

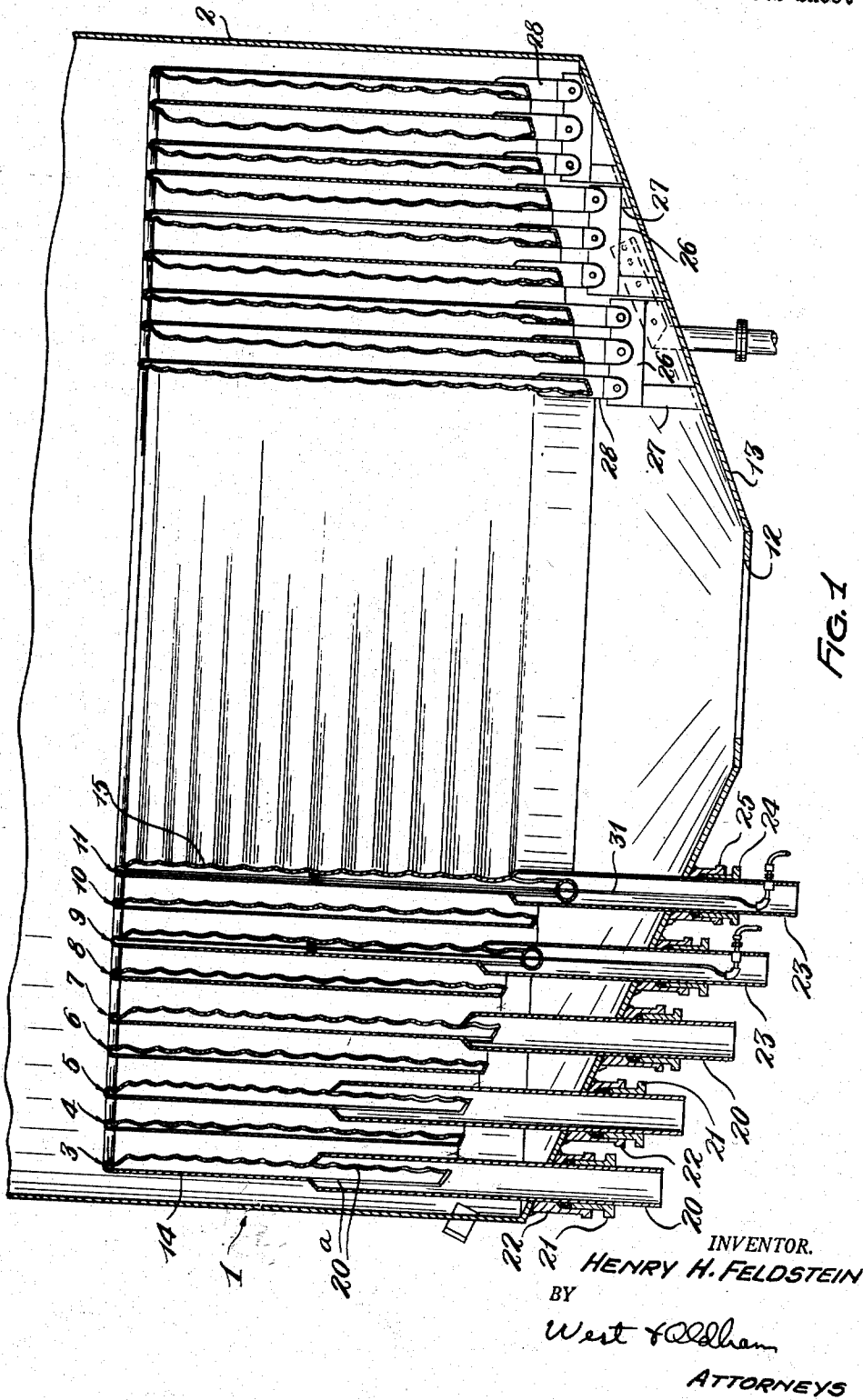
Jan. 11, 1955

H. H. FELDSTEIN
HEAT EXCHANGER

2,699,322

Filed Aug. 19, 1950

