Aug. 31, 1926. 1,597,720

W. H. CARRIER

RADIATOR OR THE LIKE

Filed Nov. 8, 1922 3 Sheets-Sheet 1

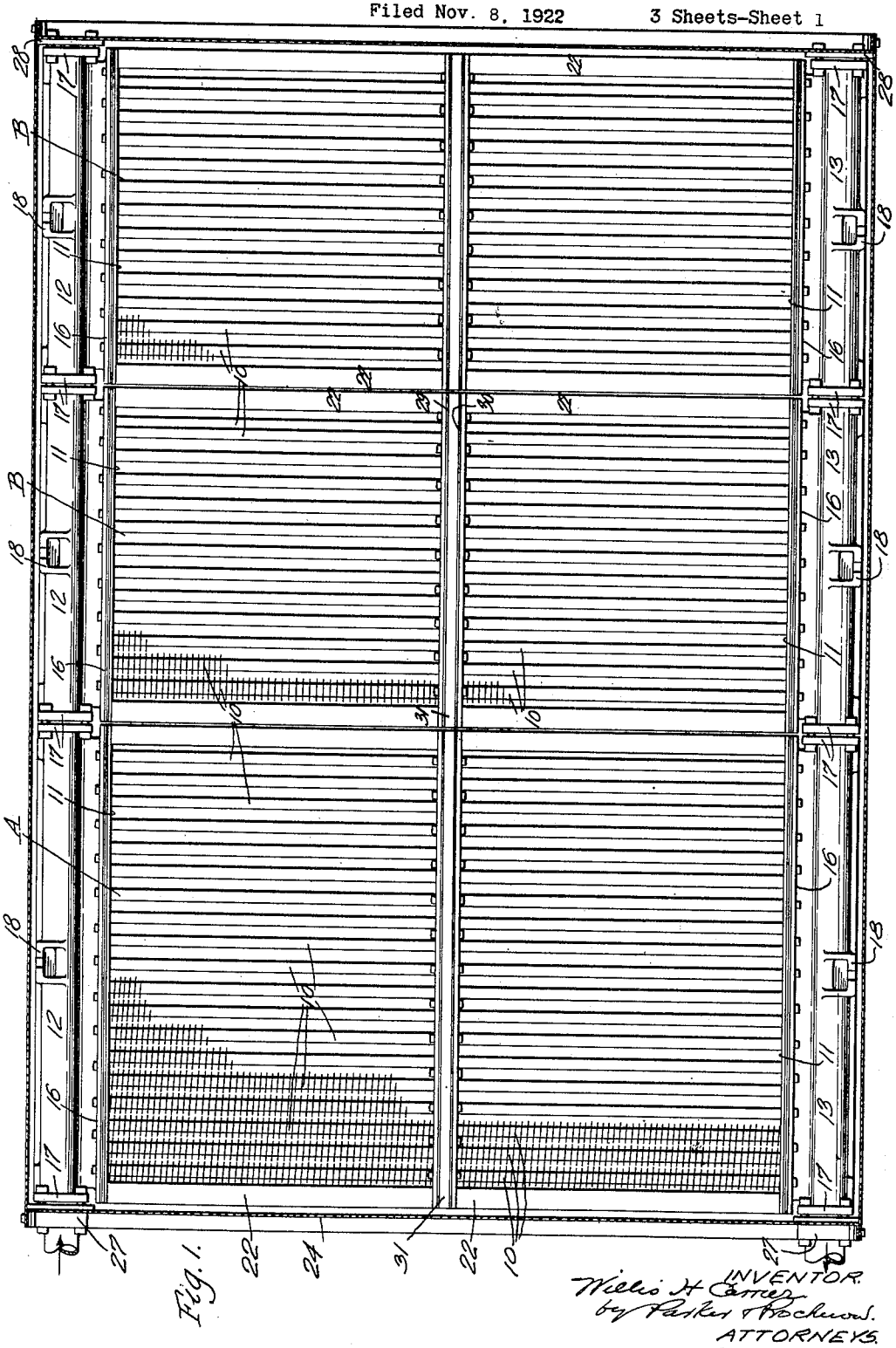

Fig. 1.

