

(No Model.)

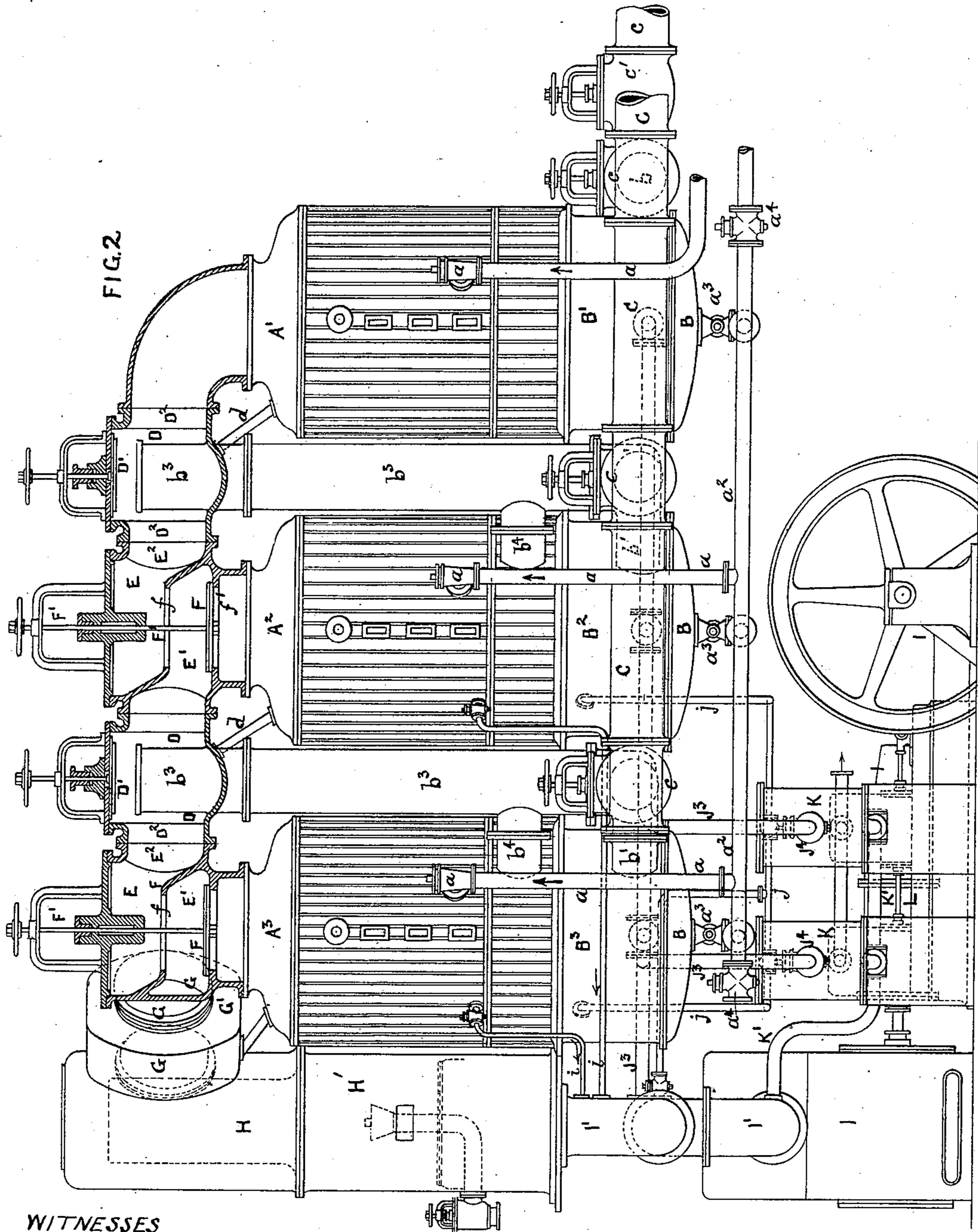
3 Sheets—Sheet 2.

J. FOSTER & J. CAMPBELL.

EVAPORATING APPARATUS.

No. 407,398.

