Aug. 18, 1970 C. BENJUMEDA ET AL 3,524,500

HEAT TRANSMISSION SYSTEM

Filed July 2, 1968 3 Sheets-Sheet 1

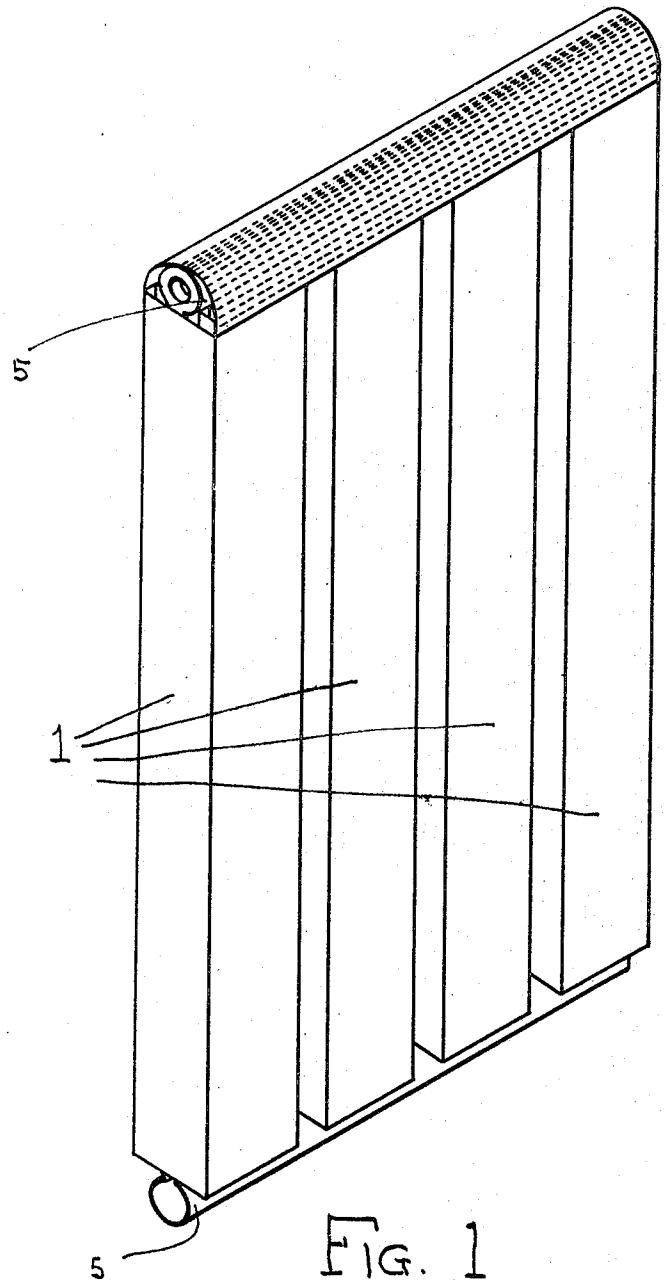