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RADIATOR OR THE LIKE

Filed Nov. 8, 1922 3 Sheets-Sheet 2

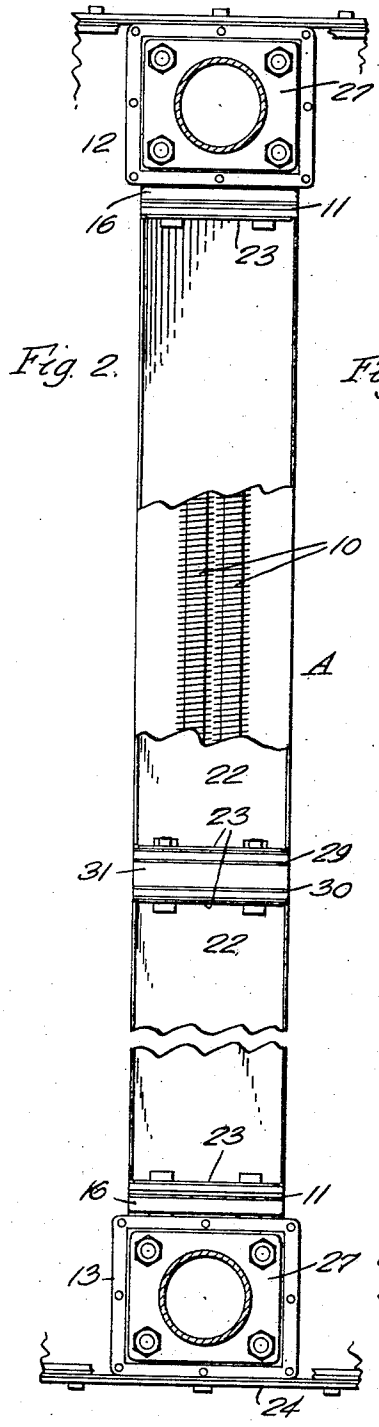

Fig. 2.

