

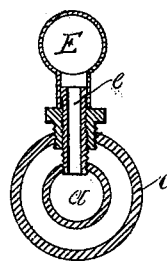
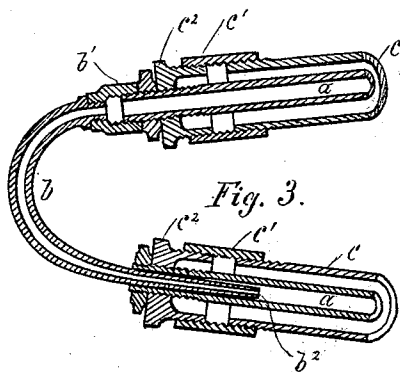
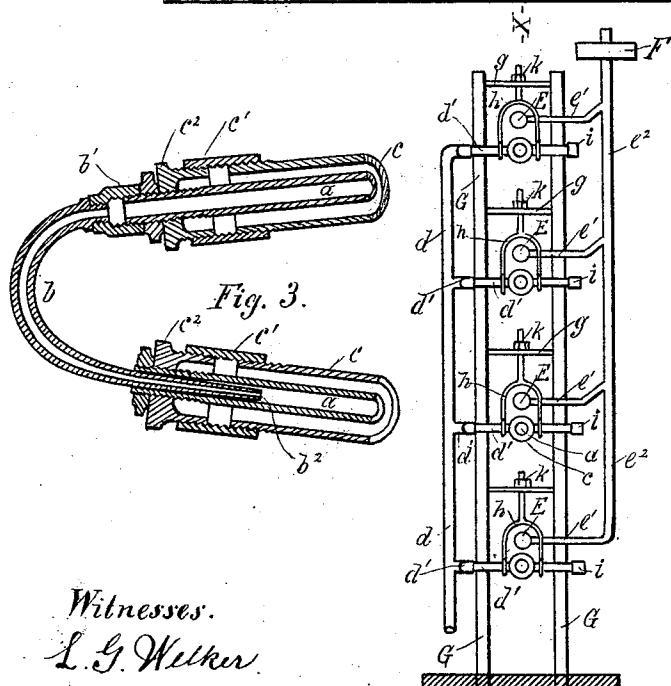
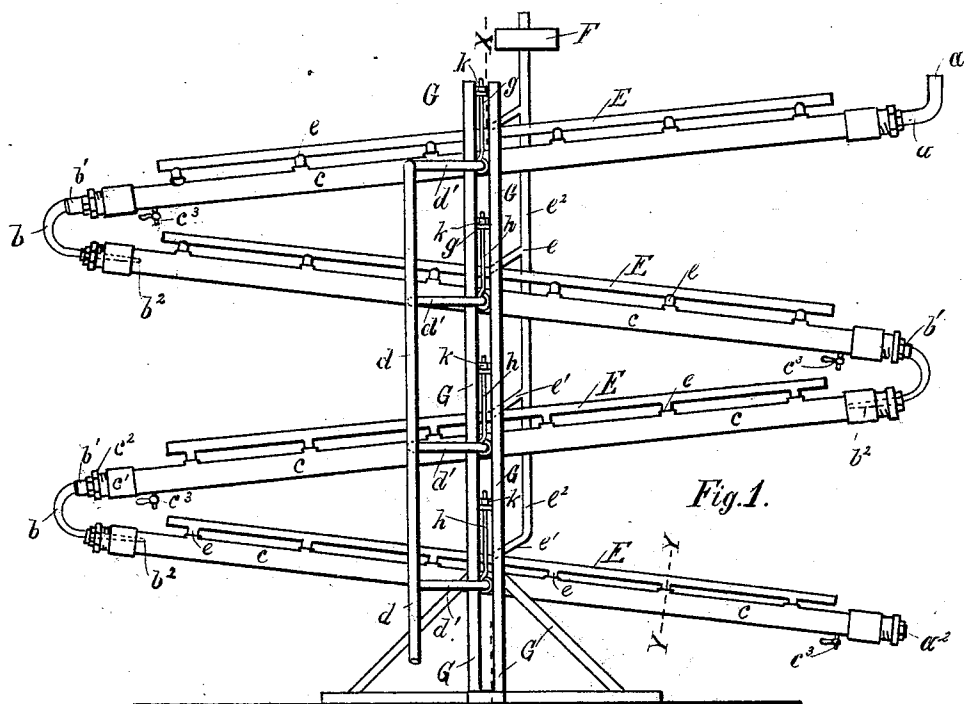
(No Model.)

