June 14, 1932. W. L. RIFENBERICK ET AL 1,862,707

HEAT EXCHANGER UNIT

Filed June 14, 1930 2 Sheets-Sheet 1

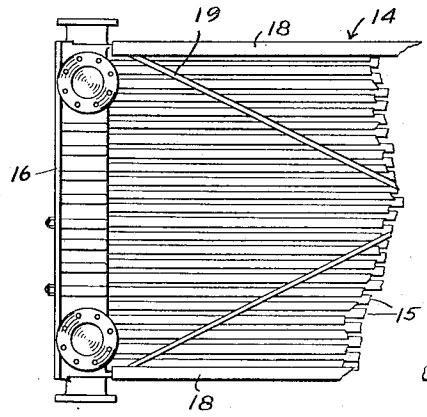
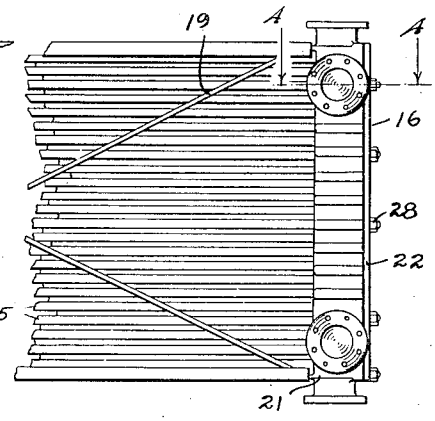


