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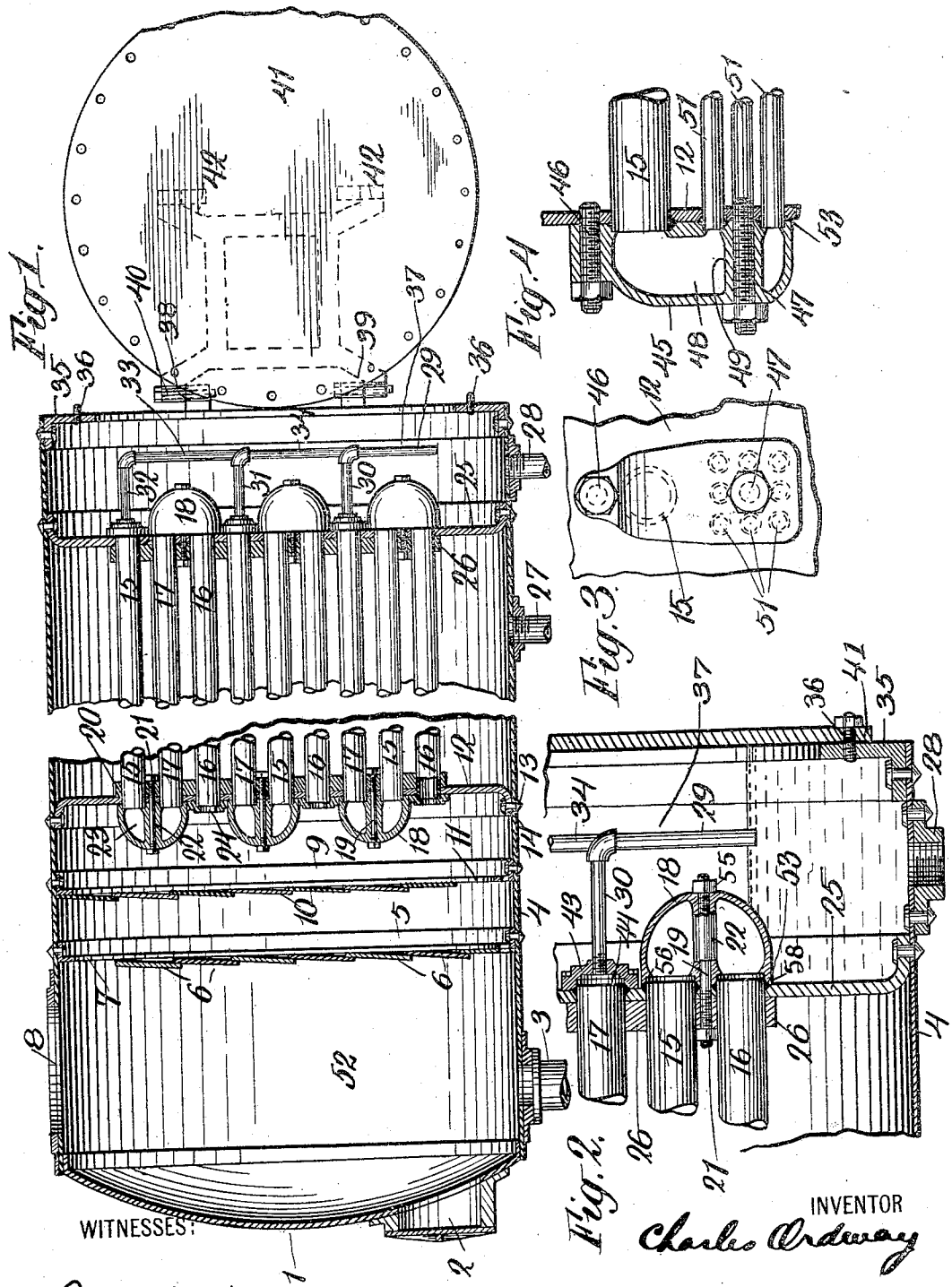
EVAPORATING APPARATUS.

APPLICATION FILED DEC. 17, 1908.

942,407. Patented Dec. 7, 1909.



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EVAPORATING APPARATUS.

942,407. Specification of Letters Patent. Patented Dec. 7, 1909.

Application filed December 17, 1908. Serial No. 468,044.

