L. F. JURY.

EXTRACTION APPARATUS.

APPLICATION FILED SEPT. 24, 1906.

898,482. Patented Sept. 15, 1908.

3 SHEETS—SHEET 1.

FIG. 2

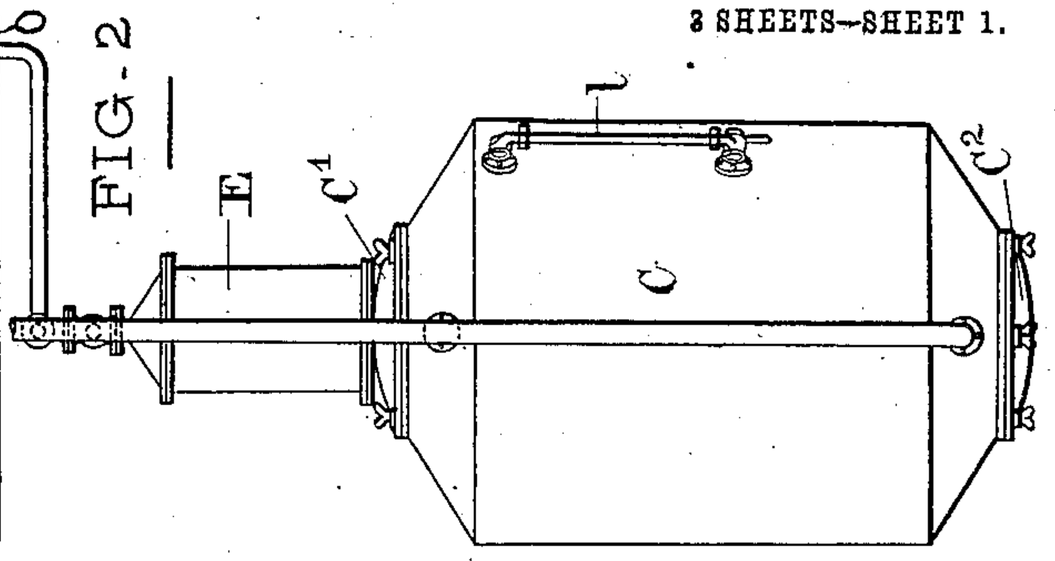
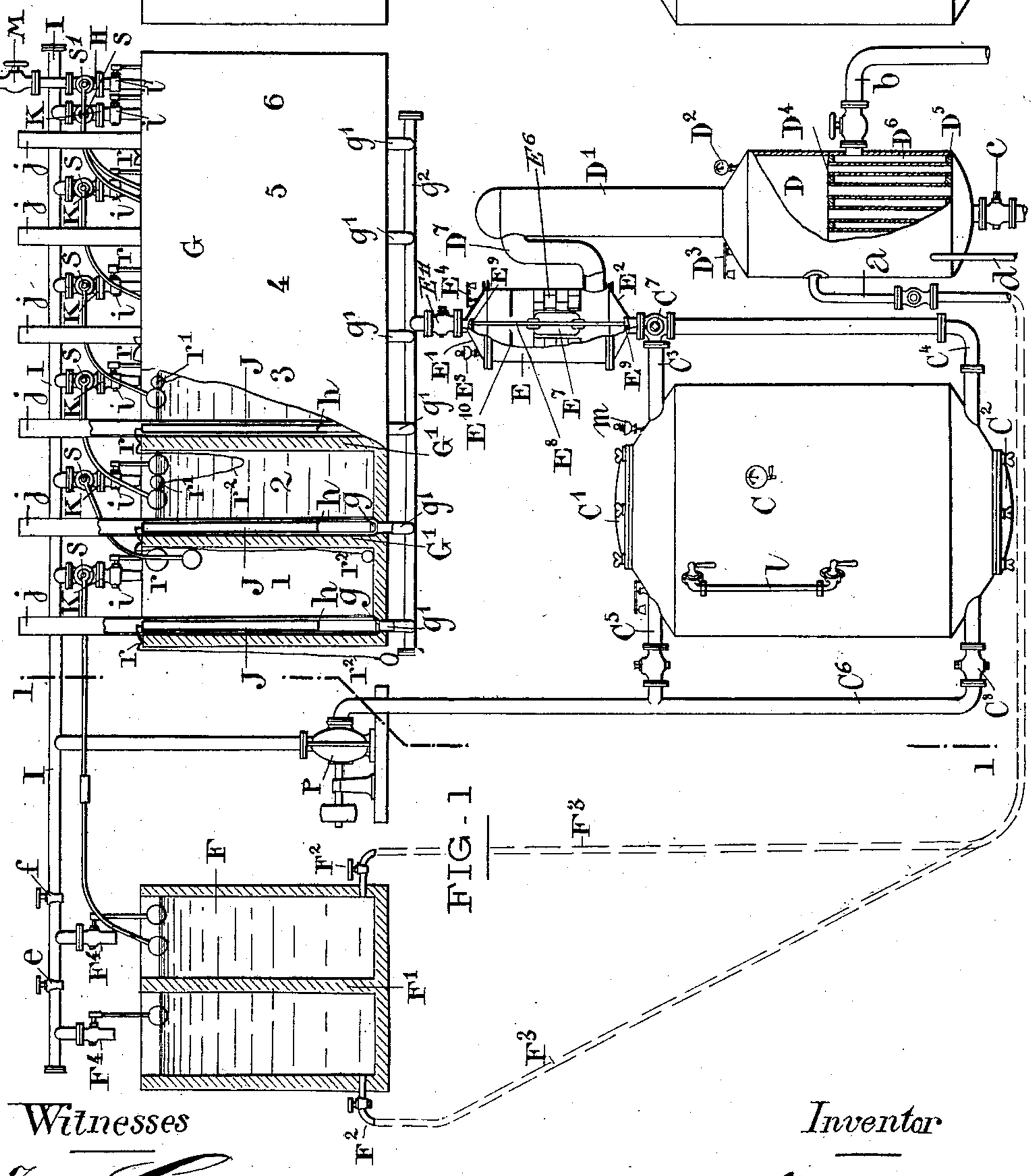


