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2,682,391

HEAT EXCHANGER WITH REMOVABLE LINER

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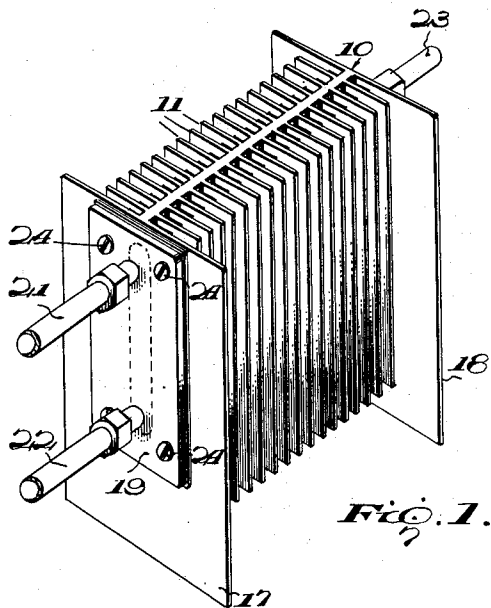


FIG. 1.

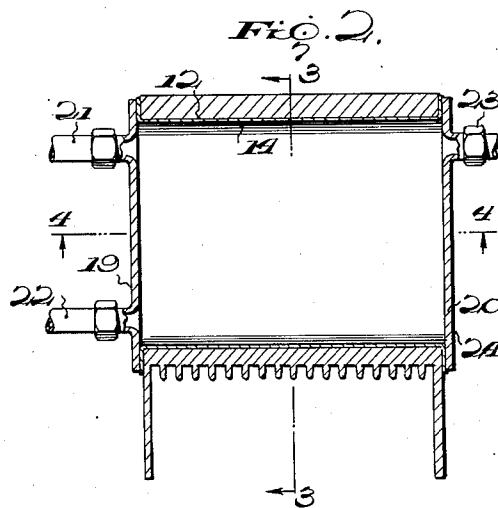


FIG. 2.

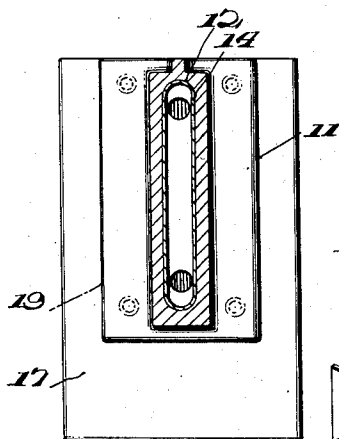


FIG. 3.

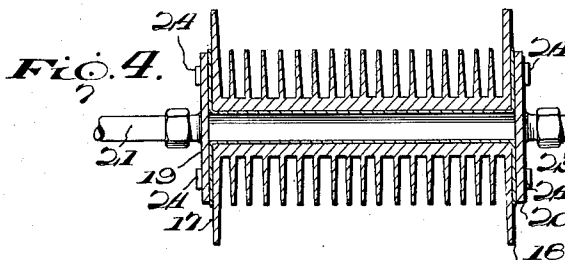


FIG. 4.

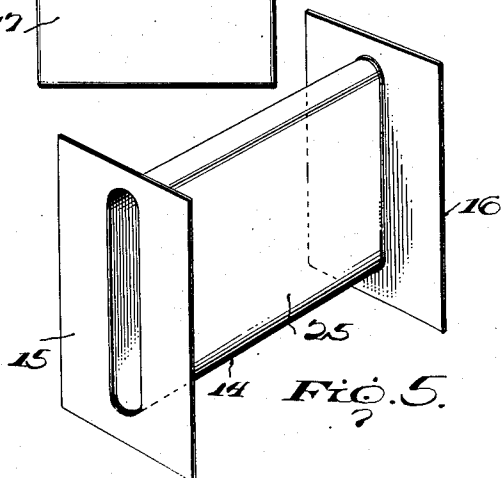


FIG. 5.

