Feb. 28, 1967 J. L. CURREN 3,306,352

COMPACT COILED TUBE HEAT EXCHANGER

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Fig. 1.

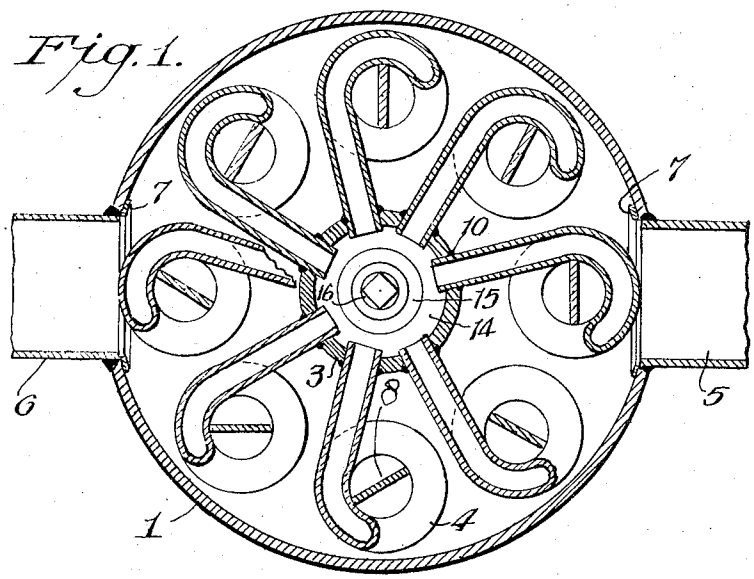
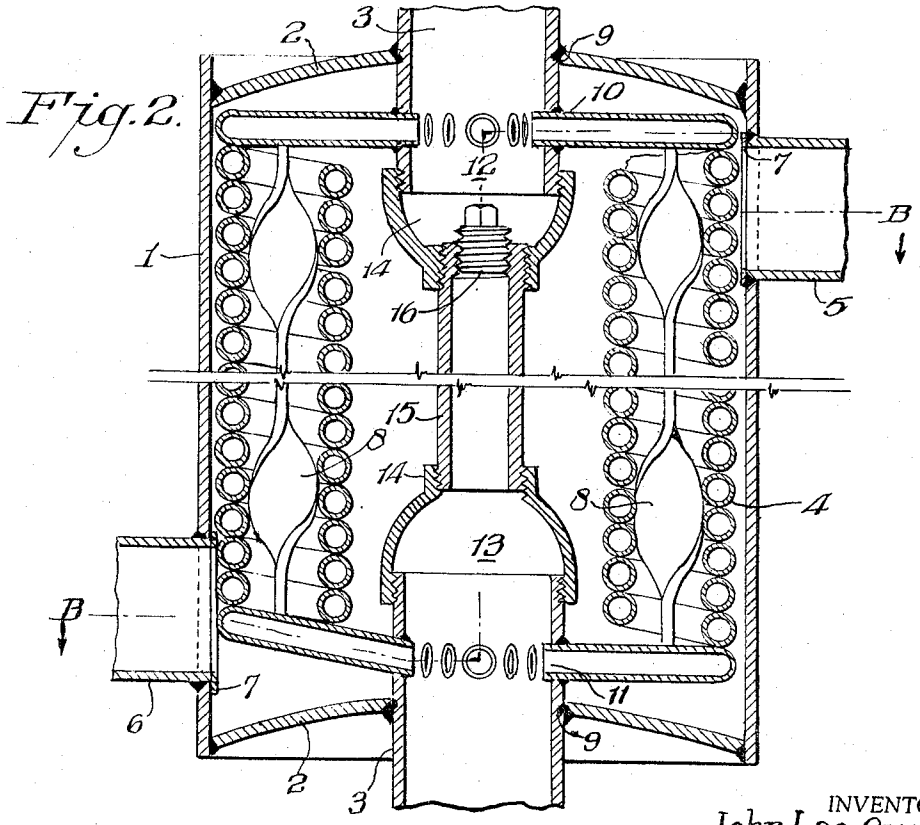


Fig. 2.