To all whom it may concern:

Be it known that I, CHARLES ORDWAY, a citizen of the United States, and resident of the city, county, and State of New York, have made certain new and useful Inventions Relating to Evaporating Apparatus, of which the following is a specification, taken in connection with the accompanying drawing, forming part of the same.

This invention relates to evaporating apparatus and relates especially to the construction of evaporators suitable for multiple effect work and comprising special combined return bends and packing means for the tubes and other features as hereinafter specified.

In the accompanying drawings showing an illustrative form of this invention, and in which the same reference numerals refer to similar parts in the several figures, Figure 1 is a vertical longitudinal section, parts being broken away. Fig. 2 is a similar partial section on a larger scale showing the return bends. Fig. 3 is an end view showing another form of return bend. Fig. 4 is a longitudinal section thereof.

In the illustrative embodiment of this invention shown in the drawings the shell 4 of the effect is preferably formed of uniform diameter throughout of regular boiler plate construction, the joints being calked in the regular way, except where such flanges as serve to connect the liquor feed pipe 28, the water drip 27 and so forth, are connected. The tube sheets 12, 25 are also riveted within the shell as in boiler construction and are spaced apart at the proper distance as well as being provided with the desired number of properly spaced holes to accommodate the evaporating tubes supported in the steam space for heating.

A suitable feed chamber 37 may be conveniently formed within the body of the shell 4 by spacing the tube sheet 25 in from the end of the shell. Also, if desired, a door 41 mounted on suitable hinges, such as 39 pivoted to the door by the pins 42 and to the shell end by the pins 40 may be provided to give access to the feed chamber, the tube sheet and end connections, this door and its opening in the end flange 35 being preferably of such size as to include the entire area of the tube sheet in which the evaporating tubes are spaced. This door may of course be tightly held in closed position by any desired means, such for example, as the studs 36 in the end flange 35 coöperating with suitable holes in the door which is held in position by the coöperating nuts as shown in Fig. 2. The vapor chamber 52 is also preferably formed within the shell 4 and suitable baffles may be conveniently provided by riveting the annular baffle flanges 5, 9 upon the shell and bolting or otherwise securing thereto the sectional baffles 6, 10 so as to leave an opening 11 in the inner baffle plate and other suitable openings, such as 7, in the outer compound baffle plate and liquor drain openings adjacent the shell of the effect. Each of the sectional baffles overlaps the adjacent ones slightly at its upper and lower edges, as indicated in the drawing, so as to effectively guide the vapor around the compound baffle plates. In this way the baffle plates may be formed sufficiently narrow so that they can be conveniently withdrawn from the man-hole 2 provided in the end of the head 1 at the outer end of the vapor chamber 52 with which the liquor discharge pipe 3 and the vapor discharge 8 communicate.

The tube sheets may be conveniently reinforced by securing thereto throughout the area in which the tubes are located suitable backing plates, such as 26 formed of cast iron or other stiff material and bolted to the coöperating face of the tube sheet at intervals. The return bolts 19 serve for this purpose and may conveniently have their threaded inner ends screwed into the tube sheet to the end of the threads so that the threaded ends pass loosely through the corresponding holes in the backing plate 26, after which the backing nuts 21 are screwed home, rigidly holding the backing plate to the tube sheet and leaving the return bolts 19 projecting therefrom. These return bolts may also serve to secure the return bends in position and simultaneously pack the joints around the evaporating tubes in this construction. This may be accomplished by forming the integral projecting flanges 58 of the return bend 18 encircling the tube ends with suitable inclined annular recesses around the tubes, the tube sheet being formed with similar recesses so as to accommodate a gasket of rubber or other material slipped around each tube end. The return bend when forced into position by the nut 55 on the end of the return bolt 19 tightens all these packings and packs each tube joint. The return bend is preferably formed with

a bolt casing 22 extending therethrough so as to prevent any contact between the circulating liquor and the bolt and the tube apertures in the return bend communicating with the tubes are preferably alined therewith and constricted or formed with inclined edges 56 so as to guide the liquor centrally into the tube as well as prevent the liquor leaving the tube from impinging upon its edge and causing excessive abrasion.

