July 2, 1935. W. E. OAKEY 2,007,000

PROCESS FOR MAKING EXTENDED SURFACE CONVECTORS

Filed Jan. 9, 1931

Fig. 1.

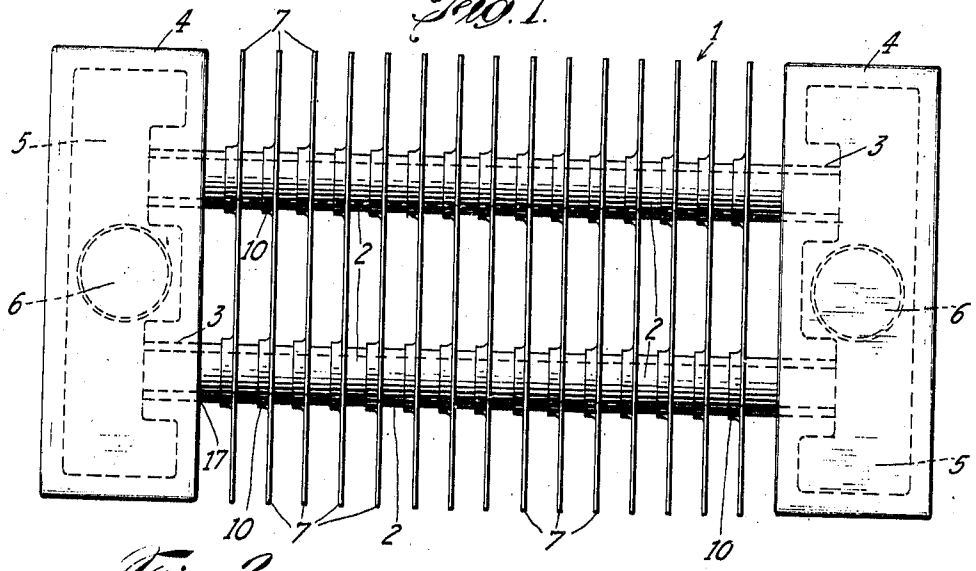



Fig. 3.

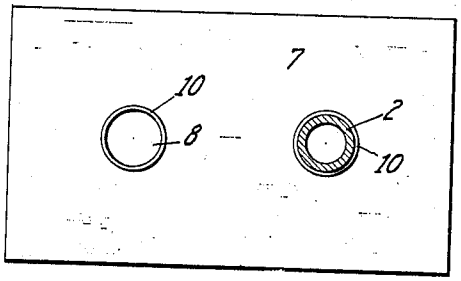
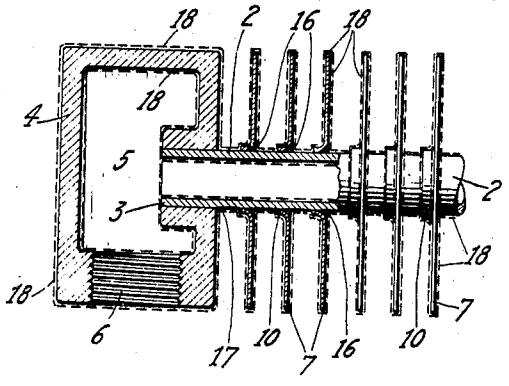



Fig. 2.

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Patented July 2, 1935 2,007,000

# UNITED STATES PATENT OFFICE

2,007,000

## PROCESS FOR MAKING EXTENDED SURFACE CONVECTORS

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Application January 9, 1931, Serial No. 507,559

6 Claims. (Cl. 29—157.3)

My invention relates to heating and cooling apparatus and particularly to the manufacture of convectors of the extended surface type.

In certain forms of heating and cooling devices of the extended surface type it is customary to provide the conductor, such as a tube or tubes, through which the heating or cooling fluids pass, with a series of plates or fins the surfaces of which, in effect, constitute extensions of the heat transfer surface of the conductor. Such plates or fins are often assembled on the conducting tube by pressing the tube through openings formed therefor in the fins, the fins being held in place on the tube by friction, and, in some cases, by subsequently soldering the fins to the tubes.