Patented July 23, 1889.



WITNESSES,

E. J. Griswold.
Geo. A. Crane.

INVENTORS,

James Foster and
John Campbell.

Howson and Howson

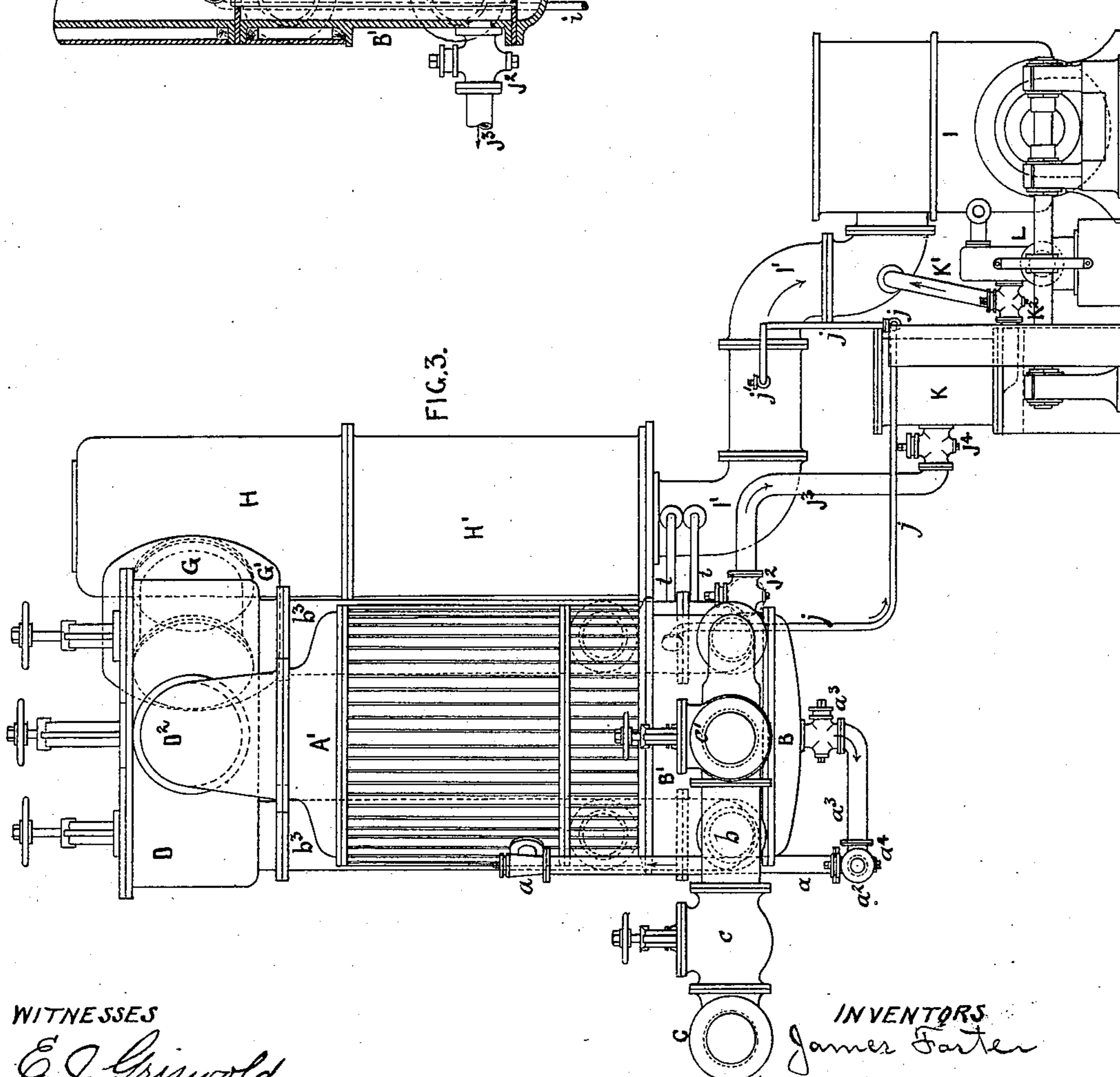