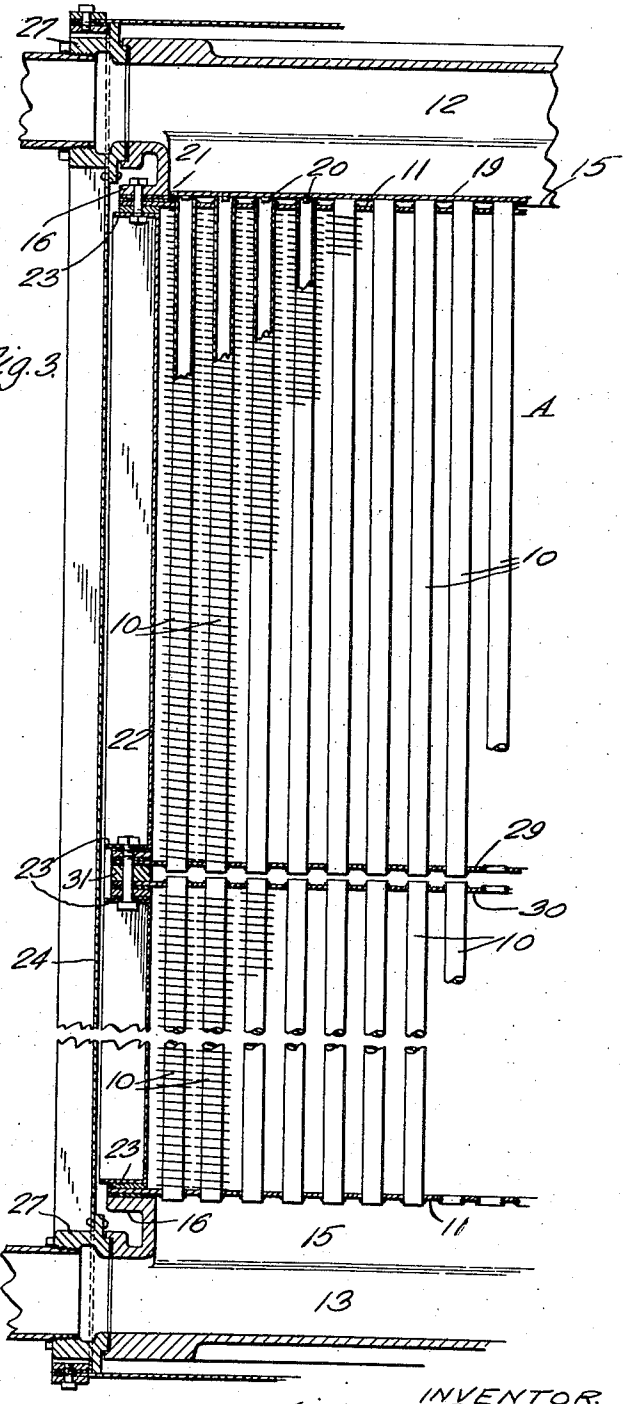

Fig. 3.

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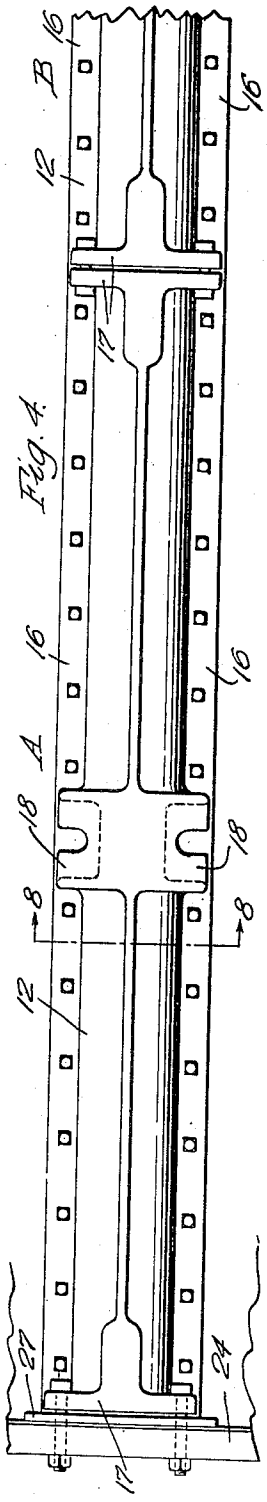

