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HEAT EXCHANGER

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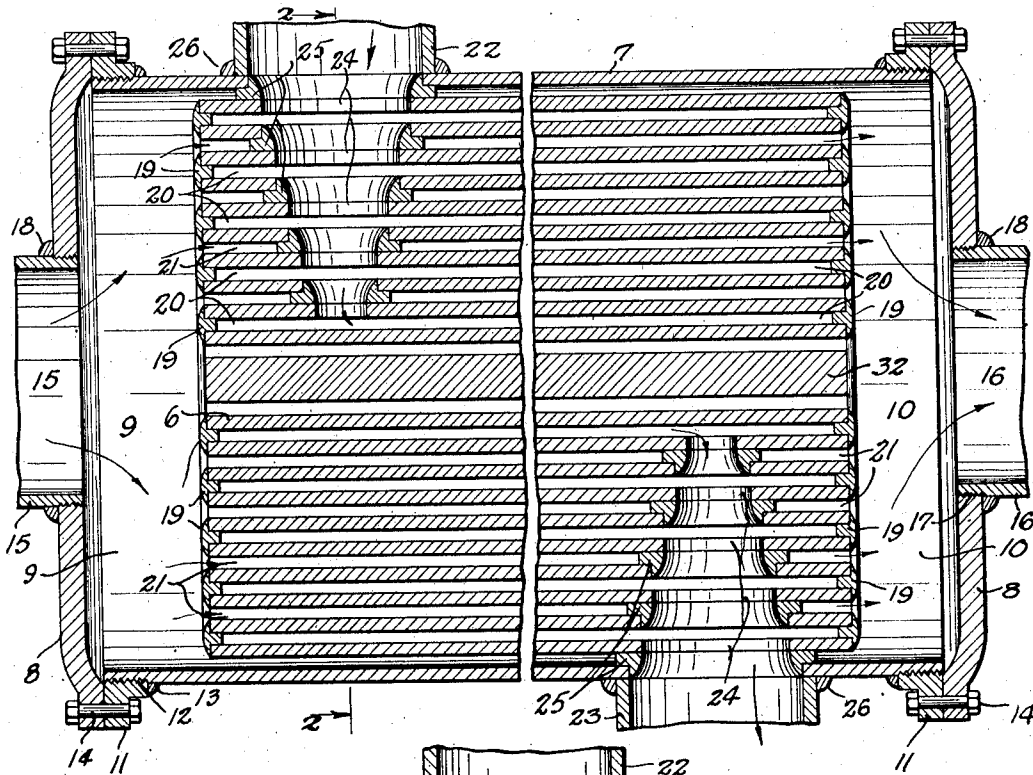


Fig. 1.

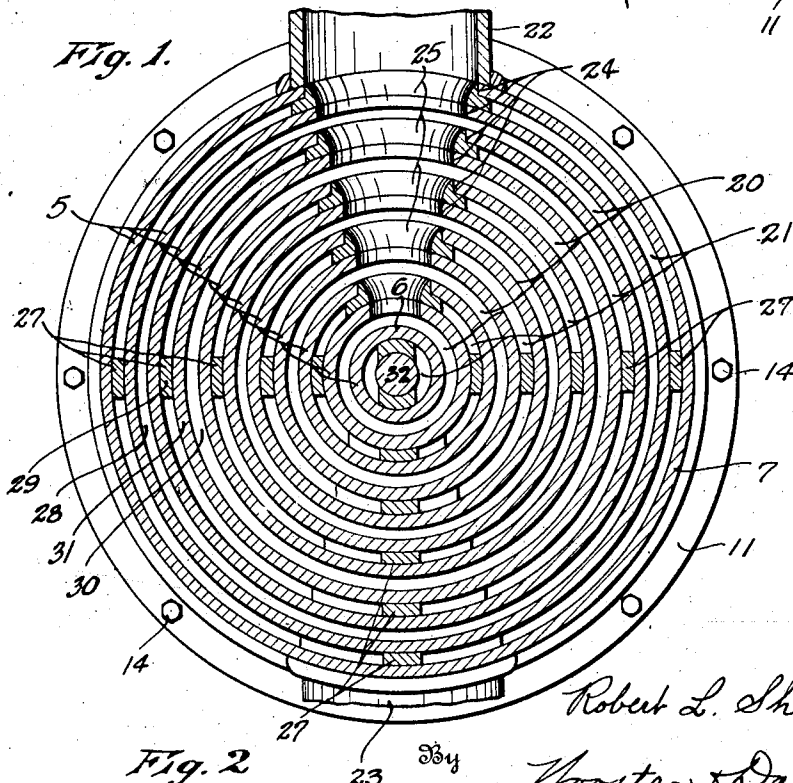


Fig. 2

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HEAT EXCHANGER.