4 Sheets-Sheet 1



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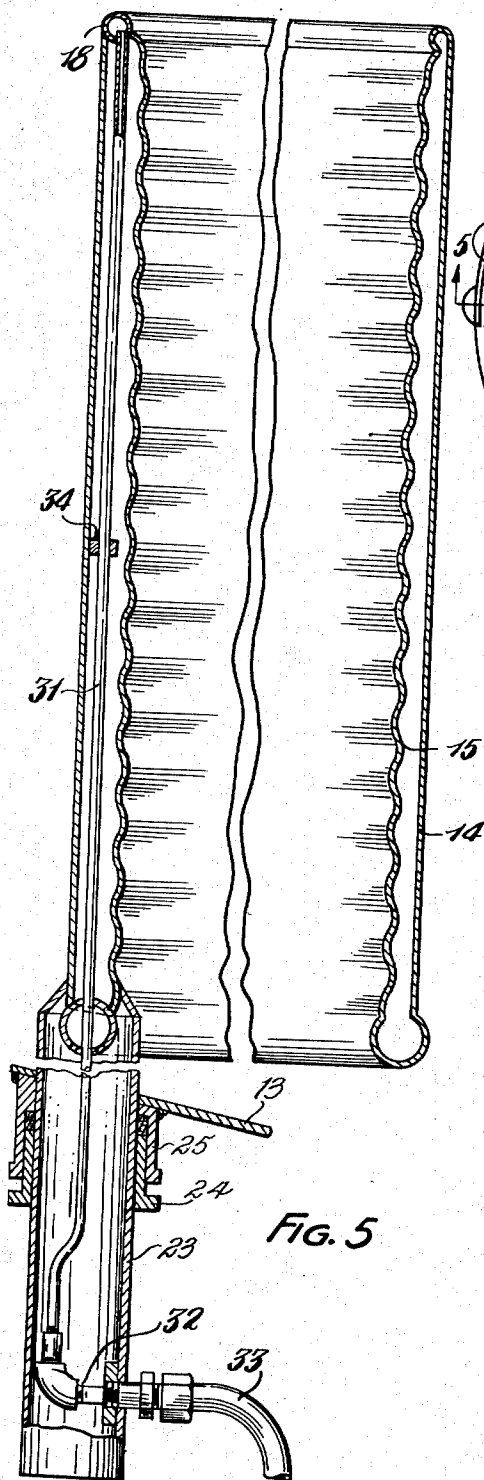


