

No. 652,536.

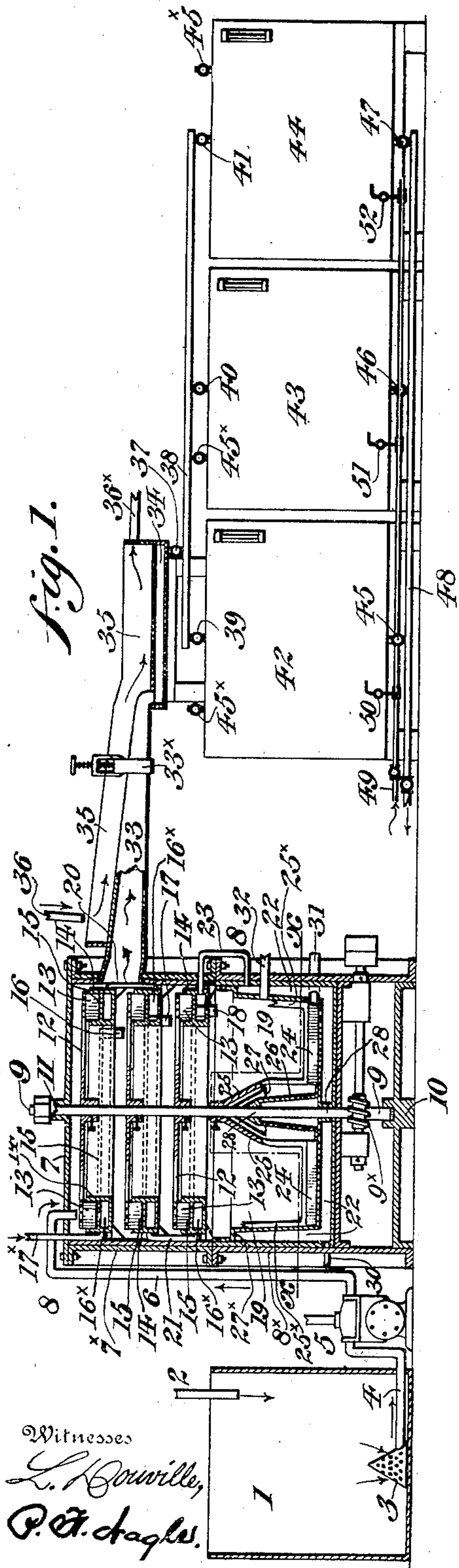
Patented June 26, 1900.

J. C. FLEMING.
EVAPORATING APPARATUS.

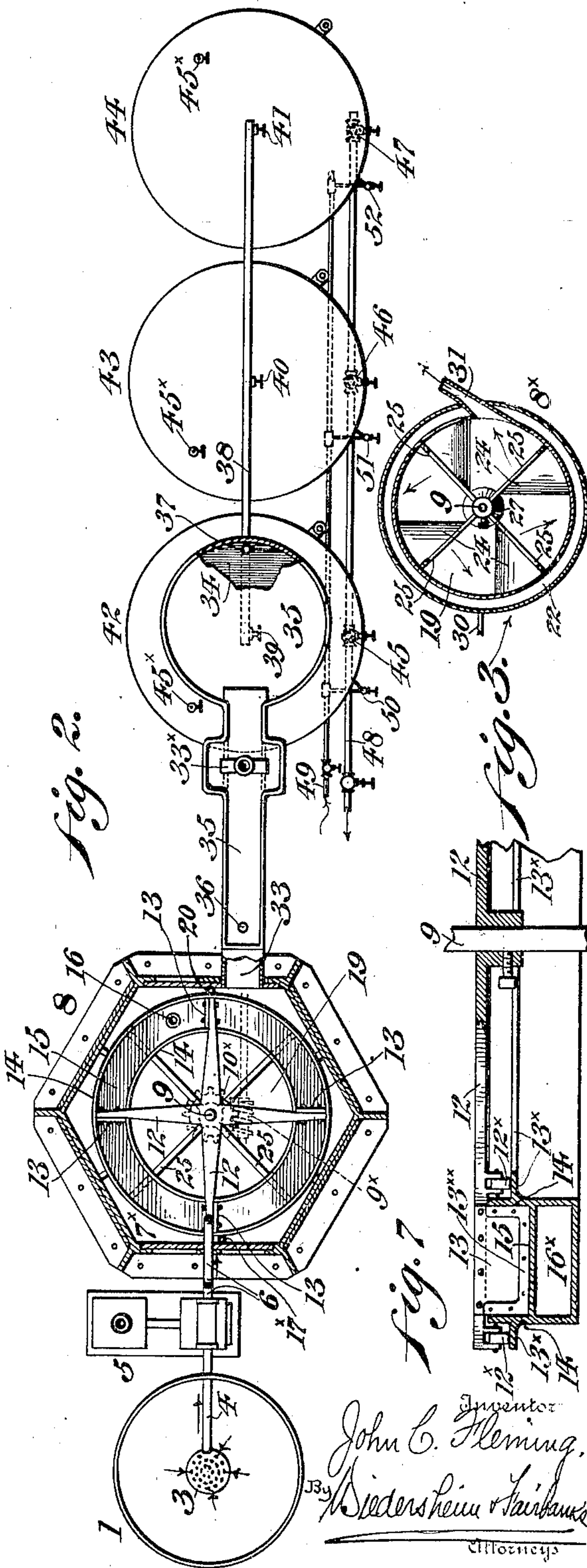
(Application filed Mar. 2, 1899.)