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This invention relates to a heat exchanger or a heat exchange device for the transfer of heat from one fluid medium to another through intervening walls, and has for an object to provide a device which will require a minimum amount of space for a given amount of heat transfer surface.

It is also an object of the invention to provide a device of this character in which practically all of the material entering into the construction is used for heat transfer purposes, thus economizing in the amount of material required for a given heat transfer capacity.

It is a further object of the invention to provide a device in which the surfaces liable to be corroded by electrolytic action may be protected, and where all the joints are easily accessible for inspection or repair.

It is another object of the invention to so construct a device of this character that the condensing medium is in thin layers over the active surfaces to reduce to a minimum the amount of the condensing liquid required, and to also economize in the amount of power required for circulating the condensing medium.

It is a still further object of the invention to provide a device of this character in which all spaces containing a certain medium, such as poisonous gases or vapors, are surrounded by the condensing medium, such as water, so that should there be any leakage of the poisonous gases or vapors it would be into the water, and therefore, carried away with it without danger to life or property.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawing forming a part of this specification, and indicating the construction which is considered at present as involving the preferred form of my invention, similar reference characters being employed throughout the various figures to indicate corresponding elements. In this drawing,

Fig. 1 is a vertical longitudinal section through the device, and

Fig. 2 is a transverse section substantially on line 2-2 of Fig. 1.

The device illustrated comprises a plurality of spaced concentric tubes, preferably cylindrical in cross section, and indicated by the numeral 5, and these tubes, of

course, increase progressively in diameter from the inner tube 6 to the outer tube 7, the outer tube is, however, extended beyond the ends of the remaining tubes and is in effect an outer casing which encloses the remaining tubes, and it is closed at its opposite ends by heads 8 forming chambers 9 and 10 at the opposite ends of the remaining or inner tubes. These heads may be secured to the outer tube or casing by any suitable means, such as flanged rings 11, either threaded to the shell, as indicated at 12, or welded, as indicated at 13, or both, the heads being bolted to these flanges by bolts 14 so that they may be removed for inspection, cleaning or repair of the surfaces and elements enclosed by this outer tube. The heads have connected thereto inlet and outlet fluid connections 15 and 16 for entrance and exit of the cooling fluid to and from the chambers 9 and 10 respectively. These connections are usually pipes and may be connected to the heads by any suitable means such as screw threads 17 or welds 18 or both.

The alternate adjacent tubes 5 are welded together at their opposite ends, as indicated at 19, to secure these tubes together in proper spaced relation and also to cut off communication of the alternate spaces 20 between these tubes with the chambers 9 and 10, but the remaining alternate spaces 21 between the tubes are in open communication with these chambers at the opposite ends of the tubes. Therefore, fluid passing into the chamber 9 will pass longitudinally of the tubes through the spaces 21 to the opposite chamber 10 and pass out through the outlet 16.

Connections are also provided for passing another fluid through the spaces 20 on the opposite sides of the tubes from the spaces 21. In the present construction this comprises two lateral connections 22 and 23 in communication with the spaces 20 through openings 24 in the sides of the tubes. To secure a more uniform distribution of this fluid to the spaces 20 the openings 24 through the sides of the tube progressively decrease in diameter from the outer to the inner tube, and they are located in alignment, as shown. The alternate adjacent tubes are welded together about these openings as indicated at 25 to secure the tubes together which are not secured by the welds 19 and also to cut

off communication of these openings and the connections 22 and 23 with the spaces 21 through which the fluid from the chamber 9 flows. This arrangement of the openings 5 24 also facilitates the welding operation and places the weld where it may be easily inspected or repaired. The connecting tubes 22 and 23 are preferably welded to the outer tube or casing 7, as indicated at 26. It will 10 then be apparent that fluid flowing in, for example, at the connection 22 will be distributed into the spaces 20 and will pass about the tubes in these spaces and out through the connection 23. As the fluid 15 in the spaces 21 and chambers 9 and 10 may be of low pressure and the fluid in the spaces 20 may be of relatively high pressure this construction permits of easy bracing or supporting of the walls of the tube 20 to strengthen them without increasing the thickness of these walls. This is done by inserting in the spaces 20 strips of metal 27 which rest against the opposed walls of the adjacent tubes and will transmit pressure from the wall of one tube to that of the next adjacent tube. Thus, for instance, a portion of the force of the high pressure in the space indicated at 28, Fig. 2, will be transferred by strip 29 to the next adjacent 30 tube and counterbalanced by the pressure in the space 30 pushing in the opposite direction on the tube 31, and this is the action throughout the device.