FIG. 5

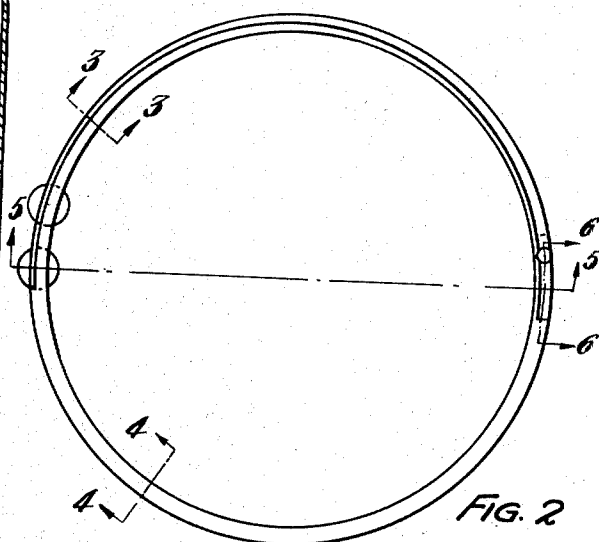


FIG. 2

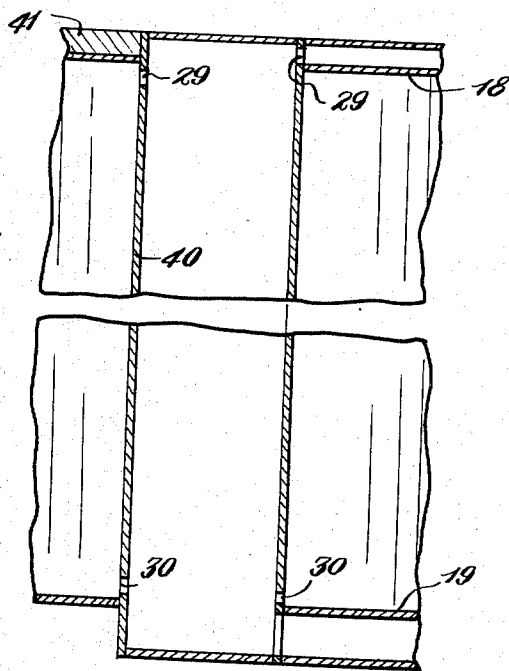


FIG. 6

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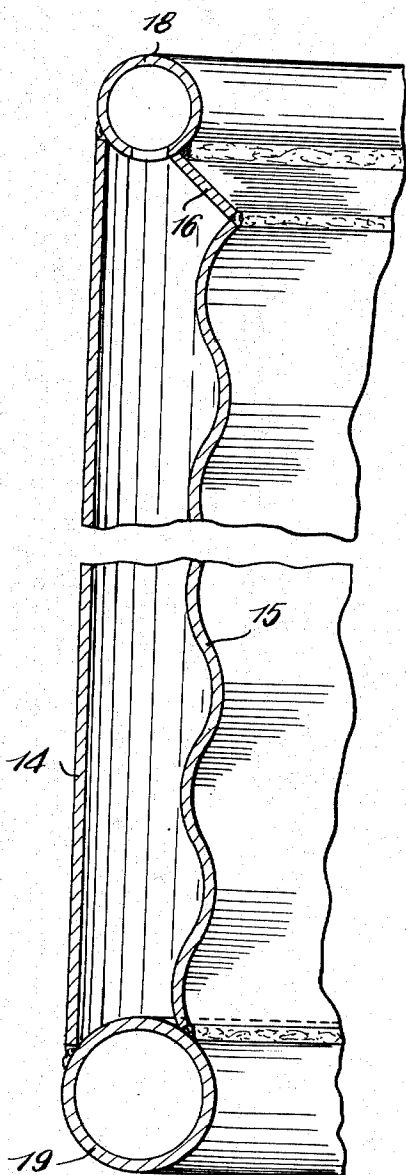