FIG. 1

HEAT TRANSMISSION SYSTEM

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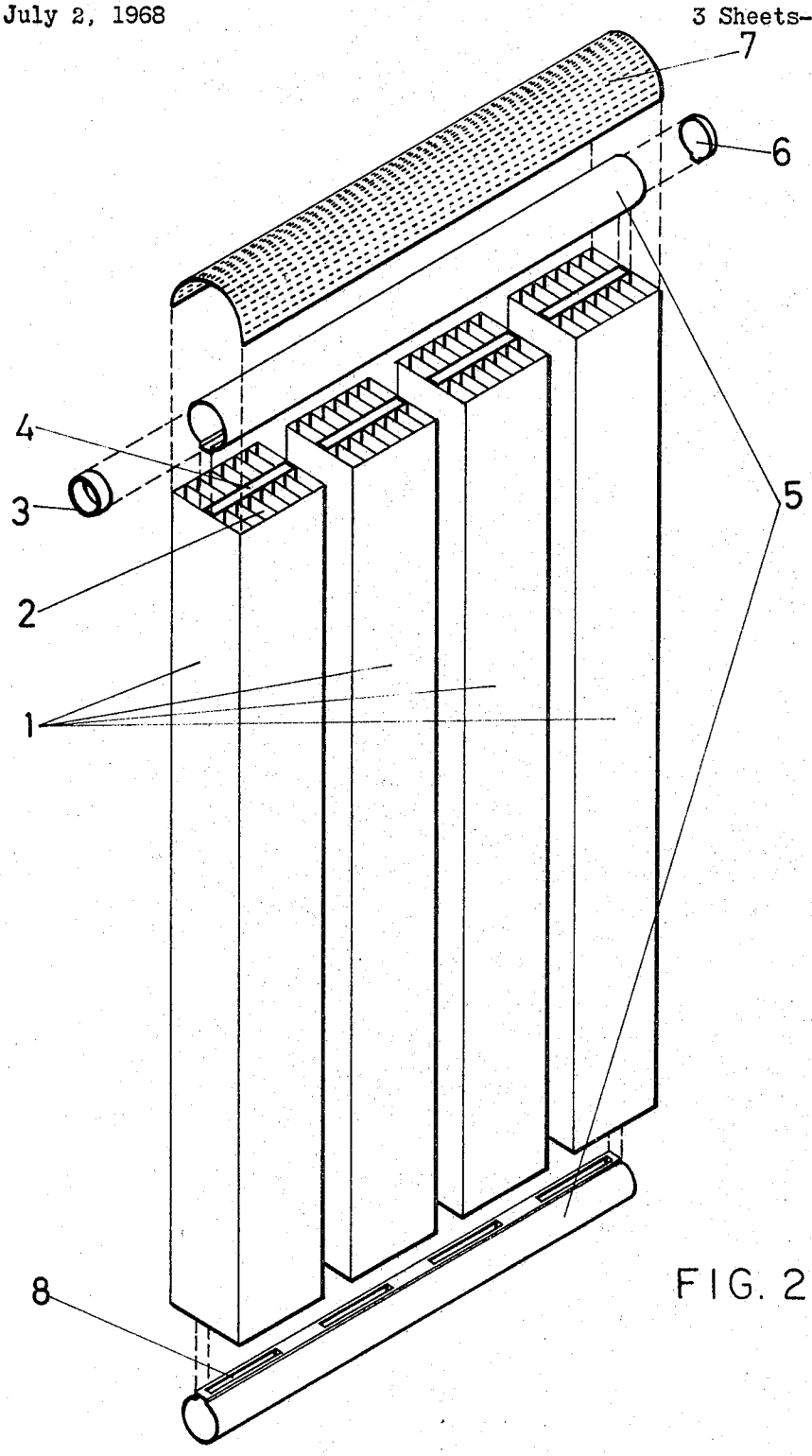