(No Model.)

3 Sheets—Sheet 1.



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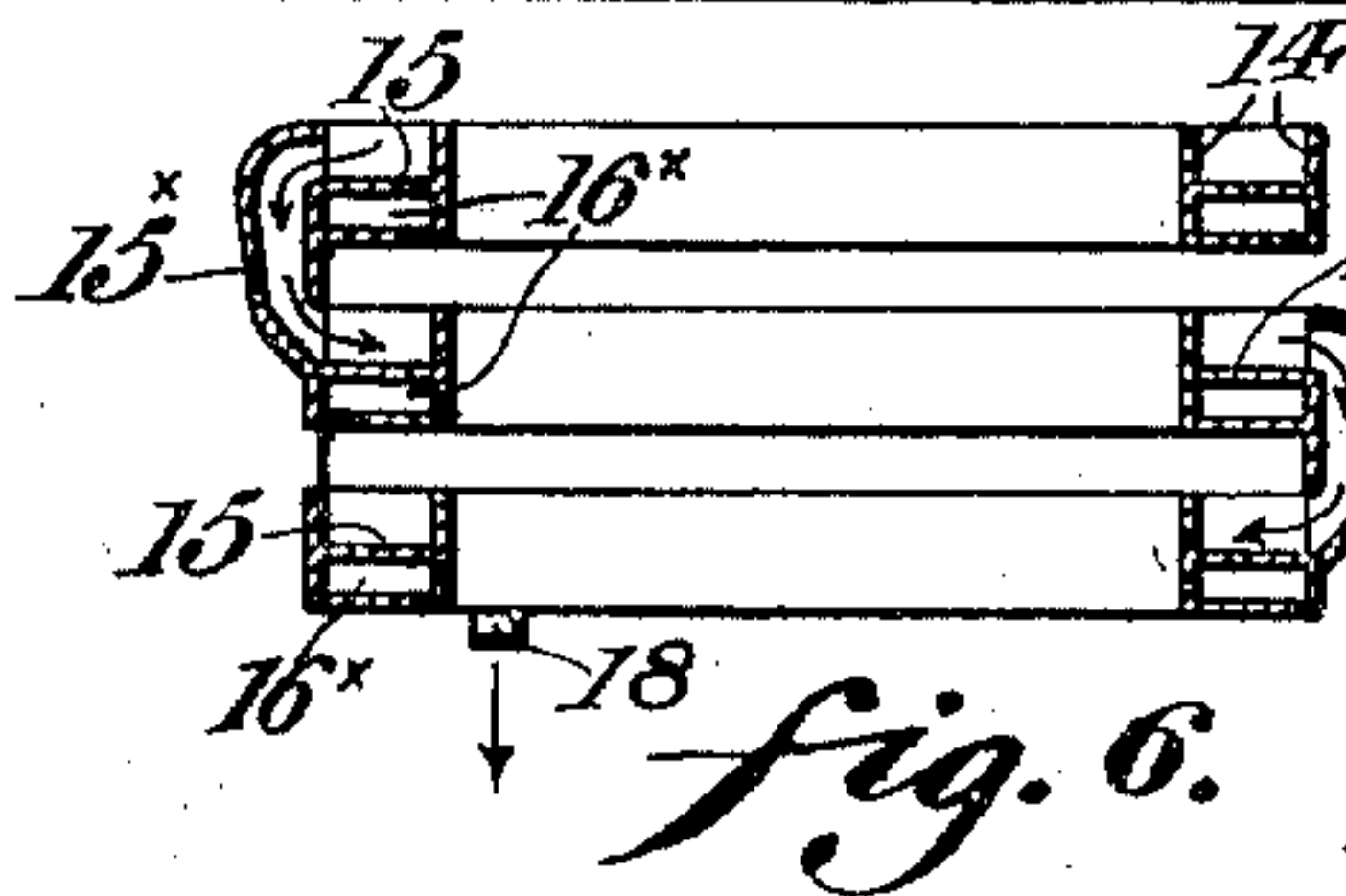