Fig. 1



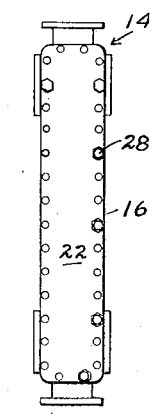


Fig. 2

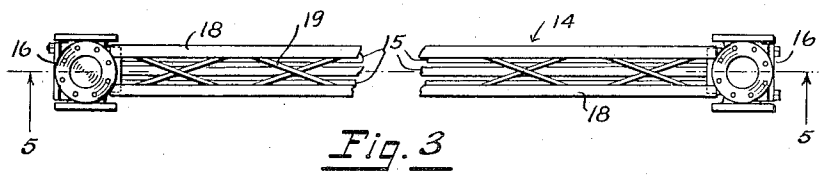


Fig. 3

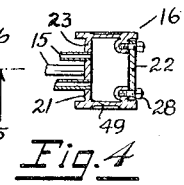


Fig. 4

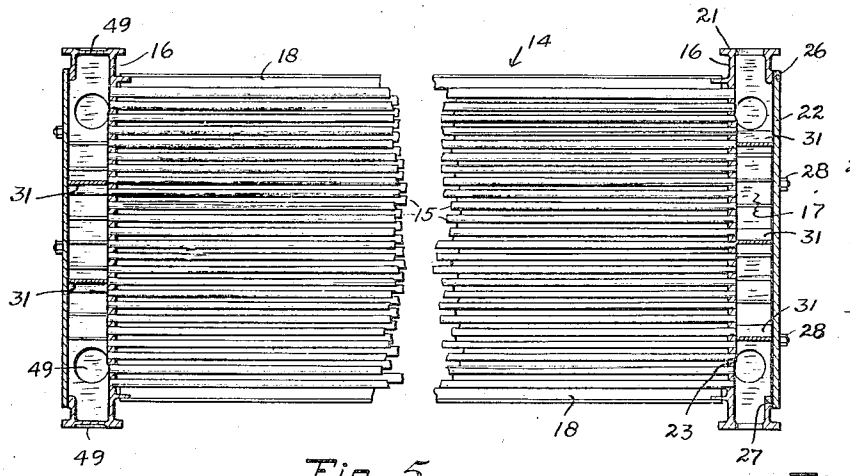


Fig. 5

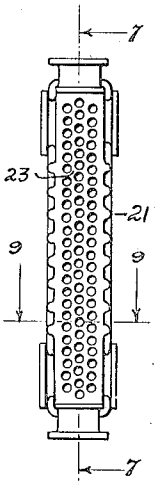


Fig. 6

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HEAT EXCHANGER UNIT

Filed June 14, 1930 2 Sheets-Sheet 2

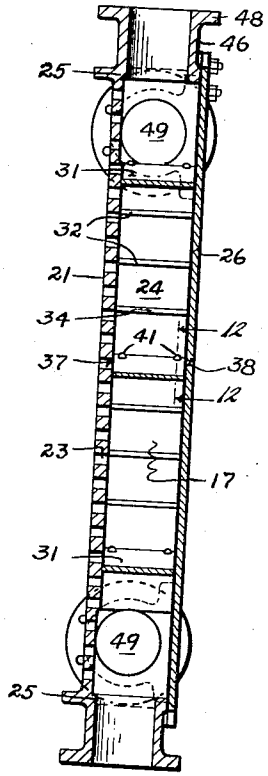


Fig. 7

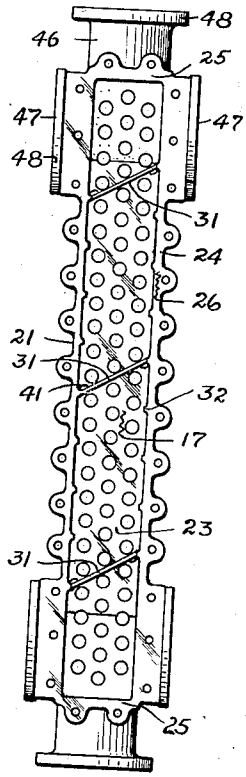


Fig. 8

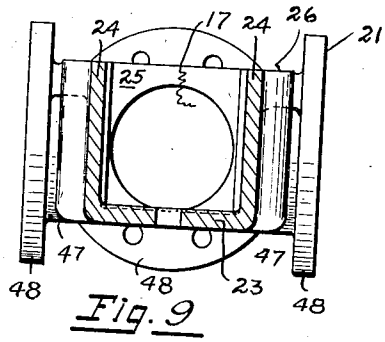


Fig. 9

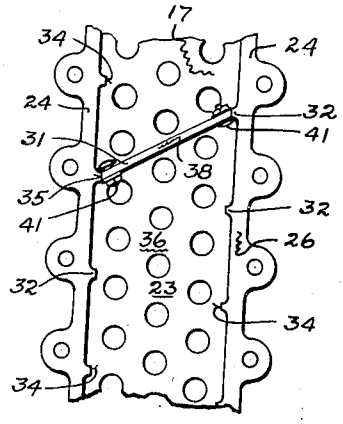


Fig. 10

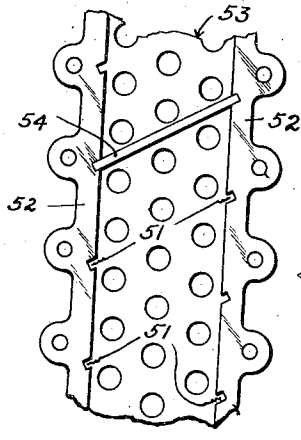


Fig. 13

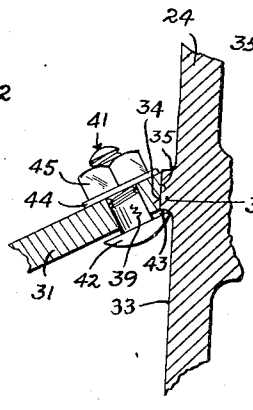


Fig. 12

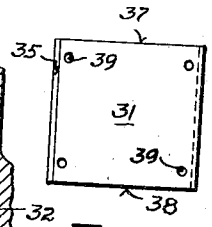


Fig. 11

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Patented June 14, 1932

1,862,707

UNITED STATES PATENT OFFICE

WILLIAM L. RIFENBERICK AND CHARLES O. SANDSTROM, OF LOS ANGELES, CALIFORNIA

HEAT EXCHANGER UNIT

Application filed June 14, 1930. Serial No. 461,128.

