Dec. 31, 1963 L. H. BARTON 3,116,394

HEATER

Filed Feb. 2, 1962

FIG. 1

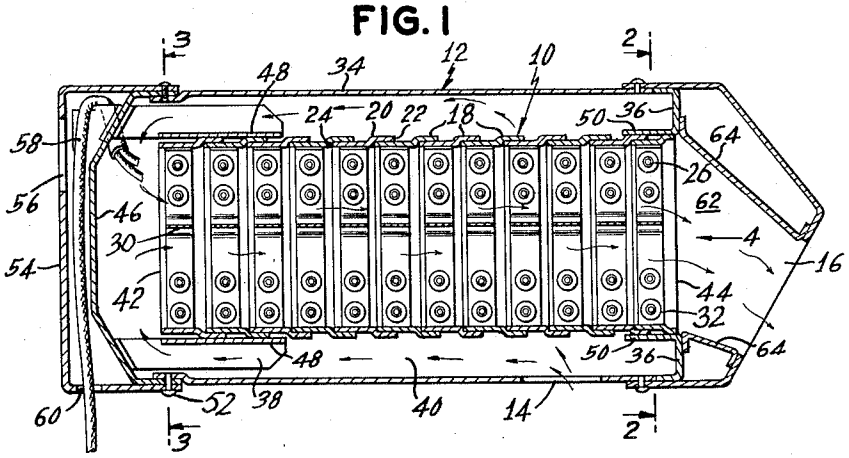


FIG. 2

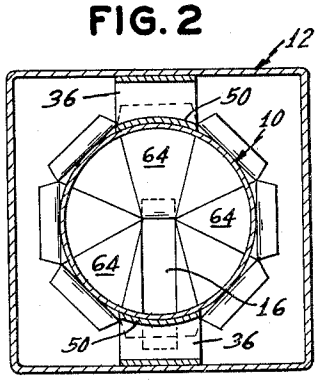


FIG. 5

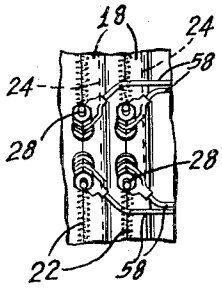


FIG. 3

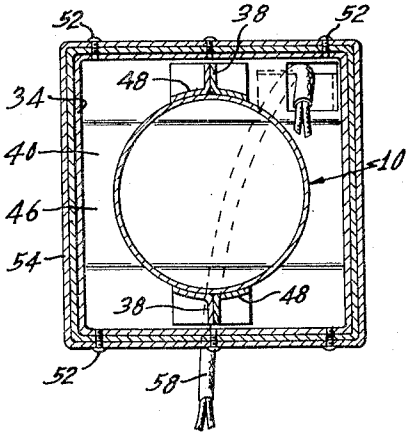
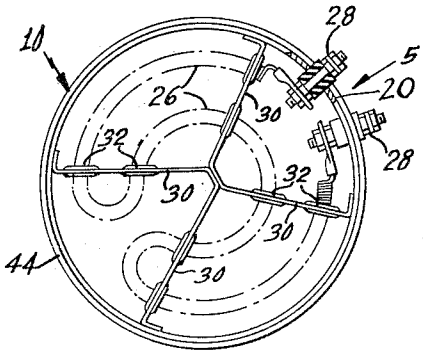


FIG. 4



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HEATER

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This invention relates to heaters and, more particularly, to a heater comprising a series of preformed individual tubular sections.

One of the objects of the invention is to provide a heater of the type indicated with heating sections which are held together by interengagement with each other in such a way as to eliminate the need for separate securing means, whereby to permit rapid and easy removal or additions of heating sections so that a heater of various lengths and corresponding various heating capacities may be readily provided.

The above and other objects, features and advantages of the invention will be more fully understood from the following description of the invention considered in connection with the accompanying drawings which are illustrative of the presently preferred embodiment of the invention but not in limitation thereof.

In the drawings:

FIG. 1 is a vertical sectional view of a heating apparatus embodying the heater of the present invention;

FIG. 2 is a vertical sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a view of one end of the heater looking in the direction of arrow 4 of FIG. 1; and

FIG. 5 is a view of part of the heater looking in the direction of arrow 5 of FIG. 4.

Referring now to the drawings in detail, the tubular heater 10 is shown herein mounted in an air heating apparatus 12 which has an inlet opening 14 for air which is to be delivered to it by a blower (not shown) and a rectangular shaped outlet opening 16 for the outflowing heated air. The heated air flowing through the outlet opening may be used for various purposes, for example and without limitation, for directing a blast of heated air on the heat-shrinkable wrapper of a package for shrinking said wrapper and thereby providing a package having a neat and taut wrapper, as described in the U.S. patent application of Martin Siegel and Seymour Zelnick, Serial No. 170,629 filed February 2, 1962, which is assigned to the assignee of the present application.