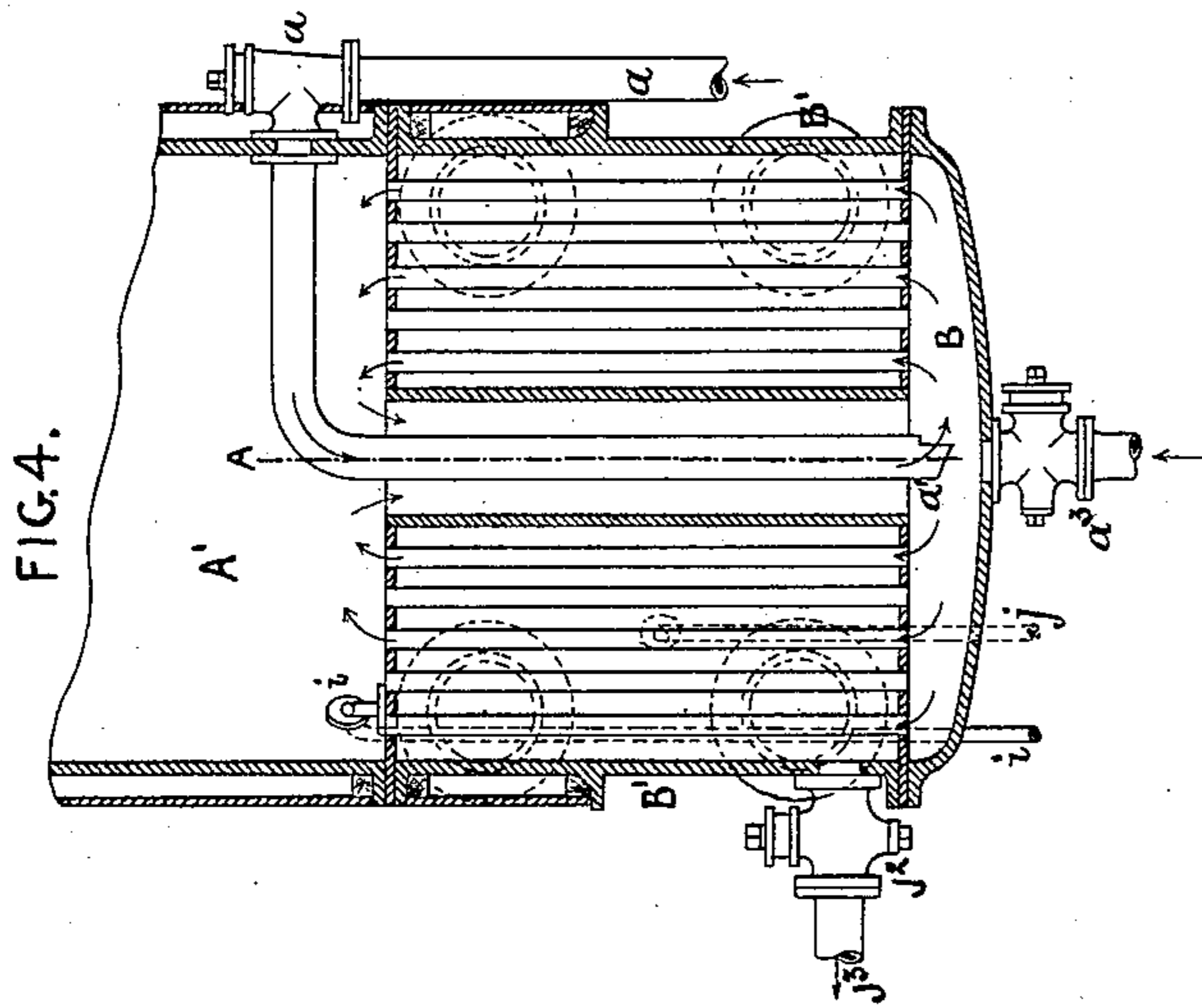
(No Model.)

3 Sheets—Sheet 3.

J. FOSTER & J. CAMPBELL.
EVAPORATING APPARATUS.

No. 407,398.

