June 9, 1942. F. K. FISCHER 2,285,651

MULTIPLE BUNDLE VAPOR GENERATOR

Filed Oct. 25, 1940 2 Sheets-Sheet 1

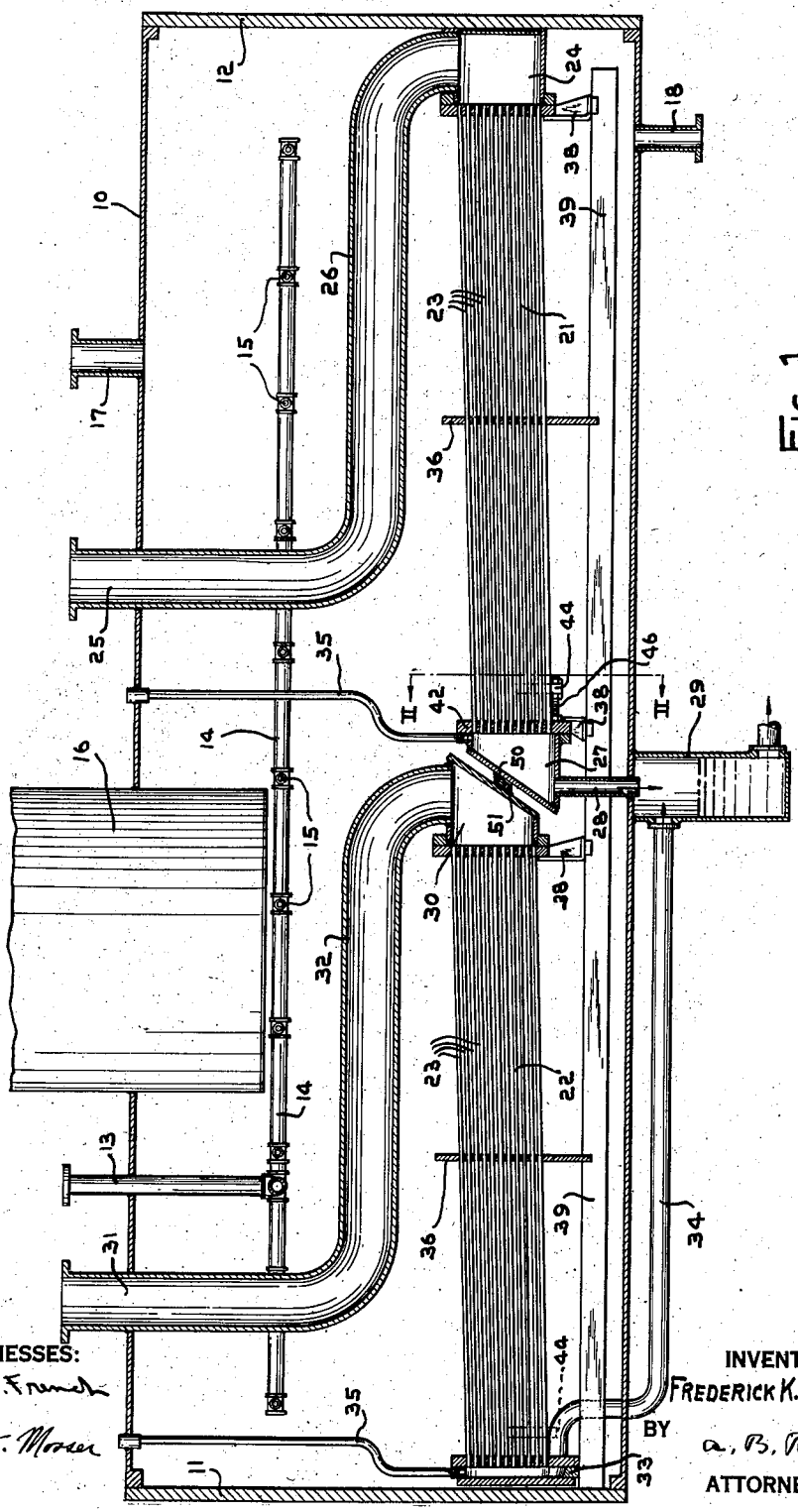


FIG. 1.