It is desirable that an effective bond be provided between the conducting tube and the fins mounted thereon both to increase the effectiveness of the heat transfer of the heating or cooling device and also to provide a rigid structure. It is also desirable to protect the surfaces of the heating or cooling device against deterioration.

A feature of my invention resides in the provision of an effective conducting bond between a conducting tube or tubes and the plates or fins whose surfaces constitute extensions of the surfaces of the conducting tube or tubes.

A second feature resides in fixedly securing the plates or fins to the conducting tube or tubes in order to provide a strong and rigid heating or cooling unit.

A third feature resides in providing the surfaces of the heating or cooling unit with a coating which protects them against rusting, etc., and also serves to improve the appearance of the unit.

A fourth feature of my invention resides in providing the conducting bond, securing the fins to the conductors and applying the protecting and finishing coating in a single operation.

Other features and advantages of my invention will become apparent upon consideration of the following detailed description and the appended claims taken in conjunction with the accompanying drawing.

In the drawing:—Figure 1 is a plan view of a heating or cooling unit constructed in accordance with my invention,

Figure 2 is a side elevation, partially in section of a portion of the unit shown in Figure 1, and

Figure 3 is a view in elevation of one of the plates or fins of the convector unit and shows one of the fluid conductor tubes in section.

Referring to Figures 1, 2 and 3, the heating or cooling unit 1 comprises seamed, or seamless, steel tubes 2 pressed into openings 3 provided therefor in headers 4, which may be of gray or malleable iron or sheet steel. Each header 4 is formed with an interior chamber 5 communicating with the tubes 2 and is also provided with a suitable port 6 for connecting the unit in the heating or cooling system. Mounted on the tubes 2 between the headers 4 is a series of plates or fins 7, the surfaces of which, in effect, constitute extensions of the surfaces of the tubes.

Each of the fins 7, one of which is shown in elevation in Figure 3, comprises a plate, which may be of sheet steel, provided with openings 8 for the tubes 2. Bosses 10 are provided on the fins adjacent the openings 8, as by extrusion of the fin in forming the openings. The fins 7 are supported in spaced relation, as in jigs, and the tubes 2 are then pressed through the bosses 10 and openings 8 in the fins to assemble the fins in spaced relation on the tubes. The tubes 2 with the fins 7 thereon are then combined with the headers 4 by pressing the ends of the tubes into the openings 3 provided in the headers.

When the fins, tubes and headers are thus assembled into a heating or cooling unit, the unit may then be dipped as a whole into a suitable flux bath. The heating unit is then dipped into and moved about in a brazing bath of molten brass. The molten brass adheres to the exterior surfaces of the fins 7, tubes 2 and headers 4, and also to the interior surfaces of the tubes 2 and headers 4, thus affording a coating for protecting these surfaces against rusting and the possible deteriorating action of the heating or refrigerating fluids.

The molten brass also acts to braze the fins 7 to the tubes 2 and the tubes to the headers 4, the molten brass flowing into all spaces between the fins and tubes and the tubes and headers, as indicated at 16 and 17 in Figure 2. The brazing metal not only serves to braze the fins rigidly to the tubes but also forms an effective conducting bond between the tubes and fins.

The brass coating thus provided on the surfaces of the fins, tubes and headers forms a shell, as indicated by the irregular line 18 in Figure 2, within which the headers 4, tubes 2 and fins 7 are imbedded. Viewed in another light, the finished heating and cooling unit may be considered a cast brass convector produced by dipping a core made up of the headers, tubes and fins into molten brass, the core in the casting operation becoming firmly imbedded within a brass shell. The exterior surfaces of this shell form a continuous heat transfer surface, thereby increasing the effi-

ciency of the heating or cooling unit since the brass shell is a very good conductor.

It is to be noted that by brazing the fins to the tubes and the tubes to the headers, as above described, a perfect metallic joint is formed between the fins and tubes and the tubes and headers. This metallic joint forms a better conducting bond than when the fins are held on the tubes by a soldered joint or by friction. Solder is a poor heat conductor and soldered joints are liable to oxidation, which may act as an insulator at the joints thus impairing the effectiveness of the solder as a conducting bond between the tubes and fins. When the fins are held on the tubes by friction the resulting joint does not form an efficient conducting bond between the tube and fins. A friction joint is particularly disadvantageous if the convector unit is immersed in a fluid to heat or cool the latter. Such immersion results in rusting at the joints, thus insulating the fins from the tubes and destroying whatever conductive qualities friction joints might possess.