FIG. 3

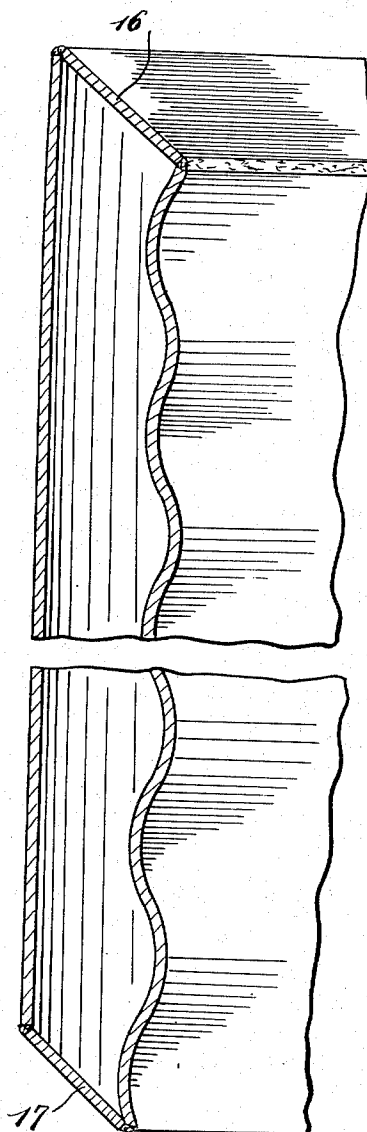


FIG. 4

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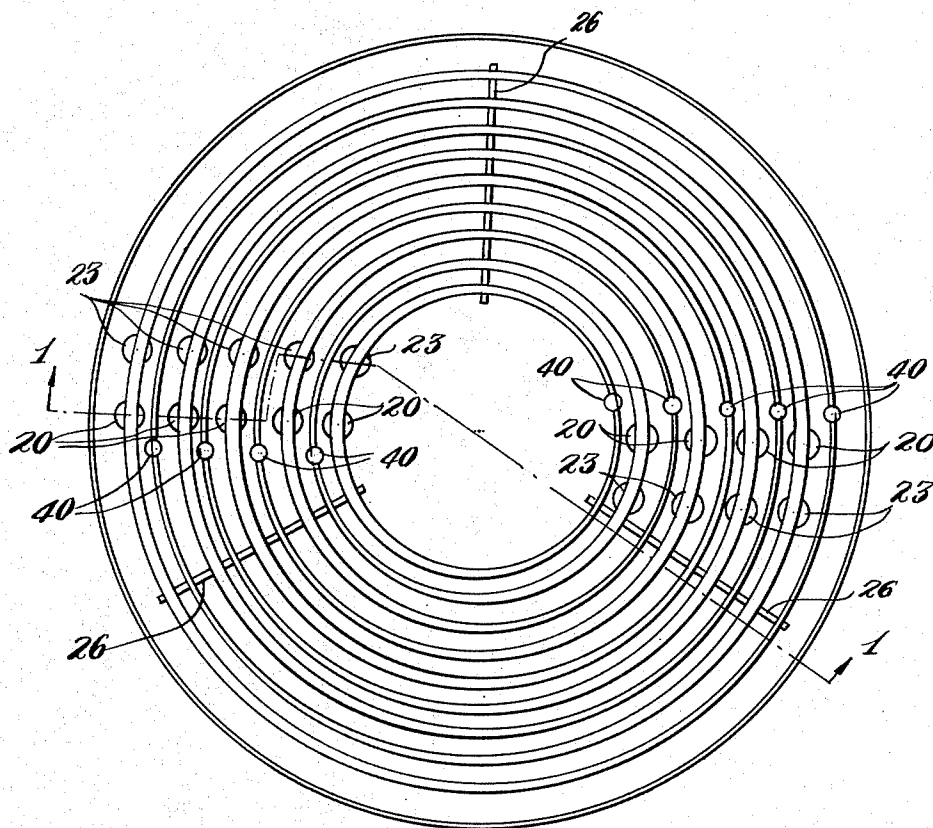


FIG. 7

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HEAT EXCHANGER

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4 Claims. (Cl. 257—28)

The invention relates to evaporators and similar structures, particularly to apparatus adapted to receive a liquid substance therein for transmitting quantities of heat thereto, or for withdrawing heat therefrom, which apparatus may have a vacuum set up therein.

The general object of the present invention is to provide a new and improved type of an evaporator apparatus which is of maximum strength with use of a minimum amount of material.

Another object of the invention is to provide an evaporator wherein a plurality of concentric heating ring elements are provided and wherein portions of such ring elements are supported upon supports to permit ready movement or self adjustment of the ring elements with increases or decreases in the diameters thereof due to thermal expansion or contraction.

Another object of the invention is to provide heating ring elements which have effective means therein for passage of heating fluid thereto and removal of incondensable gases and any liquid condensates from such heating means.

Yet another object of the invention is to provide a heat-transfer ring element in an evaporator or other apparatus wherein a cylindrical outer wall is provided in the ring element with a corrugated inner wall being formed in the element to provide a maximum strength ring element with use of minimum amounts of material prepared at minimum cost.

The foregoing and other objects and advantages of the invention will be made more apparent as the specification proceeds.

For a better understanding of the invention, attention is directed to the accompanying drawings, wherein:

Fig. 1 is a vertical section through apparatus embodying the principles of the invention, which section is taken on line 1—1 of Fig. 7;

Fig. 2 is a plan view of one of the heating elements of the invention;

Figs. 3, 4 and 5 are vertical sections taken on lines 3—3, 4—4 and 5—5 of Fig. 2;

Fig. 6 is a partially broken away enlarged vertical section taken on line 6—6 of Fig. 2; and

Fig. 7 is a plan of the apparatus of Fig. 1.

Corresponding numerals will be used to refer to corresponding parts in the drawings and specification whereby identification and correlation of such corresponding parts are facilitated.