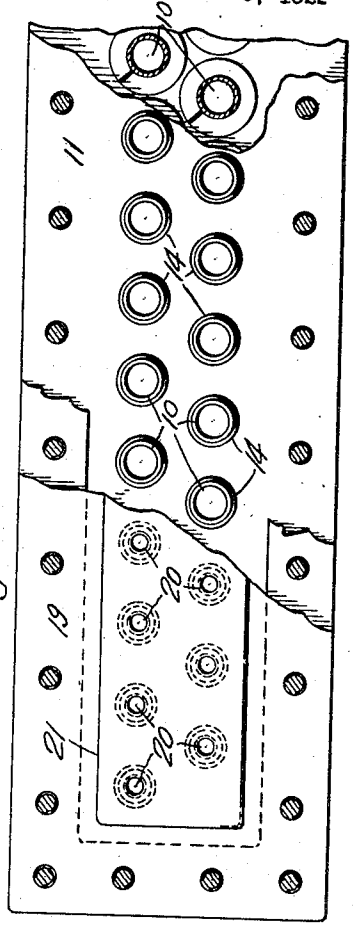

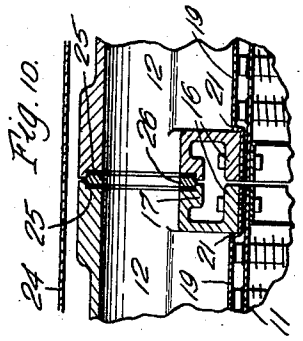

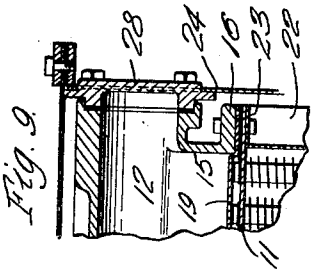

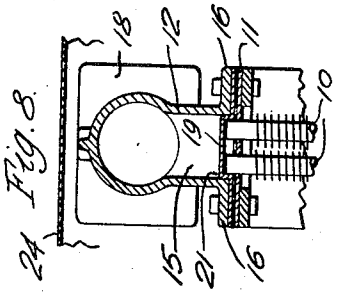

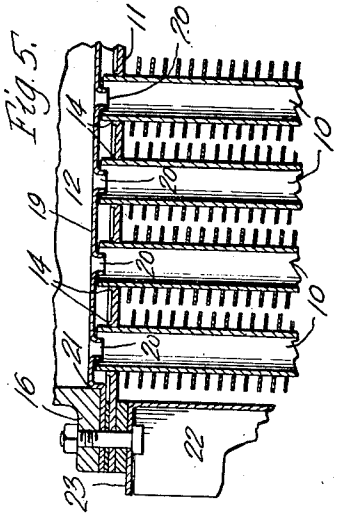

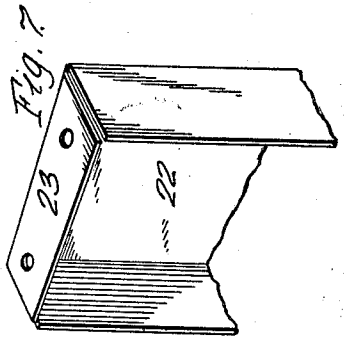

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Patented Aug. 31, 1926. 1,597,720

UNITED STATES PATENT OFFICE.

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RADIATOR OR THE LIKE.

Application filed November 8, 1922. Serial No. 599,643.

This invention relates to a tubular heater or radiator in which a suitable fluid such as steam or hot water is caused to flow through the tubes of the radiator or heater for heating air, gas or the like passing over the external radiating surfaces of the heater, or if desired, for the purpose of cooling the fluid flowing through the radiator.

One object of the invention is to provide an efficient and desirable heater or radiator which can be manufactured at the minimum cost and is extremely flexible as to size, being composed of units or sections. Other objects are to construct the radiator sections or units so that they are interchangeable and reversible, that is the units have no rights or lefts and are alike top and bottom, all parts being therefore interchangeable and reversible; also to construct the units so that a metal of high conductivity, such as brass, can be used for the radiating tubes while the headers and connecting frame bars can be made of less expensive metal, the headers being preferably made of cast iron and the frame bars made of pressed sheet steel, the construction nevertheless permitting the necessary expansion of the tubes and tube plates without danger of leakage; also to construct the radiator frame so as to permit free longitudinal expansion of the radiating tubes while still insuring a stiff, strong frame; and also to form the frame bars so as to adapt any desired number of radiator sections or units to be readily assembled in a single radiator and to permit ready connection of the radiator with a casing or duct for the air or gas to be heated; also to provide an efficient means for uniformly distributing the steam or heating fluid to the several tubes of the radiator and for breaking up any air pockets in the tubes themselves and insuring a maximum heat transmission therefrom; and also to improve radiators in the other respects hereinafter described and set forth in the claims.

In the accompanying drawings:

Fig. 1 is a face view of a series of radiator units constructed in accordance with this invention and which are shown as arranged in an air duct.

Fig. 2 is an end elevation partly broken away, of a radiator unit, and on an enlarged scale.

Fig. 3 is a fragmentary longitudinal sectional elevation thereof.

Fig. 4 is a fragmentary plan vew thereof.

Fig. 5 is a fragmentary vertical section thereof showing the fluid distributor plate.

Fig. 6 is a fragmentary sectional plan view of the distributor plate and the adjacent tube plate.

Fig. 7 is a fragmentary perspective view of one of the end frame bars of the radiator.

Fig. 8 is a transverse sectional view on line 8—8, Fig. 4 of one of the headers of the radiator.

Fig. 9 is a fragmentary longitudinal vertical section of one end thereof.

Fig. 10 is a similar view showing the steam tight joint between two adjacent headers.

The heater or radiator is composed of any desired number, one or more, of sections or units A and B, which are alike except that they are preferably made in two different lengths, in the ratio to each other of two to three to enable a radiator of any desired length which is a multiple of the difference in length between said sections to be made by appropriate assembling of the sections of either or both lengths.