The heater 10 of the present invention has provision for readily adding and removing heating sections 18 so that a heater of different lengths and corresponding heating capacities can be easily provided. More particularly, each heating section comprises a hollow tubular member 20 formed of metal or other suitable material and having opposite open ends. One end 22 is larger than the opposite end 24 and has an inside diameter which is slightly greater than the outside diameter of end 24 so that the latter end of the adjacent heating section 18 can be inserted in end 22 whereby adjacent heating sections are frictionally connected to each other by the engaged co-mating ends 22 and 24. In this manner a plurality of nested removable heating sections 18 may be easily provided to form a heater 10 having the desired or necessary heating capacity. The heating capacity of the heater may be readily varied by adding or removing any number of heating sections 18 and this may be done by inserting the smaller end 24 into the larger end 22 of the adjacent section, in the case of increasing the heating capacity of the heater, or by merely pulling the end heating section longitudinally from the adjacent end

of the adjacent section, in the case of reducing the heating capacity of the heater. The rigid material of tubular member 20 permits a relatively large number of sections to be joined to each other in the manner described to provide a relatively rigid tubular heater 10 of various lengths and corresponding heating capacities.

Each heating section 18 includes a helically wound electric resistance wire 26 which is in the form of a reflexed loop as shown in FIG. 4. The ends of the wire are connected to the insulated terminals 28 which are mounted on the tubular member 20. A pair of V-shaped frame members 30 are suitably connected to each other and tubular member 20 and support wire 26 in its looped form. The wire extends through openings formed in the frame members and the openings are provided with insulating bushings 32 to insulate the wire from the frame members.

The wires 26 of the heating sections 18 can be connected in any suitable manner. For example, where twelve heating sections are provided as shown herein, the heating wires from four heating sections can be connected across one phase of a 3-phase power supply and another group of four heating wires can be connected across another phase of the power supply while the remaining wires can be connected across the remaining phase of the power supply. Obviously, the heating wires can be electrically connected in any suitable manner.

The heating apparatus 12 comprises an elongated hollow housing 34, generally rectangular in cross section. The heater 10 is supported at its ends in the housing 34 by brackets 36 and 38 with the outer surface of the heater 10 spaced from the side walls of the housing so that the heater is surrounded by an air preheating space 40. The open end 42 of heater 10 provides an inlet for the air and the opposite open end 44 of the heater provides an outlet for the heated air. A shield 46 encloses the inlet end 42 of the heater and is spaced therefrom. The shield supports brackets 38 which are provided with arcuate flanges 48 (FIG. 3) which provide the supporting surfaces for the adjacent end of the heater and brackets 36 are also provided with arcuate supporting surfaces 50 (FIG. 2) for supporting the adjacent end of the heater. Brackets 38 should be of sufficient length to overlie a number of heating sections 18 so that if one or more sections are removed, the brackets will still engage and support the end of the heater 10. If a relatively large number of sections are removed, then the lengths of the brackets must be increased so that the end of the resulting heater can be supported by the bracket.

The shield is removably secured to the end of the housing 34 by screws 52 which also removably secure a cover 54 to the end of the housing 34. The end cover is provided with an access opening 56 which permits access to the wires 58 from the heating sections 18 and an opening 60 is provided in the cover through which the wires extend. It will be observed that access to heater 10 is provided by removing the cover 54 and shield 46.

During operation of the heating device 12, the air which is to be heated enters the heating device through inlet 14 and flows through the pre-heating space 40 toward the inlet end 42 of the heater 10. During this flow, the incoming air is pre-heated by the heat transmitted from the heater as well as by the heat which may be contained in the side walls of housing 34. This preheating of the air is not only an efficient and economical method of heating the incoming air but, in addition, helps maintain the side walls of the housing cool thereby eliminating the necessity of providing insulation therefor. The pre-heated air enters heater 10 through inlet 42 and flows longitudinally thereof over the electrical resistance wires 36 wherein the air is raised to the proper temperature and is discharged from the heater through outlet 44 and flows through passage 60, formed by the transi-

tion member 64, and from the heating apparatus through outlet 16 in the form of a continuous blast of heated air. It will be observed that the flow of air through the heating apparatus 12 is counterflow.

While I have shown and described the preferred embodiment of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What is claimed is:

1. Heating apparatus, comprising:

(*a*) a longitudinally extending tubular heater having a plurality of heating sections releasably interengaged with each other at adjacent ends,

(*b*) a housing for said heater, and

(*c*) means for supporting said heater in said housing,

(*d*) said supporting means comprising longitudinally spaced brackets engaging the adjacent ends, respectively, of said heater,

(*e*) one of said brackets extending longitudinally of said heater and overlying at least two of said heating sections at the corresponding end of said heater so that when one of said heating sections is removed said one bracket still engages the adjacent end of the heater for supporting said heater in said housing.