Patented July 23, 1889.



WITNESSES

E. J. Griswold.
Geo. A. Crane.

INVENTORS

James Foster
and John Campbell.

Horsman and Horsman

UNITED STATES PATENT OFFICE.

JAMES FOSTER, OF SAMARANG, AND JOHN CAMPBELL, OF SOERABAYA,
JAVA.

EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 407,398, dated July 23, 1889.

Application filed October 29, 1887. Serial No. 253,796. (No model.) Patented in England December 29, 1886, No. 17,041; in France May 11, 1887, No. 183,489; in Belgium May 12, 1887, No. 77,447; in Spain August 18, 1887, No. 7,039, and in Austria-Hungary November 19, 1887, No. 55,028.

To all whom it may concern:

Be it known that we, JAMES FOSTER and JOHN CAMPBELL, subjects of the Queen of Great Britain and Ireland, and residing, respectively, at Samarang and Soerabaya, in the Island of Java, have invented certain Improvements in and connected with triple-effet Evaporating Steam Vacuum-Pans used for Boiling Sugar and for other Evaporating Purposes, (for which Letters Patent have been obtained in Great Britain, No. 17,041, dated December 29, 1886; in France, No. 183,489, dated May 11, 1887; in Belgium, No. 77,447, dated May 12, 1887; in Austria-Hungary, No. 55,028, dated November 19, 1887, and in Spain No. 7,039, dated August 18, 1887,) of which the following is a specification.

This invention comprises certain improvements in the construction and arrangement of valves and valve-chests and their branches for leading off the steam or vapor from the sugar-liquor in the pans of triple-effet or multiple evaporating-vessels to the steam-heating chambers of the other pans, and also to their vacuum-chests and air-pumps, and in the pipe-fittings and their valves or taps for conveying the high pressure or live steam to the closed heating-vessels of said pans.

These improvements will add much to the effective action of the steam and vacuum in causing the boiling or evaporation of the juices of beet-root, sugar-cane, or other saccharine liquids by the pans, and they also render possible the isolation and separate working of any one, two, or more of these evaporating-pans better than heretofore and with greater economy of steam heat.

In the accompanying drawings, Figure 1 on Sheet 1 is a sectional plan showing our improvements applied to an arrangement of double or triple effet or multiple boiling or evaporating sugar-liquor vessels $A' A^2 A^3$, erected each in a vertical line over their tubular steam-heating chambers $B' B^2 B^3$. This figure also shows the condensing vacuum-chest $H H'$, air-pump engine I , condensed-water pump L , and other requisite fittings, all illustrative of our invention. Fig. 2 on Sheet 2 is a sectional side elevation, and Fig. 3 on

Sheet 3 an end elevation, both corresponding to Fig. 1, while Fig. 4 on Sheet 3 is a sectional elevation, drawn to a larger scale, of the lower closed steam heating or boiling chamber B' of the vacuum-pan A' , looking in the opposite direction to Fig. 3; and Fig. 5 on Sheet 1 is a sectional elevation, also drawn to a larger scale, of one of the new or improved water-traps K for drawing off the condensed water of the steam and vapor from the lower part of the steam-heating chambers $B' B^2 B^3$ of the vacuum sugar-pans $A' A^2 A^3$.

The live steam is brought from any ordinary steam-boiler by transverse pipes b , and is discharged toward the center A of the closed steam-heating chambers $B' B^2 B^3$ below the sugar-boiling vessels $A' A^2 A^3$ through two or more radial branch pipes $b' b'$, which form an angle with one another within one hundred and sixty degrees, and which are herein shown as entering the chambers $B' B^2 B^3$ on opposite sides of a central line $1 1$, Fig. 1, and at an angle thereto which may vary from twenty to thirty degrees up to ninety degrees. An outer casing provided with two or more inlets may be substituted for the radial pipes $b^2 b^3$ when desired. These transverse steam-pipes b are each fitted with a controlling-valve c in a branch leading to one main longitudinal pipe C from the steam-boiler, and these valves may be operated so as to isolate any one of the pipes $b b b$ at will. These transverse steam-pipes b between each pair of the lower steam-heating chambers $B' B^2$ and $B^2 B^3$ have one (or preferably two) tall vertical pipes b^3 leading up to and within transverse and longitudinal save-all trap-valve chambers D above and between each pair of boilers $A' A^2$ and $A^2 A^3$. The covers of these chambers D are fitted with valves D' , carried on screw-threaded spindles passing out through stuffing-boxes in the covers over the top end of each pipe, so as to shut these pipes off and isolate the succeeding boiler A^2 from being heated by the steam or vapor evaporated in the first or preceding boiler A' .