In the arrangement indicated in Figs. 1 and 2 the liquor fed in through the feed pipe 28 rises within the feed chamber so as to enter each one of the series of feed pipes 29, 33, 34 extending into the same as shown in Fig. 2 so that liquor is simultaneously fed to the caps 43 of each coil of the evaporator through the horizontal sections 30, 31, 32 of these feed pipes. Liquor from the pipe 30, for instance, passes into and through the evaporating tube 17, then through a return bend 18 connecting the other end of this tube with the tube 15 below and then after passing through the tube 15 passes through the return bend 18 connected with the evaporating tube 16 from which it may issue through a suitable discharge cap, such as 24. These feed caps and discharge caps may of course be formed with similar angular recesses so as to pack the gaskets around the coöperating tubes and have similar constricted tube apertures communicating with the tubes.

Of course, where a single evaporating tube connects with a series of smaller diameter tubes a corresponding change may be made in the shape and construction of the return bend which may be formed as indicated in Figs. 3 and 4. In this case the projecting flanges of the return bend 45 may be formed to inclose the ends of the large evaporating tube 15 projecting beyond the tube sheet 12 and also to similarly inclose the ends of the plurality of smaller tubes 51 acting in multiple to receive the liquor therefrom. The return bend may be formed with similar constricted tube openings to direct the liquor as it passes out of and into the various tubes and may also be provided with suitably shaped annular recesses in the projecting flanges adjacent the tube openings in which gaskets 53 around each of the tubes may be accommodated in connection, if desired, with similar recesses in the coöperating portion of the tube sheet. This return bend is also indicated as provided with an integral bolt casing 49 through which the return bolt 47 passes to engage the threaded aperture in the tube sheet and force the return bend into position in connection, if desired, with other bolts 46 passing through suitable holes in the return bend and engaging the tube sheet. It is thus apparent that the liquor from the tube 15 will enter the passage 48 in the return bend and pass into the several tubes 51 in which it is distributed in a sufficiently uniform manner under working conditions. Such return bends as described are of course very easily applied and enable the tubes to be quickly and effectively packed in the tube sheets. Leakage of air into the tubes of the effect is also minimized by forming the feed chamber 37 within the shell of the effect itself so that any openings in the feed connections or return connections in this chamber or in the vapor chamber cannot cause any air leakage into the tubes.

Having described this invention in connection with a number of illustrative embodiments thereof, to the details of which disclosure the invention is not of course to be limited, what is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims.

1. In evaporating apparatus, a riveted and calked shell for an effect having substantially uniform diameter, tube sheets provided with spaced tube apertures riveted in said shell adjacent its ends to form a vapor chamber and a feed chamber within said shell ends, tubes in said tube apertures extending through the intermediate steam space; baffle flanges riveted to said shell within said vapor space, a manhole in said shell communicating with said vapor space, sectional baffles removably bolted to said baffle flanges and removable through said manhole, the end of said shell adjacent said feed chamber being formed with an inspection hole of substantially the same area as said tube ends, a hinged door normally closing said hole, feed pipes and connected feed caps communicating with the tubes of each coil, backing plates coöperating with said tube sheets, return bolts securing said backing plates and tube sheets together and projecting therefrom, return bends having integral inclosing casings for said bolts and projecting flanges encircling a plurality of said tubes and constricted tube apertures alined with said tubes to guide the liquor with respect thereto, there being coöperating inclined annular recesses in said projecting flanges and tube sheet around said tubes and gaskets therein to automatically pack said tubes as said bends are forced home.

2. In evaporating apparatus, a riveted shell for an effect having substantially uniform diameter, tube sheets provided with spaced tube apertures riveted in said shell adjacent its ends to form a vapor chamber and a feed chamber provided with inspection openings, tubes in said tube apertures extending through the intermediate heating space, baffle flanges secured to said shell within said vapor space, sectional baffles removably bolted to said baffle flanges and removable through the inspection opening in said vapor space, a hinged door normally closing the inspection opening in said feeding space and being of substantially the

same area as the tube ends, feed connections within said feed chamber and communicating with the tubes of each coil to supply liquor thereto from said feed chamber, backing plates coöperating with said tube sheets, return bolts securing said backing plates and tube sheets together and projecting therefrom, and return bends having integral projecting flanges encircling a plurality of said tubes and inclined annular recesses in said flanges and the tube sheets around said tubes and gaskets therein to automatically pack said tubes as said return bends are forced home.

