

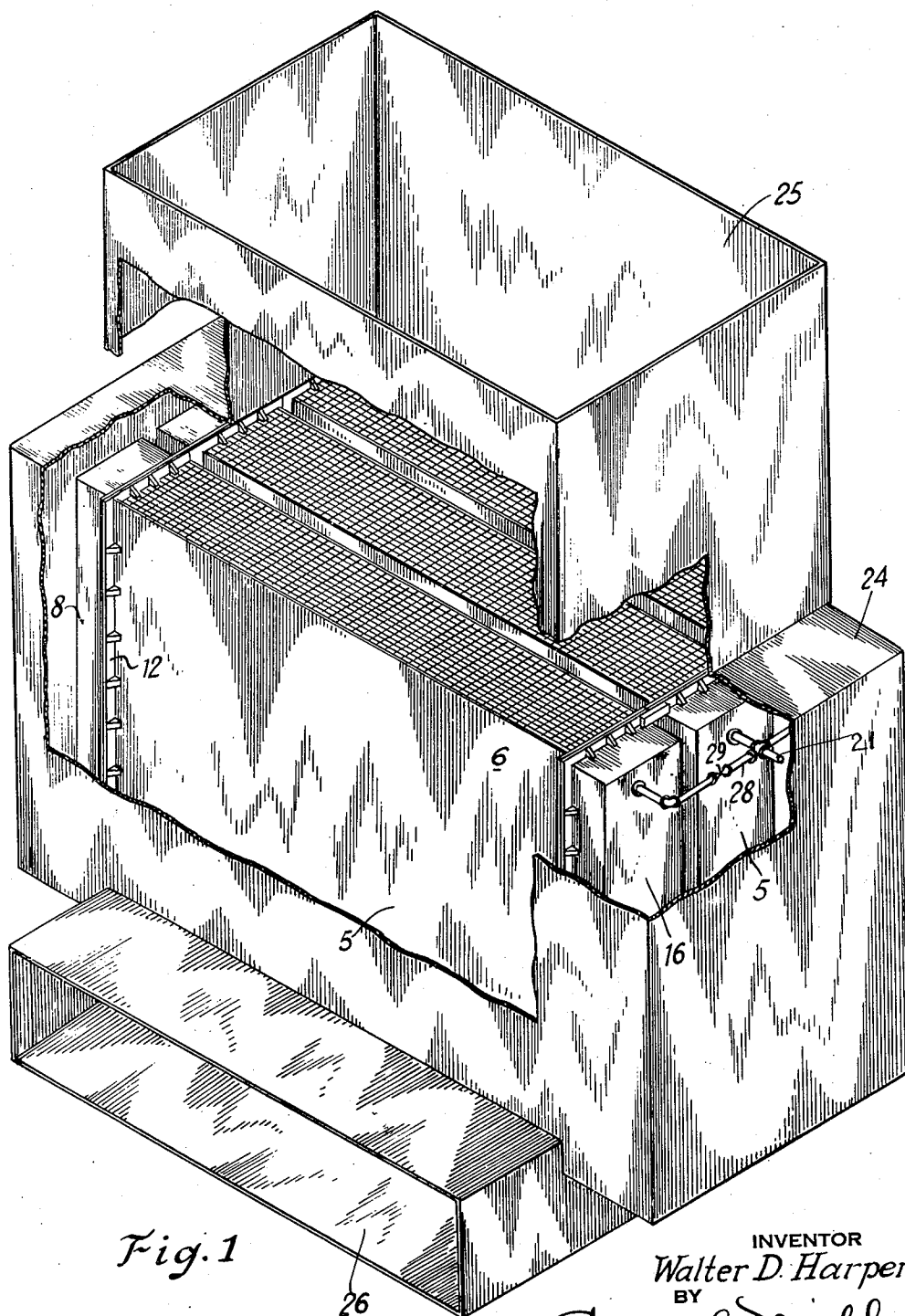
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W. D. HARPER
HEAT EXCHANGE SYSTEM