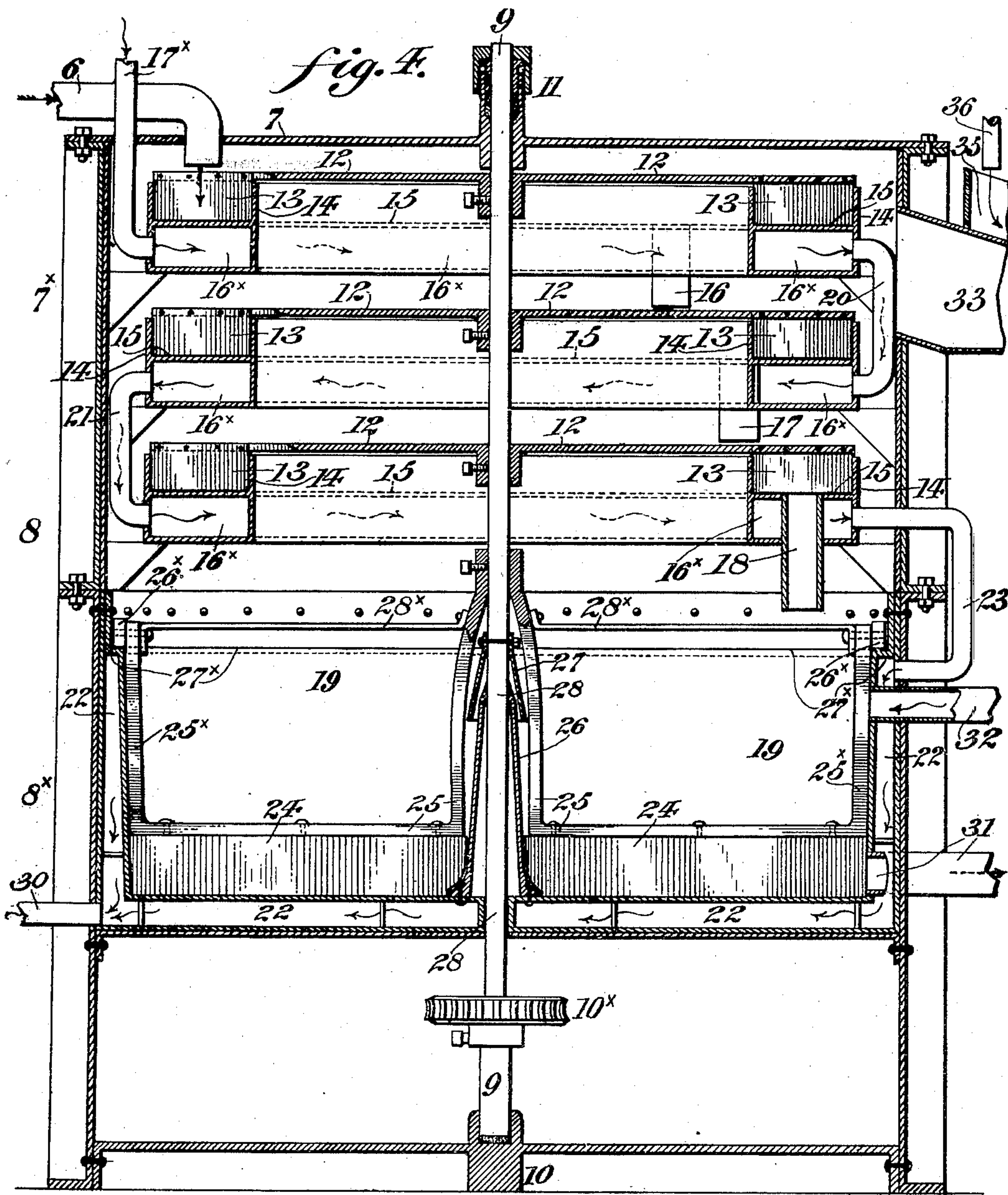
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3 Sheets—Sheet 2.



