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ELECTRICAL BASEBOARD HEATER

Filed June 2, 1965

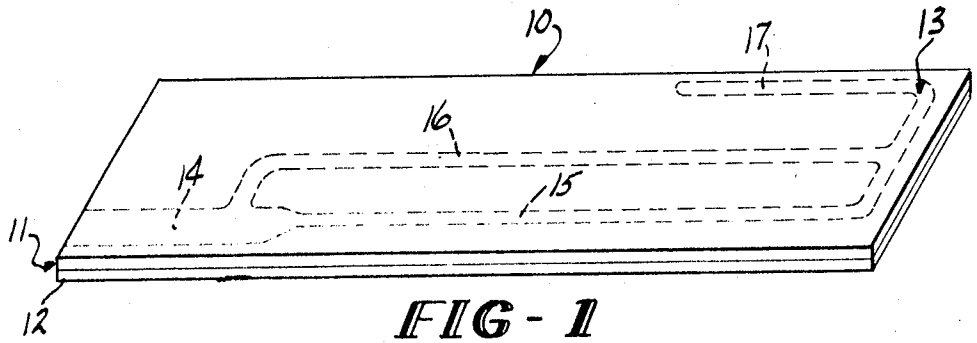


FIG - 1

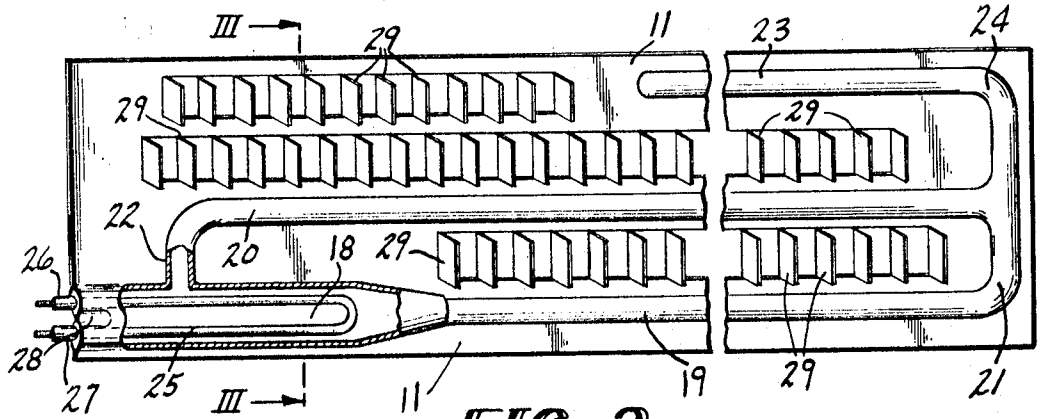


FIG - 2

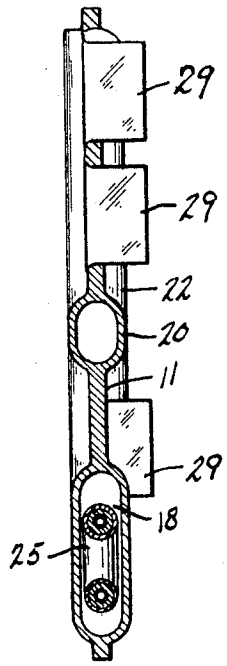


FIG - 3

INVENTOR.
THERON F. PAULS
BY Robert H. Bachman
ATTORNEY

United States Patent Office

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ELECTRICAL BASEBOARD HEATER

Theron F. Pauls, Godfrey, Ill., assignor to Olin Mathieson Chemical Corporation, a corporation of Virginia

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ABSTRACT OF THE DISCLOSURE

An electric baseboard heater comprises a pair of metal sheets united along a plane and having portions extending away from the plane in a pattern to form a self-contained, sealed tubular fluid circulation path. The path includes a lower horizontal run, an upper horizontal run and curved end portions interconnecting the upper and lower runs. An integral fluid expansion tube communicates with the circulation path. An electric heating element is received in an enlarged pocket portion formed in one end of the lower run. The fluid circulating path is filled with a heat exchange fluid. In order to increase the heat exchange surface, areas of the sheets not employed in forming the fluid circulating path and expansion tube are provided with fins.

This invention relates in general to a heat exchanger construction, and more particularly to a heat exchanger construction including an electrical heating element for use as a baseboard heater or the like.

Baseboard heaters commonly in use, for example in heating residential areas, commonly comprise a series of discrete tubes in which a fluid, for example water, circulates in a sealed path. This fluid within the tubes of the heat exchanger may be heated as by an electrical heating element, heat exchange taking place between the fluid within the tubes and a second heat exchange medium exteriorly of the heat exchanger, most often air. Such devices are highly limited in their heat exchange capacity due to the relatively small areas of heat exchange surface available. Additionally, such a heat exchanger is highly susceptible to damage during shipment and in use.