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4 Sheets-Sheet 1



INVENTOR
Walter D. Harper
BY
Carl Miller
ATTORNEY

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W. D. HARPER
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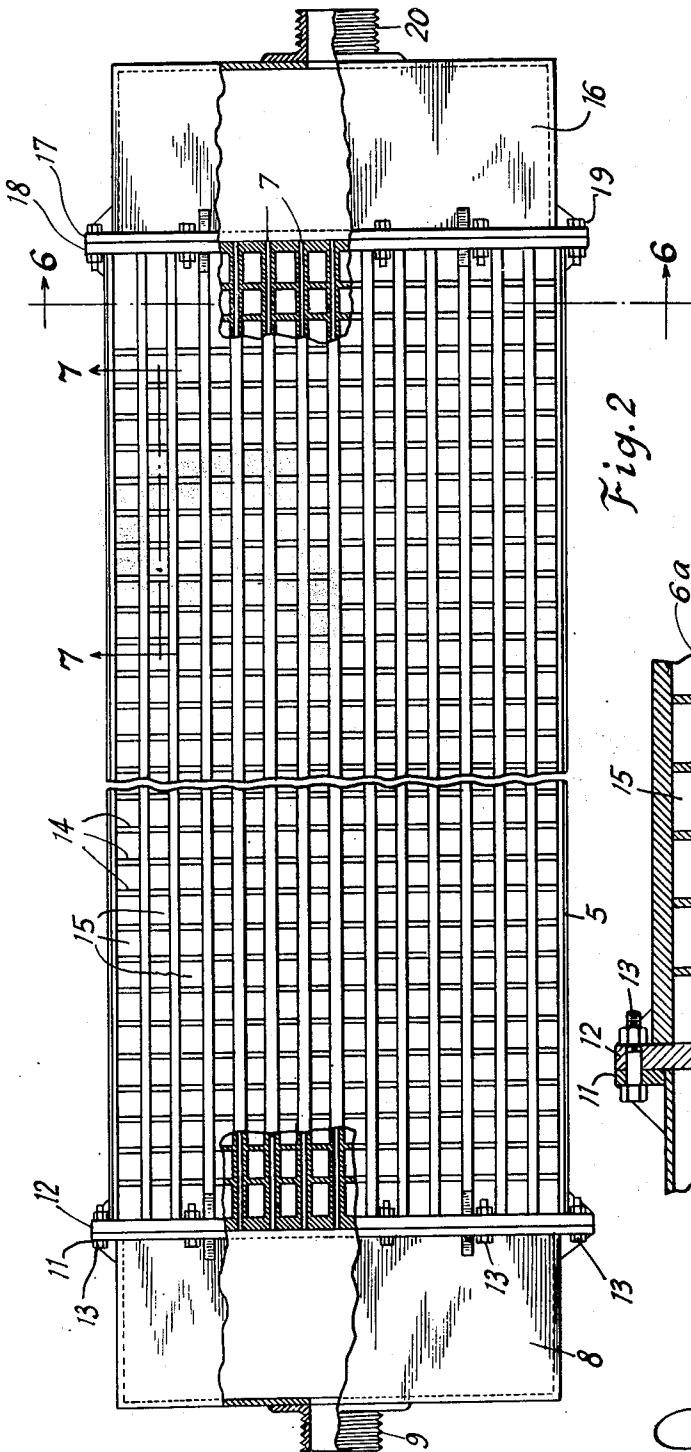


Fig. 2

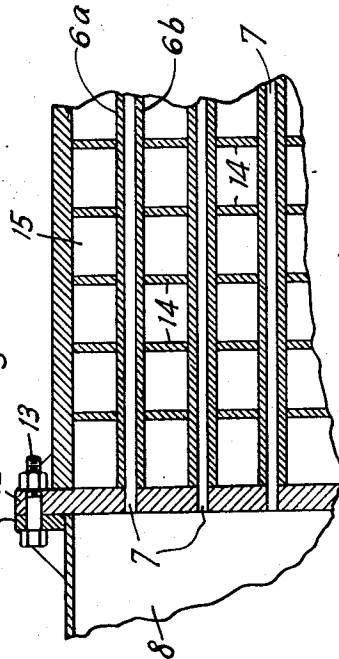


Fig. 3

INVENTOR
Walter D. Harper
BY
Carl Miller
ATTORNEY

April 19, 1949.