3. In evaporating apparatus, a riveted shell for an effect having substantially uniform diameter, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within said shell ends provided with inspection openings, tubes mounted with their ends in said tube apertures, baffle flanges secured to said shell within said vapor space, sectional baffles removably bolted to said baffle flanges and removable through the inspection opening in said vapor chamber and a removable door of substantially the same area as said tube ends closing the inspection opening in said feed chamber to give access to the tube ends and connections therein and feeding and return connections within said feed chamber and communicating with said tubes.

4. In evaporating apparatus, a shell for an effect, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within said shell ends provided with inspection openings, tubes having their ends mounted in said tube apertures, a removable door having substantially the same area as said tube ends mounted on one of the ends of said shell to give access to said tube ends and connections and feeding and return connections communicating with said tubes.

5. In evaporating apparatus, a shell for an effect, tube sheets provided with spaced tube apertures secured in said shell to form a vapor chamber and feed chamber within said shell ends, tubes having their ends in said tube apertures, a manhole mounted in the end of said shell communicating with said vapor chamber, baffle flanges secured to said shell within said vapor chamber and sectional baffles removably secured to said baffle flanges and removable through said manhole.

6. In evaporating apparatus, a shell for an effect, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within said shell, tubes having their ends in said tube apertures, feed pipes and connected feed caps communicating with the tubes of each coil and return bends having integral inclosing casings and projecting flanges encircling a plurality of said tubes and formed with inclined annular recesses in said projecting flanges and tube sheets around said tubes and gaskets in said recesses to automatically pack said tubes as said return bends are forced home.

7. In evaporating apparatus, a shell for an effect tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber, tubes having their ends in said tube apertures, backing plates coöperating with said tube sheets, return bolts securing said backing plates and tube sheets together and projecting therefrom, return bends having integral inclosing casings for said bolts and projecting flanges encircling a plurality of said tubes, there being coöperating inclined annular recesses in said projecting flanges and tube sheets around said tubes and gaskets therein to automatically pack said tubes in said tube sheets.

8. In evaporating apparatus, a shell, tube sheets in said shell and secured thereto, tubes having their ends located in tube apertures in said tube sheets, backing plates coöperating with said tube sheets, return bolts securing said backing plates and tube sheets together and projecting therefrom, return bends having integral inclosing casings for said bolts and projecting flanges encircling a plurality of said tubes and constricted tube apertures alined with said tubes to guide the liquor with respect thereto, there being coöperating inclined annular recesses in said projecting flanges and tube sheets around said tubes and gaskets in said recesses to automatically pack said tubes in said tube sheets.

9. In evaporating apparatus, a riveted shell for an effect having substantially uniform diameter, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within the ends of said shell, tubes mounted in said tube apertures, the end of said shell inclosing said feed chamber being provided with an inspection opening of substantially the same area as the tube ends, a removable door coöperating with said opening to give access to the tube ends and connections within said feed chamber and feeding and return connections within said feed chamber and communicating with said tubes.

10. In evaporating apparatus, a shell for an effect, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within the ends of said shell, tubes mounted in said tube apertures, a removable door coöperating with the effect end to give access to the tube ends and connections with-

in said feed chamber, return connections within said feed chamber connecting said tubes into coils and feeding connections within said feed chamber comprising depending feed pipes connected with each of said coils and having their lower ends on substantially the same level to receive the liquor supplied to the lower portion of said feed chamber.

11. In evaporating apparatus, a shell for an effect, tube sheets provided with spaced tube apertures secured in said shell to form a feed chamber therein, means to give access to said feed chamber and tube apertures therein, and connections within said feed chamber communicating with the tubes and comprising a series of depending feed pipes to dip into the liquor supplied to said feed chamber.

12. In evaporating apparatus, a substantially cylindrical riveted shell for an effect having substantially uniform diameter, tube sheets provided with spaced tube apertures secured in said shell adjacent its ends to form a vapor chamber and a feed chamber within the ends of said shell, tubes secured in said tube apertures, there being an inspection opening in the end of said shell inclosing said feed chamber of substantially the same area as the tube ends, a removable door coöperating with said opening to give access to the tube ends and connections within said feed chamber and feeding and return connections within said feed chamber and communicating with said tubes.

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