

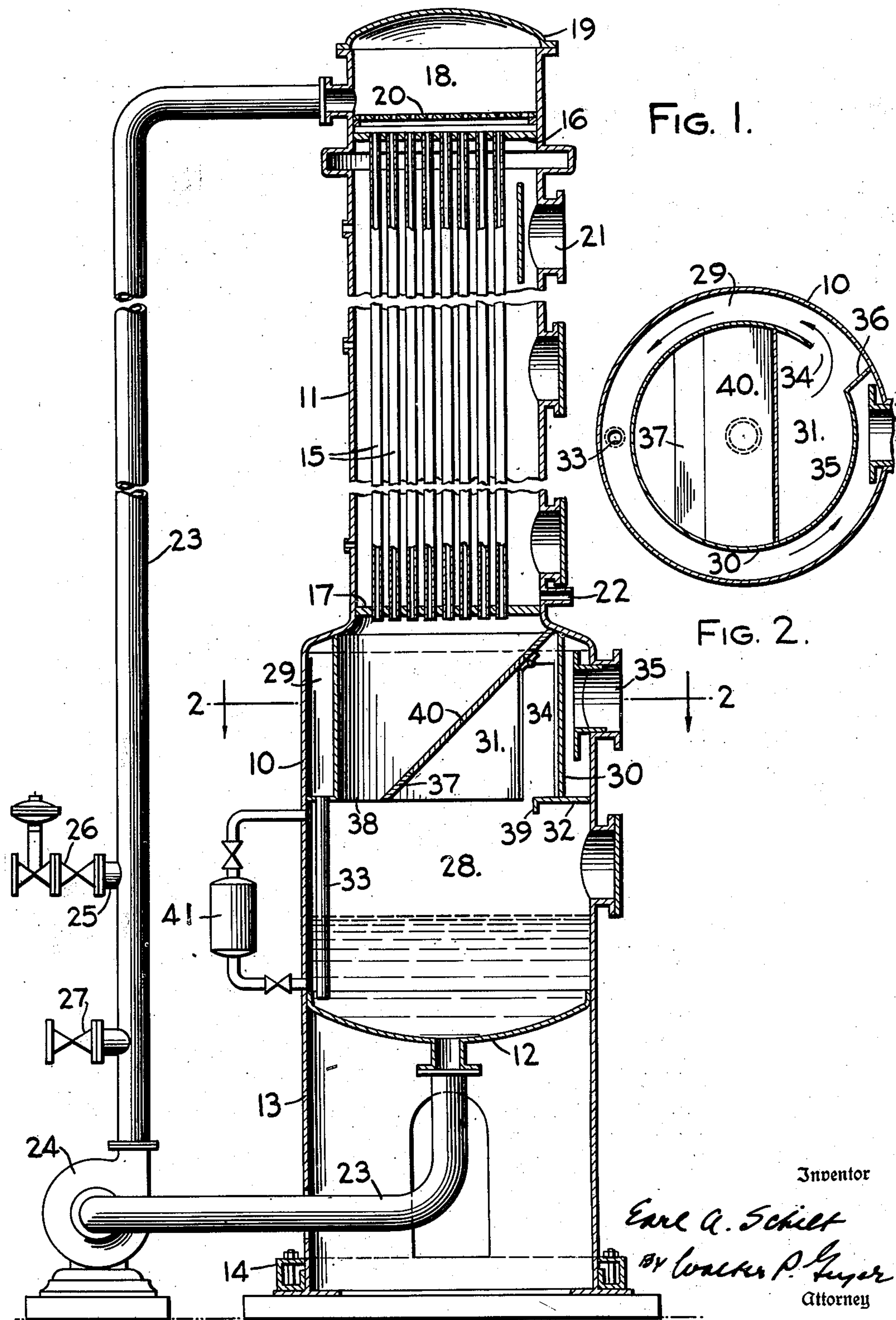
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FALLING FILM EVAPORATOR WITH SUBJACENT SEPARATING CHAMBER

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FALLING FILM EVAPORATOR WITH
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1 Claim. (Cl. 159—13)

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This invention relates to certain new and useful improvements in evaporators, but more particularly to the falling film type of evaporator which is used for concentrating all types of liquors and more especially those liquors in which the presence of scale-forming materials constitute a major problem.

One of the objects of the invention is to provide an evaporator of this character which is so designed and constructed that the steamchest thereof is set directly above and supported by the vapor body in vertical alinement therewith, thereby forming a complete self-supporting unit for bolting to a supporting pad and in which no additional structural steel supports are required.

Another object is to provide a falling film type evaporator having simple and effective baffle means for initiating the separation of the liquor and vapor component's in a manner to cause the liquor-vapor mixture to be directed and collected at one side of the vapor body, where the liquor will flow by gravity to the receiving chamber thereof and the vapor will be caused to be directed to a separator at the opposite side of the vapor body without encountering any further streams of liquor.

In the accompanying drawings:

Figure 1 is a central longitudinal section, in part fragmentary, of the evaporator embodying my invention. Figure 2 is a horizontal section taken in substantially the plane of line 2—2, Figure 1.

Similar characters of reference indicate corresponding parts throughout the several views.

In the preferred embodiment of the invention shown in the drawing, it consists generally of a vapor body or tank 10 and a comparatively long steamchest or chamber 11 disposed directly above and supported by and axially of the vapor body, these parts being made in sections and then welded or otherwise connected to form a unitary structure. The latter is cylindrical in shape and has a dished bottom 12 with the cylindrical wall of such body having a depending supporting extension 13 provided at its lower end with a suitable attaching base 14 for bolting to a pedestal and thereby form a complete self-supporting unit.

