Aug. 30, 1932. P. P. HENSHALL ET AL 1,874,009

EXPANDED TUBE RADIATOR

Filed May 28, 1930 2 Sheets-Sheet 1

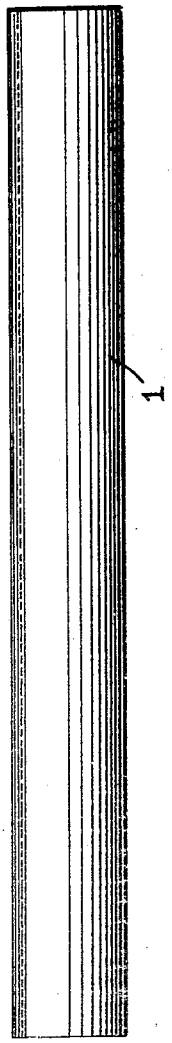

Fig. 1.

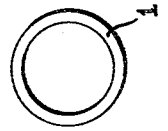

Fig. 2.

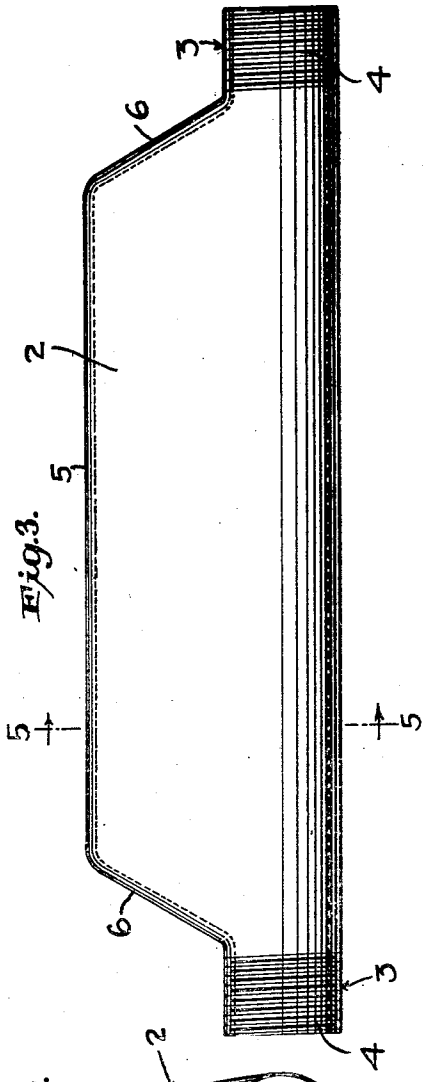

Fig. 3.

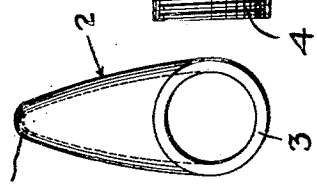

Fig. 4.

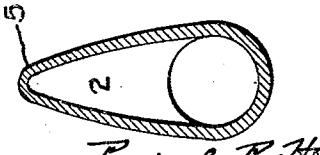

Fig. 5.

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EXPANDED TUBE RADIATOR

Filed May 28, 1930 2 Sheets-Sheet 2

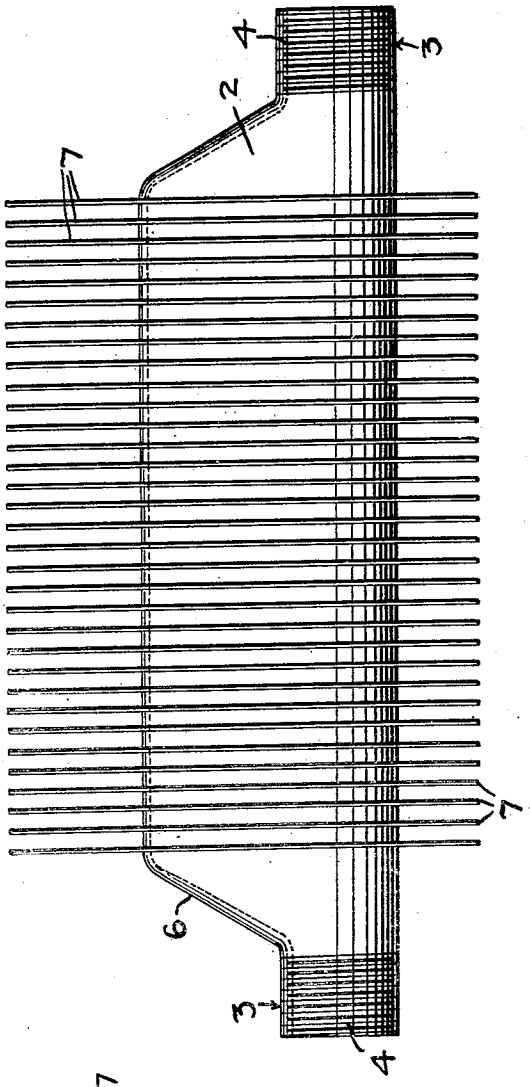

Fig. 7.