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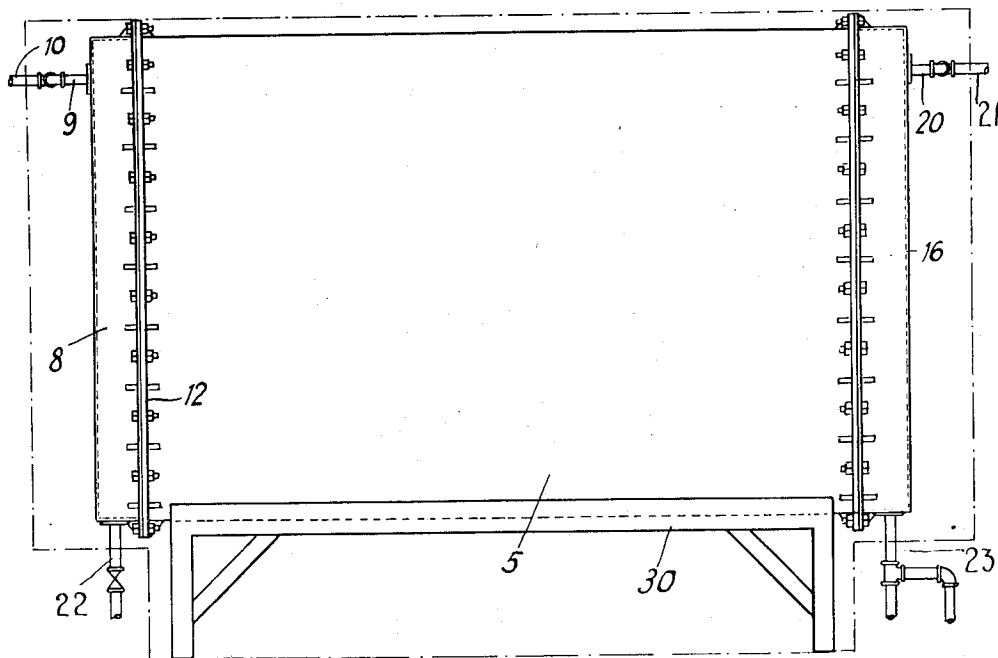
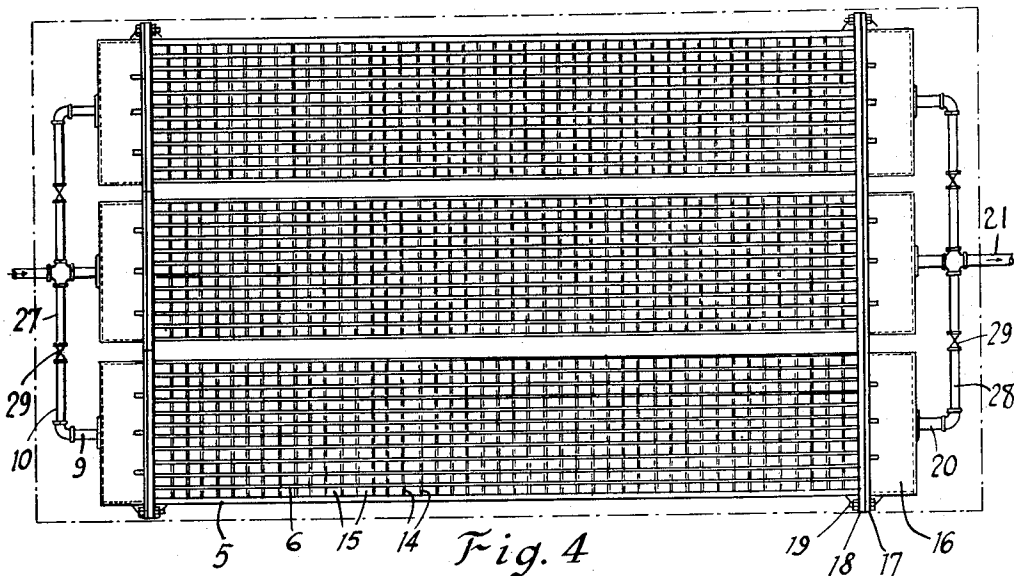