FIG. 1



Witnesses

Jean Germain

Guillaume Dioche

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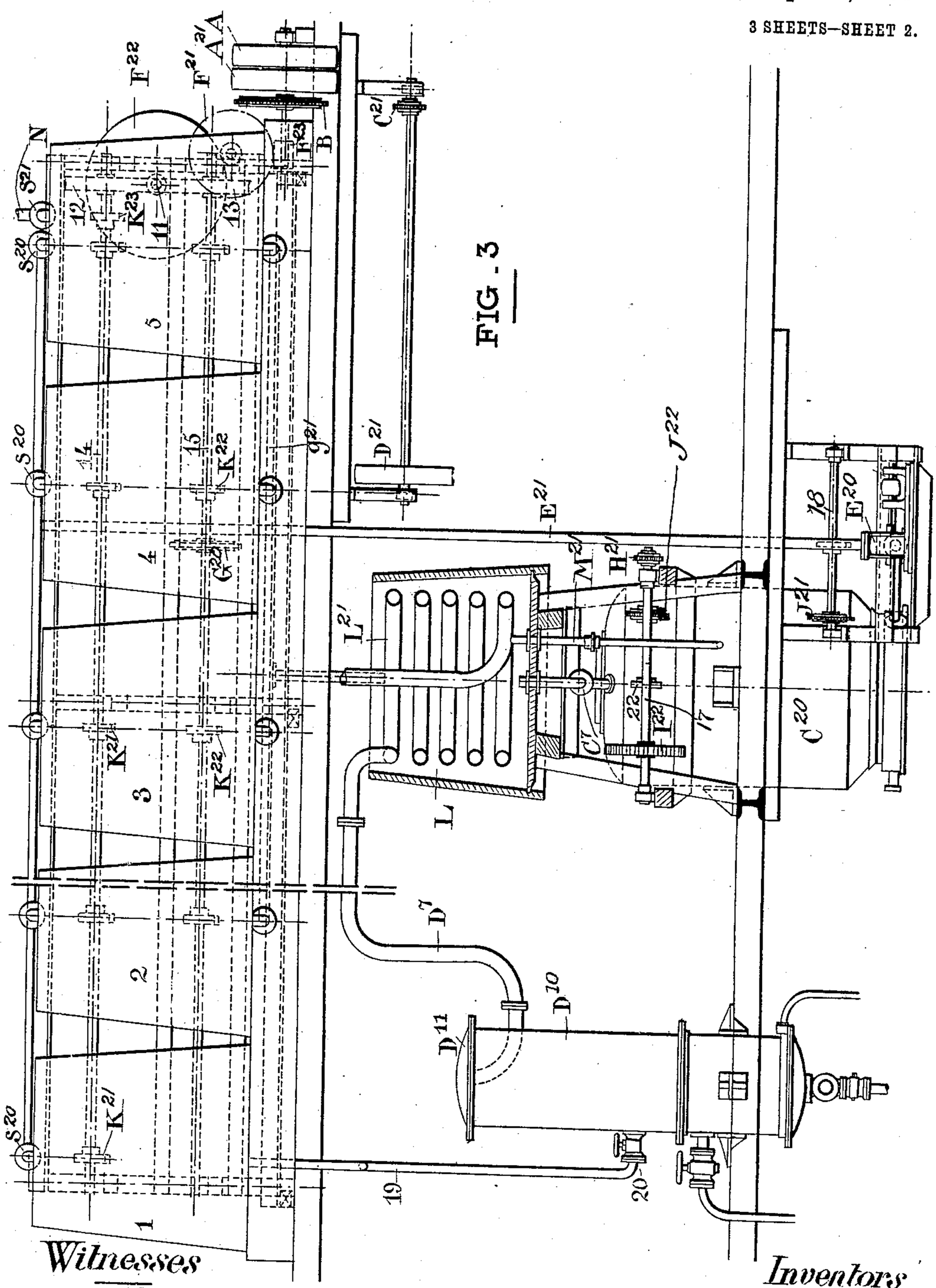

