Dec. 28, 1943. M. F. KENT ET AL 2,337,899

HEAT EXCHANGER

Filed July 1, 1942

Fig. 1.

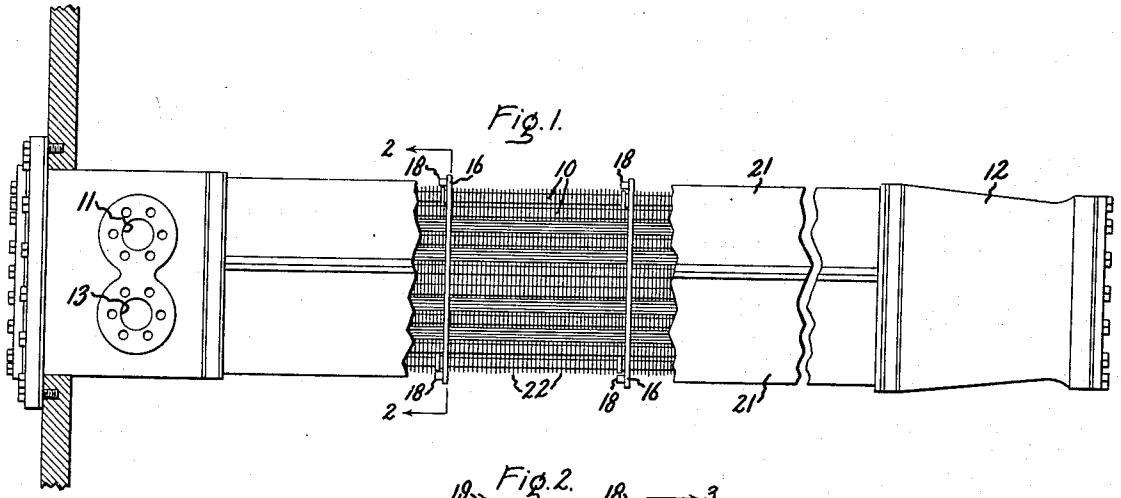


Fig. 2.

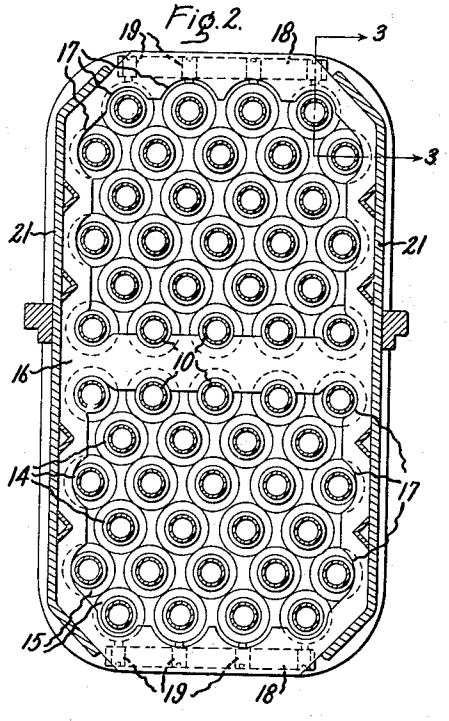
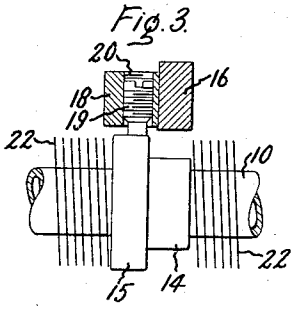


Fig. 3.



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HEAT EXCHANGER

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5 Claims. (Cl. 248—49)

Our invention relates to heat exchangers and more particularly to that type heat exchanger which is used as a surface cooler for ventilating medium used for cooling electrical apparatus or dynamo-electric machines.

An object of our invention is to provide an improved and compact heat exchanger.

Another object of our invention is to provide an improved heat exchanger having a plurality of tubes assembled in a compact and rigid structure.

Further objects and advantages of our invention will become apparent and our invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing Fig. 1 is a side elevational view, partly broken away, of a heat exchanger provided with an embodiment of my invention; Fig. 2 is a sectional view, taken along line 2—2 of Fig. 1; and Fig. 3 is a sectional view, taken along line 3—3 of Fig. 2.

