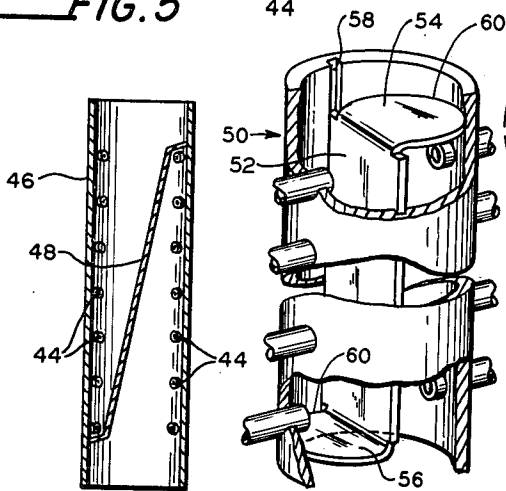
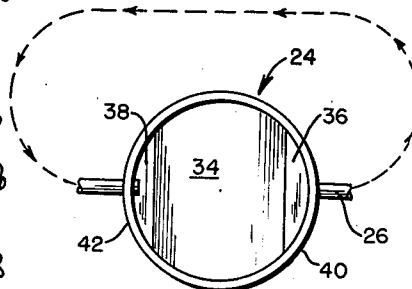


FIG. 6

FIG. 7

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3,223,155 HEADER CONSTRUCTION FOR UNIT HEATER COIL

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1 Claim. (Cl. 165—176)

This invention relates to heat exchangers particularly adapted for use in forced air unit heaters.

The principles of the invention and the benefits derived therefrom are especially applicable to heat exchangers used in either vertical type or horizontal type unit heaters. Therefore, the invention will be considered primarily in such an environment, with emphasis given to the vertical type unit heaters.

The heat exchanger of a typical vertical unit heater is provided with two separate headers, one serving as the supply and the other as the return header. Typically, each header is a length of pipe with one end threaded for connection to the branch piping, and its opposite end closed with an end cap welded or brazed thereon. In one arrangement, the two headers are vertically disposed in side-by-side relation with the threaded end of one header projecting above the end cap of the other header, and the threaded end of the other header projecting below the end cap of the first header. The two headers are secured in fixed relation to resist relative movement due to thermal stresses and the like by a plate extending tangentially along the walls of the two headers, or by other suitable fastening means.

In contrast with the typically old header arrangement, the header arrangement of this invention comprises a single tubular element or pipe which serves as both the supply and return distribution chambers by virtue of interior partition means extending generally lengthwise within the pipe with opposite ends sealed against diametrically opposite walls at vertically spaced locations encompassing the ends of the heat exchange tubes connected to the header. With this single pipe header arrangement the supply and return ends of the header are axially aligned so that swivelling of the heater at any time is facilitated.

In one arrangement of the invention, the partition means is disposed to promote the flow distribution of the heating medium to the tubes by having its major portion extending generally diagonally relative to the axis of the pipe to form oppositely directed tapered chambers within the pipe. In an alternative arrangement, the major portion of the partition means extends along the axis of the single pipe header with opposite end portions of the partition means oppositely directed to seal against opposite interior faces of the pipe. While there is some degree of sacrifice in flow distribution with the latter arrangement, this is offset by the lessening of manufacturing problems encountered.

It is preferred that with either arrangement, the partition means seals against the interior face of the header pipe, at both top and bottom, closely adjacent the respective top and bottom heat exchange tubes on the opposite sides of the header pipe. This results in the header being effectively self-venting and self-draining by mini-

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mizing the usual pockets found at the upper and lower ends of the headers.

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 partly broken isometric view of a vertical type unit heater in which the heat exchanger or coil of the invention is incorporated;

FIGURE 2 is a partly broken face view of a header according to the invention;

FIGURE 3 is a top view of the header of FIGURE 2;

FIGURE 4 is a face view of a coil incorporating the principles of the invention and adapted for use in a horizontal type unit heater;

FIGURE 5 is a top view of the heat exchanger of FIGURE 4;

FIGURE 6 is a vertical sectional view of the header of FIGURE 4 taken along the line 6—6 of FIGURE 4; and

FIGURE 7 is a broken isometric view of a header embodying an alternative form of the invention.