2 Sheets—Sheet 1.

A. P. LEIST.
EVAPORATING APPARATUS.

No. 520,438.

Patented May 29, 1894.



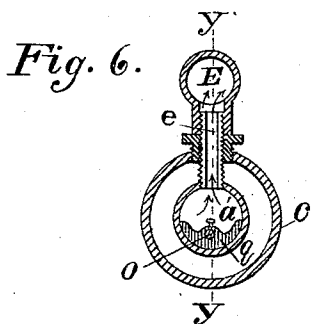
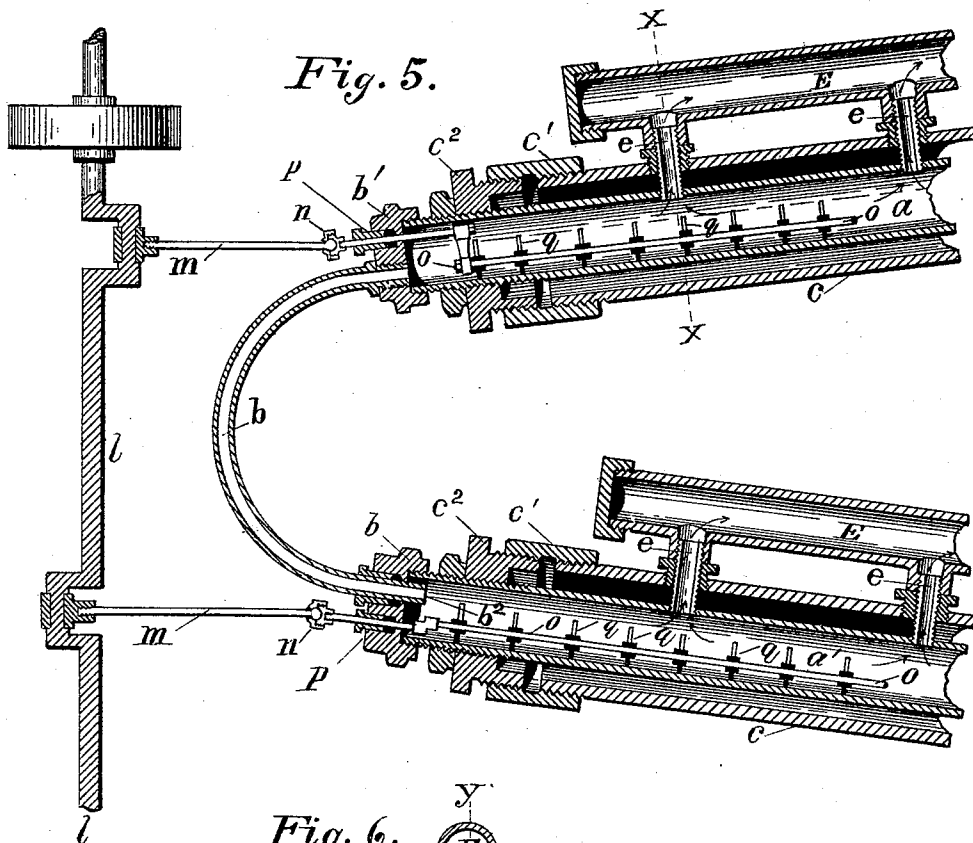
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Witnesses.

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UNITED STATES PATENT OFFICE.

ABRAHAM P. LEIST, OF LIBERTY CENTRE, OHIO.

EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 520,438, dated May 29, 1894.

Application filed September 4, 1891, Serial No. 404,693. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM P. LEIST, of Liberty Centre, Henry county, Ohio, have invented certain new and useful Improvements in Evaporating Apparatus, of which the following is a specification.