Fig. 5

INVENTOR
Walter D. Harper
BY
Carl Miller
ATTORNEY

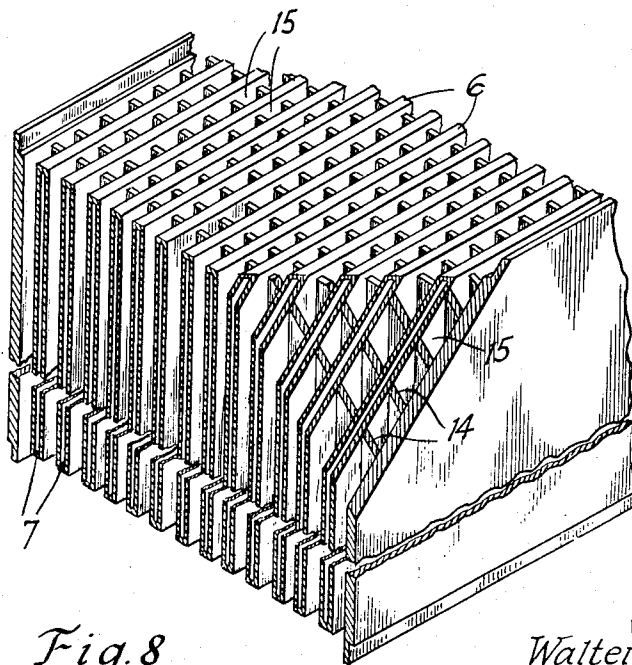
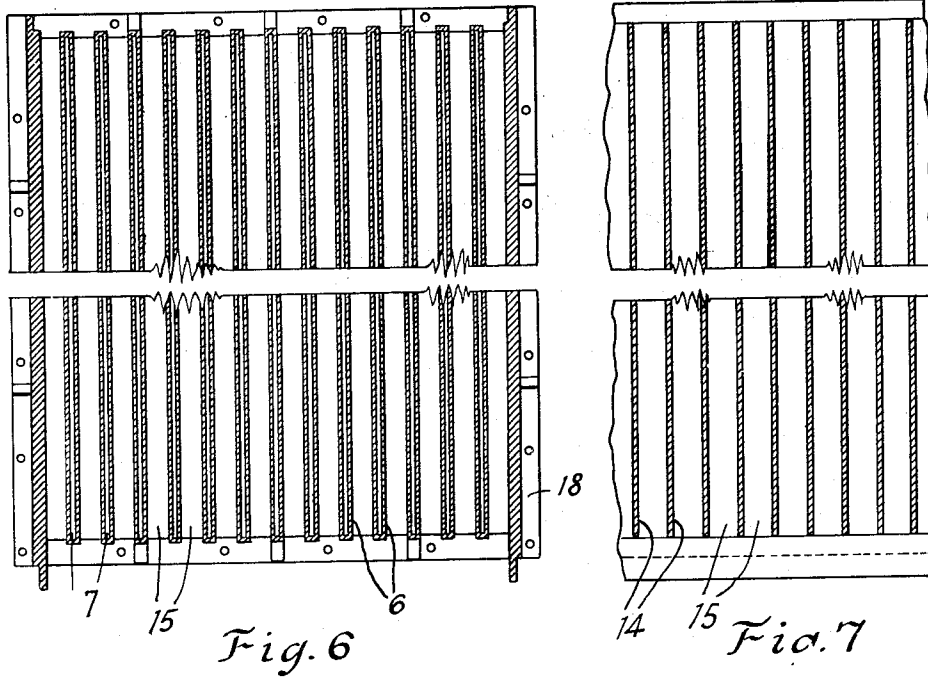
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INVENTOR
Walter D. Harper
BY
Carl Miller
ATTORNEY

UNITED STATES PATENT OFFICE

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HEAT EXCHANGE SYSTEM

Walter D. Harper, Florence, S. C.

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1 Claim. (Cl. 257--245)

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This invention relates to an improved heat exchange system, and one of its objects is to provide a series of narrow spaces in hollow walls in vertical planes parallel to each other with vertical metal spacers disposed between adjacent hollow metal walls, means for causing a horizontal flow of coolant materials through the hollow walls and means for causing a vertical flow of fluent materials through the passages between adjacent hollow metal walls, whereby the maximum transfer of heat from vertically flowing fluent materials to the horizontally flowing coolant will be obtained in the shortest period of time.

With the above and other objects in view, the invention comprises certain new and useful constructions, combinations and arrangements of parts, clearly described in the following specification, and fully illustrated in the drawings, in which—

Fig. 1 is a perspective view of the heat exchange apparatus, with the outer wall of the housing broken away.

Fig. 2 is a top plan view of the heat exchanger, showing parts broken away and other parts in section, on a larger scale.

Fig. 3 is a fragmentary sectional view, enlarged, showing the hollow metal walls and spacers.

Fig. 4 is a top plan view of the heat exchanger, showing three parallel units assembled into a single system.

Fig. 5 is a side elevation thereof.

Fig. 6 is a fragmentary sectional view, taken on line 6—6 of Fig. 2, looking in the direction of the arrows.

Fig. 7 is a similar view, taken on line 7—7 of Fig. 2, looking in the direction of the arrows.

Fig. 8 is a sectional perspective view of the hollow walls and intermediate spacers.

Referring to the accompanying drawings, which illustrate the practical embodiment of the invention, 5 designates a heat exchange unit, which includes a plurality of vertically disposed walls 6, which are hollow and which provide narrow horizontal-flow passages 7 between the side plates 6a and 6b of these walls. All of the horizontal-flow passages 7 open at one end into the loading or input chamber 8, which is supplied with a pipe nipple 9 for connection to a feed pipe 10. This chamber is provided with an attaching flange 11, which is secured to the attaching flange 12 of the unit 5, by means of bolts 13 or by welding.