FIG. 3

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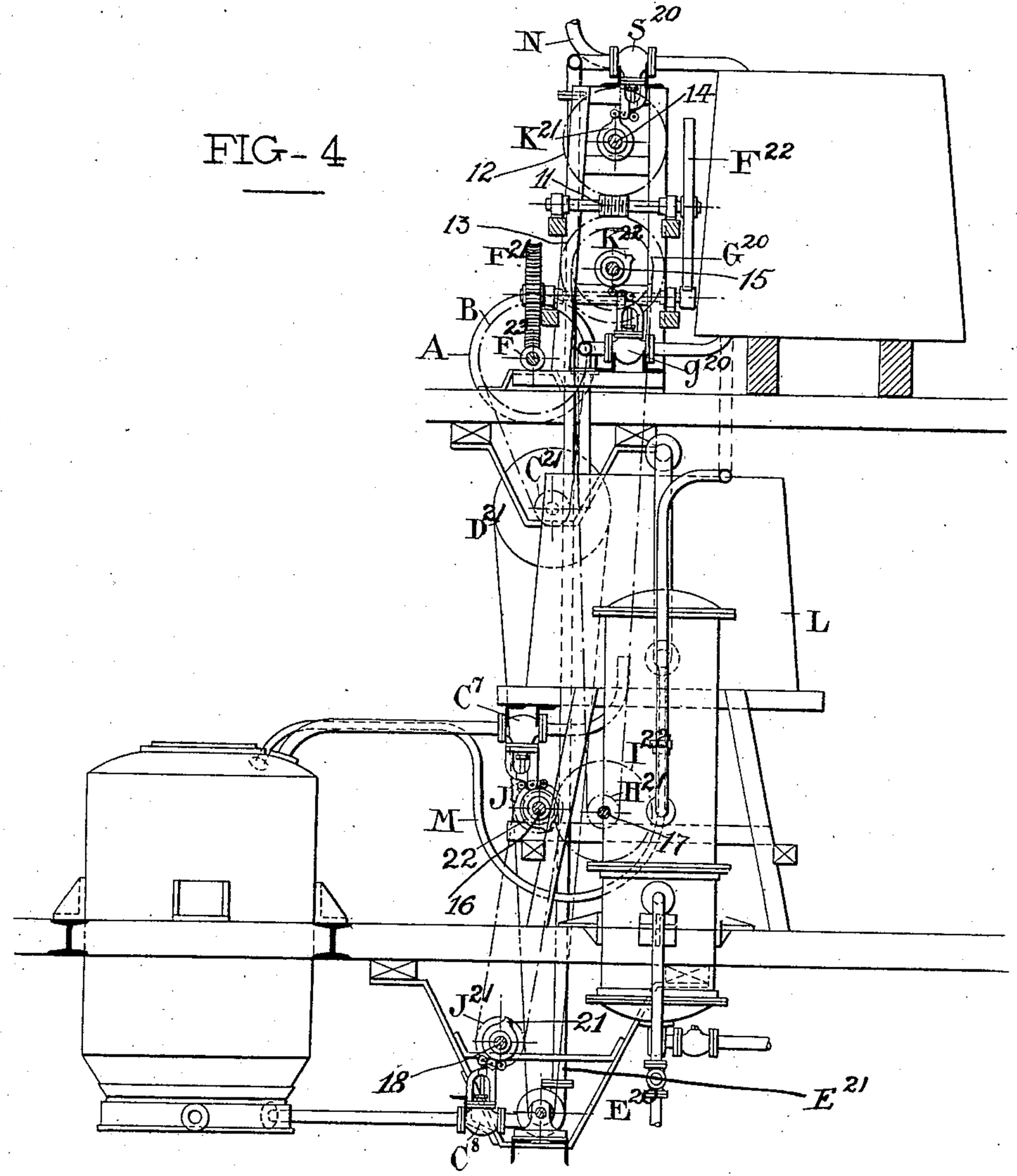
3 SHEETS—SHEET 3.