My invention relates to that class of evaporating apparatus in which the liquid to be evaporated is passed through a pipe or tube inclosed in a chamber supplied with steam or other heating medium, and, more particularly, to a means for regulating the flow through such pipe or tube of its contained liquid; and the objects of my invention are to dispense with the separating chambers heretofore in use in this class of evaporating apparatus; to provide a cheap, simple and efficient means for controlling the quantity of fluid admitted to the evaporating tube, the time that such liquid shall be subjected to the heat of the tube in passing through the same, and the consequent reduction of the evaporated product, to provide a means for readily and easily cleansing the interior of my apparatus, and to provide means for agitating the contents of the evaporating tube. I attain these objects by means of the device shown and illustrated in the accompanying drawings, made part hereof, in which—

Figure 1, is a side elevation of my device; Fig. 2, a vertical, cross-sectional elevation on line X, X; Fig. 3, a central, longitudinal, sectional view, in detail, of the inner and outer tubes hereinafter referred to, together with the flexible joint connecting the same. Fig. 4, is a cross-section of said tubes on line Y, Y, showing detail of pipe connection; Fig. 5, a central, vertical, longitudinal sectional view (on line y, y, Fig. 6,) of a portion of my device provided with my agitators, and Fig. 6, is a cross-section of the same, on line x, x, Fig. 5.

Like letters of reference represent like parts throughout the several views.

In the drawings *a* is a pipe having a zig-zag or sinuous course, disposed, preferably, in a vertical plane and having inlet *a'* and outlet *a''*. This pipe is made up of straight sections united at their adjoining ends by flexible, curved tubes *b*, which form a part of the line of pipe *a* from inlet to outlet. The curved parts *b* are readily detachable (as

shown in Fig. 3), by unscrewing coupling *b'*, which is provided with an interior right and left handed screw-thread, and then withdrawing from its socket the opposite end, *b''*, which is made slightly tapering in order to form a snug fit.

The straight sections of pipe *a* are placed inside of pipes *c*, the annular space between the two pipes forming a chamber for steam or other heating medium. Both ends of each pipe *c* are closed by pipe *a* and couplings *c'* and *c''*. At its lower end each section of pipe *c* is provided with a drip-cock, *c''*, which may be suitably connected with troughs or pipes leading to any desired point. The annular chambers between pipes *a* and *c* are supplied with steam through steam-pipe *d* and branches *d'*.

E, *E*, are vapor-pipes placed above and parallel with pipe *c*, and connected with pipe *a* by branches *e e* passing through pipe *c*. (See Fig. 4.) From each pipe *E* a branch-pipe *e'* leads to a pipe *e''* which is connected with *F*, which indicates an exhaust-fan or pump or other means of producing a partial vacuum in pipes *a*, *e*, *E*, *e'* and *e''*.

The system of pipes, connected as above described, is suspended in a stout frame *G*, from cross-pieces *g*, by means of yokes or hangers *h*, the arms of which terminate in loops which embrace branch-pipes *d'*, close to where they are screwed into pipe *c*, and lugs or projections *i* on pipe *c* directly opposite pipe *d'* pipes *d'*, and lugs *i* thus forming trunnions or pivots upon which the several sections of the system of pipes may be tilted or inclined at a greater or less angle to the horizontal. The shanks of the yokes or hangers *h* which pass through cross-pieces *g* are screw-threaded at top and are provided with nuts *k*, by means of which the yokes or hangers and the various sections of their suspended burden may be raised or lowered at will. It will be observed that the pivotal points of the various sections of pipe *c* are fixed exactly midway of their length, respectively, so that the pipes are evenly balanced upon their supports.