The adjacent side metal plates are spaced apart by means of vertical metal spacers 14, which thus provides a plurality of vertical-flow passages

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separated by the hollow metal walls and the vertical spacers. All of these vertical-flow passages 15 are open at their upper ends and open at their lower ends.

The other end of the unit 5 is provided with a chamber 16, which is secured thereto by the flange 17 which is attached to the end flange 18 of the unit 5 by means of bolts 19, or by welded joints. The chamber 16 is equipped with a pipe nipple 20, to which the discharge pipe 21 is connected.

The chamber 8 is provided with a drain 22, and the chamber 16 is provided with a drain 23.

Three similar units 5 may be coupled together, or only two such units, or more than three such units. The battery of units thus organized, or any single unit employed alone, is enclosed by the metal housing 24, which has an open upper end 25 to receive a large flow of fluent material, and a horizontal outlet 26, located on one lower side of the battery. This housing thus provides an air chamber space which surrounds the single unit or the battery of heat exchange units. Air or other fluid to be cooled thus flows outside of each and all units, and through the vertical-flow passages 15, and out through the discharge opening or outlet 26.

When a battery of heat exchange units is provided, the intake pipes of each unit may be coupled with a union conduit 27, and in a similar manner the outlet pipes may be coupled by the union conduit 28, each of which is provided with separating valves 29. The single unit or the battery of units may be supported on a suitable base 30.

The narrow horizontal-flow spaces or passages 7, through which the fluent material used as a cooling medium, which may be a gas or liquid, flows, cause the material thus flowing to move in a thin sheet-like mass, so that the internal circulation of the mass will bring all particles flowing into frequent frictional contact with the side walls which bound these narrow vertically disposed horizontal-flow passages.

The metal spacers which divide the spaces between the hollow vertical walls into a plurality of passages, are additional means for effecting the transfer of heat between the fluent material flowing through those passages 15 and the coolant flowing in the primary passages 7, for these spacers serve as conductors for the heat which is absorbed by them from the fluent material and conducted to the metal side plates which form the hollow vertical walls. The heat thus conducted to the hollow walls is again absorbed and

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conveyed away by the coolant flowing in the passages 7.

The construction of the hollow vertical walls permits of the use of walls of any height, length and thickness, and the arrangement of the intermediate metal spacers provides fluid passages between adjacent hollow walls, which will permit the flow of any desired quantity of fluid, whether gas or liquid, to be cooled. The construction of the hollow vertical walls further permits the use of any required quantity of coolant flowing within those walls to lower the temperature of the material which must be cooled.

The construction also permits thorough and easy cleaning of any and all flow passages, and the replacement of any part, with the least loss of active service.

The heat exchange system is particularly adapted for space or room heating in winter, by causing hot water or other hot fluent material to flow through the horizontal passages and room air to flow through the vertical passages; or for cooling room air during the summer, by causing cold water or other cooling medium to flow through the horizontal passages and room air to flow through the vertical passages.

It is understood that any available fluids for heating or cooling may be employed, and this will of course depend upon local service conditions. It is also possible to cause flue waste gases, or other waste products of fuel combustion, to flow vertically through the system, and water or room air to flow horizontally through the system, thus conserving heat which otherwise may be wasted.

The system may be also applied for heating fuel oil, by causing hot water or steam to flow through either the horizontal or vertical passages and the oil through the other passages; and may be used for cooling oil or other liquids by causing hot oil or hot liquid to flow either horizontally or vertically, and the coolant water or air to flow through the other passages.

It is understood that various changes in the

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details of construction, their combination and arrangement, may be made in carrying out the invention, defined by the claim herein set forth.

Having described the invention, I claim as new:

In a heat exchange unit, a casing, a series of vertically disposed pairs of plates, a vertically disposed end wall at both ends of each pair of said plates, a plurality of vertically disposed parallel cross-plates between the plates of each of said pairs, said cross-plates being adapted to assure predetermined distance between the plates of each of said pairs, to serve as heat conductor between the fluid flowing through each pair of plates and to provide a plurality of vertically disposed flows in each pair of plates, each of said pairs of plates being close to its adjacent pairs of plates in order to provide a narrow horizontally disposed flow between adjacent pairs of plates, a chamber at each end of the series of plates adapted to enter and exit, respectively, the fluid for the horizontally disposed flow, means for mounting the series of plates in said casing and means for supplying fluids for the vertically and the horizontally disposed flow, respectively.

WALTER D. HARPER.

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