Oct. 25, 1927. **1,646,384**

Y. E. BERGSTRÖM

METHOD OF PRODUCING RADIATORS

Filed Dec. 19, 1924

Fig. 1

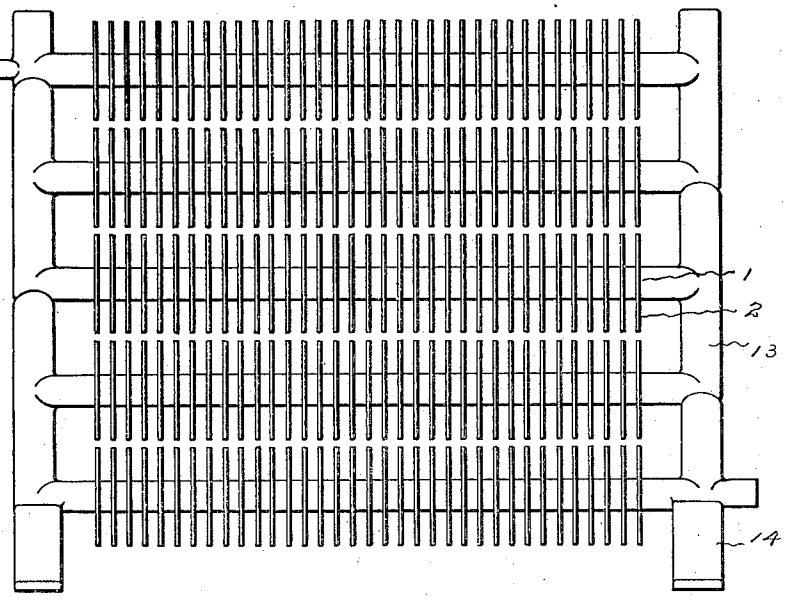


Fig. 2

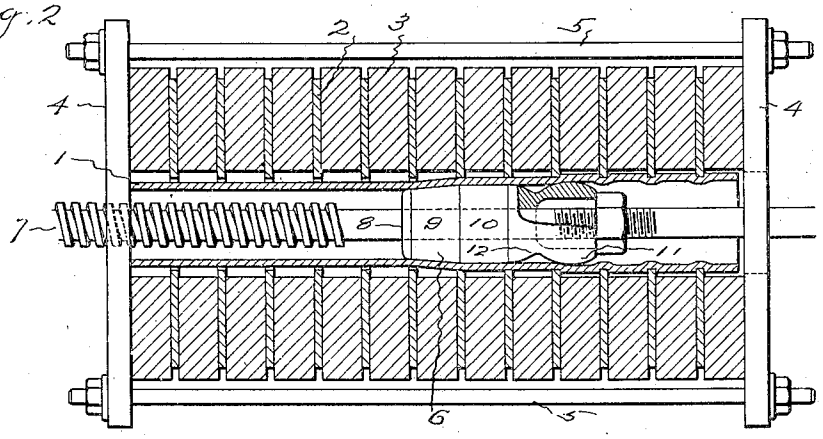


Fig. 3

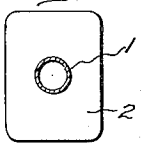


Fig. 4

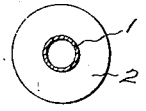


Fig. 5

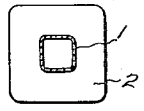


Fig. 6

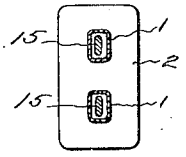


Fig. 7

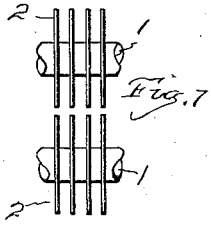
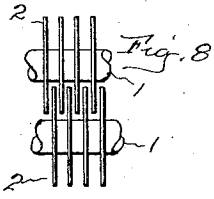


Fig. 8



Inventor

Ingve Emanuel Bergström,

by Harry P. Williams

Atty.