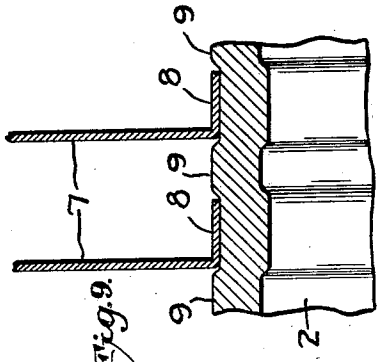

Fig. 9.

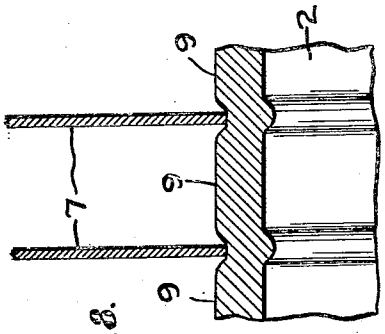

Fig. 8.

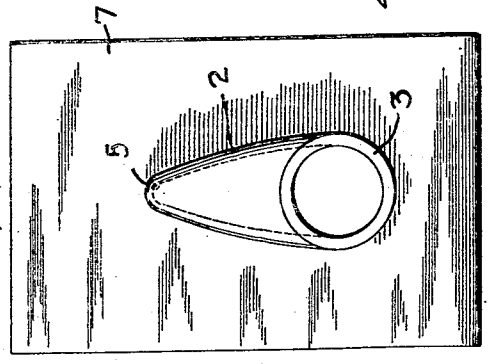

Fig. 6.

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UNITED STATES PATENT OFFICE

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EXPANDED TUBE RADIATOR

Application filed May 28, 1930. Serial No. 456,342.

This invention relates to radiators, and particularly has reference to the type of radiators comprising a tube and a plurality of heat radiating plates or fins massed on the tube in spaced apart relation.

Radiators of the type indicated may be used in various relations, such as for concealed radiation, for cabinet or covered radiation, in heating and ventilating units, and in various relations where it is desirable to either carry off heat for cooling or evaporating purposes, or to transmit or transfer heat for various industrial purposes.

In its simple form the radiator includes a single, tubular member or fluid enclosure having a plurality of plates, disks or fins applied thereto; but, it is to be understood that the radiator may include a plurality of tubes suitably arranged, each carrying a plurality of plates or fins, or a plurality of tubes having a plurality of plates or fins arranged thereon. The tubes or fluid enclosures are preferably made from a single piece of circular tubing composed of a comparatively soft, malleable, ductile and flexible material adapted to be formed as desired.

Among the objects of the invention may be noted the following: to provide a radiator composed of a tubular member and a plurality of radiating plates, the tube being expanded in suitable manner into heat transmitting contact with the plates; to provide a radiator composed of a tube having affixed thereto a plurality of radiating plates or fins, the center of the tube being expanded or distended in a predetermined manner and to a predetermined shape; to provide a radiator consisting of a single tubular member expanded into suitable form and having fixed thereto intimately and rigidly a plurality of spaced apart radiating plates or fins; to provide a radiator composed of a tubular member a portion of which is expanded to provide a fluid receiving chamber and having on its exterior a plurality of spaced apart radiating plates.

With the above objects in view and others which will be detailed during the course of this description, the invention consists in a radiator having certain novel characteristic features and in the process for producing the same hereinafter described and claimed.

In order that the invention may be clearly understood, drawings are provided wherein:

Figure 1 is a view showing a light, single, metallic tube of uniform diameter throughout its length from which the fluid enclosure is produced;

Figure 2 is a view showing the tube of Figure 1 in end elevation;

Figure 3 is a view in side elevation of the fluid enclosure after it has been expanded to a predetermined degree and form;

Figure 4 is a view showing the tube of Figure 3 in end elevation;

Figure 5 is a transverse section taken on the line 5—5 of Figure 3;

Figure 6 is an end elevation of the fluid enclosure shown in Figure 3, having applied thereto in intimate thermal relation at least one radiating fin or plate;

Figure 7 is a view showing in side elevation a fluid enclosure such as Figure 3 with a plurality of fins or plates applied thereto in spaced apart relation;

Figure 8 is an enlarged sectional view of an expanded tube showing a plurality of plates applied thereto in accordance with the invention, the plates being broken or curtailed due to the limitations of the sheet, said plates being devoid of flanges; and

Figure 9 is a view similar to Figure 8 showing the plates provided with affixing flanges.

Referring to the drawings, the numeral 1, Figure 1, indicates tubing of which the radiator may be composed, the same being shown, for example merely, as circular in cross-section. This tube may be made of copper, brass, aluminum or any other material which is found suitable, and which may be found to be susceptible of expansion, distention or distortion, without fracture, into the predetermined shape, or for the particular purpose or use contemplated.