FIG- 4



Witnesses:

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Guillaume Pioche

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UNITED STATES PATENT OFFICE.

LOUIS FRANCIS JURY, OF VERNAISON, FRANCE.

EXTRACTION APPARATUS.

No. 898,482. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed September 24, 1906. Serial No. 336,047.

To all whom it may concern:

Be it known that I, LOUIS FRANCIS JURY, a citizen of the French Republic, residing at Vernaison, Department of the Rhône, in France, have invented certain new and useful Improvements in Extraction Apparatus, of which the following is a specification.

This invention consists in apparatus for the manufacture of tannic and dye extracts, and of certain extracts for alimentary and pharmaceutical purposes which is so designed that the steam produced by the evaporation is utilized for heating the water used for the extraction, and that the extraction of the juice is automatically controlled.

The invention is illustrated in the annexed drawing, in which

Figure 1 is a side-view of the improved apparatus, partly in section, and Fig. 2 a section on the line 1—1 of Fig. 1. Figs. 3 and 4 are a longitudinal section and a cross-section respectively, illustrating a modification of the invention.

The apparatus illustrated in Figs. 1 and 2 comprises: a diffusion chamber C, a concentrator D, a condenser E, a reservoir F for strong solution and a reservoir G for weak solution. The cylindrical diffusion chamber C is preferably of copper, but a hermetically closed wooden vessel can be used instead of a copper vessel. This chamber has a conical top and bottom, and is provided with a water gage *l*, a vent valve *m*, and hermetically fitting covers C^1 and C^2 at the top and bottom, the said covers being removed for the introduction and discharge of the raw material.

C^3 and C^4 two lateral pipes connect the diffusion chamber to the condenser E, and two similar pipes C^5 and C^6 symmetrically arranged at the opposite side connect the diffusion chamber to a pump P connected to a horizontal pipe I arranged above the reservoirs F and G. Suitably arranged cocks C^7 and C^8 allow of introducing liquid from the condenser to the upper part of the diffusion-chamber C and of discharging the said liquid from the lower part of the said chamber or vice versa. By reversing the flow of liquid the tendency of the latter to form channels in the raw material is counteracted; the formation of such channels prevents the uniform distribution of the liquid and the efficient utilization of the raw material. The capacity of the diffusion chamber is proportional to the quantity of raw material to be treated per day, and the dimensions of the other parts of the apparatus are proportional to this capacity.