Reference now should be had to the details of the structure shown in the drawings and an evaporator is indicated as a whole by the numeral 1. This evaporator 1 includes a tank 2 which has a plurality of heating cylinders or ring elements 3 through 11 positioned therein in concentric relationship thereto. A valve opening 12 may be formed in the lower portion of the tank 2 which has a bottom 13 that is inverted frusto-conical shape.

As an important feature of the present invention, each of the ring elements 3 through 11 is provided with an outer cylindrical wall 14 whereas an inner wall 15 of each of the heating ring elements is corrugated with the corrugations extending annularly around the element to give same maximum strength against collapse. The inner and outer walls 14 and 15 are spaced from each other by means of top and bottom rings or members 16 and 17, respectively, each of which is inclined in a direction towards the center of the heating element in a direction of from top to bottom thereof. Members 17 extend

about 180° around the circumference of the rings. The components of the ring elements may be assembled in any desired manner, and usually are welded together.

Another important feature of the invention is that an air and gas return tube or pipe, or other enclosure 18 and a condensate return tube or pipe or other enclosure 19 is provided for each of the heating elements. Figs. 3 through 6 of the drawings best show the construction of an individual heat transfer ring element and all elements 3 through 11 are of similar construction.

The air and gas return pipes 18 and condensate return pipes 19 all extend only approximately 180° around the circumference of the different elements. The condensate return pipes 19 form a bottom portion in the section of the heating element in which it is positioned and combines with the bottom member 17 to complete that portion of the ring element. The air and gas return pipes 18 only replace a portion of the top member 16 in the different heating ring elements, all as best shown in Figs. 3 through 6 of the drawings. It also should be noted that the inner and outer walls 14 and 15 may not be completely concentric to each other and that at one portion of the ring element, the air and gas return pipe 18 forms the complete closure for the upper portion of such ring element whereas at a diametrically opposed portion of the individual heating element, the top member 16 is required to combine with the pipe 18 to complete the closure of the upper portion of the heating element. Such change in operative widths of the heating elements gradually occurs throughout the circumference of same with the inlet portion thereof being the thickest.

In order to supply heating fluid to each of the heating elements, an inlet pipe or tube 20 is fixedly secured to each element at the lower portion thereof with such inlet pipe usually being larger in diameter than the thickness of the element. The portions of the inner and outer walls 14 and 15 lying within the inlet pipes 20 are removed at 20^a to permit free flow of any desired heating material, such as steam, into the interior of the different heating elements. Any suitable heating fluid supply means (not shown) may be connected to the inlet pipes 20. Suitable glands and packing 21 secure the inlet pipes 20 to the lower portion of the tank bottom 13 by means of stuffing boxes 22 that are secured to and extend downwardly from the bottom 13.

Drain tubes or pipes 23, Fig. 5, connect individually to each of the heating elements 3 through 11 and extend downwardly therefrom being likewise secured in position to the bottom of the tank by means of glands and stuffing boxes 24 and 25, respectively.

It should be noted that, as shown in Fig. 7, the individual inlet and drain pipes that connect to the different heating elements are positioned in substantially diametrically opposed relationship in adjacent heating elements. These drain pipes and inlet pipes serve to position one portion of each of the ring elements fixedly whereas the remaining portions of the elements are supported on suitable means to permit expansion and contraction of the different heating elements with changes in temperatures of the heating medium. The air tight connections of the drain and inlet pipes with the ring elements seals same, and prevents air leakage from the atmosphere to the interior of the tank 2 where a vacuum does exist. Such positioning means may include slides or positioning brackets 26 which have feet 27 extending downwardly therefrom and resting secured to the upper surface of the bottom 13. Support links 28 connect each of the slides 26 to the individual elements in any conventional manner for expansion or contraction of such elements, as by a slidable connection between the links 28 and the slides 26.