FIG. 2

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HEAT TRANSMISSION SYSTEM

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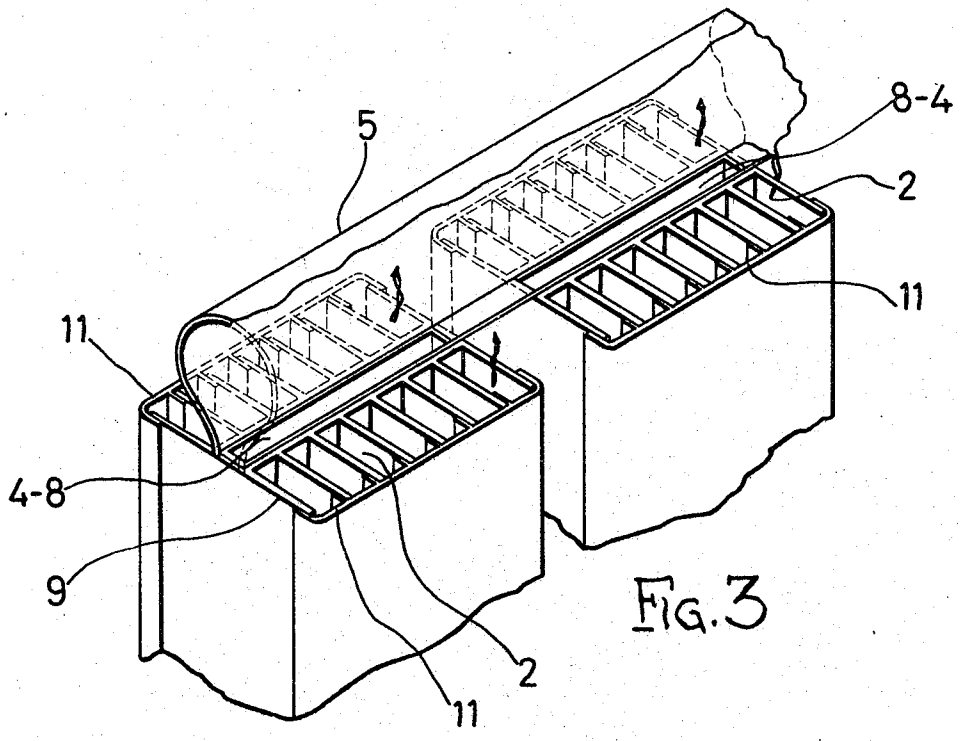


FIG. 3

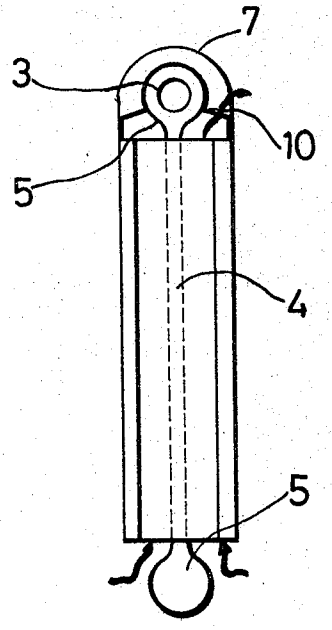


FIG. 5

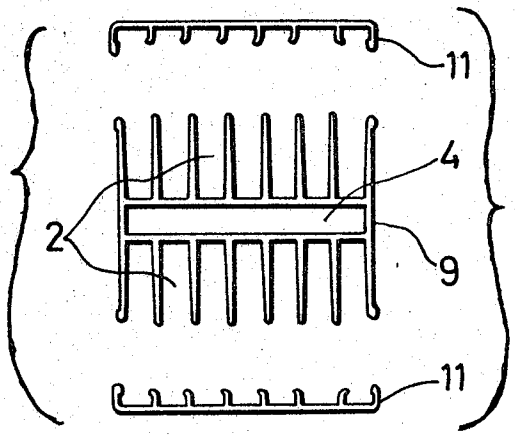


FIG. 4

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HEAT TRANSMISSION SYSTEM

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Int. Cl. F24h 9/12
U.S. Cl. 165—129 4 Claims

ABSTRACT OF THE DISCLOSURE

A heat transmission system generally made of material of good heat conductivity and chambers providing for the flow therethrough of one fluid under pressure and a second fluid by convection, the chamber through which the fluid under pressure passes having a generally horizontal cross section which is long and narrow so as to promote heat transmission through the surface of the chamber over an extended area in relation to the fluid passing through said chamber which may be a relatively thin film, the chamber through which the fluid passes by convection including a multiplicity of conduits of vertical height sufficient to promote convection and which are in association throughout their vertical height with a wall of said first chamber which in generally horizontal cross section has been characterized as long.

This invention relates to heat exchange apparatus and more particularly to a construction involving separated sets of passageways through one set of which a fluid may pass under pressure, such as negative pressure, like a vacuum and through another set of which a fluid may pass by convection.