2. A heater, comprising a series of heating sections releasably engaged with each other in end-to-end relation, each of said sections comprising a hollow tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, each of said members having an electric resistance wire positioned therein in the path of flow of said fluid for the heating thereof, adjacent ends of adjacent members having interfitting companion parts frictionally engaged only with each other to form said series of heating sections and movable longitudinally and axially of each other for connecting and disconnecting said members.

3. A heater, comprising a series of heating sections releasably engaged with each other in end-to-end relation, each of said sections comprising a hollow cylindrical tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, each of said members having an electric resistance wire positioned therein in the path of flow of said fluid for the heating thereof, adjacent ends of adjacent members having interfitting companion parts frictionally engaged only with each other to form said series of heating sections, one of said adjacent ends of each of said adjacent members having an outside diameter slightly less than the inside diameter of the other one of said adjacent ends, said one adjacent end of each of said adjacent members being nested within said other adjacent end and releasably held in said nested position by friction only to permit longitudinal and axial movement of said members with respect to each other for connecting and disconnecting said members.

4. A heater, comprising a series of heating sections releasably engaged with each other in end-to-end relation, each of said sections comprising a hollow tubular member having opposite open ends for the flow of gaseous fluid longitudinally through said member for the heating of said fluid, each of said members having an electric resistance wire positioned therein in the path of flow of said fluid for the heating thereof, said electric resistance wire comprising a helically wound coil of wire extending in a direction transversely of the path of flow of said fluid, each of said members having a pair of inwardly extending terminals, said coil of wire having opposite ends connected to said terminals, respectively, and a reflexed part between said opposite ends, adjacent ends of adjacent members having interfitting companion parts frictionally engaged only with each other to form said series of heating sections and movable longitudinally and axially of each other for connecting and disconnecting said members.

5. A heater, comprising a series of heating sections releasably engaged with each other in end-to-end relation, each of said sections comprising a hollow cylindrical tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, each of said members having an electric resistance wire positioned therein in the path of flow of said fluid for the heating thereof, said electric resistance wire comprising a helically wound coil of wire extending in a direction transversely of the path of flow of said fluid, each of said members having a pair of inwardly extending terminals, said coil of wire having opposite ends connected to said terminals, respectively, and a reflexed part between said opposite ends, adjacent ends of adjacent members having interfitting companion parts frictionally engaged only with each other to form said series of heating sections, one of said adjacent ends of each of said adjacent members having an outside diameter slightly less than the inside diameter of the other one of said adjacent ends, said one adjacent end of each of said adjacent members being nested within said other adjacent end and releasably held in said nested position by friction only to permit longitudinal and axial movement of said members with respect to each other for connecting and disconnecting said members.

6. Heating apparatus, comprising a heater having a series of heating sections releasably engaged with each other in end-to-end relation, each of said sections comprising a hollow tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, each of said members having an electric resistance wire positioned therein in the path of flow of said fluid for the heating thereof, adjacent ends of adjacent members having interfitting companion parts frictionally engaged only with each other to form said series of heating sections and movable longitudinally and axially of each other for connecting and disconnecting said members, a housing for said heater, and means for supporting said heater in said housing, said supporting means comprising longitudinally spaced brackets engaging the adjacent ends, respectively, of said heater, one of said brackets extending longitudinally of said heater and overlying at least two of said heating sections at the corresponding end of said heater so that when one of said heating sections is removed said one bracket still engages the adjacent end of the heater for supporting said heater in said housing.

7. A heating section for a heater, comprising a hollow tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, an electric resistance wire positioned in said member in the path of flow of said fluid for the heating thereof, each end of said member being cylindrical, and one end of said member having an outside diameter slightly less than the inside diameter of its opposite end to permit a plurality of said members to be releasably connected to each other in end-to-end relation and releasably held in said position by friction only.

8. A heating section for a heater, comprising a hollow tubular member having opposite open ends for the flow of a gaseous fluid longitudinally through said member for the heating of said fluid, an electric resistance wire positioned in said member in the path of flow of said fluid for the heating thereof, said electric resistance wire comprising a helically wound coil of wire extending in a direction transversely of the path of flow of said fluid, said member having a pair of inwardly extending termi-

nals, said coil of wire having opposite ends connected to said terminals, respectively, and a reflexed part between said opposite ends, each end of said member being cylindrical, and one end of said member having an outside diameter slightly less than the inside diameter of its opposite end to permit a plurality of said members to be releasably connected to each other in end-to-end relation and releasably held in said position by friction only.

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