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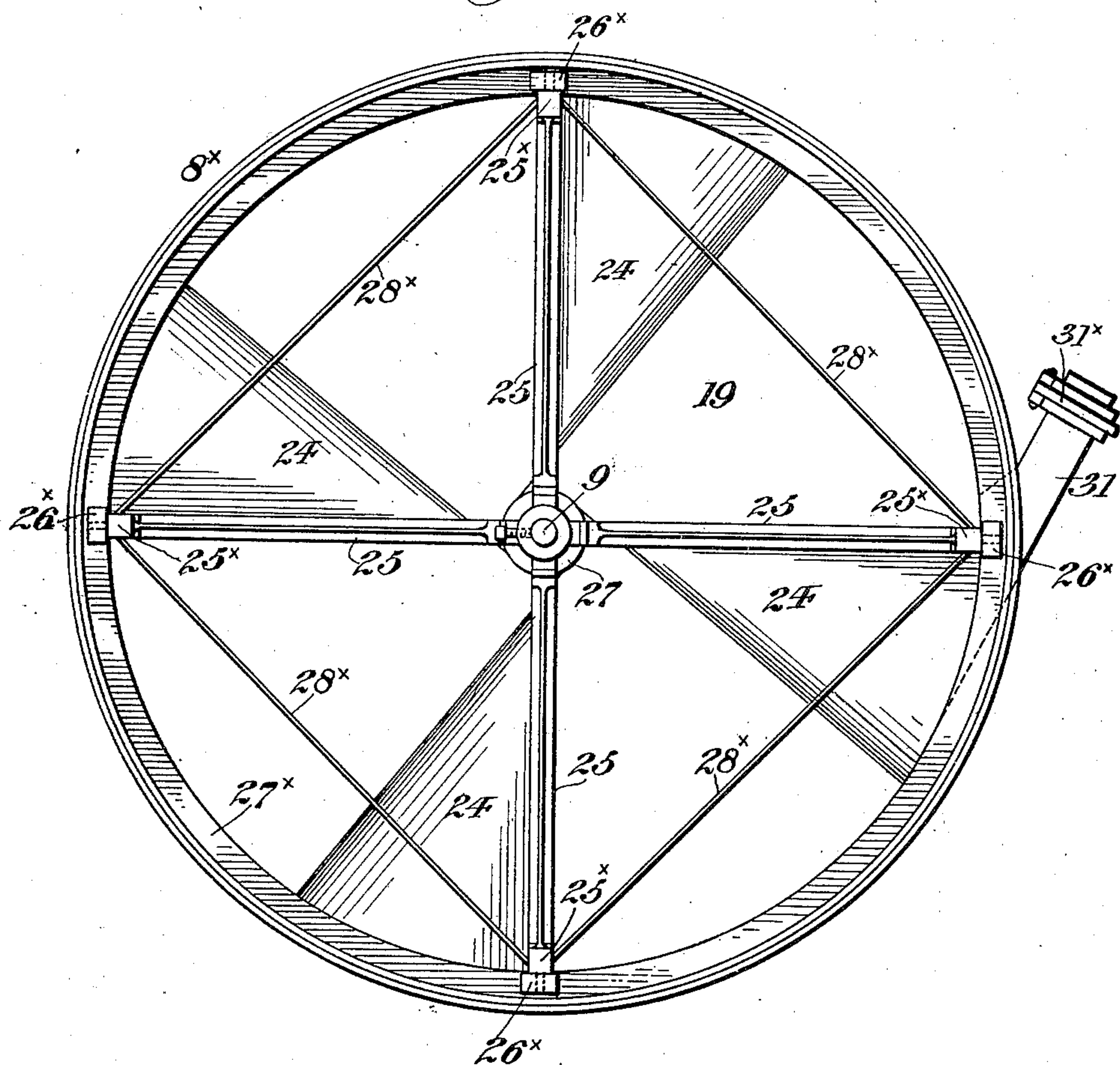
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3 Sheets—Sheet 3.

fig. 5.