In Figures 3 to 7, inclusive, the tube 1 is shown as expanded in a predetermined and desired manner to produce a chambered, radiator tube or fluid enclosure 2, the expanded

portion being between the ends of the basic tube, leaving the latter at 3 normal or unexpanded. This normal portion may be of any desired length; but, according to our invention, is of a length sufficient to provide inlet and outlet attaching members suitable for use as a radiator, for example, in a heating and ventilating unit. The members 3 are, for example, externally threaded as at 4, to provide attaching means for coupling the enclosure 2 in the fluid system employed. As shown, the enclosure 2 is given the form in cross-section,—Figures 4 and 5,—of a prolate oval, the base of which is left normal and the body of which is expanded, distended or distorted into the considerably narrowed portion 5. Preferably, the expanded tube is so treated as to provide the inclined, diverging ends 6 which merge into the normal extensions 3.

By shaping the tube 1, between its ends, into the enclosure of the form indicated at 2, the stream-line remains coincident with the base of the tube, or the tubular extensions 3, the chamber of the tube beyond said stream-line being formed tapering, as at 5, permitting the necessary expansion of the fluid for heat transmitting purposes and also providing inclined walls for rapid drainage into the stream-line of the tube as clearly shown in Figures 4 and 5.

To increase the radiation, fins or plates 7 are provided in spaced apart relation along the length of the enclosure 2. These plates 7 may be rectangular or any other shape and are, of course, provided with openings of the ultimate shape of and for the reception of the enclosure, said fins or plates being made to adhere rigidly and intimately to the periphery of the enclosure, the contact being made without solder, brazing or other connecting media than the intimate contact produced by expanding the tube so as to engage the plates and provide heat transmitting contact all around without diminution, the same as if the plates were integral with the tube. The plates 7 may be devoid of other formation than the central opening to receive the tube; but, said plates may also be provided about their opening with angular flanges 8 for more or less extensive contact with the periphery of the tube, the expansion of the latter causing intimate adhesion of the plates and tubes through the medium of said flanges.

It is to be understood that while the tubular or chambered fluid enclosure or radiator tube has been shown in the form of a prolate oval in cross-section, the same can be given any other desired form in cross-section according to the forms of dies which are employed; and various shaped dies may be employed during the process of expanding the tubes in order to produce the desired ultimate shape. The form shown offers no resistance inside or outside to the passage of fluid. The process employed is as follows:

The cylindrical tube 1, of Figure 1, is heated in a furnace, placed in a die, and expanded a little, heating and expansion being alternately employed. A series of varying sizes and shapes of dies are utilized until the desired shape is obtained of a size just a little less than that for the finished enclosure. The plates with conforming openings, flanged or plain, are then inserted in slots provided in the final die, the slots permitting the circumference of the openings to more or less loosely engage the periphery of the expanded tube at this stage of the process when said tube is inserted through the plates and die, the latter holding the plates in parallelism and in the proper grouped relation. The tube is then finally expanded until the inner edges of the plates or surfaces of the flanges are caused to bury themselves in the circumference of the tube, as shown in Figures 8 and 9, the tube being distended by this final step between the plates as indicated at 9, which operation performs the double function of providing the separating members 9 between the plates and causing the latter to intimately engage and coalesce with the periphery of the tube, and form a perfect thermal transmitting contact or connection. The successive heating and cooling of the tube results in annealing the latter.

The expansion or distension of the tubes may be accomplished hydraulically, pneumatically, mechanically, or by a combination of the foregoing processes; and as before suggested, the successive dies may be of different shapes as well as size in order to eventually produce the shape and size desired for the completed radiator and its chamber, which shape may vary from that shown in the drawings, it being understood that the shape shown is suggestive merely and is not to be taken as a limitation of the invention.

It will be understood that one or more of the tubes may be employed for and in a radiator according to the use of the latter, and that the heating fluid may be steam, water or hot air, and that the radiators may be used in various kinds of systems employing the effects of vacuum and the various fluids. The tubes and radiating fins may be also employed in a cooling system wherein the fins will absorb the heat and the tubes will carry the cooling medium.

An important use of the radiator, whether in the form of a single tube with radiating fins or plates, or a plurality of tubes, is in a heating and ventilating unit. In such units the radiator will occupy but very little space, provide a maximum of radiating surface, have very little weight and, consequently, will permit not only a very material reduction in the size of the unit as a whole; but, will enable the installation of the radiator in the unit at the factory and permit its transportation in and with the unit. This

means economy in labor, cost, material, installation, and also maintenance because a single radiator tube with its fins or plates is easily extracted from the unit and quite readily repaired by additions or substitutions or replacements.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A radiator comprising a steam enclosure made from a single piece of tubing and having circular end members externally threaded, a body member having its base semi-circular in form between said end members, and having an elongated portion in continuity with the semi-circular body portion extending transversely of the tubing.

2. A radiator having the structure recited in claim 1, and provided with a plurality of rectangular radiating plates conforming centrally to the exterior of the radiator.

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