The concentrator D consists of a cylindrical evaporating chamber surmounted by an elevated dome D^1 provided with a pressure gage D^2 and a safety valve D^3. Within the cylindrical chamber two plates D^4 and D^5 support a group of tubes D^6 in which circulates the solution supplied from the reservoir through the pipe *a* in order to be concentrated and outside the said tubes circulates steam supplied through the pipe *b;* the concentrated product is evacuated through a cock *c* at the convex bottom of the concentrator. The water of condensation is evacuated through a pipe *d*. The dome D^1 is connected by a pipe D^7 to the condenser E. In the condenser E the steam generated by the boiling of the juice in the concentrator D is condensed by the weak juices supplied from the reservoir G; this juice and the condensed steam pass into the diffusion chamber C. The condenser is cylindrical and of copper with two perforated conical covers E^1 and E^2 bolted to flanges near its ends, so that the said covers are adapted to be removed for cleansing purposes; the condenser is provided with a vent-valve E^3 and a safety valve E^4. The lower part of the condenser contains a series of split rings E^6 arranged to act as baffles, and the tubular part within the latter serves as a guide for a float E^7 through which passes a vertical rod E^8. To the ends of the latter are fixed plugs E^9 adapted to alternately close the inlet and outlet openings of the condenser. The level of the liquid in the condenser is thus kept practically constant. Above the baffles E^6 a circular plate E^{10} is provided, perforated at its center for the passage of the rod E^8, the edges adjacent the rod being bent upwards so as to allow the liquid to pass through in a thin stream. The liquid flowing from the reservoir G through the cock E^{11} is thus brought into intimate contact with the steam flowing from the concentrator D.

The reservoir F containing the strong solution is a wooden vat divided in two compartments by a liquid-tight partition, F^1, each compartment being of sufficient capacity to receive a full charge of juice from the diffusion chamber. Each compartment is provided with a discharge-cock F^2 to which is connected a pipe F^3 leading to the concentrator D.

Ball-valves F^4 connected to the pipe I above

the reservoir F are severally opened when the liquid in the respective compartment of the latter falls below a certain level. Cocks *e* and *f* allow of cutting off the supply of liquid from the pipe I to the compartments of reservoir F. The reservoir G for the weaker solution is a wooden vat divided by water-tight partitions G^1 into compartments 1, 2, 3, 4, 5 and 6, of the same capacity as the compartments of the reservoir F.

Above each compartment in the reservoir G a vertical tube K is connected to the pipe I and above the compartment 6 is arranged a water-pipe H provided with a stop-cock M. Each tube K contains two ball-valves *s* and *i*, the ball of the valve *i* being in the compartment below the tube, and the ball of the valve *s* being in the preceding compartment of the series, the compartment 6 being regarded as the last of the series. The ball of valve *s* of the first compartment is placeable in one or other of the compartments of reservoir F. The valve *s* in each tube K is closed when the preceding compartment is empty and is opened when the liquid level has risen in the said compartment. The pipe H has two valves s^1 and i^1. The valve s^1 in the pipe H acts in the opposite sense to the valves *s;* its ball is in the compartment 5 and rises and falls with the liquid level, but the valve is so constructed that it is open when the compartment 5 is empty and closed when the said compartment is full. The valves i^1 of pipes H and *i* of pipe K are open when the compartments directly below them are empty, and are closed when these compartments are full.

Each compartment in the reservoir G contains a slotted copper tube *j*. This tube serves for the vertical guidance of a float J the lower end of which forms a valve *g* adapted to close the upper end of a short tube g^1 leading from the bottom of the compartment to a horizontal pipe g^2 connected to the cock E^{11}. The valve J is tubular and an internal partition *h* therein closes an air chamber at the lower end of the valve so that the latter normally floats when there is enough liquid in the compartment to raise it and lifts the valve from its seat unless held depressed by a spring finger *r* engaging over the upper end of the tube J. The ascent of the tube J takes place in the longitudinally slotted guide tube *j*.

The spring finger *r* is adapted to be removed from the position in which it engages the tube J by a float r^1 located in the preceding compartment of the series, the said float being connected to the spring finger by a cord r^2 so that when the said preceding compartment is empty the weight of the float disengages the spring finger whereupon the tube J is free to ascend to allow juice to flow through the tube g^1 from the compartment in which the tube J is situated. The tube J returns by gravity to its lower position when all or nearly all the solution has been discharged. As the preceding compartment will have become filled the float r^1 is raised and the spring finger is free to lock the tube J when the latter has again fallen. The spring finger *r* extends through a slot in the guide *j* and bears against the side of the tube J during the descent of the latter, so that when the said tube has reached its lowest position the spring finger engages its upper edge and locks it. The spring finger *r* coöperating with the tube J in the compartment 1 is connected to a cord r^2 adapted to be operated by hand.

