A corrugated indirect heating coil is disclosed. The heating coil includes an intake and an exhaust. Tubing connects the intake and exhaust together in fluid communication. The tubing includes a plurality of corragations formed thereon to maximize surface area for heat exchange. The tubing is preferably wound into coils and supported by a frame.
CORRUGATED INDIRECT WATER HEATER COIL

CROSS-REFERENCE TO RELATED APPLICATION

This patent document claims priority to earlier filed U.S. Provisional Patent Application No. 61/790,881, filed on Mar. 15, 2013, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field

The present patent document relates generally to water heaters and more specifically to a corrugated indirect water heater coil used in water heaters and other heat transfer appliances.

2. Background of the Related Art

Efficient transfer of heat between fluid circulating in a coil to another heat transfer medium, such as heating hot water in hot water heaters or in other HVAC systems, is desirable. The industry is always seeking new ways to minimize energy loss in appliances and maximize heat transfer between heat transfer mediums.

Therefore, there is a perceived need in the industry for an improved device for transferring heat in open and closed loop heating systems.

SUMMARY OF THE INVENTION

The corrugated indirect heating coil solves the problems of the prior art by providing a heater coil that includes corrugations to maximize surface area and, thus, heat transfer, between heat transfer mediums. The mediums may include water to water, steam to water, glycol to water, brine to water, and the like, as is known in the art, and may be used in open and closed loop systems, but is not limited thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description, appended claims, and accompanying drawings where:

FIG. 1 shows a perspective view of a heating coil;
FIG. 2 is a partial cross-section view of a heating coil tubing;
FIG. 3 is a partial cross-section view of an intake of a heating coil tubing, inset A of FIG. 2;
FIG. 4 is a partial cross-section of an embodiment of a heating coil illustrating the dimensions thereof;
FIG. 5 is an end view of an embodiment of a heating coil illustrating the dimensions thereof;
FIG. 6 is a partial cross-section of another embodiment of a heating coil illustrating the dimensions thereof;
FIG. 7 is an end view of another embodiment of a heating coil illustrating the dimensions of the tubing; and
FIG. 8 is an end view of another embodiment of a heating coil illustrating the dimensions thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the pages of the drawings, the heating coil is shown generally at 100. The heating coil 100 includes a coiled piece of tubing 102 with high thermal transfer capabilities. Such coils are often made of copper, aluminum and other metals. The tubing 102 includes an intake 104 and an exhaust 106, which may include threaded ends 108a, 108b for attachment to the heating and cooling system. The tubing 102 may be supported by a frame 110. The height of the coils of tubing 102, as measured from a centerline the exhaust 106 and intake 104, is from about 15.23" to about 16", and the height l, as measured from the bottom to the top of the frame 110, is from about 17.72" to about 18.63". The coiled tubing 102 is pitched, allowing for a compact design and flow of heat transfer medium through the tubing 102. The distance D from each coil of tubing 102 is from about 2" to about 3" and more preferably from about 2.19" to about 2.61".

The tubing 102, between the intake 104 and exhaust 106, includes a plurality of corrugations 112, which have a variation of about 1.392" to about 1.601". In other embodiments, the variation may lie between about 1.380" to about 1.728", at the粗 of the corrugation 112, to 1.618" to about 2.023" at the peak of the corrugation. The corrugated tubing 102 may be formed initially from straight tubing having an exterior diameter of about 1.500" and an interior diameter of about 1.375". The corrugations 112 maximize surface area between the two heat exchange mediums, enhancing energy efficiency.

The outer diameter D2 of the coils of the tubing 102 may be from about 10" to about 20", or more preferably from about 12.44" to about 15.74". Other outer diameter of about 13.12" and about 17.9" are also desirable. The inner diameter D1 of the coils of the tubing 102 may be from about 8.5" to about 15" or more preferably from about 10.54" to about 13.6". In other embodiments, the diameter D2 of the coils of tubing 102 may be about 12.25". Distance D3, from the coil of the tubing 102 to the intake 104 (or exhaust 106) is from about 13.5" to about 22" or more preferably from about 15.15" to about 20.2".

The thickness of the tubing 102 itself is preferably between about 0.0112" and about 0.0148". The inner diameter of the tubing 102 itself may be about 1.358" to about 1.698".

The dimensions of the tubing 102 may be varied depending upon the application intended and the system the heating coil 100 may be placed in. Specifically, the dimensions listed herein are for heating applications for odd sized tanks, varying 15" to 23". Industry standard dimensions are frequently even sizes, ranging 14" to 26". The heating coil includes dimensions optimal to retrofit a variety of existing water heater systems on the market.

Critically, the ratio of various dimension sin the corrugations in relation to the dimensions of the coil of tubing are need for manufacturability and optimal heat transfer. Specifically, the range of the ratio of 2.023" (O major) from FIG. 4 to the range identified as 12.44" to 15.78" in FIG. 5, and exhibited again in FIGS. 6 and 8, respectively. Additionally, the pitch between corrugations 112 to the inner diameter D1 of the coiled tubing 102 allow for the manufacturability. While the heat transfer performance is optimized by the range of ratios between the O major dimension and O minor (identified in FIG. 4 as 1.358" to 1.698") and the ratio of the pitch and wall thickness (identified in FIG. 4 as the dimension from 0.0112" to 0.0148"").

Therefore, it can be seen that the corrugated indirect heating coil provides a novel solution to providing a heat exchange coil that improves over existing heat exchange coils.
by providing a more energy efficient way of transferring heat between two heat exchange mediums. The corrugations in the tubing provide enhanced surface area, thereby, maximizing the heat exchanged.

[0024] It would be appreciated by those skilled in the art that various changes and modifications can be made to the illustrated embodiments without departing from the spirit of the present invention. All such modifications and changes are intended to be within the scope of the present invention except insofar as limited by the appended claims.

What is claimed is:

1. A heating coil, comprising:
   an intake;
   an exhaust; and
   tubing connecting the intake and exhaust in fluid communication, the tubing including a plurality of corrugations.
2. The heating coil of claim 1, wherein the tubing is wound into a plurality of coils.
3. The heating coil of claim 2, wherein an outer diameter of the coils of the tubing is about 12.44" to about 15.74".
4. The heating coil of claim 2, wherein an outer diameter of the coils of the tubing is about 12.25".
3. The heating coil of claim 2, wherein the coils are supported by a frame.
4. The heating coil of claim 1, wherein the intake includes a threaded end.
5. The heating coil of claim 1, wherein the exhaust includes a threaded end.
6. The heating coil of claim 1, wherein the corrugations have a variation of between about 1.380" to about 1.728", at a trough of the corrugation, to about 1.618" to about 2.023" at a peak of the corrugation.
7. The heating coil of claim 6, wherein the corrugations have a variation between a trough and a peak of the corrugation of between about 1.392" to about 1.601".
8. The heating coil of claim 1, wherein the tubing is formed from straight tubing having an exterior diameter of about 1.5" and an interior diameter of about 1.375".
9. The heating coil of claim 1, wherein the tubing has a thickness of between about 0.0112" and about 0.0148".
10. The heating coil of claim 1, wherein the tubing has an inner diameter of between about 1.358" to about 1.698".

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