In accordance with the instant invention, it has been found that the above-noted disadvantages may be overcome by incorporating the tubes circulating the internal heat exchange medium into a generally flat sheet. Areas of the sheet not including the tubes may be employed as secondary heat transfer surfaces, with or without the use of additional fins to further increase the effective heat exchange area. This construction additionally retains the tubes in their desired position, and aids in securing the heat exchanger in its desired position for use.

While tubes may be incorporated in a generally flat sheet in a variety of methods, the most expeditious method has been found to be that described in United States Patent 2,690,002. This method involves the application of a suitable predetermined pattern of weld-inhibiting material between component sheets, pressure welding all adjoining areas except those separated by the weld-inhibiting material thereby forming a unified composite panel, and inflating along the unwelded areas to expand the tubes integral with the resultant tubed panel. This panel, when provided with an internal heat exchange medium and an electrical heater, is highly advantageous over the baseboard heaters now in use.

Having thus generally described my invention, it becomes a principal object thereof to provide an improved heat exchanger construction adapted for transfer of heat between an internal and external heat exchange medium.

Another object of the present invention is to provide a heat exchanger construction having a system of tubes integral with a generally flat sheet.

Still another object of the present invention is to provide a heat exchanger construction of the above description incorporating an electrical heater within the system of tubes.

Still another object of the present invention is to provide a heat exchanger construction of the above character which is highly efficient, compact, and economical to manufacture, adapted for use as a baseboard heater.

Other objects and advantages will become apparent to those skilled in the art as a detailed description of a particular embodiment proceeds with reference to the drawings which form a part hereof, and in which:

FIGURE 1 is a plan view of a blank which may be employed in forming the heat exchanger construction of the instant invention;

FIGURE 2 is a perspective view of the heat exchanger construction in accordance with this invention produced from the blank shown in FIGURE 1;

FIGURE 3 is a cross-section of the construction of FIGURE 2, taken along the lines III–III thereof.

Referring now to the drawings and particularly to FIGURE 1, there is seen an illustrative embodiment of a blank indicated generally by **10** produced as set forth in greater detail in the above-mentioned U.S. Patent 2,690,002. In accordance with that method, two oblong sheets **11** and **12**, for example of aluminum, are superimposed with a pattern of weld-inhibiting material, indicated generally by **13**, situated between the sheets **11** and **12**. As known in such method, the pattern **13** is a foreshortened version of the desired pattern of tubular passageways in the finished article. This pattern consists of an entry portion **14** extending inwardly from one edge of the composite sheets, and communicating bands **15**, **16**, and **17** extending along the length of the composite sheets. As can be seen in FIGURE 1, bands **15**, **16**, and **17** are in intercommunication at one end thereof, and bands **15** and **16** are each in communication with the entry portion **14**. It will be apparent that the entry portion **14** corresponds to a hollow pocket which will be adapted to receive an electrical heater inserted from the edge of the sheet, and that bands **15**, **16**, and **17** correspond to the tubes in the finished article for circulation of an internal heat exchange medium.

The stack of component sheets **11** and **12** with the pattern of weld-inhibiting material **13** sandwiched there-

between is then temporarily secured together as by clamps, spot welding, or the like to prevent relative movement between the sheets **11** and **12**. The assembly thus formed is then heated to the required temperature and set through a pair of pressure rolls which exert sufficient pressure on the stack to firmly unite the sheets **11** and **12** together into a single integrated sheet in the areas not coated with the weld-inhibiting material **13**. Simultaneously with the bonding operation, the sheets **11** and **12** undergo a substantial reduction in thickness as well as an elongation in the direction of rolling, whereby the foreshortened pattern of weld-inhibiting material is increased to a length corresponding to the desired pattern of tubes in the finished article. The pattern of weld-inhibiting material **13** of the resultant sheet may subsequently be inflated by introduction of a fluid-distending pressure, as through the entry portion **14**. Such action will expand the portions of the sheet separated by the weld-inhibiting material **13**, forming the desired tubes within the sheet **11**.

Thus, as is shown in FIGURE 2, inflation of entry portion **14** results in an expanded tubular portion, or enlarged pocket portion, **18**. The pocket portion **18** extends to the left edge of the sheet **11** to allow for insertion of an electrical heater unit to be described hereinafter. Extending to the right of the pocket portion **18** is a substantially horizontal tube, or lower run, **19**, which is formed from the expansion of the band **15** of FIGURE 1. Substantially parallel to the lower run **19** is a substantially horizontal tube, or upper run, **20**, resulting from expansion of the band **16**. Run **20** is in communication at one end thereof with the run **19**, as at **21** and the other end with the pocket portion **18**, as at **22**. Extending upwardly from one end of the upper run **20** in a margin portion above said upper run is an additional tube, or expansion tube portion **23**, which is formed from expansion of the band **17**. The expansion tube portion **23** is in intercommunication with the runs **19** and **20** as by connecting portion **24**.