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EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 652,536, dated June 26, 1900.

Application filed March 2, 1899. Serial No. 707,451. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. FLEMING, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Evaporators, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of an improved construction of an evaporator which is capable of general adaptation, for instance, in sugar-refineries or pork-packing establishments and may be employed for the evaporation of syrups, wool liquor, and various other liquors or liquids in which solid material may be present, wherein the material to be evaporated is forced into a series of annular or cylindrical troughs or pans arranged as conveyers and contained within an air-tight casing, said pans being superposed above each other, each pan having thereunder a compartment for the reception of steam or hot water, said compartments being connected and an outlet being provided for withdrawing the products of evaporation and for condensing the steam, whereby no waste occurs and all the materials employed are utilized to their fullest extent without creating any offensive odors.

It also consists in the employment of rotary scrapers which serve to continuously agitate and displace the matter or material to be evaporated, whereby the evaporation is more rapid, and as a consequence a saving of fuel and time is effected. It further prevents the material to be evaporated from becoming overheated at any given point, which in some cases would discolor the material to be evaporated. The scrapers are furthermore useful in keeping the pans or troughs clean, and in so doing the continuous stream of material to be evaporated is received on naked iron, which instantly causes the material to evaporate more readily and actively.

It also consists in the employment of a lower receptacle under the superimposed annular pans, which is provided with rotary agitators or stirrers mounted upon a vertical shaft, provision being made for preventing the bearings of said shaft from becoming clogged by means of an upwardly-extending shield whose

interior contains a box for said shaft, a hood being also employed above said shield.

It further consists in the employment of antifriction devices consisting of annular tracks upon which travel casters or rollers supported upon the adjacent portions of the arms carrying the upper scrapers and the lower agitators or stirrers.

It also consists in the employment of a conduit leading to a condenser, said conduit having on the top thereof a channel for the reception of water or other liquid, whereby steam passing through said conduit is partly condensed at an earlier period of its passage through said conduit, the latter being provided with a suitable valve or gate by which communication between the evaporator and condenser may be closed, means being provided for conveying the water of condensation to a suitable tank or tanks and provision being made for withdrawing said water or other solution from said tanks and for creating a vacuum in the latter when it is desired to exhaust or withdraw the contents of the evaporator.

It further consists of novel details of construction, all as will be hereinafter fully set forth, and particularly pointed out in the claims.

Figure 1 represents a sectional diagrammatic view of an evaporator embodying my invention, a portion of the adjuncts thereof being shown in elevation. Fig. 2 represents a plan view of Fig. 1, showing the evaporator with the cover thereof removed. Fig. 3 represents a section on line $x x$, Fig. 1. Fig. 4 represents a vertical sectional view of the evaporator on an enlarged scale. Fig. 5 represents a plan view of the bottom of the evaporator, the upper portion of the casing thereof and the evaporating-pans being removed. Fig. 6 represents a sectional view on a reduced scale, showing a different manner of making the connections between the evaporating pans or troughs. Fig. 7 represents a side elevation, on an enlarged scale, of a scraper and its adjuncts, showing also the antifriction devices therefor.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a tank or vat into which the material to be treated is introduced by means of a pipe 2 or similar device.

3 designates a perforated hood located in the lower portion of the tank 1 and having the suction-pipe 4 leading therefrom to the pumping device 5 of any suitable construction, the material passing from said pump through the pipe 6, which leads through the top 7 of the evaporator 8, the latter being provided with a suitable casing made in upper and lower sections 7^x and 8^x, respectively, the casing being in the present instance hexagonal in cross-section, as will be understood from Fig. 2, although this shape may be varied without departing from the spirit of my invention. It will be seen from the foregoing that the casing is closed, or, in other words, is air-tight, and that the delivery-pipe 6 is practically trapped, so as to prevent the passage therethrough of anything except the material to be treated and in the direction of the casing.

9 designates an upright shaft which is mounted in suitable bearings 10 in the lower portion of the evaporator, the upper extremity of said shaft being mounted in suitable bearings or a stuffing-box 11, which is located in the top plate 7.