Patented Oct. 25, 1927. 1,646,384

UNITED STATES PATENT OFFICE.

YNGVE EMANUEL BERGSTRÖM, OF WEST HARTFORD, CONNECTICUT, ASSIGNOR TO THE VULCAN RADIATOR COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

METHOD OF PRODUCING RADIATORS.

Application filed December 19, 1924. Serial No. 757,060.

This invention relates to the manufacture of heat exchange apparatus, that is, devices for conducting heat from an internal source outward such as steam, hot water and electrically heated radiators, feed water heaters, condensers and similar apparatus, also economizers or apparatus of like nature for conducting heat from an external source inward.

The object of the invention is to provide a method of manufacture whereby very efficient apparatus of the character mentioned that are small in size for their radiating capacity, light in weight, strong and durable, can be cheaply and rapidly produced for use as single units, such for instance as is employed in railway cars under the seats, or may be assembled in batteries, as for household heaters, condensers and economizers.

This object is attained by arranging the required number of perforated radiating flanges or fins of sheet or cast metal having the desired outline and properly spaced, upon a tube or pipe of ductile metal, as soft steel or copper, of the necessary length and cross section, and expanding the tube from the interior so that it will closely fit the walls of the openings in the fins, and in fact cause the inner edges of the fins to become indented into the exterior wall of the tube, thus not only ensuring a close metallic contact but tightly holding the fins in place so that they will not loosen under changes in temperature.

In the accompanying drawings Fig. 1 shows an elevation of a radiator constructed according to this invention. Fig. 2 is a section on larger scale showing the means employed for retaining the fins and expanding the tube into them. Figs. 3 to 6 inclusive illustrate various shapes of fins and tubes that may be used. Fig. 7 indicates one way in which the units may be related. Fig. 8 indicates another way of arranging units that are formed according to this invention.

The tubes 1 may be round, square, oblong or oval in cross section and of any desired length, depending upon the use to which the unit is to be put. These tubes are formed of ductile metal, as soft steel, copper or other suitable metal. The fins 2 may be made of rolled sheet metal or of cast metal which has good heat conducting properties, for instance copper. These fins are relatively thin but may be any thickness, outline and size depending upon the capacity required, and they are provided with one or more perforations of a size slightly larger than the exterior diameter of the tube upon which they are to be mounted.

In practicing this method a number of the fins are spaced the required distance apart by blocks 3 and the radiating fins and spaced blocks clamped in any convenient manner, as by a frame consisting of end plates 4 connected by bolts 5. The tubes to which the fins are to be fastened are located in the opening through the fins and blocks and a plunger 6 having sections of larger exterior diameter than the interior diameter of the tube is drawn or pushed through the tube by a threaded shaft 7 or other appropriate means.

In Fig. 2 the dimensions or fit of the parts are somewhat exaggerated or distorted in order to clearly bring out the feature of this invention. In practice the openings in the fins are but slightly larger in diameter than the exterior diameter of the tube. The tube expanding plunger has a head section 8 that will readily pass into the tube, a tapering section 9 that will enter and expand the tube until the exterior diameter is practically the same as the diameter of the openings in the fins, and a cylindrical section 10 that will for a short period maintain the tube at the diameter to which it is expanded by the tapering section. The plunger also has a section 11 that is slightly larger in diameter than the diameter of the openings in the fins less the thickness of the walls of the tube. This section 11 is made hollow and is connected with the remainder of the plunger by a reduced neck 12 so that it will expand the tube between the fins to a slightly greater extent than the diameter of the openings in the fins, but may contract as it passes through the fins during its travel through the tube. As a result of this the inner ends of the fins become slightly embedded in the tube when the unit is finished.