Referring to the drawing we have shown a heat exchanger of a type used as a surface cooler for electrical apparatus and machines wherein cooling fluid is adapted to be circulated through a plurality of tubes 10 from a header which is supplied with cooling medium through a supply connection 11. The cooling fluid is adapted to pass longitudinally through the tubes 10 and to be circulated by a return header 12 arranged at the end of the heat exchanger opposite the intake or supply connection 11 and to be exhausted through an exhaust connection 13. In order to obtain this recirculation of cooling fluid, the tubes are arranged in two substantially identical assemblies the upper half of which is supplied with cooling medium from the intake connection 11 and the lower half of which is connected with a header connecting with the exhaust connection 13. Both sets of tubes open into the recirculation header 12. The tubes in each set are assembled in a plurality of spaced apart rows with the tubes in adjacent rows arranged in staggered relationship, as more particularly shown in Fig. 2. In order to obtain a rigid assembly of the tubes and to minimize vibration, as well as to provide for the passage of ventilating medium over the tubes without too great a loss in pressure head, each tube is provided with a rigid spacing collar element 14 and these collars are arranged in axial alignment intermediate the ends of the tubes. A plurality of these collars may be used depending upon the length of the tubes and the stiffening required. These collars 14 are formed with a circumferentially extending flange 15 and these flanges are arranged in supporting relationship in contact with adjacent collar flanges on adjacent tubes. A locating supporting bracket including a frame 16 having curved supporting openings 17 formed in the surface thereof is arranged about the assembly of tubes, and the curved frame surfaces 17 are arranged in contact with the reduced collar portions 14 to provide a frame having as deep a section as possible adjacent the parts 17 to assure maximum rigidity thereto. The curved supporting surfaces 17 of the frame 16 are arranged in contact with the collars 14 on the outer tubes of the assembly for holding these collars, and therefore the tubes, in assembled relationship. A transversely extending bar 18 is secured to one side of the frame 16 and a plurality of adjustable set screws 19 threadedly engage openings 20 in the bar 18 and are screwed into tight engagement with the adjacent outer collar flanges 15 of the adjacent outer tubes 10, thus biasing all of the tube collar flanges into intimate rigid engagement with each other for preventing relative displacement of the tubes in the assembly. In the illustrated construction, the biasing bar 18 and set of adjustable screws 19 are arranged at each open end of the heat exchanger. The sides of the heat exchanger are closed by sheet metal covers 21 which are rigidly secured to the frames 16 and to the header constructions at each end of the heat exchanger. In order to increase further the heat exchanging capacity of the heat exchanger, each tube 10 is provided with a spiraled outwardly extending heat exchange fin element 22 which provides relatively large heat exchange surfaces for each tube. With such an arrangement vibration of the tubes may be reduced to a minimum without relying upon the relatively flexible contact provided by the fins on the tubes. The flanges 15 on the collars 14 are made slightly larger than the diameter of the fins 22 to maintain the fin surfaces out of contact with each other, thereby further assuring against disturbing noises arising from the vibration and contact of the fin elements on the different tubes. The staggered arrangement of the tubes also increases the available heat transfer surface within a given space and provides a more efficient heat exchanger for given overall dimensions.

While we have illustrated and described a particular embodiment of our invention, modifications thereof will occur to those skilled in the art. We desire it to be understood, therefore, that our invention is not to be limited to the particular arrangement disclosed, and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a heat exchanger having an assembly of a plurality of tubes arranged in staggered relationship, outwardly extending heat transfer surfaces on said tubes, a rigid element arranged on each of said tubes and intermediate the ends thereof, said rigid elements being larger than said heat transfer surfaces and arranged in contact with adjacent rigid elements on adjacent tubes with a locating supporting bracket arranged about said assembly of tubes and in contact with said rigid elements on the outer tubes of said assembly of tubes, and means arranged in engagement with rigid elements on said outer tubes for biasing said tube rigid elements into intimate rigid engagement with each other for preventing relative displacement of said tubes.

2. In a heat exchanger having an assembly of a plurality of tubes arranged in rows with the tubes in adjacent rows arranged in staggered relationship, a collar arranged on each of said tubes in axial alignment and intermediate the ends thereof, said collars being arranged in supporting relationship in contact with adjacent collars on adjacent tubes with a locating supporting bracket arranged about said assembly of tubes and in contact with said collars on the outer tubes of said assembly of tubes, and means including an adjustable set screw in said bracket arranged in engagement with a collar on an outer tube for biasing said tube collars into intimate rigid engagement with each other for preventing relative displacement of said tubes.

3. In a heat exchanger having an assembly of a plurality of tubes arranged in a plurality of spaced apart rows with the tubes in adjacent rows arranged in staggered relationship with spiraled outwardly extending heat transfer surfaces on said tubes, a collar with a circumferentially extending flange thereon arranged on each of said tubes and intermediate the ends thereof, said collar flanges being arranged in contact with adjacent collar flanges on adjacent tubes with a locating supporting bracket arranged about said assembly of tubes and in contact with said collars on the outer tubes of said assembly of tubes, and means arranged in engagement with said outer tube collar flanges for biasing said tube collar flanges into intimate rigid engagement with each other for preventing relative displacement of said tubes.

4. In a heat exchanger having an assembly of a plurality of tubes arranged in a plurality of spaced apart rows with the tubes in adjacent rows arranged in staggered relationship with spiraled outwardly extending heat transfer surfaces on said tubes, a collar with a flange thereon arranged on each of said tubes in axial alignment and intermediate the ends of said tubes, said collar flanges being arranged in supporting relationship in contact with adjacent collar flanges on adjacent tubes with a locating supporting bracket arranged about said assembly of tubes and in contact with said collars on the outer tubes of said assembly of tubes, and means including an adjustable set screw in said bracket arranged in engagement with a collar flange on an outer tube for biasing said tube collar flanges into intimate rigid engagement with each other for preventing relative displacement of said tubes.

5. In a heat exchanger having an assembly of a plurality of tubes arranged in a plurality of spaced apart rows with the tubes in adjacent rows arranged in staggered relationship, a collar with a circumferentially extending flange thereon arranged on each of said tubes in axial alignment and intermediate the ends of said tubes, said collar flanges being arranged in supporting relationship in contact with adjacent collar flanges on adjacent tubes with a locating supporting bracket arranged about said assembly of tubes and in contact with said collars on the outer tubes of said assembly of tubes, and means including an adjustable set screw in said bracket arranged in engagement with a collar flange on an outer tube for biasing said tube collar flanges into intimate rigid engagement with each other for preventing relative displacement of said tubes.

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