12 designates arms mounted on the shaft 9 and terminating at their extremities in the blades or scrapers 13, which are adapted to rotate within the annular troughs or pans 15, which are superposed above each other and held in position by any desired means. In the present instance I have shown three pans 15, provided with the upwardly-extending sides 14, which may incline outwardly, if desired, said pans being superposed upon each other, and it being apparent that the number of said pans can be increased or diminished, according to requirements. Each of the pans has an outlet-pipe 16, 17, and 18 depending therefrom for the purpose of conducting the material successively from the top to the bottom pan, it being noticed that said pipes are arranged out of alinement with each other, as will be understood from Fig. 1 or Fig. 4, the pipe 18 discharging into the lower compartment 19, as is evident. If desired, I can connect the pans 15 by means of pipes 15^x, which extend exteriorly thereof, as will be understood from Fig. 6, whereby dropping of the liquid upon the arms 12 or the scrapers is prevented. Each of the pans 15 has a steam-compartment 16^x located thereunder, steam being conducted to the upper compartment by means of a pipe 17^x and thence downwardly by means of the connecting-pipes 20 and 21, steam being conducted from the lowest compartment 16^x by means of the pipe 23 to the space or jacket 22, which surrounds the compartment or kettle 19, said compartment or kettle 19 being of greater area than the upper pans 15 and having revolving therein the

blades or agitators 24, which latter are mounted on the arms 25, which are elongated in practice, as seen in Figs. 1 and 4, and secured to the shaft 9 by any suitable means.

26 designates a conical or tapering shield which is attached to the lower portion of a stationary kettle 19 and has its top covered by the hood 27, which is secured to the shaft 9 and revolves therewith, whereby it will be seen that the material in the kettle 19 is prevented from reaching the bearings 28 of the shaft 9.

In order to effectively support the agitators 24 and to reduce friction to a minimum, I extend the arms 25 upwardly to form the members 25^x, which scrape the sides of the kettle 19 and effectively commingle and prevent any accumulation of material therein, said upright members having the rollers 26^x journaled therein, which are adapted to travel upon the annular track or ledge 27^x, formed upon the upper portion of the jacket or chamber 22, although it will be understood that said track may be formed by other means without departing from the spirit of my invention. The members 25^x are further strengthened or stiffened by means of the braces 28^x, which latter extend between said members, as will be best understood from Fig. 5.

30 designates an outlet-pipe for steam from the jacket 22, it being of course understood that for evaporating certain kinds of material it might be expedient to use hot water at the desired temperature instead of steam, said water entering the compartments 16^x through the pipe 17^x and being conducted downwardly by means of the pipes 20, 21, and 23 into the chamber 22 and leaving the latter through the pipe 30, as is evident.

31 designates an outlet for the kettle 19, said outlet or nozzle being preferably located tangentially, as will be understood from Fig. 3, so as to facilitate the egress of the material to be evaporated, and being provided with a gate 31^x, the object of which is evident.

32 designates a pipe leading into the kettle 19 at a point preferably above the lower portion thereof, said pipe being employed for the introduction of steam into the interior of the evaporator when it is desired to create a vacuum therein, which is done in the same way as in the tanks, as hereinafter explained.

In practice I employ the construction seen in Fig. 7 for supporting the scrapers and reducing friction, in which the arms 12 are provided with the rollers or antifriction devices 12^x, journaled therein, which latter travel on the inner and outer tracks 13^x, which project from the walls of the pans 15, the scrapers 13, attached to said arms, being provided with a facing 13^x, of hard rubber or other suitable material, which can be replaced whenever desired, it being understood that the interior surface of the pans 16^x adjacent to said scrapers can be lined with enamel or other suitable material, which is desirable in evap-

orating certain liquids. The scrapers can be adjusted up and down relative to their pans by moving the arms 12 to the desired extent upon the shaft 9, or other suitable adjusting means can be employed, as is evident.

33 designates a conduit having a valve or gate 33^x therein leading from the upper portion of the evaporator to a chamber 34, the top of said conduit being provided with a channel 35, into which water is introduced through the pipe 36, said water leaving said channel through the pipe 36^x, whereby the steam entering the compartment 34 is condensed, the water of condensation passing through the valve 37 into the pipe 38 and flowing thence through the valves 39, 40, and 41 into the tanks 42, 43, and 44, respectively, the contents of said tanks being withdrawn through the valves 45, 46, and 47, respectively, which communicate with the pipe 48, leading to any desired point.