The invention relates to a heat exchanger unit of the tube type, and particularly to a header structure for such a unit.

An object of the invention is to provide a unit of the class described wherein the header cavities are arranged to be variably partitioned for adapting the unit to the provision of different flow arrangements therein.

Another object of the invention is to provide an adjustable and removable partitioning means for the header cavities.

A further object is to provide units of the class described which are particularly adapted for assembly in multiple to provide larger units.

Yet another object is to provide a header structure of the class described having a minimum number of separate parts.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of typical embodiments of the invention which are illustrated in the accompanying drawings, in which:—

Figure 1 is a fragmentary side elevation of a heat exchanger unit embodying the present invention.

Figure 2 is an end elevation of the unit.

Figure 3 is a fragmentary plan view of the unit.

Figure 4 is a fragmentary section at 4—4 in Figure 1.

Figure 5 is a sectional elevation at 5—5 in Figure 3.

Figure 6 is an elevation of a header member of the unit as viewed from the tube plate side thereof.

Figure 7 is an enlarged sectional view of the header member providing the tube plate, said view being taken at 7—7 in Figure 6.

Figure 8 is an elevation of the member shown in Figure 7, the cover being removed.

Figure 9 is an enlarged plan section of the header member taken at 9—9 in Figure 6, a partition member below the plane of the view being removed, also the cover.

Figure 10 is an enlarged view of a portion of the showing of Figure 8.

Figure 11 is an upper face view of a partition member for mounting in the header.

Figure 12 is an enlarged fragmentary section at 12—12 in Figure 7 and showing the details of a partition-securing means of the invention.

Figure 13 is a view similar to Figure 10, but disclosing an alternative means for mounting a partition in the header.

In the provision of a heat exchanger for use with one or more fluids, it has heretofore been a usual custom to provide units which have been specifically designed for the given fluid, or fluids, at given initial temperatures, reference being made not only to fluid heaters and coolers generally, but to condensers and the like. But conditions as to the nature or temperatures of fluids to be handled may change, whereby the aforesaid special units may become obsolete for use, and must be replaced. In accordance with the present invention, however, a heat exchanger unit is provided whereby the effective section and length of a fluid stream therethrough may be adjustably varied to meet various situations and the one unit may thus serve to meet many requirements. It will be obvious that units such as the present, through their adaptability to provide various operative combinations, may be used more or less universally in plants where a number of different such units to meet different conditions are now used, whereby a marked economic advantage results, both through the avoidance of replacement costs and the quantity production of the units made possible by their adaptability to meet a wide range of circulation requirements.

F · purposes of illustration, the features of the present invention are disclosed as incorporated in the structure of an atmospheric

cooler unit 14 wherein a bank of tubes 15 is connected between a pair of headers 16 providing fluid distribution chambers, or cavities, 17. As shown, spacers 18 and braces 19 connect the headers 16, whereby a provision to permit any required longitudinal expansion of the tubes relative to the spacers and braces must be made; in the present instance it is assumed that the tubes bend laterally under any longitudinal compressive stresses resulting from their expansion. As particularly disclosed, the tubes of the bank are horizontally disposed and the tube bank is somewhat higher than it is wide whereby the headers are seen as elongated elements having their longitudinal axes vertical.

The headers 16 may be exactly alike, as is particularly shown, and the present invention is specifically incorporated in the structure of said headers. By particular reference to Figures 4 to 10 inclusive, each header 16 is seen to comprise a generally trough-like member 21 and a plate 22 arranged for bolting in place to close the open side of the member 21. The wall 23 of the member 21 is perforated to fixedly receive the extremities of the tubes 15 whereby said wall comprises a tube plate for the assembled unit. The longitudinal side walls 24 and end walls 25 of the member 21 extend perpendicularly from the wall 23 and terminate at a continuous and finished rim face 26 against which the peripheral portions of the inner face 27 of the cover plate 22 are arranged to be fitted, said latter face being preferably finished and plane for its entire area. Stud bolts 28 are utilized for securing the cover plate 22 in its said mounted position.