The manner in which the apparatus is charged and works is as follows: For charging the apparatus, raw material is introduced into the diffusion chamber C, and the concentrator D is charged with juice prepared or stored for that purpose in one of the compartments of the reservoir F. At the same time steam is admitted through the pipe *b* and the water cock M is opened. Since, at starting, all compartments of the reservoir G are empty the spring fingers *r* are raised, but in the absence of liquid, the valve-tubes J will rest on their seats. The valve-tube J of the compartment 6 is now lifted by hand and the pump started. The water which enters the compartment 6 lifts the tube J and flows thence through g^1 g^2 and E^{11} to the condenser E, where it condenses the vapor flowing from the concentrator D. This water and the water of condensation flow through the cock C^7 and through the pipe C^3 or C^4 to the diffusion chamber until it is filled. Water will continue to flow into and through the compartment 6 so long as juice is pumped from the diffuser, and when this action ceases, water will flow into compartment 6 until it is full and valve i^1 is closed. Juice is formed by the action of the water on the raw material in the diffusion-chamber, and this juice is pumped by the pump P into the empty compartment of the reservoir F, into which has been placed the ball of the ball-valve *s* of the first compartment of the reservoir G. When the respective compartment of the reservoir F is full, the ball-valve F^4 above it closes, and the ball of the valve *s* will have been raised so that the valve *s* above the compartment 1 of the reservoir G opens, so that juice is now pumped into the said compartment 1. When the latter is full its valve *i* closes and the valve *s* of compartment 2 opens, so that juice now enters the said compartment 2. In the same way it fills compartments 3, 4 and 5. As each compartment fills, the tube J of the next compartment is locked by the spring finger *r*, because the entrance of liquid into the compartments of the reservoir G lifts the floats r^2 and causes the spring fingers *r* to engage the valve-tubes J, so that the latter will not be lifted by the liquid when it enters the next

compartment. The juice entering the compartment 5 lifts the balls of the valves s^1 and s in the tubes H and K of the compartment 6, and when the compartment 5 is full, juice flows through the tube K of compartment, but the flow of water through the tube H is cut off, the valve s^1 in the latter having been closed. At or prior to this moment the valve-tube J of compartment 6 must be lowered on to its seat by hand and closes the orifice g; the spring finger r, which previously abutted against the said valve-tube J then engages upon the upper end thereof, and prevents the lifting of the valve-tube by the liquid which enters the compartment 6 through the tube K. When the compartment is full the valves i^1 i of the tubes H and K are both closed. All compartments of the reservoir G are thus filled with solution of different strengths, the raw material is spent or exhausted and the solution which has passed through the concentrator is in the form of an extract. After having once been started and charged in this manner the apparatus remains in normal working order for an indefinite period.