49 designates a valved steam-pipe leading through the medium of the valves 50, 51, and 52 to the tanks 42, 43, and 44, respectively, each of the latter having cocks 45^x, wherefrom it will be seen that when it is desired to create a vacuum in said tanks it is only necessary to close the valves 37, 45, 46, and 47 and after opening the cocks 45^x to permit steam to flow in through the pipe 49. As soon as the steam appears at the cocks 45^x the steam-supply is cut off and the cocks 45^x closed. When the steam condenses, a vacuum will be formed in the tanks, and upon opening the valves 37, 39, 40, 41, and 33^x a communication is opened to the top of the evaporator, whereupon the gases or vapors therein immediately flow into the tanks, as is evident.

The operation is as follows: The rotation of the shaft 9 is effected by any suitable means, as, in the present instance, a worm 9^x and worm-wheel 10^x, the rotation of said shaft causing the scrapers 13 and the stirrers or agitators 24 to rotate in unison. The heating medium having been introduced into the compartments 16^x through the pipe 17^x is conducted downwardly to the jacket 22 and discharged therefrom through the pipe 30. The pump having been started, the material to be evaporated is forced upwardly into the troughs or pans, said material descending from pan to pan after being conveyed around the latter through the pipes 16, 17, and 18 or their equivalents, the pipes 15^x. (Seen in Fig. 6.) The rotation of the scrapers causes the material to be agitated to the desired extent, and since the material is spread around the surfaces of the pans in a thin body a maximum area for evaporation is exposed, the material finally descending into the kettle 19 through the pipe 18, where the finishing steps in the act of evaporation occur, the material being withdrawn through the pipe or nozzle 31, as has been explained.

Through the medium of the shield 26 and

the hood 27 provision is made for preventing clogging of the shaft-bearings, as is evident from Figs. 1 and 4. By supporting the arms 12 and 25, the scrapers 13, and also the agitators 24 in the manner indicated in Figs. 4 and 7 it will be evident that friction will be reduced to a minimum and the weight of the arms and their adjuncts will be effectually supported.

The steam and other gaseous products that leave the upper portion of the evaporator through the conduit 33 are condensed with great rapidity by means of the cold water flowing through the channel 35, the products of evaporation being received in the compartment 34 and conducted thence to the tanks 42, 43, and 44, while the manner of creating a vacuum in said tanks and the object and function of said vacuum have already been explained.

The rotary scrapers are an important feature of this invention and possess certain marked advantages over prior evaporators of which I am informed in that they promote evaporation by continuously agitating and displacing the material or matter, and since the evaporation takes place with greater rapidity the device is economical in that it saves fuel and time and is an advance in the art. The scrapers furthermore prevent the material or matter from becoming overheated at any given point owing to this constant agitation and displacement of the material, and thus obviate discoloration of the material which sometimes occurs from this cause. The pans and troughs are kept clean also, so that the continuous stream of material matter is received on naked iron, and this further increases the rapidity of the evaporation, as it is found that the material or matter evaporates with increased readiness and activity when the pans or troughs are kept clean. The evaporator is thus of marked utility in that it reduces the amount of fuel as well as time necessary to effect the evaporation of a certain amount of material or matter.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An evaporator consisting of a casing, an upright shaft journaled therein, arms provided with scrapers mounted on said shaft, annular pans suitably supported in which said scrapers are adapted to rotate, compartments for heating fluid located underneath each of said pans, connections common to each of said pans, connections common to each of said compartments, annular tracks located on each side of said pans, and rollers supporting said scrapers and traveling on said tracks.

2. In an evaporator, an air-tight casing, an upright shaft having scrapers mounted thereon, annular pans in which said scrapers are adapted to rotate, heating devices for said pans, a plurality of tanks, a conduit leading

from said evaporator to said tanks, and means for creating a vacuum in the latter.

3. In an evaporator, a casing, an upright shaft located therein, a plurality of annular pans supported in said casing, arms mounted on said shaft and provided with scrapers rotatable in said pans, means for conducting the material from the upper to the lower pans, a kettle of greater area than said pans, for receiving the contents of the latter, a jacket surrounding the sides and base of said kettle, the latter being located in the lower portion of the evaporator, agitators located therein and means for heating the lower portions of said pans.