FIGURE 1 illustrates a vertical type unit heater incorporating the heat exchanger of the invention. The major parts of that heater include a cabinet structure comprising a generally circular top wall 10 having a central recess 12 which receives the fan motor 14 and a downwardly spaced ring shaped bottom wall 16 which has a downwardly flared central opening 18 which serves as the shroud for the propeller fan 20. The top and bottom walls of the heater are secured together by means not shown and have sandwiched between their outer marginal edges the heat exchanger or coil 22 which is of circular form generally and includes a header pipe 24, heat exchange tubes 26, and fins 28 carried by the heat exchange tubes to provide extended surface heat exchange.

The direction of air flow induced by fan 20 during operation of the vertical unit heater is radially inwardly through the circular coil 22 to pick up heat as it flows past the fins 28 and tubes 26, and then downwardly through the central opening 18. Conventional practice with these vertical type unit heaters is to suspend them above the space to be heated and the heated air is forced downwardly into the space.

The heat exchanger described herein may be used with either hot water or steam as the heating medium. When hot water is used, it is supplied to the bottom end of the header and is returned to the hot water return piping through the top of the header pipe. When steam is used as the medium, it flows in the opposite direction, i.e., top supply, and bottom return.

In accordance with the invention, the single header pipe 24 serves as both the supply and return header by virtue of its interior being divided by partition means into a supply chamber and a return chamber.

The header pipe 24 shown in FIGS. 2 and 3 is a single length of pipe having opposite threaded ends 30 and 32 to facilitate connection of the header to the branch piping. The interior of the pipe is divided generally lengthwise by partition means 34 which has an upper end 36 sealing against one interior face in the upper part of the pipe header, and an oppositely directed lower end 38 which seals against the diametrically opposite interior face in the lower part of the header. With the

partition means disposed to extend diagonally or at an angle to the longitudinal axis of the header as illustrated, its general shape in outline follows that of an ellipse, with the ends 36 and 38 varying in accordance with the angles at which they are disposed relative to the major portion of the partition means. Thus the edges of all parts of the partition means fit closely against the interior of the pipe for the length of the partition means, and at least the edges of the ends 36 and 38 are welded or brazed to the interior face of the pipe along those edges.

The circular coil described in connection with FIG. 1 includes the series of the heat exchange tubes 26, spaced one above the other, each extending from the one wall portion of the pipe 24 in a circular path back to the generally diametrically opposite wall portion. The open ends of the tubes 26 are inserted through holes provided in both of the opposite wall portions and are secured by brazing or welding. Thus the tubes secured to the right wall section designated 40 in FIGS. 2 and 3 are open to the chamber within the header pipe to the right of the partition means 34, and the tube ends secured to the left wall section designated 42 are in open communication with the left chamber.

The flow path of a hot water heating medium through the header is illustrated in FIG. 2 by the arrows. As there shown hot water supplied to the bottom threaded end 32 flows into the right chamber and is distributed to those ends of the heat exchange tubes 26 in communication with the right chamber. The water flows through the tubes as indicated by the broken line of FIG. 3 and exits out of the opposite ends of the tubes into the left chamber. From the left chamber it flows upwardly out of the pipe through top threaded end 30. The flow path of steam would be in the opposite direction with the steam entering through the top threaded end 30, and passing successively through the left chamber, the heat exchanger tubes where the steam would be to a greater or lesser degree condensed, the right chamber and out of the bottom threaded end 32.

It will be observed that as a result of the partition means 34 being arranged in the generally diagonal disposition within the header pipe 24, both the right and left chambers have a tapering cross section in the direction of flow of the heating medium. Thus an advantageous flow arrangement is obtained in which the heating medium tends to be equally distributed to the tubes irrespective of whether the medium is hot water or steam.

By making the overall height of the partition means just sufficient to encompass the span of the tubes, i.e., by having the upper end 36 contact the interior face of the pipe wall just above the upper tube and the lower end 38 contact the wall just below the lower tube, air and water pockets are minimized. This arrangement is advantageous with respect to a steam system in that it is effectively self-draining, and with respect to a hot water system in that it is effectively self-purging.