As stated the radiating fins may be of sheet or cast metal of good conductivity and they may be oblong, square or any other shape as illustrated in Figs. 3 to 6, and the tubes may be round, square, oblong or any

other shape as illustrated in those figures. Furthermore there may be more than one opening in the fins as illustrated in Fig. 6. The ductile tubes may be any length and may have as many fins mounted upon them as is required for the capacity of the unit to be formed, which fins can be so separated as to give the most efficient radiation for the space in which they are to be located. The units may be used singly or they may be connected in battery formation, either side by side, or interleaved as illustrated in Fig. 8. The tubes may be welded to headers 13 of any desired shape and these headers may be mounted vertically or horizontally upon supporting legs 14 of approved design.

By practicing this method the connection between the tubes and fins is so close that very efficient conductivity is attained and large capacity may be obtained in a small space, in a structure which is relatively light in weight. This produces a unit which is easily handled and transported at a low cost, and will occupy a comparatively little room. With this structure there is less breakage than with the cast metal radiators, and more efficient conductivity than with radiators in which flanges are welded to tubes. For electrically heated radiators one or more openings may be made in the fins, as illustrated in Fig. 6 and tubes may be expanded in both the openings simultaneously. Suitable electrical units 15 may be mounted in such tubes in the usual way.

The invention claimed is:

1. The method of producing a heat exchange unit which consists in clamping perforated metal radiating flanges parallel with each other and spaced apart with the perforations in line, passing a tube through the perforations of the flanges thus clamped of substantially the same diameter as the perforations in the flanges and expanding the tube by a contractible plunger, the maximum diameter of which is slightly larger than the diameter of the openings in the flanges, less the thickness of the walls of the tube, which plunger contracts in passing the flanges, whereby the tube between the flanges is expanded to a greater extent than the diameter of the openings in the flanges and the edges of the flanges thus embedded in the outer surface of the tube.

2. The method of producing a heat exchange unit which consists in clamping perforated metal radiating flanges parallel with each other and spaced apart with the perforations in line, passing a tube through the perforations of the flanges thus clamped, of substantially the same diameter as the perforations in the flanges, gradually expanding the tube from the interior outwardly until it binds tightly against the edges of the flange perforations, holding the metal of the tube thus expanded from the interior for an interval, and finally further expanding the tube by a contractible plunger, the maximum diameter of which is slightly larger than the diameter of the openings in the flanges, less the thickness of the walls of the tube, which plunger contracts in passing the flanges whereby the tube between the flanges is expanded to a greater extent than the diameter of the openings in the flanges and the edges of the flanges thus embedded in the outer face of the tube without any substantial reduction in the thickness of the tube.

3. The method of producing a heat exchange unit by a cold process which consists in clamping perforated metal radiating flanges parallel with each other and spaced apart with the perforations in line, passing a tube of substantially the same exterior diameter as the perforations through the perforations of the flanges thus clamped, gradually expanding the tube from the interior outwardly until it binds tightly against the edges of the flange perforations, holding the metal of the tube thus expanded from the interior for an interval, and finally expanding the tube by mechanical means the diameter of which is slightly larger than the diameter in the openings in the flanges less the thickness of the wall of the tube, whereby the tube between the flanges is expanded to a greater extent than the diameter of the openings in the flanges, and the edges of the flanges are embedded in the outer surface of the tube without becoming bent or distorted.

4. The method of producing a heat exchange unit without the employment of heat, which consists in clamping and holding against deflection a plurality of thin metal centrally perforated disks, parallel with and spaced from each other and with the perforations in alignment, passing a tube of substantially the same external diameter as the diameter of the perforations in the disks through said perforations, gradually from one end expanding the tube transversely until its outer wall binds tightly against the edges of the perforations in the disks, for an interval holding the metal of the tube thus expanded until it becomes set, and then further exerting outward pressure in the interior of the tube and causing the walls of the perforations to become embedded in the outer surface of the tube without being distorted and causing the wall of the tube between the disks to expand to a greater diameter than the diameter of the perforations in the disks.

YNGVE EMANUEL BERGSTRÖM.