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MULTIPLE BUNDLE VAPOR GENERATOR

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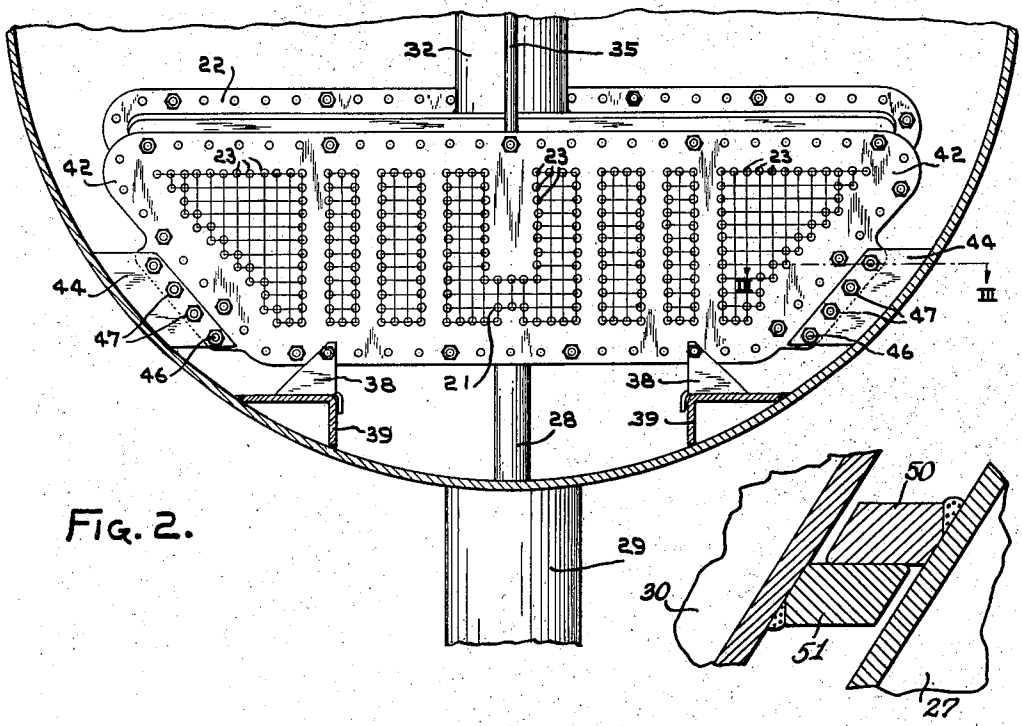


FIG. 2.

FIG. 4.

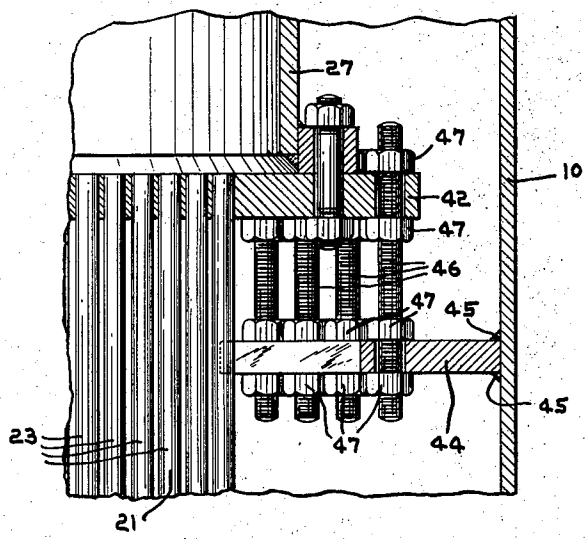


FIG. 3.