It is also to be noted that by brazing the fins to the tubes and the tubes to the headers a stronger connection is provided between these parts than may be obtained by soldering these parts to each other, since the brazing metal unites the various parts into an integral whole. The fins, tubes and headers are more rigidly and permanently secured to one another by a brass brazing than by soldered connections since the brazing brass is not subject to fatigue, due to expansion or contraction as a consequence of the flow of heating or cooling fluids as soldered connections are. As a result, the fins and other parts of the heating or cooling unit are less apt to be twisted or otherwise distorted when the unit is installed in a heating or cooling system.

The joining of the tubes to the headers by the brazing metal also provides a fluid-tight joint between these parts, which joint is superior to a friction joint, or a soldered joint, since fatigue of the solder may result in leakage.

Inasmuch as dipping the assembled parts of the heating or cooling unit in liquid brass secures the tubes, fins and headers to one another, provides an effective conducting bond between the tubes, fins and headers, and applies a rust-proof coating to the interior and exterior surfaces of the unit, all in a single operation, the manufacturing costs of such units are appreciably reduced. Since a brass coating is applied to the exterior surfaces of the heating or cooling unit, it is unnecessary to subsequently gild or paint the unit to secure a pleasing appearance when the conditions of installation so require. As a result the manufacturing costs are further reduced.

Although I have described my invention in connection with a convector unit having a pair of conducting tubes it is to be understood that my invention is equally applicable to a convector unit having only a single conducting tube or one having more than two tubes.

It will be apparent from the foregoing description that a heating or cooling unit constructed in accordance with the principles of my invention is efficient in operation, rigid in construction, neat in appearance and may be economically manufactured.

While my invention is described above in its preferred form, there are many changes and variations which may be made without departing from the spirit thereof, and I desire to include all such changes and variations within the scope of the appended claims.

I claim:

1. The method of manufacturing a convector which comprises assembling a series of sheet metal fins of small area on a conducting tube, assembling headers to the ends of the tube, and dipping the assembled unit in liquid brass to form a metallic bond between the fins and the tube and between the tube and the headers and to imbed the tube, fins and headers within a brass shell which forms an effective conducting and protective surface for the unit.

2. The method of manufacturing a convector having a conductor tube connected at each end to a header and provided with a series of sheet metal fins of small area thereon the surfaces of which constitute extensions of the surface of the tube, which comprises mounting the fins on the tube, assembling the tube to the headers and dipping the assembled unit in liquid brass to imbed the tube, fins and headers within a brass shell having a continuous heat conducting surface.

3. The method of manufacturing a convector which comprises assembling a series of ferrous sheet metal fins of small area on a conducting ferrous metal tube, assembling a ferrous metal header on each end of the tube, and dipping the assembled unit in a molten brazing bath to form a metallic bond between the fins and the tube and between the tube and the headers and to apply a protective and finishing coating to all the exterior and interior surfaces of the convector.

4. The method of manufacturing a convector which comprises assembling a series of sheet metal fins of small area on a conducting tube and dipping the assembled unit in liquid brass to form a metallic bond between the fins and the tube and to imbed the tube and fins within a brass shell which forms an effective heat conducting, and protective surface for the unit.

5. The method of manufacturing a convector having a conductor tube provided with a series of sheet metal fins of small area thereon, the surfaces of which constitute extensions of the surface of the tube, which consists in mounting the fins on the tube, and dipping the assembled unit in liquid brass to imbed the tube and fins within a brass shell having a continuous heat conducting surface.

6. The method of manufacturing a convector which comprises assembling a series of ferrous sheet metal fins of small area on a conducting ferrous metal tube, and dipping the assembled unit in a molten brazing bath to form a metallic bond between the fins and the tube and to apply a protective and finishing coating to all the exterior and interior surfaces of the unit.

WILLIAM E. OAKEY.