Each section or unit of the radiator comprises parallel, vertical, radiating tubes 10, which are secured at their ends in tube plates 11, by which they are connected to upper and lower headers 12 and 13. The radiator tubes are preferably made of brass or other metal of high conductivity and are preferably provided with radiating fins formed by strips of sheet brass or the like wound helically around the tubes and soldered or brazed thereon. Tubes of any other construction adapted to give the required radiation can however be used. The tube plates 11 are also made of brass or of metal having the same coefficient of expansion as the tubes, and the tube-receiving

holes in the plates are preferably made by punching so as to form an outwardly projecting flange or lip 14 around each hole. The tubes have a driven fit into the flanged holes and are sweated therein, thus insuring strong, tight joints between the tubes and tube plates. Each header is tubular or hollow and preferably consists of a casting having a longitudinal opening 15 in one side bounded by lateral flanges 16 to which the tube plate 11 is bolted with a suitable packing gasket interposed between the tube plate and header to ensure a steam tight joint. The tube plates thus close the open sides of the headers and join the tubes with the headers so that the steam or heating medium can flow from one header to the other through the tubes. The headers are also formed with flanged ends 17 for bolting together, end to end, the headers of adjacent radiator units to form a radiator of desired length. The opposite ends of each header have the same form and the upper and lower headers are alike, thereby enabling the parts to be interchanged and reversed. Each header, as shown, is also provided at its outer side between its ends with lateral, slotted lugs 18 to receive bolts for fastening the radiator in place, or for securing the radiator units together one on top of another.

A distributing device for the steam or heating fluid is provided at the upper ends of the tubes. This device preferably consists of a sheet metal plate 19, extending horizontally over the tube plate at the upper ends of the tubes and having punched perforations with downwardly projecting lips forming small nipples 20 which enter the upper ends of the several tubes. These perforations are relatively small, the area of all of the perforations for a radiator being substantially equal to the cross sectional area of the supply pipe for the steam or heating fluid. This distributing plate insures a substantially uniform distribution of the steam or heating fluid to the several radiating tubes, and the nipples produce an ejector action within the radiating tubes which tends to break up any air pockets and give a maximum transmission even though a considerable amount of residual air be present mixed with the steam. Preferably, the distributing plate is provided with offset marginal flanges which are secured between the edges of the tube plate and the flanges of the header to make a tight joint between the distributing plate and the header and prevent the entrance of steam into the space between the tube plate and the distributing plate. The marginal shoulder 21 formed by offsetting the edge of the distributing plate fits in the side opening 15 of the header. The distributing plate is thus definitely located in the header so as to insure the registration of each of the perforations in the plate with one of the tubes.

The upper and lower headers of each radiator unit or section are connected at their ends by upright end frame bars 22 which are preferably made of sheet steel pressed into channel shape, and arranged to provide outwardly projecting front and rear vertical flanges at each end of the radiator unit. The webs of the channel bars have outwardly bent end portions 23 which are bolted to the flanges at the ends of the headers. These bent ends can flex or give more or less and thus permit longitudinal expansion of the radiator tubes and movement of the headers toward and from each other due to the expansion and contraction of the tubes, without straining the connections between the frame bars and the headers. Nevertheless the channel end bars form wide stiff braces between the headers which prevent any twisting or weaving movement or displacement of the headers relatively to each other and relieve the radiating tubes and tube plates from strain. The headers and end bars 22 form the casing or frame of the radiator unit, thus obviating the necessity for any other casing and protecting the radiator from damage, and at the same time allowing for expansion and contraction of the radiator. When two or more units are connected to form a long radiator, the flanged end frame bars serve to fill the spaces between the radiating tubes of adjacent sections so as to obstruct the passage of air through the spaces which would otherwise be left between the units. Similarly, the end bars 22 obstruct the spaces between the ends of the radiator and the adjacent walls of the chamber or air duct 24 within which the radiator may be mounted.

The headers of adjacent units or sections are secured together by bolts connecting the flanges at the adjacent ends of the headers and in order to properly aline the headers of adjacent units and provide a simple and reliable expansion joint, the ends of the headers are countersunk or provided with circular recesses 25, and an alining ring 26 fits in the opposed recesses in the adjacent headers with suitable packing provided between the ends of the ring and the bottoms of the recesses. When the bolts connecting the flanges are tightened, the packing is compressed, but the packing being confined within the recess is prevented from spreading edgewise when the bolts are tightened, and thus insures a steam tight joint.