As is known in the art, the expansion of the tubular passageways may be so regulated that a number of desired cross-sectional configurations may be obtained. As illustrated in the drawings, particularly FIGURE 3, the tubes are here shown as being symmetrical about a plane passing through the sheet **11**, but this is by way of example only. As can also be seen in FIGURE 3, the patterns **14** and **15** are so applied that the resulting pocket portion **18** is of greater extent along the plane of symmetry than is the run **19**. The pocket portion **18** is thus relatively flat and of a configuration to receive the electrical heating element **25**.

Considering again FIGURE 2 of the drawings, it will be evident that the pocket portion **18**, the lower run **19**, and the upper run **22** form a self-contained, sealed tubular path for circulation of a heat exchange medium. In communication with this path is the expansion tube portion **23**; to assure drainage of fluid collecting in the expansion tube portion **23**, this portion **23** may slant downwardly slightly toward its end **24**. If so desired, the expansion tube portion **23** may extend upwardly to the upper edge of sheet **11**, in which case the open end thereof could be crimped closed after addition of the heat exchange medium.

As noted above, the pocket portion **18** is so dimensioned as to receive a hairpin-shaped electrical heating element **25**, of any of the conventional constructions. The heating element **25** shown is in the shape of a U with the ends thereof comprising electrical terminals **26** and **27**, to which a source of electrical power may be connected. The pocket portion **18** at the edge of the sheet **11** may be closed in any suitable manner, thereby sealingly supporting the terminals **26** and **27**. This may be accomplished, for example by crimping the area **28** between the terminals **26** and **27**, and sealing the area as by heliarc welding.

Thus, it will be evident that the internal heat exchange medium, for example water, may be heated in the pocket portion **18**, flow upwardly through the portion **22** into the upper run **20**, returning to the pocket portion **18** through the lower run **19**. Obviously, as the heat exchange medium moves along the run **20**, heat transfer will take place throughout the sheet **11**. Expansion tube portion **23** allows for expansion of the fluid circulating through runs **20** and **19** and insures that all fluid collecting in the portion **23** will drain back into the lower run **19** and thence into the pocket portion **18**.

In order to increase the heat exchange surface of the remaining portions of the sheet, areas of the sheet **11** not employed in forming the tubes may be provided with fins **29**. The fins **29** may be formed in any desired manner, as by perforating the sheet **11** and bending a portion of the sheet out of the plane of said sheet, leaving slots between adjacent fins. Such fins **29** may be formed to extend out of either side of the sheet, but are here shown as extending to one side of the sheet, see FIGURE 3. As shown, the fins **29** may be provided above the upper run **20** and between the runs **20** and the expansion portion **23**, as well as between the lower run **19** and upper run **20**, in order to achieve maximum heat exchange capacity. However, it will be evident that areas of the sheet **11** are left unperforated to achieve stability in the resulting heat exchanger construction and protect the fluid circulating tubes from damage in shipment or use.

It will be apparent from the foregoing description and accompanying drawings that there have been provided a heat exchanger construction adapted for use as a baseboard heater which is believed to provide a solution to the aforementioned problems and achieve the aforementioned objects. It is to be understood that the invention is not limited to the illustrations described and shown herein which are deemed to be merely illustrative of the best modes of carrying out the invention and which are susceptible of modification of form, size, arrangement of parts, and detail of operation, but rather is intended to encompass all such modifications as are within the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. An electrical baseboard heater, comprising

two sheets having portions united to each other along a plane,

said sheets having portions extending away from the plane in a pattern to form a self-contained sealed tubular path having

a lower substantially horizontal run,

an upper substantially horizontal run, and

curved end portions connecting said upper and lower runs whereby to provide a selfcontained, sealed path for circulating flow of a fluid therein,

an integral expansion tube communicating with and extending from the sealed path of circulating flow,

said lower run having at its one end an enlarged pocket portion,

together with

a fluid contained within said path, and

an electrical heating element within the pocket portion, said heating element having electrical terminal ends which spacedly support said element within the path of circulating flow through the pocket.

2. An electrical baseboard heater, comprising

two oblong sheets having portions united to each other along a plane of symmetry,

said sheets having portions extending symmetrically away from the plane of symmetry in a pattern forming a tubular path having

a lower substantially horizontal run,

an upper substantially horizontal run, and

curved end portions connecting said upper and lower runs whereby to provide a path for circulating flow of a fluid therein,

said sheets having a margin portion above said upper run, said margin portion containing at one side of

the oblong an inner expansion tube in communication with and extending from the path of circulating fluid flow,

said lower run having a portion at its one end which is of greater extent along the plane of symmetry than the remainder of said path whereby to provide a hollow relatively flat pocket,

together with

a fluid contained within said path, and

a hairpin-shaped electrical heating element within the pocket, said heating element having electrical terminal ends which spacedly support said element within the path of circulating flow through the pocket.

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ANTHONY BARTIS, Primary Examiner

U.S. Cl. X.R.

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