Over the second boiler A^2 and each succeeding boiler would be fitted an isolating valve-chest with double ports $f f'$ and cham-

bers E E' over each other, and a double-faced valve F in the lower division E', carried on a central spindle F', passed out through a stuffing-box in the cover of the chamber E above, so as to shut the port f' and isolate the boiler A² or shut the port f in the central division and isolate the preceding boiler A'. These isolating double-valve chambers D and E E' are all connected in line by branches D² E², as seen in Figs. 1 and 2, so as to lead by one branch and pipe G from the valve-chamber E' of the last boiler A³ of the set direct to the save-all and vacuum chamber H H', fitted over and around the upper part of the usual vertical injection stand-pipe and condenser H', and connected by the pipes I', leading to the air-pump engine I; or, when desired, an intermediate save-all chamber G', with baffle-plate g , may be fitted in the pipe G. These save-all chambers D D and G' or H have each pipes d , leading from the lowest part of the chambers to the top of the adjacent boilers A' A² A³, to conduct all liquor trapped in them back into their respective boilers. The vertical valve-pipes b^3 b^3 are connected by branches b^4 b^4 above those b' b^2 at their lower ends, leading into the upper part of the closed tubular steam-heating vessels B² B³, to lead in the steam or vapor boiled off from the one boiler A' or A² at an angle toward the center A of the steam-heating vessels B² B³, in the same manner as that described in reference to the branch pipes b' b^2 of the steam-pipes b below them.

A further improvement consists in the fitting of an arrangement of a set of longitudinal pipes J J with separate branches and controlling three-way taps or cocks J², leading from the lower parts of the steam-heating chambers B' B² B³, to draw off the condensed water from these chambers by the branch J' to the pipe I' of the condenser H', and the branches J³ and cocks J⁴ to the different condensed-water-discharge traps K, connected by pipes and three-way cocks K' K² to the suction-pipe or valve-chamber I' of the air-pump I or to the auxiliary pumps L. Small pipes j j are also led from the upper part of the steam-heating chambers B² B³ to the upper part of the water-traps K and to the pipes I' of the condenser, and they are fitted with controlling taps or cocks j' to regulate the pressure in the trap K above the water and to keep it the same as that in the steam-heating chambers B² B³ and in the condenser H', so as to allow the water to be drawn off from these vessels B² B³ or K by the pipes K' or J' to the air-pump I or to the auxiliary pumps L.

Pipes and cocks i i' are led from the upper part of the steam-heating tubular chambers B² B³ of each boiler, and are connected directly to the pipe I', leading between the condenser H' and the air-pump I, to draw off all gases and air which accumulate in these chambers B² B³ and enable these chambers to be worked by steam or vapor below the pressure of the atmosphere.