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COMPACT COILED TUBE HEAT EXCHANGER

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This invention relates to a completely new design in a heat-exchanger.

An object of this invention is to provide a highly efficient heat-exchanger of relative light weight and portable. Another object of this invention is to provide an exchanger, where conditions demand a great volume of high temperature hot water for batch use, or for continuous flow service. Still another object of this invention is its use as a generator for domestic hot water service, of large or small demands, in conjunction with steam heating boilers or hot water heating boilers. Yet another object of this invention is its use as a supplemental unit, where and when intermittent peak demands for high temperature hot water cannot be supplied by the regular installed domestic hot-water system.

These objects are accomplished by a heat exchanger consisting primarily of (a) a housing made of a section of heavy weight streamline tubing or piping, with prebulged heads attached in each end, said housing having an inlet and outlet as noted below; (b) a pipe assembly extending through each of the mentioned prebulged heads; (c) a series of coils vertically disposed in the housing and attached to the pipe assembly; and (d) a spiral wiping vane spaced in the center of each coil.

The heat exchanger of this invention in its preferred embodiment is described more specifically with reference to the accompanying drawings wherein:

FIG. 1 is a sectional plan taken substantially on the line B—B of FIG. 2.

FIG. 2 is a sectional elevation taken through the center of FIG. 1.

Referring to the drawings, in which like reference characters indicate like parts, this new heat exchanger has component parts as herein noted.

A housing or jacket **1**, preferably of copper, having prebulged ends or heads **2**, and an inlet **6**, and an outlet **5** for introducing and withdrawing liquid heat exchange medium (normally the heat absorbent). The ends **2** are provided with an opening preferably at or near the center, to provide clearance for top and bottom sections of a novel pipe assembly, described below, for introducing the other heat exchange medium (normally the heat supplier, particularly steam).

A pipe assembly **3** which is vertically disposed in jacket **1**, and extends through and beyond the ends thereof, as shown in FIG. 2, to form a pressure tight vessel with above mentioned inlet **6** and outlet **5**. This pipe assembly, which is preferably of brass, comprises an upper section **12**, and a lower section **13**. The upper and lower sections of the pipe assembly are separated and connected through reducers **14**, as shown in FIG. 2, to a smaller section of pipe **15**. Pipe plug **16** is inserted in upper end of smaller pipe **15** to complete formation of the steam supply or pressurized chamber **12**, and the return or condensate nonpressurized chamber **13**. The top and bottom sections of the said pipe assembly, are provided with a notched groove **9**, said grooves objectively placed within the weld areas at each end of exchanger, and functions to further aid retention of internal pressure.

A nest of objectively sized tubular coils **4**, preferably of copper, vertically positioned within the jacket **1**. These coils are, advantageously circularly disposed around pipe assembly **3**, as shown in FIG. 1. The upper end **10** of each coil is connected to the supply chamber **12**, and

the lower end **11** of each coil is connected to the return chamber **13** of the pipe assembly.

A close fitting spiral wiping vane **8** is positioned in the center of each coil **4** and preferably extends the full length of the coil.

Refinements in the construction of this heat exchanger include the following additional features. Lock and flared joints **7** are provided on the exchanger ends of inlet **6** and outlet **5** to serve as a positive arrestor against dislodgement by internal pressure.

When this exchanger is put into operation, the housing is always full of water, or other liquid medium, before admission of steam to steam chamber for distribution to each of the vertical coils. Study has proven that, in vertical liquid flow, the steam flow must be countercurrent for high efficiencies.