The steamchest or chamber 11 has a plurality of vertical tubes 15 therein in which the liquor is boiled and these tubes are supported in top and bottom tube sheets 16 and 17, respectively. Above the top tube sheet is a liquor box 18 having a detachable cover 19 and in the lower

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portion of which, in spaced relation to such tube sheet, is a removable distributing plate 20 through which the liquor is adapted to flow by gravity onto the top tube sheet in such a fashion that a thin film of liquor will flow from this tube sheet into all parts of all the tubes. Steam is admitted to the chest through an inlet 21 and at its lower end a condensate drain 22 is provided. The dished bottom of the vapor body 10 is in liquor circulating communication with the liquor box 18 through the medium of piping 23 in which a circulating pump 24 is interposed. Connected to the discharge side of this piping is a liquor inlet 25 including a control valve 26, and 27 indicates a valve-controlled liquor outlet disposed in the discharge side of the piping below the liquor inlet.

The lower portion of the vapor body 10 constitutes a receiving chamber 28 for the liquor and vapor delivered thereto from the tubes 15 while the upper portion thereof is shaped to provide a centrifugal separator including an outer annular chamber 29 formed by a concentric wall 30 spaced from the outer wall of the vapor body. This concentric wall with the lower tube sheet 17 defines a vapor-receiving hood 31 in direct open communication with the receiving chamber 28, and the lower end of the annular chamber 29 is closed by a horizontal wall 32 and has a drain pipe 33 depending therefrom to a point short of the dished bottom of such receiving chamber. The separator wall 30 has a vertical inlet or opening 34 therein through which the vapor passes to the annular chamber 29 from the chamber 28 and the vapor body has a vapor outlet 35 therein adapted for connection to a condenser or succeeding effect evaporator. An extension 36 on the concentric wall 30 bridged substantially radially across the annular chamber 29 separates the hood-outlet 34 from the body-outlet 35, whereby the vapor after entering the annular chamber travels in a circular course before being discharged from the vapor body and any remaining liquor droplets entrained therein are discharged through the drain pipe 33.

For the purpose of obtaining adequate primary separation of the liquor and the vapor issuing from the tube section of the steamchest into the upper portion of the vapor body, I provide effective baffling means which preferably consists of a baffle wall 37 disposed at an angle or substantially diagonally across the vapor-receiving hood 31 from the upper end thereof to the lower end thereof, its lower end being spaced from the adjoining portion of the concentric wall 30 to

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provide a passage 38 adjacent the bottom of the separating chamber for the gravity flow of the liquor and vapor to the companion side of the receiving chamber 28. At the opposite side of the bottom of the separating chamber and forming an extension of its bottom wall 32 is a lip-like baffle 39 which prevents the liquor from being splashed into the separator-inlet 34. If desired, the baffle 37 may include a door-section 40 which may be opened to provide access to the bottom tube sheet and facilitate repair or replacement of the tubes 15.

A liquid level control device 41 is provided for regulating the liquor level in the chamber 28, as indicated, by controlling the flow of incoming liquor.

In operation, the pump 24 delivers liquor from the pool in the bottom of the vapor body to the distributing plate 20 in the liquor box 18. This plate allows the liquor to flow by gravity onto the top tube sheet 16 of the steamchest, distributing it in a fashion so that a thin film of liquor will flow from this tube sheet into all parts of all the tubes. This thin film of liquor will flow downward on the walls of the tubes and its flow will be further accelerated by the vapor velocity generated when the thin film of liquor is boiled by the heat from the steam side of the tubes. As the high velocity mixture of liquor and vapor leaves the lower ends of the tubes and enters the upper end of the vapor body 10, it strikes the sloping face of the baffle 37 which guides and directs it to one side of such body for passage through the opening 38 into the upper end of the receiving chamber 28. The liquor strikes the adjoining side wall of this chamber and runs down the same to collect in the pool in the bottom, while the vapor, being lighter, and following the path of least resistance reverses its direction and passes upwardly around the bottom of the inclined baffle into the open vapor hood 31, from which it passes into the annular chamber 29 of the centrifugal separator where any remaining liquor droplets are thrown out and removed through the drain pipe 33.

The liquor issuing from the tubes 15 at a high velocity is mixed with the vapor as a fine mist or as a plurality of small droplets and the inclined baffle 37 functions to effectively initiate the separation of the components by collecting the vapor-liquor mixture and directing it to one

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side of the vapor body where the liquor mist will agglomerate into larger and heavier particles of sufficient weight to drop by gravity out of the vapor stream into the pool at the bottom of the chamber 28. The vapor, on breaking away from the liquor at this one side of the vapor body, can then pass across toward the opposite side thereof, without encountering any further streams of liquor, and thence pass upwardly where it is directed by the underside of the inclined baffle toward the inlet 34 of the separator.

I claim as my invention:

In an evaporator of the character described, a vapor body adapted for communication at its upper portion with a chamber for a mixture of liquor and vapor and with its lower portion constituting a liquor-receiving chamber, a centrifugal separating chamber disposed circumferentially about the upper portion of said vapor body and having a vertical vapor inlet for the passage of vapor thereto and a vapor outlet, an inclined baffle wall disposed across the upper portion of the vapor body in overhanging relation to and with its underside facing said vapor inlet and with its lower end terminating substantially at the lower elevation of the vapor inlet and laterally short of the adjoining side of said vapor body to provide a discharge for the liquor and vapor, and a lip-like baffle provided at the opposite side of the vapor body adjacent the lower end of the separating chamber to prevent the liquor being splashed into the same through said vapor inlet.

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