By reference to Figure 5, it will be noted that a transverse partitioning of the header chambers 17 is effected, and that such partitioning provides for a zig-zag fluid flow through the tubes and headers. Baffle members 31 effect the aforesaid partitioning of the chambers, and said partition members are removably and adjustably mounted in place for accomplishing a major object of the present invention; namely, the provision in the unit of flow paths of different lengths as may be required or desired. As particularly shown in Figure 5, two partitions 31 are provided in one header cavity and three partitions are provided in the other header cavity, whereby the zig-zag fluid path provided makes six longitudinal traverses of the unit, the fluid entering and leaving the unit at the opposite ends of the cavity of the last mentioned header. By utilizing more or fewer of the partitions 31 in the different headers, the unit may be utilized to provide flow paths of varying length whereby to meet a wide range of requirements for its operative use.

For mounting the partitions 31 in the headers, we prefer to provide ridges or ribs 32 extending across and from the inner faces 33 of the opposed header walls 24, and to secure the partitions to appropriate pairs of said ridges. The set of ribs 32 of each wall 24 are integral therewith and are formed with mutually coplanar faces 34. All of the ribs 32 are mutually parallel, and the planes of the two sets of faces 34 are also parallel in the present instance. For reasons to be hereinafter brought out, the partitions are arranged to be mounted in oblique relation to the longitudinal axes of the headers. Accordingly, and as shown, said partitions may comprise rectangular plates having opposite edge portions appropriately bevelled to provide finished edge faces 35 for simultaneous engagement with faces 34 of ribs at opposite sides of the header cavity. When a partition is mounted in place, it is arranged to extend perpendicularly from the inner face 36 of the tube plate 23, said face and the opposed edge face 37 of the partition being finished to provide a sealed joint along their line of engagement. The said disposal of the partition is preferably such that said partition does not obstruct any of the perforations of the tube plate. The partition edge face 38 at the opposite edge from the face 36 is also finished and is arranged to be closely engaged by the inner face 27 of the cover plate 22 when the latter is in place whereby to complete a transverse and sealed partitioning of the cavity by means of the partition; if desired, a transversely resilient gasket may be engaged between the cover plate 22 and rim face 26 for insuring the desired close fit of a partition in its place.

As shown in detail in Figure 12, the means provided for securing a partition 31 to the ribs comprises the provision in the partition of transverse bolt holes 39 for the reception of bolts 41. The holes 39 are each so located with respect to a partition edge face 35 that a portion of the head 42 of a bolt 41 appropriately engaged therein will lie opposite said face and engage a side 43 of the rib 32 engaged thereby. In this manner, the rib may be wedgedly clamped between the bolt head 42 and the partition face 35 for sealedly fixing it in place. The number of bolts used as described will, of course, be determined by the size of the partition, it being noted that the pressures at opposite sides of the partitions are always substantially equal. The oblique mounting of the partitions is seen to make possible the use of the securing bolts as shown and described, and is also, in the present case, necessitated by the specific tube arrangement if maximum unit compactness for the given number of tubes is desired. A sealing washer 44 is preferably engaged between the bolt nut 45 and the partition plate.

To provide for variable connections to and from the units, a plurality of ports is provided at each header end. As shown, inlet and outlet ports are provided in nozzles com-

prising thimbles 46 extending transversely from the end walls 25 and in thimbles 47 extending transversely from the side walls 24 and adjacent the end walls 25 whereby connections are provided in three directions at each header end. In the present instance, flanges 48 are provided at the outer ends of the various nozzles for connecting a unit to a similar unit or to pipes as required. In initially providing the headers, integral knock-out partitions 49 are preferably provided in the various nozzle passages whereby only those passages which are to be used need to be primarily opened. Upon the use of a unit in subsequent and different installations, any nozzles not then to be used would be closed with suitable cover plates (not shown) mounted on the nozzle flanges 48. The present structure of a header member 21 to provide the tube plates, the connection nozzles, and the partition mounting ribs in a one piece structure which may be cast entire is seen to greatly minimize manufacturing costs while permitting a varied use of the unit as hereinbefore brought out.