Prior to the instant invention, it has been the practice to build convectors for heating or cooling which include heat exchange apparatus comprising a finned coil enveloped by a casing. In such prior apparatuses a heating or cooling fluid may be passed through the coil and a fluid or air to be thermally affected is passed about the coil in most cases by a fan. Such prior constructions have been relatively difficult to manufacture and have been inefficient in operation. The finned coils of such prior apparatuses are of such dimension that they usually require adapters in order for them to be associated with the piping system of a building construction, and in such constructions the air flow about the coil is generally insufficient for the purpose intended unless auxiliary apparatus such as a fan or a thermostatically controlled blower is utilized.

It is an object of the instant invention to provide a heat exchanger of thermally conductive material which will be readily easy to incorporate into an ordinary piping system which may be fabricated of simple heat conductive materials, such as sheet metal, which will be neat in appearance and which will require no auxiliary apparatus such as fans or blowers and at the same time economically afford the desired result.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawing.

FIG. 1 is a perspective view of a heat exchange apparatus in accordance with the invention;

FIG. 2 is an exploded perspective view of a heat exchange apparatus in accordance with the invention;

FIG. 3 is a fragmentary enlarged perspective view illustrating some details of the upper manifold and its connection to the heat conducting passage of two spaced heat exchange elements and also illustrating the convection passages associated with each heat conducting passage;

FIG. 4 is an enlarged exploded top plan view of one of said heat exchange elements; and

FIG. 5 is a somewhat reduced side elevation of the heat exchanger.

Referring now to FIGS. 1 to 5 of the drawings, the heat exchange elements 1 may be fabricated of thermally conductive sheet metal having an exterior configuration in the form of a rectangular parallepiped and thus present a clean, neat and attractive exterior. Within each parallelepiped there is provided a multiplicity of convection passages 2 formed by plate-like fins which are in thermal association with the exterior walls or plates 11 of the elements 1 and also with the generally wide, though thin, heat conducting passages 4 which extend all the way through each of the heat exchange elements 1. The first and last of the plate-like fins 9 which extend from each wide side of the passages 4 are in the planes of the narrow sides of said passages 4.

Thermal exchange by conduction takes place between the fluid in the passages 4 and the separated fluid in the convection passages 2.

The lower ends of the convection passages 4 are fed from the lower manifold 5 on the upper side of which there is provided a series of elongated openings 8. Fluid leaves the passages 4 through the upper manifold 5, which is provided on its lower surface with a series of elongated openings such as the openings 8 described in connection with the lower manifold 5.

The manifolds 5 are of such diameter that they may be readily associated, by suitable threading or other commercial coupling, with the normal piping utilized in building construction for the passage of fluids therethrough so that it is not necessary to use unusual or expensive or special adapters. The elements 3 and 6 shown in the drawing serve to illustrate schematically the use of connectors for this purpose as described.

A cowling or cover plate 7 which may be formed of sheet metal and arched as illustrated in the drawing, is utilized to cap the heat exchange apparatus. This cowling or cover plate 7 may have tiny slits extending therethrough so that air passing through the convection passages of the heat exchange elements 1 will be permitted to emerge as shown by the arrows while at the same time the interiors of the elements 1 will remain relatively clean and efficient.

As the horizontal cross section of the passages 4 is long and narrow, so that each pasageway 4 has a relatively wide wall and a relatively narrow wall, the fluid therein will present an efficient thermal transfer area to the surface of said passageways 4 which, in turn, are conductively associated with every plate-like fin which forms a part of convection passages 2 and which in turn is thermally associated with the exterior surface 11 of the heat exchange elements 1.

As illustrated, there are four heat exchange elements 1 to a heat exchange apparatus unit with each element 1 being arranged vertically so that the convection passages 2 are open both at the bottom and the top.

The fluid may be passed through the lower manifold 5, through the conduction passages 4, and out through the upper manifold 5 under the influence of pressure such as negative pressure like a vacuum. Fluid passes through the convection passages 2 by convection.

On each wide side of the conduction passage 4 of each element 1, there are seven convection passages 2 so that for each heat exchange element 1 there are fourteen convection passages 2.