4. In an evaporator, a closed casing, a lower kettle situated therein for the reception of the material to be evaporated, a shaft mounted in said kettle, a shield supported on the base of said compartment and extending upwardly, through which shield said shaft passes and a depending flaring hood covering the upper extremity of said shield, whereby clogging of the bearings of said shaft is prevented.

5. The combination of a tank and pumping devices therefor, an evaporator having a casing, a shaft supported therein, a plurality of pans located in said casing, the upper of said pans receiving the material from said pump, heating-compartments located adjacent each of said pans, connections common to the latter and to the several heating-compartments, respectively, arms carrying scrapers supported from said shaft, a lower kettle in which the products of evaporation are received, a heating-jacket for said kettle, an outlet from the latter, arms carrying agitators located in said compartment and supported from said shaft and antifriction devices for said agitators and scrapers.

6. In an evaporator, a series of superimposed annular pans, heating-compartments located thereunder, connections common to each of said pans and heating-compartments respectively, a lower kettle, a jacket surrounding the same, scrapers adapted to rotate within said annular pans, agitators adapted to rotate in said kettle, rollers mounted upon the arms carrying said scrapers, annular tracks upon which said rollers are adapted to travel, an annular track in the lower kettle, and upright arms carrying rollers, the latter being adapted to travel on said latter track.

7. In an evaporator, a shaft having arms depending therefrom, agitators secured to the lower portion of said arms, the latter being continued upwardly so as to scrape the sides of the kettle in which said agitators are contained, braces for said arms, rollers mounted on the upper extensions of said arms, and tracks upon which said rollers are adapted to travel.

8. In an evaporator, a casing, an upright shaft contained therein, a plurality of annular pans 14 superimposed above each other, a lower kettle 19, connections 16, 17 and 18 for

conveying the material from the upper of said pans to said compartments, a heating-chamber located adjacent each of said pans, connections common to each of said heating-chambers, a jacket surrounding said lower kettle, a connection common to said jacket and one of said pans, scrapers revolving in the latter and agitators or stirrers adapted to revolve in said lower compartment.

9. The combination of a casing, having evaporating devices therein, a conduit leading therefrom to a compartment, a plurality of tanks adjacent to the latter, connections from each of said tanks to said compartment, a condenser located above said conduit, cocks for permitting the discharge of air from each of said tanks, a valved conduit leading from said tanks for conducting the water of condensation from each of the latter and a valved steam-pipe discharging into each of said tanks for the purpose of effecting the creation of a vacuum therein, according to requirements.

10. In an evaporator, a casing, a plurality of annular pans supported therein, tracks located adjacent to said pans, a shaft carrying arms and provided with scrapers adapted to rotate in said pans, rollers mounted on said arms and adapted to travel on said tracks, heating-compartments located adjacent to each of said pans, a lower kettle having agitators mounted therein, arms extending upwardly from said agitators, rollers mounted on said arms and an annular track upon which said rollers are adapted to travel whereby the weight of said agitators is sustained and friction reduced to a minimum.

11. An evaporator consisting of a closed casing, an upright shaft carrying arms, scrapers depending from said arms, a series of annular pans suitably supported in which said scrapers are adapted to rotate, a receptacle to receive the material after it passes through said pan and from which an outlet leads through the casing, a heating-compartment located under each of said annular pans, means for conducting the heating medium to and from said pans, means for rotating said shaft and scrapers, and means for conveying the vapors of evaporation from said casing.

12. An evaporator consisting of a casing, an upright shaft journaled therein, arms carried by said shaft, scrapers carried by said arms, a series of annular pans in which said scrapers are adapted to rotate, a series of heating-compartments located adjacent to said pans, means for conducting the heating medium to and from said compartments, a passage leading from each of said pans to the pan below, a lower kettle, agitators mounted on said shaft and adapted to scrape the sides and bottom of said kettle and means for rotating said shaft.

13. In an evaporator, an air-tight casing, an upright shaft having scrapers mounted thereon, annular pans in which said scrapers are adapted to rotate, heating devices for said

pans, a plurality of tanks, a conduit leading from the evaporator to said tanks and means for condensing and withdrawing the gaseous products from said evaporator.

5 14. In an evaporator of the character stated, a kettle, an agitator therein, a heating-jacket around said kettle, a shaft carrying said agitator, a shield connected with said kettle and

having said shaft passed freely therethrough, and a hood firmly secured to said shaft and 10 covering the top of said shield.

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