The water-drawing-off pipes J³ and traps K are all arranged below the level of the lowest water-receiving parts of the steam-heating chambers B' B² B³, so as to draw off the condensed water from these. The water condensed from the steam in all or any particular steam-heating vessel is led into one or more water-receivers or steam and water traps K, preferably of the improved construction shown in Fig. 5, having an automatic arrangement consisting of the ball-float k , which has attached to its underside a sleeve-socket k' , working over a short stand valve-seat k^2 over the outlet-pipe K', with lateral side ports K² in both below the water-level W, whereby it is impossible for any steam or vapor to be drawn off with the water by the auxiliary pumps L or by the air-pump I of the vacuum main condenser H', if there are no auxiliary pumps or if these latter are out of order. By this arrangement the openings k^2 of the automatic exit-valve k of the trap K are always below the admission-level of the water by the pipe J³, so that the float k falls with the level of the water and shuts these outlet-openings, always retaining some water in the bottom of the trap, and prevents steam or vapor being extracted by the vacuum or auxiliary pipes K', but will draw off all the water as it collects by the using of the float k and maintain the vacuum in the trap K. The receivers or traps K are so connected at the tops by pipes and cocks j j' to the upper part of the steam-heating chambers of the vessels B² B³ and to the vacuum-space in main condenser-pipe I' or pump I that the water can either fall by its own gravitation into the receivers K (which are placed lower than steam-chambers B B' of the evaporating-vessels) and then be either drawn off by the auxiliary pump L or by the main condenser-pump I through the pipes K', as regulated by the cocks K². Each drawing-off trap would be preferably fitted with a glass or other water-gage outside.

The juice is supplied to each vacuum pan or vessel A' A² A³ much in the usual manner by a pipe and cock a outside the chamber, and then down through a central circulating-pipe a' , either from the source of supply to the first vessel A' or through the pipe a^2 to any of the other vessels A² A³, as seen particularly in Figs. 2 and 4. The liquor is drawn off from the lower part B of each vessel A' A² A³ below the heating-vessels B' B² B³ through the discharge cock and pipe a^3 , leading to the horizontal pipe a^2 , which is fitted with cocks a^4 for that purpose or for supplying it from any one vessel into the other.

We obtain by these improvements the evaporation of a much greater percentage of juice than by the present system of evaporation in double, triple, or other multiple effects with the same amount of heating-surface. The live and evaporated steam are so introduced by these improvements to the first, second, third,

or more vessels B' B^2 B^3 by the pipes b^3 and branches b' b^2 and b^4 b^4 at two or more places in each vessel at such angles as to obtain the greatest heating effect and give the most efficient circulation of the juice being treated. From the first vessel A' the steam or vapor arising from the juice or liquid being treated passes into the first save-all valve-chamber D , having an arrangement of valves D' D' for isolating the steam-heating chamber B^2 of the second vessel A^2 , by one or two pipes b^3 b^3 , when the valves D are opened and the isolating-valve F closes the port f , to be distributed to two or more branches b' b^2 b^4 b^4 at the said angles, either by using the branches b' b^2 b^4 b^4 or it might be a casing with two or more corresponding inlets. The steam arising from the juice or liquid being evaporated in all the vessels is led off through the same arrangement of save-alls, pipes, and valves as from first vessel to second vessel. By this system the steam or vapor passing from one vessel (A to A^3) to another has the freest possible channel-way to all the heating-vessels B' to B^3 and to the condenser H' , being connected with branches D^2 E^2 and valve-chests D and E E' , as seen particularly in Figs. 1 and 2, in a straight center line between the ordinary isolating-valves D' E and top of vessels, thus reducing friction and condensation to a minimum.

We claim as our invention—

1. In multiple evaporating steam vacuum-pans, the combination of a series of evaporat-

ing-vessels and their steam-heating chambers with connecting valve-boxes at the top, vertical pipes b^3 between the vessels opening at the upper ends into the said valve-boxes, with controlling valves, and near their lower ends having two or more branches b' b^2 b^4 opening radially into each adjacent heating-chamber, substantially as described.

2. The combination of a series of evaporating-vessels having heating-chambers at their lower ends with a supply-pipe C and valved transverse pipes b , each of which has two or more branches opening radially into the adjacent heating-chamber, substantially as described.

3. The combination of a series of evaporating-vessels having heating-chambers at their lower ends and having connecting valve-boxes at their upper ends with a supply-pipe C , valved transverse pipes b , upright pipes b^3 , opening into the said boxes at their upper ends and provided there with valves, and branches on the pipes b , opening radially into the heating-chambers, all substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JAMES FOSTER.
JOHN CAMPBELL.

Witnesses:

J. P. N. KYLE,
D. FELISE.