While the present structure is shown and described as an atmospheric cooler, it will be obvious that the tubes thereof may be disposed in a liquid medium without in any way effecting the operativeness and advantages of the adjustable header partitions, said medium being either in the form of spray or drops of liquid, or comprising a liquid bath.

In Figure 13 an embodiment is shown in which partition receiving slots 51 are provided in the opposite side walls 52 of a trough-like member 53 similar to the previously described member 21. The baffle or partition 54 comprises an imperforate and rectangular plate having the opposite edge portions cut off square and arranged for a sliding fit in and between a pair of the slots 51. In correspondence with the previously described embodiment, the partition 51 is oblique to the walls 52. This mounting of a baffle partition, while simpler, has the disadvantage that sedimentary or other deposits may penetrate between the partition and slot sides to make a removal of the partition difficult.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while we have described the principle of operation, together with the device which we now consider to be the best embodiment thereof, we desire to have it understood that the device shown is merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described our invention, we claim as new and desire to secure by Letters Patent of the United States the following:—

1. In a heat exchanger, a generally trough-like header member having a wall formed as a tube plate and side walls integral with said wall, said side walls provided with mutually parallel and relatively low ribs extending from and across the opposed inner faces thereof, and a partition for removable and entirely lateral engagement with and between ribs of the different side walls whereby to partition the header space.

2. In a heat exchanger, a generally trough-like header member having a wall formed as a tube plate and having side walls, said side walls each provided with a plurality of inwardly protruding ribs extending from and across the inner faces thereof, said ribs presenting mutually parallel and planar outer faces, a cover plate for the open side of said member, a partition for simultaneous and solely lateral engagement with and between said rib faces of the different side walls and with and between said tube plate and cover plate for completely partitioning the header cavity, and means coactive between said partition and the ribs engaged thereby to releasably fix the partition to the ribs.

3. In a heat exchanger, a generally trough-like header member having a wall formed as a tube plate and side walls extending from said wall, said side walls each provided with a rib extending from and across the inner face thereof, said ribs being mutually parallel, and a partition removably and engaged solely laterally thereof with and between said ribs whereby to partition the header space.

4. In a heat exchanger, a generally trough-like header member having a wall formed as a tube plate and side walls extending from said wall, said side walls each provided with a rib extending from and across the inner face thereof, said ribs being mutually parallel, and relatively low with respect to the walls from which they extend, a partition for removable and entirely lateral engagement with and between said ribs whereby to partition the header space, and means cooperative with said ribs to releasably secure said partition thereto in operative position.

5. In a heat exchanger, a generally trough-like header member having a wall formed as a tube plate and side walls extending from said wall, said side walls each provided with a rib extending from and across the inner face thereof, said ribs being mutually parallel, a partition for removable and entirely lateral engagement with and between said ribs whereby to partition the header space, and bolt means carried by said partition and coactive with said ribs to releasably clamp said partition thereto.

6. In a heat exchanger header, a generally trough-like unitary member having a wall formed as a tube plate and side and end walls integral with said wall, a closure plate for removable and sealed engagement in the

open side of said member, integral thimbles at the extremities of the member extending longitudinally and laterally therefrom and providing ports for said header, said thimbles arranged for coaxial registration with like thimbles of a like member disposed adjacent the first member and while the members are axially aligned or laterally related.

In testimony whereof we affix our signatures.

WILLIAM L. RIFENBERICK.
CHARLES O. SANDSTROM.