From the foregoing description the manner of operating my device is obvious. Steam or other heating medium is introduced into the annular chambers between pipes *a* and *c* through steam-pipe *d* and branches *d'*. The

fluid to be evaporated is admitted from an elevated tank (not shown in the drawings) into pipe *a* at inlet *a'* and by its own gravity is caused to traverse the sinuous course of pipe *a*, the more volatile part of the fluid being, as it proceeds, vaporized by contact with the hot pipe *a*, the vapor escaping through pipes or taps *e* into pipes *E* from whence it is drawn through pipes *e'* and *e''* to pump *F* or its equivalent, while the concentrated product finally escapes at outlet *a''*. Should this product be too much concentrated an increased flow may be obtained, and the time of exposure of the fluid to the heat of the inner pipe may be lessened, and the evaporation diminished accordingly, by increasing the pitch or inclination of one or more of the sections of pipe *a*, which may be accomplished by the vertical adjustment of yokes or hangers *h* through nuts *k*, the straight sections *a*, *c*, tilting on their pivotal bearings, and the flexible joints or parts *b* yielding to the slight movement of these sections at their angles. Should the evaporated product be found too thin, the opposite result may be obtained by reversing the adjustment just referred to, and it will be readily seen that the apparatus may be adjusted so that the first part of the evaporation will be slow and the last part rapid or vice versa, according to the requirements of the fluid under treatment.

In the evaporation of some liquids they become quite thick and tend to clog the evaporating tubes *a*, thus preventing a uniform product. If for this or any other reason it becomes desirable to agitate the contents of said pipe, the flexibility of the apparatus, and its pivotal, balanced mounting, permits the entire series of pipes to be easily shaken. Figs. 5 and 6 illustrate a mechanism by means of which the contents of pipes *a* may be constantly stirred, and scraped from the bottom of the pipe, thus bathing the interior of pipe *a*, increasing its evaporating capacity, and preventing clogging. This device consists of a vertical crank-shaft, *l*, having crank-rods *m*, connected by a ball-and-socket joint, *n*, with rods *o*, passing through stuffing-boxes *p* in the end of straight section of pipe *a*. Attached to rods *o*, at a right angle thereto, are thin pieces of metal *q* rounded at their lower edges to conform to the interior of pipe *a*. The revolution of the crank-shaft *l* reciprocates rods *m* and *o* causing scrapers *q* to agitate the fluid contained in pipe *a*, with the result above mentioned.

By removing the flexible, exposed sections of pipe *b*, as above indicated, the whole interior of pipe *a* is exposed to view, and may be easily reached by swab or scraper, if necessary.

It is obvious that my device may be used in double or triple effect according to the well known systems of Rillieux and others, and means for applying "multiple effects" to my invention will readily suggest themselves without further description.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an evaporating apparatus, pipe *a* having vapor outlets *e e*, all leading to vacuum apparatus *F*, in combination with pipes *c* and means for adjusting the inclination or pitch of said pipes *a* and *c*, substantially as shown and described, for the purpose specified.

2. In an apparatus for evaporating liquids, inner pipe *a*, outer pipe *c* forming the annular space between said pipes in combination with vapor-pipe *E* connected with a series of openings in pipe *a* by means of pipes or taps *e* passing through outer pipe *c*, each of said pipes, *a c* and *E*, having adjustable pitch or inclination, said vapor-pipes *E* and *e* being suitably connected with means for producing a partial vacuum, substantially as shown and described, for the purpose specified.

3. In an evaporating apparatus the evaporating tube *a* having adjustable pitch or inclination and provided, in its interior, with a series of scrapers or agitators *q* operatively connected with a suitable driving mechanism, substantially as shown and described, for the purpose specified.

4. An evaporating apparatus comprising in its construction an evaporating pipe *a* disposed in zig-zag or sinuous lines, an outer pipe *c* inclosing pipe *a* providing an annular space between the two, a means for introducing steam or other heating medium into said annular space, a series of vapor outlets leading from pipe *a* to a common vacuum apparatus, a source of supply of liquid to the upper end of pipe *a*, means of adjusting the angle of inclination pipes *a* and *c* and their appendages, and pivotal supports for said pipes *a* and *c* and their appendages, all substantially as shown and described, for the purpose specified.

ABRAHAM P. LEIST.

In presence of—
WILLIAM RACKETT,
GEORGE L. SMITH.