The heat exchanger of FIGS. 4-6 is of a character adapted for use in a horizontal unit heater wherein the heat exchanger is disposed in a vertical plane and extends across the forward open face of the unit heater. Fan means disposed behind the heat exchanger force air drawn in the back of the unit heater through the heat exchanger and out the front part of it. In the case of a heat exchanger having this configuration, the heat exchanger tubes 44 do not make a circular loop as in the case of the heat exchanger for the vertical unit heater, but rather make a loop similar to a trombone slide. Thus preferably, the opposite ends of heat exchanger tubes are not connected to generally diametrically opposite points on the header pipe 46 but rather are connected to the pipe in locations corresponding to adjacent quadrants of a circle. The partition means 48 is essentially the same as the described partition means for the vertical unit heat exchanger and as best shown in FIG. 6 divides the interior of the header pipe 46 into the two separate cham-

bers in communication with the respectively opposite ends of the heat exchange tubes 44. The header pipe 46 functions in the same manner as the header pipe 24 of the vertical type unit heater.

The embodiments thus far described in detail have included the major portion of the partition means disposed at a slant relative to the pipe axis to provide tapered chambers for flow distribution purposes. In certain cases it may be advantageous to sacrifice to a degree the flow distribution thus achieved in favor of simplifying the fabrication of the header.

The header 50 of FIG. 7 illustrates an arrangement which incorporates the general principles of the invention in an arrangement wherein the major portion 52 of the partition means extends parallel to the axis of the pipe so that the outline of the major portion is rectangular rather than generally elliptical. Thus the chambers on opposite sides of the partition means are of uniform cross section area from top to bottom. The top and bottom ends 54 and 56 may be semi-circular in outline and extend at a right angle from the major portion 52. If desired for sealing purposes, the interior face of the pipe is provided with a pair of diametrically opposite, lengthwise extending grooves 58 (one shown) to receive the lengthwise edges of the major portion 52, and in this case the width of the major portion is designed to slightly exceed the inner diameter of the pipe. After the partition means is properly placed, the semi-circular edges 60 of the top and bottom ends 54 and 56 are welded or brazed to the interior face of the pipe. In its simplest form, the width of the major portion 52 equals the inner diameter of the pipe, the grooves 58 are omitted, only the ends 54 and 56 are welded to the pipe, and the slight leakage between the chambers on opposite sides of the partition means is ignored.

The axial alignment of the supply and return connections of a single header pipe is of greater significance for a horizontal type unit heater than for a vertical type unit heater in that swivelling the unit upon the header axis permits a substantial change in the direction in which air is discharged from the horizontal type unit heater. No change in the branch piping is required to effect this change of air discharge direction.

In addition to the manufacturing economies possible in making a heat exchanger according to the invention, the provision of a single header permits the use of heat exchange tubes of greater length and a correspondingly greater number of fins for a vertical type unit heater. Thus it is possible to obtain greater capacity from a coil of given size.

The invention claimed is:

A heat exchanger construction for a unit heater comprising a longitudinally-extending tubular header element having oppositely spaced axially aligned supply inlet and return outlet means; a plurality of looped heat exchange tubes arranged in spaced relationship to each other with corresponding opposite ends thereof communicably connected to said header element wall in longitudinally-extending spaced first and second rows; partition means extending generally longitudinally in said header element with the peripheral edges thereof sealed against the interior face of said header element to divide said header element into a separate supply chamber communicating with said supply inlet means and said first row of corresponding ends of said looped heat exchange tubes and a separate return chamber communicating with said return outlet means and said second row of corresponding ends of said looped heat exchange tubes, said partition means being sized to span a distance within said header element slightly greater than the distance between diametrically opposite extremities of said first and second spaced rows of corresponding heat exchange tube ends to minimize pockets adjacent said row extremities, the major portion of said partition means extends generally diagonally in said header element so that each of said chambers

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is generally tapered in the direction of heating medium flow in said chambers with said partition means having end portions which are angled to engage the interior face of said header element immediately adjacent the diametrically opposed extremities of said first and second rows.

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