Fig. 6 of the drawing best shows that the inlet ends of both the air and gas return pipe 18 and condensate pipe 19 are connected by a pipe 40 which has apertures 29 and 30, respectively, provided in the upper and lower portions thereof for passage of excess steam, air or gas, and condensate into the pipes 18 and 19 respectively for passage from the evaporator of the invention. In order to prevent the non-condensable gases from mixing with the steam entering the elements, a separate air and

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gas discharge pipe or tube 31 is positioned within each of the ring elements in vertical alignment with the drain pipe or tube 23 provided therefor. These air and gas discharge tubes 31 connect to the discharge end of each of the air and gas return pipes 18 and extend down through the interior of the heating elements and into the drain pipes 23. The tubes 31 connect through conventional fittings 32 to return conduits 33. Brackets 34, within the elements, aid in holding the return tubes 31 in position. Rods 41 may be secured in the upper portions of the ring elements to complete the rings started by the air and steam return pipes 18.

It will be appreciated that the ends or discharge portions of both the air and gas return pipes and condensate pipes 18 and 19 will be lower than the inlet ends thereof to facilitate flow of liquid or fluid through such pipes to the discharge ends thereof.

Sometimes it might be desirable to position only alternate elements on a given bracket 26, or other supports may be provided for the ring elements to permit movement of same with relation to the fixed supply and exhaust pipes positioning one portion thereof.

By positioning the individual heating elements in the apparatus in the manner indicated, and by the construction disclosed, it is possible to provide a sturdy evaporator device which can be constructed at a minimum of expense and by the use of a minimum amount of material whereby it is submitted that the objects of the invention have been achieved.

While one complete embodiment of the invention has been disclosed herein, it will be appreciated that modification of this particular embodiment of the invention may be resorted to without departing from the scope of the invention as defined by the appended claims.

Having thus described my invention, what I claim is:

1. A heat exchanger comprising a container, a hollow sleeve-type heating element positioned in said container, means for supplying heating fluid to the said element, said heating fluid supply means comprising only one inlet pipe that connects to said element, said inlet pipe and the portions of the said element connected thereto being immovably positioned, and a fixedly positioned drain pipe connected to said element circumferentially adjacent the said inlet pipe; said heating element including an air and gas return tube at its upper margin, a condensate return tube at its lower margin, both of such tubes being of approximately 180° in peripheral extent with relation to the said heating element margins and being open only adjacent their ends, the discharge end of each condensate return tube extending to a point adjacent said drain pipe and the inlet end of each such tube connecting to the interior of said element, and a gas and air discharge pipe positioned in said drain pipe and connected to the discharge end of said air and gas return tube.

2. A heat exchanger comprising a container, a plurality of concentric radially-spaced hollow-sleeve type separate heating elements positioned in said container, said elements each having a smooth cylindrical outer wall and a corrugated inner wall, fixedly positioned

means for supplying heating fluid to the said elements, and drain means immediately circumferentially adjacent said heating fluid supply means for withdrawing spent heating fluid from said elements; said heating fluid supply means and said drain means comprising steam pipes that connect to said elements, a fixedly positioned drain pipe connected to each of said elements adjacent the one of the said steam pipes connected thereto, and slide means for supporting other circumferential portions of each of said elements is provided to permit expansion and contraction of said elements.

3. A heat exchanger comprising a tank, a plurality of concentric hollow sleeve-like heating elements in said tank, fixedly positioned inlet means and fixedly positioned drain means for said heating elements secured to circumferentially adjacent portions of and supporting each of said heating elements, slide means adjustably supporting said heating elements at portions of said elements circumferentially spaced from said inlet means and said drain means, an air and gas return tube at the upper margin of each of said heating elements and operatively connecting at one end to the interior of said heating element substantially diametrically opposite to said inlet means, outlet means connecting to said air and gas return tube, and a condensate return tube at the bottom of each of said heating elements and operatively connecting at one end to the interior of said heating elements substantially diametrically opposite to said inlet means, the opposite ends of said condensate return tubes connecting to said drain means.

4. A heat exchanger as in claim 2 wherein each of said heating elements has an air and gas return tube at its upper margin and a condensate return tube at its lower margin, both of such tubes in each element being of approximately 180° in peripheral extent with relation to the said heating element margins and being open only adjacent their ends, one end of each condensate return tube connecting to said drain pipe and one end of each said air and gas return tube, the other ends of said condensate return tubes communicating to the interior of said element, and outlet means connecting to the other end of said air and gas return tube.

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