As before explained, the radiator units are preferably made in two different lengths, one being approximately fifty percent longer than the other. For instance, if one unit is two feet in length, the other unit is made three feet in length. This enables a radiator to be made of any desired even or odd num-

ber of feet in length, not less than the length of the shorter unit. For example, a two-foot radiator is made by using one two-foot unit; a three-foot radiator by using one three-foot unit; a four-foot radiator by combining two of the two-foot units, and a five-foot radiator by combining a two-foot and a three-foot unit, whereas a six-foot radiator is made by using two of the three-foot units, and a seven-foot radiator by two of the two-foot units and one three-foot unit, etc.

27 represents a coupling flange adapted to be bolted to the end flange of the header at one end of the radiator and having a screw threaded outer end or other means for connection with a steam supply or exhaust pipe, and 28 represents a blank flange adapted to close the headers at the opposite end of the radiator.

In the radiator as illustrated in the drawings, the radiating tubes 10 do not extend continuously from one header to the other, but the tubes are divided or interrupted intermediate of the two headers, and the adjacent ends of the alined upper and lower sections of the tubes are secured in two intermediate tube plates 29 and 30, which are bolted at their edges to an interposed rectangular frame 31. The end frame bars 22 are similarly divided, and the ends of the frame 31 are bolted between the out-bent ends of the upper and lower sections of the end bars 22. This construction allows greater expansion of the tubes 10, and is desirable for radiators in which the tubes are of considerable length. When shorter tubes are used, this construction is not necessary.

While the radiator or heater is primarily intended for heating air by the use of steam in the radiator, nevertheless the described construction adapts the device either for cooling a liquid circulated through the radiator or for cooling air or the like by circulating a suitable cooling medium through the radiator.

I claim as my invention:—

1. In a radiator or the like, the combination of opposite tubular headers having open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of spaced tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers, and end braces connecting said headers at their end portions, said end braces yieldably connecting said headers and permitting relative movement of the headers due to the expansion and contraction of said radiating tubes.

2. In a radiator or the like, the combination of opposite tubular headers having open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of spaced tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers, and end braces connecting said headers at their end portions, said end braces being of channel-shape cross section and having yielding connections with said headers which permit relative movement of the headers due to the expansion and contraction of said radiating tubes.

3. In a radiator or the like, the combination of opposite tubular headers having open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of spaced tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers, and end braces connecting said headers at their end portions, said end braces being of channel-shape cross section and having bent ends secured to and yieldably connecting said headers.

4. In a radiator or the like, the combination of headers having relatively rigid walls and relatively flexible tube plates, a plurality of separate relatively flexible spaced radiating tubes secured at their opposite ends in said flexible tube plates of said headers and forming fluid passages connecting said headers, and end braces at the end portions of said headers and cooperating with said headers to form a protecting structure for said radiating tubes.

5. In a radiator or the like, the combination of opposite like tubular headers having open sides facing each other, each of said headers being alike end for end whereby said headers are interchangeable and reversible, like flexible tube plates secured to said headers and closing the open sides thereof, a plurality of spaced tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers, and like end braces connecting the end portions of said headers.

6. In a radiator or the like, the combination of opposite headers having relatively rigid walls and open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of spaced radiating tubes of relatively high conductivity fixed at their ends in said tube plates and forming fluid passages connecting said headers, and end braces connecting said headers at their end portions and with said headers forming a protecting frame for said radiating tubes.

7. In a radiator or the like, the combination of opposite tubular headers having open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers and a fluid distributing plate arranged in one of said headers adjacent the tube plate thereof and having nipples projecting into the ad-

jacent ends of said tubes for distributing the fluid to the several tubes.

8. In a radiator or the like, the combination of opposite tubular headers having open sides facing each other, a flexible tube plate secured to each header and closing the open side thereof, a plurality of tubes fixed at their ends in said tube plates and forming fluid passages connecting said headers, and a fluid distributing plate arranged in one of said headers adjacent the tube plate thereof and having flanged perforations therein forming nipples projecting into the adjacent ends of said tubes for distributing the fluid to the several tubes.

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