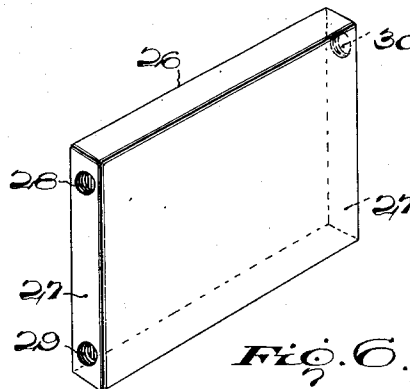


FIG. 6.

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HEAT EXCHANGER WITH REMOVABLE LINER

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1 Claim. (Cl. 257—150)

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My invention relates to a new and improved heat exchanger. More particularly my invention is directed to apparatus for transferring heat from one fluent material to another, whether the material be in the form of a gas, liquid, or granular solid.

It is well known that the efficiency of heat exchangers is quickly impaired by deposits of tenacious scale or sludge from the fluent materials passing therethrough. Such incrustations are formed, for example, in heat exchangers in which hard water is used. The presence of dissolved calcium and magnesium salts in the water are responsible for its so-called hardness. In addition to these salts, there may also be present varying amounts of sodium salts, silica, alumina, iron, and manganese. Various methods and devices are used for cleaning the heat exchangers such as brushing, gas blasts or vacuum treatments, and agitating devices along with various chemical agents, such as free acids, which corrode the scale. But these procedures involve burdensome financial losses due to the cost of and time lost in shut-downs for the elaborate chemical and mechanical cleaning operations necessary to remove the dense and hard deposits.

By the present invention these losses are substantially minimized by the provision of a removable liner in the heat exchanger outer member which may be easily and economically replaced after use. The liner is a thin-walled member which is pressed into abutting engagement with the exchanger outer member by the fluent material passing therethrough, thereby insuring highly efficient heat exchange by conduction.

The various objects and features of the invention will be fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a perspective view of a heat exchanger embodying the present invention;

Fig. 2 is a longitudinal vertical section of the heat exchanger in Fig. 1;

Fig. 3 is a view taken on line 3—3 of Fig. 2;

Fig. 4 is a view taken on line 4—4 of Fig. 2;

Fig. 5 is a perspective view of the liner employed in the heat exchanger shown in Figs. 1—4; and

Fig. 6 is a perspective view of an alternative form of liner.

The drawing merely illustrates a certain embodiment of the invention for the purpose of teaching how to apply it but it is to be understood

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that the drawing as well as the following detailed description are not intended to express any limitations of the invention and the scope thereof.

The heat exchanger shown in Figs. 1 to 4 represents a form of the invention particularly adapted for installation in a gas water heater. As shown in the drawing, the heat exchanger includes an outer member 10 having fins 11 integral therewith which provide a large area for contact with the hot gases produced by a suitable heat source, such as a gas burner. The outer member 10 has an opening or passage 12 into which is placed the removable liner or waterway 14. As seen in Fig. 5, the waterway 14 has end flanges 15 and 16 which are adapted to lie against the ends 17 and 18 respectively of the outer member 10. Over these end flanges 15 and 16 are mounted suitable adapters, such as the end plates 19 and 20, which are equipped with suitable pipe fittings and connections 21, 22 and 23; connection 21 being suitable for a safety pressure release valve. The adapters 19 and 20 are drawn into fluid tight engagement with the end flanges of the waterway 14 by suitable tightening or fastening means, such as the cap screws 24. In some instances it may be necessary to provide gaskets at these locations to safeguard the fluid-tight integrity of the system. The outer member 10 may be made of metal and is preferably a metal casting having the passage 12 cast therein to reduce the machining costs to a minimum. I have discovered that excellent heat exchange characteristics are obtained by making the body 25 of the waterway 14 of thin-walled construction thereby providing a flexible character to the body 25 which permits it to be pressed outwardly into abutting contact with the walls of the passage 12. This expansion of the waterway body 25 is caused by the pressure of the water flowing through the waterway 14 and if the waterway is of metal construction, expansion due to heat advantageously adds to the outward movement caused by the water pressure. By this arrangement, therefore, I have developed a heat exchanger which does not require adherence to close tolerances during production, while at the same time insuring complete surface to surface contact of the replaceable waterway with the outer member during use to insure heat exchange therebetween by conduction.