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Patented June 9, 1942 2,285,651

UNITED STATES PATENT OFFICE

2,285,651

MULTIPLE BUNDLE VAPOR GENERATOR

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Application October 25, 1940, Serial No. 362,827

5 Claims. (Cl. 257—236)

The present invention relates to vapor generators of the type wherein a medium contained in a receptacle is vaporized by heat derived from a second medium of higher temperature passing through tubes immersed in the first medium, more particularly to generators of this type wherein there are two or more tube bundles arranged in end-to-end relation, and has for its object the bowing of the tubes of all of the bundles during operation to facilitate disengagement of scale therefrom.

In accordance with the invention, there is provided, together with the shell and multiplicity of tube bundles therein, means carried by the shell for limiting movement away from each other of the boxes of each bundle of tubes.

Where a plurality of tube bundles are arranged in end-to-end relation within an evaporator, it frequently is not sufficient to fix the length of the bundles by restraining them against both ends of the shell as proposed in Patent No. 1,943,456, granted January 16, 1934 to the Westinghouse Electric & Manufacturing Company, for in that case the bundle whose tubes deflected first would deflect further to take up the expansion occurring in the remaining bundles, with the result that the tubes in said remaining bundles would not bow. This is due to the fact that the bowing of any set of tubes results from the force of expansion acting on a lever arm, which arm is the amount that the tubes are bowed. Therefore, that bundle which is bowed first or most, has its resistance to deflection reduced almost in direct proportion to the amount it deflects.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a longitudinal sectional view through a vapor generator embodying the present invention;

Fig. 2 is a transverse sectional view taken along the line II—II of Fig. 1, looking in the direction of the arrows;

Fig. 3 is an enlarged fragmentary sectional view taken along the line III—III of Fig. 2, looking in the direction of the arrows, and

Fig. 4 is an enlarged fragmentary detail view of the interlocking lugs 50 and 51 carried by the heads 27 and 30 (Fig. 1).

Referring now to the drawings more in detail, there is shown, in Fig. 1, an evaporator comprising a shell 10 having end closures 11 and 12. Medium to be vaporized is admitted to the interior of the shell through the inlet conduit 13 and the connecting, horizontally disposed conduit 14, provided with spray nozzles 15. Vapor generated within the shell is drawn off through the separator 16, which may be of any suitable construction and forms no part of the invention herein disclosed. Suitable inlet and outlet connections, such as 17 and 18, respectively, may be provided for flushing out the shell.

A plurality of tube bundles, for example, bundles 21 and 22, are positioned within the shell in end-to-end relation, the bundle 21 comprising a plurality of tubes 23, an inlet box 24 to which a suitable heating medium such as steam is supplied through the inlet opening 25 and conduit 26, and an outlet box 27 from which condensate collecting in the tubes is drained through the outlet conduit 28 to the hotwell 29.

In like manner, the tube bundle 22 comprises a plurality of tubes 23 connected to an inlet box 30 adapted to receive heating medium through the inlet 31 and conduit 32, the heating medium passing through the tubes 23 to the outlet box 33 from which the condensate is led to the hotwell 29 by means of the discharge conduit 34. Air and non-condensable gases collecting in the discharge boxes 27 and 33 are vented to the exterior of the shell through the conduits 35. While only two tube bundles are shown, the invention is applicable where three or even more bundles are arranged to end-to-end relation.

Suitable means, such as the intermediate tube support plates 36, are provided for bracing and spacing the tubes of each bundle. The ends of the bundles are supported through brackets 38 upon the track structure 39 for longitudinal movement thereon.