The materials of construction can be greatly varied, as can the length, diameter, number and size of coils, so that capacities can be predetermined. In design of this exchanger, allowances are made for absorption of most heat in the condensate near bottom of coil. This phase of heat absorption allows for pressure-free condensate at point of discharge, thereby eliminating use of any thermal or pressure-actuated steam trap. Similarly, the outside diameter of the housing section is so chosen for a minimum clearance around the nested vertical coils, which extend from the steam changer to the condensate chamber.

The above-mentioned piping assembly has a four-fold function, as follows: (1) It furnishes a degree of rigidity in the vertical plane, (2) the enlarged top section of this assembly functions as a steam distribution chamber, supplying steam to each of the nested vertical coils, (3) the bottom enlarged section of this assembly functions as a condensate chamber, made free of pressure by insertion of ½" brass pipe plug in top of ¾" schedule "80" section of brass pipe as shown in FIG. 2, (4) the top and bottom sections of this assembly are provided with a notched groove, said groove functioning as a key joint to further internal pressure retention.

The heat-exchanger in this invention has the following features and advantages: (a) designed for simplicity of manufacture, (b) designed for highest B.t.u. capacities per unit weight, (c) easily portable for certain remote uses, (d) in assembly, cold spring is applied to each coil, in its vertical plane, for the purpose of elimination of stresses or strains, due to variables of heat application to the coils, (e) designed to furnish an unlimited supply of high temperature water, which temperature is strictly prohibitive for any regular industrial or domestic hot-water system, (f) designed for batch load heating up to 210° F., (g) designed for use, with proper valving, for open flow service at any constant volume, and constant temperature up to 210° F., such as required in dairy, food processing, candy and drug manufacture, and in other types of industry, (h) designed to function economically as a preheater.

Insofar as I am aware, no other heat-exchanger has these advantages, at least not to an equal degree. The design of this invention is totally novel in itself, and embodies engineering features not apparent in any other heat-exchanger, at least not to my knowledge.

Although the heat-exchanger in this invention has been described as a water heat-exchanger, with particular reference to water and steam as the media of use, it is apparent that other media can be used. Also in this reference it is apparent that a substitution of metals could be applied, where advisable. In such applications, the design and assembly as shown in the drawings do apply. This invention has been described in its more simple form. It is within the scope of this invention to include all refinements, internal and external of the exchanger proper, which are part and parcel of any phase of this

heat-exchanger, including the field of all domestic or industrial uses.

Having now described the invention in specific detail, and exemplified the manner in which it may be carried into practice, it will be readily apparent to those skilled in the art that innumerable variations, modifications, applications, and extensions of the basic principles involved may be made without departing from its spirit and scope.

What is claimed is:

1. A heat exchanger comprising:

(a) A jacket having bulged top and bottom sections, and having an inlet and outlet to permit passage of a liquid through the jacket,

(b) A pipe assembly vertically disposed in said jacket, and extending through the top and bottom thereof, said assembly having an upper supply chamber hermetically sealed from a lower return chamber,

(c) A nest of tubular coils vertically disposed in said jacket and positioned in close proximity to the jacket and the pipe assembly, the upper end of each coil being connected to the supply chamber of said pipe assembly, and the lower end of each coil to the return chamber of said pipe assembly, the combined cross sectional areas of the tubes comprising said coils being less than the cross sectional area of the supply chamber, and

(d) A thin spiral wiping vane in the center of each coil.

2. The heat exchanger of claim 1, wherein the top and bottom sections of the pipe assembly each contain a notched groove at the locus where the pipe assembly extends through the jacket thereby forming key joints to aid retention of internal pressure.

3. The heat exchanger of claim 1, wherein the upper and lower chambers of the pipe assembly are hermetically sealed from each other by means of a smaller diameter section of pipe which is connected to said upper and lower chambers through reducers and which has a pipe plug inserted in its upper end.

4. The heat exchanger of claim 1, wherein the internal ends of the inlet and outlet of the jacket have lock and flared joints to serve as a positive arrestor against dislodgement by internal pressure.

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