The diffusion chamber is re-charged with raw material when necessary and the solution in the charged compartment of the reservoir F is caused to flow to the concentrator. This compartment is then cut off from the system by closing the cock e or f and the ball belonging to the first valve s is placed in the empty compartment of reservoir F. The cord r^2 hanging out of compartment 1 of the reservoir G is then pulled by hand; the valve g in the compartment 1 is thus free to ascend, so that solution is discharged into the condenser E and flows thence to the diffusion chamber C. When the compartment 1 is empty the valve g therein falls back on to its seat and the float r^1 in the said compartment releases the valve g in compartment 2, and causes the latter to be emptied, and so on. Meanwhile solution from the diffusion-chamber is being pumped first into the empty compartment of reservoir F and afterwards to the compartments 1, 2, 3 etc. of the reservoir G. Only one compartment is, therefore, empty at a time, and while one compartment is being emptied the preceding compartment is being filled. Thus, for example, when the compartment 4 is entirely empty, the compartment 3 is full and the float r^1 in 4 belonging to the valve-tube J located in compartment 5 releases the said valve-tube, whereupon the compartment 5 begins to discharge its contents. At the same time the compartment 4 begins to be re-filled, so that the ball r^1 belonging to the valve-tube in compartment 5 ceases to pull back the spring finger to which it is connected, but since the valve-tube J is still lifted by the liquid remaining in the compartment 5, the said spring abuts against the side of the tube, and does not slip over the upper end of the latter until the compartment 5 is empty and the tube has fallen on to its seat. When the compartment 5 is empty the valve i in the tube K of the said compartment is opened, so that the re-filling of the compartment begins, the compartment 4 being at this moment full. The emptying of the compartment 5 causes the ball r^1 therein to release the valve-tube J in the compartment 6, so that the said tube rises and allows liquid to be discharged from the compartment 6. During the emptying of the compartment 5 the valve s in the tube K of compartment 6 is closed, and the valve s^1 in the tube H opened; the valves i^1 and i in the tubes H and K of compartment 6 remain closed while the compartment 6 is full. As the compartment 6 discharges its contents the valve i in the tube K is opened, and also the valve i^1 in the tube H, but the valve s in the tube K of the compartment 6 remains closed until the compartment 5 is re-filled. When the liquid in the compartment 6 has fallen to a certain level the valve i^1 in the tube H is opened, and admits water through the tube H at the same time that liquid is being discharged, until the rising liquid in the compartment 5 closes the valves s^1 in the tube H, by means of the respective float. The compartment 6 then continues to empty until the valve-tube J falls on its seat, and the spring finger r, having slipped over the upper end of the tube, prevents the lifting thereof and the further discharge of liquid. Compartment 5 being by this time full, valve s of pipe K in compartment 6 is opened and the juice flows into the latter until it is filled. The cycle of operations described can be repeated indefinitely. The apparatus is then ready for a fresh cycle of operations in which the circulation, distribution and heating of the solution are automatically controlled as before.

It is obvious that if the object in view is merely to obtain a strong solution, as for instance for tanning purposes, the diffusion-chamber and reservoirs F and G may be used without the concentrator and condenser.

In the modification illustrated in Figs. 3 and 4 the motor used for driving the pump is also used for operating the valves and cocks by which the circulation and distribution of the liquid is controlled.

In the construction shown in Figs. 3 and 4 separate vats 1, 2, 3, 4 and 5 are used instead of adjacent compartments of a reservoir. The use of separate vats has the advantage that only a single vat is required for strong solution. The motor drives a pulley A, A^{21} being a loose pulley. B is a sprocket-wheel adapted to be connected to a sprocket-wheel C^{21} for driving a pulley D^{21} and pump E^{20}. By means of a worm F^{23} the shaft of the pulley A imparts movement to the gear wheels F^{21} and F^{22}, and the wheel F^{22} drives a

worm 11 and worm-wheels 12, 13, for the purpose of rotating two shafts 14 and 15 parallel with the series of vats 1, 2, 3, 4, 5. To the lower shaft 15 is fixed a sprocket-wheel G^{20} adapted to be connected to a pinion H^{21} on a shaft 17 carrying a wheel I^{22}. The latter operates a pinion on a shaft 16 which carries a cam 22 which controls the upper cock C^7 of the diffusion chamber C^{20}, and a sprocket-wheel J^{21} fixed to the shaft 16 is adapted to drive a sprocket-wheel J^{21} on a shaft 18 for the purpose of operating a cam 21 which controls the discharge cock C^8 of the diffusion chamber. To the shafts 14 and 15 are fixed cam-wheels K^{21} and K^{22} respectively, which control the valves s^{20} and g^{20} by means of which the vats 2, 3, 4, and 5, are filled and emptied. The upper valves s^{20} are connected to the delivery-pipe E^{21} of the pump E^{20}, and the lower valves g^{20} to a pipe g^{21} leading to a vat L which serves as a condenser. In this vat L is a coiled pipe L^{21} communicating by a pipe D^7 with the dome D^{11} of the concentrator D^{10}. The steam generated by the boiling of the solution heats the solution supplied from the vats 2, 3, 4, 5. Surface condensation takes place in the vat L, and a pipe M^{21} conducts the water of condensation to the diffusion chamber. The vat 5 is provided with an additional cam-wheel K^{23} which controls a valve s^{21} in a water-pipe N. The vat 1 for the strong solution is provided with a cam-wheel K^{21} and valve s^{20} and communicates with the concentrator D^{10} by means of a pipe 19 and cock 20 controlled by hand.