Referring more particularly to Figs. 2 and 3, there is provided adjacent the outlet box 27 of the tube bundle 21 suitable means for limiting longitudinal movement of the box 27 relative to the other box 24 of that bundle. In the arrangement herein illustrated, the restraining means comprises a pair of opposed lugs or channels 44 secured in any suitable manner, as by welding at 45, to the interior surface of the shell 10. Preferably, the lugs are offset a short distance longitudinally from the tube plate 42 of the outlet box 27. A plurality of bolts 46 extend through aligned openings in the lugs 44 and tube plate 42, a plurality of nuts 47 cooperating therewith to rigidly secure the tube plate 42 with respect to the lugs. Obviously, the arrangement of threaded bolts 46 and nuts 47 permits of adjustment of the

tube plate and its associated box **27** longitudinally of the shell with respect to the lugs **44**. Such an adjustment may be desirable because of variations in dimensions resulting from manufacturing tolerances.

It will be noted that the inlet box **24** of the tube bundle **21** is positioned relatively close to or in abutting relation to the shell end closure **12**, whereby when expansion of the tubes **23** of the bundle **21** occurs, bowing of these tubes will result, due to the abutment against the cover **12** at one end and the anchorage at the other end by the lugs **44** and bolts **46**.

Suitable means, such as the lugs **50** and **51** are secured to the boxes **27** and **30**, respectively, and furnish abutting or interlocking means for these two boxes (Fig. 4).

While it will be apparent that the outlet box **33** of the tube bundle **22** may be arranged to abut against the shell enclosure **11**, it is preferred to provide duplicate anchorage comprising the lugs **44** and bolts **46** for the outlet end of this tube bundle also. Regardless of the nature of the anchorage for the box **33**, the boxes of each bundle are limited as to their movement away from each other, whereby it is assured that each bundle will bow independently of the other.

Throughout the specification and claims, the terms "outer," "outward," "inner" and "inward" refer to position of movement relative to the longitudinal center of the shell.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. In heat exchange apparatus; a shell; a plurality of tube bundles extending longitudinally of the shell and disposed in end-to-end relation, each of said bundles comprising a plurality of tubes and boxes connected to the ends thereof; means at each end of the shell securing the box adjacent each end against movement toward said end; and means carried by the shell intermediate its length for limiting movement of one of the inner boxes away from the other box of its bundle, said inner boxes being disposed in abutting relationship.

2. In heat exchange apparatus; a shell; a plurality of tube bundles extending longitudinally of said shell and disposed in end-to-end relation, each of said bundles comprising a plurality of tubes and a pair of boxes connected to the ends thereof; covers closing the ends of the shell, one of said covers abutting the outer box of the tube bundle at that end of the shell and preventing outward movement of said box; means at the other end of the shell preventing outward movement of the outer box of the tube bundle at said other end of the shell; means secured to the shell for preventing inward movement of the inner boxes of said end tube bundles, said last-mentioned means comprising lugs secured to the inner wall of the shell adjacent one of said inner boxes and to which said one inner box is secured; and means disposed between and secured to said inner boxes and serving to brace each of said inner boxes against the other.

3. In heat exchange apparatus; a shell; a pair of tube bundles extending longitudinally of said shell and disposed in end-to-end relation, each of said bundles comprising a plurality of tubes and a pair of boxes connected to the ends thereof; means at the ends of the shell securing the outer boxes adjacent said ends against movement towards the ends; and means carried by the shell limiting movement of one of the two inner boxes away from its outer box, said inner boxes being disposed in abutting relationship.

4. A structure as specified in claim 4, wherein the last-mentioned means comprises lugs secured to the inside wall of the shell adjacent one of the inner boxes and to which said one inner box is secured.

5. A structure as specified in claim 3, wherein the last-mentioned means comprises a pair of opposed lugs secured to the walls of the shell interiorly thereof and to which one of the inner boxes is secured, and including interengaging lugs carried by the two inner boxes and providing for abutment of said boxes against each other in end-to-end relation.

FREDERICK K. FISCHER.

CERTIFICATE OF CORRECTION.

Patent No. 2,285,651. June 9, 1942.

FREDERICK K. FISCHER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 32, for "arranged to" read --arranged in--; and line 48, after "lugs" insert --44--; page 2, second column, line 35, claim 4, for "in claim 4" read --in claim 3--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of August, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)