In some installations where it is required that air be heated, the unit as illustrated in the drawings is arranged in an area where heat is generated and the fluid receiving the heat is passed upwardly through the passages 2

in heat conductive transfer relation with the passageways 4 so that when cold air is passed into the lower manifold 5 under the influence of a vacuum, the heat from the ambient about the elements 1 will be transferred to the air in the passageways 4 rapidly and efficiently, which heated air may then be passed to a place where it is required through the upper exit manifold 5.

Instead of using cold air under the influence of a vacuum in manifolds 5 and passageways 4, chilled water may be passed therethrough, particularly when the heat transfer system shown in the drawing is utilized in a room to be cooled. In such a utilization, the heat generated by the occupants of the room will be transferred first to the ambient about the occupants and then by convection through the convection passages 2, wherein the heat in the air will be transferred by conduction to chilled water passed through the passages 4 from the lower manifold 5 and when the chilled water is heated, it leaves through the upper manifold 5. In such a utilization, the water in the manifolds 5 and passages 4 may be circulated in any conventional manner such as by convection or by the use of a circulating pump.

In the winter time, steam or hot water may be passed through the manifolds 5 and passages 4 so as to cause the air in an occupied room to be heated by convection after air passes through the convection passages 2 about the passages 4 through which hot water or steam passes and then the heated air will emerge through the slits in the cowling 7 and serve to warm the occupants of a room wherein the apparatus is installed.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown in the drawing and described in the specification.

What is claimed is:

1. A heat exchange element comprising means defining a first passage including a conduit having a generally rectangular horizontal cross-section with two long sides and two short sides defining major and minor surfaces, respectively, a set of spaced vertically disposed plate-like fins extending generally perpendicularly from each major surface of said first fluid passage, each set including a first fin, a last fin, and a plurality of intermediate fins, the first and last fin of each set being generally in the same plane as the first and second of said two minor surfaces, a plurality of generally vertical convection or second passages arranged on each said major surfaces of said first passage, said second passages each including an outer wall formed at least in part by a pair of generally vertical outer plates connecting said first and last fins of each set and being spaced from and generally parallel to each of said major surfaces, whereby said apparatus is in the three dimensional form of a generally vertically disposed rectangular parallelpiped having a generally horizontal cross-section

comprising an inner rectangle bounding said first passage, and an outer rectangle bounding the convection passages, said outer rectangle having two sides each of which are generally in the respective planes of the first and last fins of each set, said outer rectangle having its other two sides contacting the first and last fins of each set but being generally perpendicular thereto and spaced from the two long sides of said inner rectangle.

2. Heat exchange apparatus comprising a plurality of parallelly connected heat exchange elements as recited in claim 1, corresponding portions of each of said elements being generally in the same vertical plane but horizontally spaced from each other, an upper generally horizontal manifold and a lower generally horizontal manifold, each mainifold being formed with a series of spaced elongated openings of a configuration corresponding to the horizontal cross-section of said first passage, said upper manifold having each of its spaced elongated openings connected to the upper end of each first passage of each element, said lower manifold having each of its spaced elongated openings connected to the lower end of each passage of each element, whereby heat conducting fluid may be fed to and led from said first passages of said elements to activate the convection passages.

3. Heat exchange apparatus in accordance with claim 2, wherein said manifolds are of cylindrical cross-section and of a diameter corresponding to the diameter of connecting piping thereby eliminating the need for size changing adapters which otherwise would be necessary for connecting said apparatus into a thermal system.

4. A heat exchange apparatus in accordance with claim 2, and including a perforated upper cowling having a length corresponding to the dimension between the outer minor surface side of the first of said parallelly connected elements and the outer minor surface side of the last of said parallelly connected elements, said cowling having a projected width corresponding to the dimension between the outer plates of the convection passages of an element, said cowling having two long sides and an intermediate arched portion therebetween, said cowling being associated with said outer plates along its long sides and having its intermediate portion spaced above said upper manifold.

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