Inasmuch as a definite period is occupied by each complete cycle of operations, that is to say passage of solution from the series of vats to the diffuser and replacement of the water used for producing the strong solution it is obvious that the driving gear can be so designed that the shafts 14 and 15 make one complete revolution during this period, and that the cam-wheels can be so adjusted that the respective valves are successively opened for the discharge or supply of solution for the supply of water. The shaft 15 controls the cocks through which solution is supplied to and discharged from the diffusion chamber, and suitable pinions are provided which control the said cams in such a manner, that the contents of each vat for weak solution, and the water successively supplied, passes into the diffusion chamber after flowing through the condenser, the length of time during which the solution remains in the latter being controlled by the cams 22, 21. It will be seen that with this arrangement the contents of each vat passes together into the condenser, and then into the diffusion chamber and then to the pump. This action is in some cases more efficient than the continuous flow which takes place in the apparatus shown in Figs. 1 and 2.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. In apparatus for the purpose set forth the combination of a diffusion-chamber, a series of reservoirs, and conduits for passage of liquid from said diffusion chamber to each of the several reservoirs of said series and for passage from each of the several reservoirs of said series to the diffusion chamber, together with means whereby the level of liquid in the several reservoirs automatically controls alternative ingress and egress of liquid to and from the conduits connected with each reservoir so that the reservoirs fill and empty in series.

2. In apparatus for the purpose set forth the combination of a diffusion-chamber, a series of reservoirs, and conduits for passage of liquid from said diffusion chamber to each of the several reservoirs of said series and for passage from each of the several reservoirs of said series to the diffusion chamber, together with means whereby the level of liquid in the several aforesaid reservoirs automatically controls alternative ingress and egress of liquid to and from the conduits connected with each reservoir so that the reservoirs fill and empty in series, a further pair of reservoirs, a conduit from the diffusion chamber thereto, a concentrator, and a conduit from this pair of reservoirs to the concentrator.

3. In apparatus for the purpose set forth the combination of a diffusion-chamber, a series of reservoirs, and conduits for passage of liquid from said diffusion chamber to each of the several reservoirs of said series and for passage from each of the several reservoirs of said series to the diffusion chamber, means whereby the level of liquid in the several reservoirs automatically controls alternative ingress and egress of liquid to and from the conduits connected with each reservoir so that the reservoirs fill and empty in series, and means controllable by the contents of the reservoirs for supply of water to the last reservoir of the series.

4. In apparatus for the purpose set forth the combination of a diffusion-chamber, a concentrator, two series of reservoirs, conduits for passage of liquid from said diffusion chamber to each of the several reservoirs of both said series and for passage from each of the several reservoirs of one series to the diffusion chamber and from each of the several reservoirs of the other series to the concentrator, means whereby the level of liquid in the several reservoirs automatically controls alternative ingress and egress of liquid to and from the conduits so that the reservoirs fill and empty in series, and conduits whereby the hot vapors from the concentrator serve to heat the extracting juices flowing into the diffusion chamber.

5. In apparatus for the purpose set forth

the combination of a diffusion-chamber, a pump, a series of reservoirs, a conduit for liquid from said diffusion chamber having outlets to each of the several reservoirs of said series, float controlled valves controlling said outlets, a conduit for passage from the several reservoirs to the diffusion chamber having openings from each of said reservoirs respectively and float valves controlling said openings, and means controlling said last mentioned float valves operated by the level of liquid in the preceding reservoir of the series.

6. In apparatus for the purpose set forth the combination of a diffusion-chamber, a concentrator, a condenser, two series of reservoirs, conduits for passage of liquid from said diffusion chamber to each of the reservoirs a conduit for passage from each of the several reservoirs of one series to the diffusion chamber, means whereby the level of liquid in the several reservoirs automatically controls alternatively ingress and egress of liquid to and from the conduits so that the reservoirs fill and empty in series, a conduit from the second series of reservoirs to the concentrator, and a conduit from the condenser to the diffusion chamber for the purpose set forth.

In witness whereof I have signed this specification in the presence of two witnesses.

LOUIS FRANCIS JURY.

Witnesses:

JEANN GERMAIN,

GUILLAUME PISCHE.