In practice, the source of maintenance problems and expense lies with the liner 14 through which the water to be heated is passed since, as previously explained, deposits of scale, sand, sludge, and the like form on the walls of the liner

thereby reducing the efficiency of the heat exchanger. I have discovered that a liner of the form shown in Fig. 5, for example, may be made of a plastic material of a type which is capable of retaining its water tight integrity at the temperatures encountered. Because the liner is pressed by the water into complete abutting engagement with the passage walls, it need not possess strength characteristics capable of withstanding the pressure of the water and therefore may be quite thin and pliable in nature. When it becomes necessary to clean the deposited material from the heat exchanger, the plastic liner may be removed and disposed of or cleaned for later re-use, and a new liner inserted. It will be clear that by this expedient the expensive and time consuming cleaning operation is obviated.

In Fig. 6 is shown another type of waterway which comprises a thin-walled, box-like conduit 25 adapted for insertion into an outer member similar to that shown in Figs. 1-4, but having a passage of rectangular cross section. The end walls 27 are provided with tapped holes 28, 29 and 30 which are adapted to receive the usual pipe fittings, the hole 28 being suitable for a safety pressure release valve.

It will be noted that the water does not contact the outer member 10 at any point and therefore the problem of erosion or corrosion of the outer member by the water flowing therethrough is completely avoided. This permits the use of lower cost materials in the manufacture of outer member 10 and extends the useful life of the heat exchanger. While I have shown but two types of liners, it will be appreciated that they may be of any suitable shape and may be made of any suitable material such as plastics, aluminum, bronze, copper, brass, iron, steel, and the like. When made of metal the body portion of the conduit is preferably thin-walled to provide the flexibility necessary for movement outwardly into abutting engagement with the outer member by the pressure of the fluent material passing therethrough.

Further, while I have disclosed by way of example an embodiment of my invention which is particularly adapted to a heat exchanger for use in a hot water heater, it will be understood that my invention may be used advantageously in any device wherein heat exchange is desired between two fluent materials, such as, for example, cooling heat exchangers of the radiator type used in internal combustion engines, air compressors, and the like.

I claim:

A heat exchanger for a gas water heater com-

prising an outer metal shell-like member having a large passageway extending longitudinally and completely therethrough, said shell-like member having a plurality of laterally extending fins integral therewith providing a large heat exchange area, said shell-like member having an inlet end member and an outlet end member integral therewith each of which provides a large peripheral flat sealing surface transversely outwardly of its respective end of said shell-like member; a removable thin-walled waterway positioned within said passageway and having an inlet flange member and an outlet flange member integral with and extending transversely from their respective peripheries of the large opening therethrough over their respective inlet and outlet end members; an inlet adapter having a small opening for delivery of unheated water to said waterway and an inlet flat sealing peripheral face cooperatively aligned with its sealing surface, an outlet adapter having a small opening for discharge of heated water from said waterway and an outlet flat sealing peripheral face cooperatively aligned with its sealing surface; and means for drawing said inlet adapter and said outlet adapter toward said inlet end member and said outlet end member respectively to squeeze the waterway flange members between their respective sealing surface and peripheral face to provide a fluid-tight seal, the body of said removable waterway being of thin-walled construction to permit flexure thereof into abutting contact with said outer shell-like member by the water passing therethrough to insure heat exchange therebetween by conduction and to permit easy removal when incrustated with deposits of tenacious scale.

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