These devices may be made in practically 35 any length desired to give the required surfaces, or they may be made up of certain lengths and connected together either in series or parallel to secure the same result. It will be apparent that there are numerous 40 advantages in this construction over the constructions of the ordinary heat exchangers. For instance, it is very economical in the space required as there are practically no waste spaces in its makeup, and it requires a minimum of space in proportion to the amount of heat transfer surface secured. This is a particular advantage in congested districts where space is valuable. This feature also is economical of material as practically 50 all the material used in its construction is active material functioning for transfer of heat, and the walls may be placed closely together. The construction is also relatively inexpensive as all the joints can be welded, and therefore, fittings or screw 55 joints are not required, and the units can be built up into practically any desired size thus requiring a minimum of header construction.

60 The device is also, furthermore, of long life as it is compact with the material in close assembly and it can thus be easily protected against deterioration by electrolytic action, such for instance, as the use of zinc 65 where salt water or brine is used. It will

be noted that all joints are easily accessible for inspection or repair, and therefore, the cost of upkeep is reduced.

A further advantage of this device is economy in the use of condensing medium. 70 It will be noted from the drawing that water, for instance, used as a condensing medium passes through the spaces 21 and it is, therefore, disposed in thin layers over the active surfaces. The same is true of the 75 material, such as the gases or vapors, to be condensed or cooled in the spaces 20, and I thus secure a very rapid and efficient transfer of heat from one medium to the other. This transfer is increased because the walls 80 of the tubes may be made relatively thin as the pressures may be balanced by the strips 27, as indicated above. This economy in the use of condensing medium, furthermore, reduces the power required for pump- 85 ing or circulating this medium since the amount thereof for a given heat transfer is lower.

A particular advantage of this construction is its safety in operation. It will be 90 noted from an inspection of the drawing that the spaces 20 through which the vapor or gases to be condensed or cooled flow are entirely surrounded by the condensing or cooling medium, in the above example water. 95 Thus, for instance, if the device is used for condensing ammonia or other poisonous vapor, or an inflammable vapor, all leakage thereof will be directly into the condensing or cooling medium, such for instance, as 100 water, and will thus be absorbed by the water and carried off with it, thereby making it possible to use this device in practically any location without danger to life or property. Furthermore, the surfaces of the 105 spaces 21 are easily accessible for cleaning by simply removing the heads 8. To secure only a thin stream of condensing medium through the central tube 5 a central core such as a rod 32 may be provided suitably 110 spaced from the walls of this tube. This will prevent the flow of a large amount of inactive medium through this tube which would otherwise occur.

Having thus set forth the nature of my 115 invention, what I claim is:

1. In a heat exchange device, an outer tubular shell, a plurality of spaced concentric tubes within the shell and spaced therefrom and providing chambers at the opposite ends of said tubes, the alternate spaces 120 between the tubes being in communication with said chambers and the remaining spaces being out of communication with said chambers, laterally extending fluid inlet and outlet connections to the latter spaces comprising pipes connected to the shell and openings in the tubular members in alignment with said pipes progressively 125 decreasing in diameter toward the inner 130

tube and welded connections between alternate adjacent tubes about said openings cutting off communication of said openings with the first mentioned spaces, and fluid inlet and outlet connections to said chambers.

2. In a heat exchange device, a plurality of spaced concentric tubes, said tubes being provided with a series of lateral openings in alignment and progressively decreasing in diameter toward the center tube, there being free communication from these openings to the alternate spaces between the tubes and the alternate adjacent tubes being welded together about the openings at

the remaining spaces to cut off communication therewith.

3. In a heat exchange device, a plurality of spaced concentric tubes with the alternate adjacent tubes welded together at both ends thereof to close the ends of the alternate spaces between the tubes, said tubes being provided with aligned lateral openings, and the alternate adjacent tubes being welded together about said openings to prevent communication of the remaining alternate spaces between the tubes with said openings.

In testimony whereof I affix my signature.
ROBERT L. SHIPMAN.