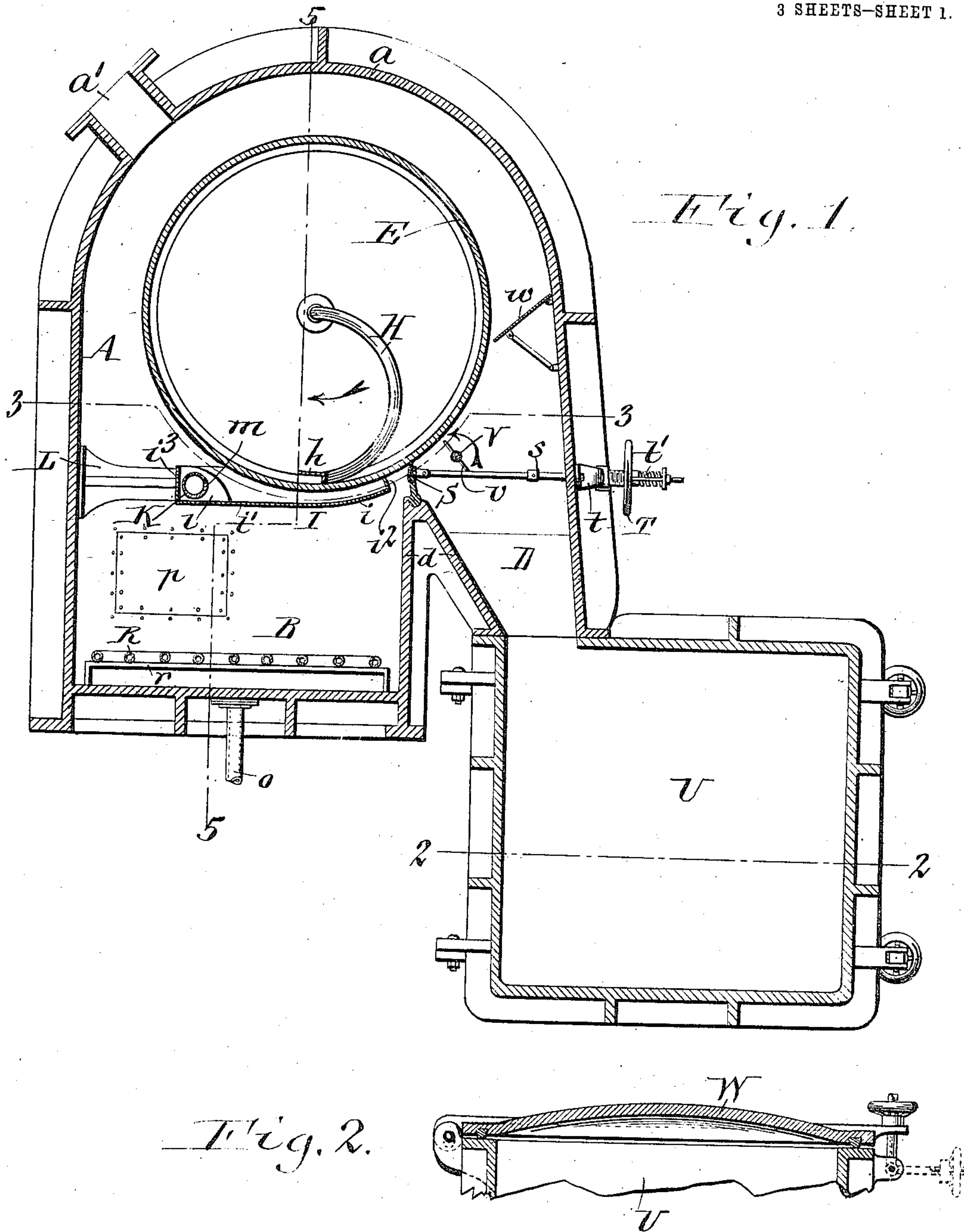


O. S. SLEEPER.
 DRYING APPARATUS.
 APPLICATION FILED AUG. 19, 1909.

993,892.

Patented May 30, 1911.

3 SHEETS—SHEET 1.



Witnesses:
 Walter H. Popp.
 John H. Schoemaker

Inventor
 Oliver S. Sleeper
 by Geyer & Popp
 Attorneys.

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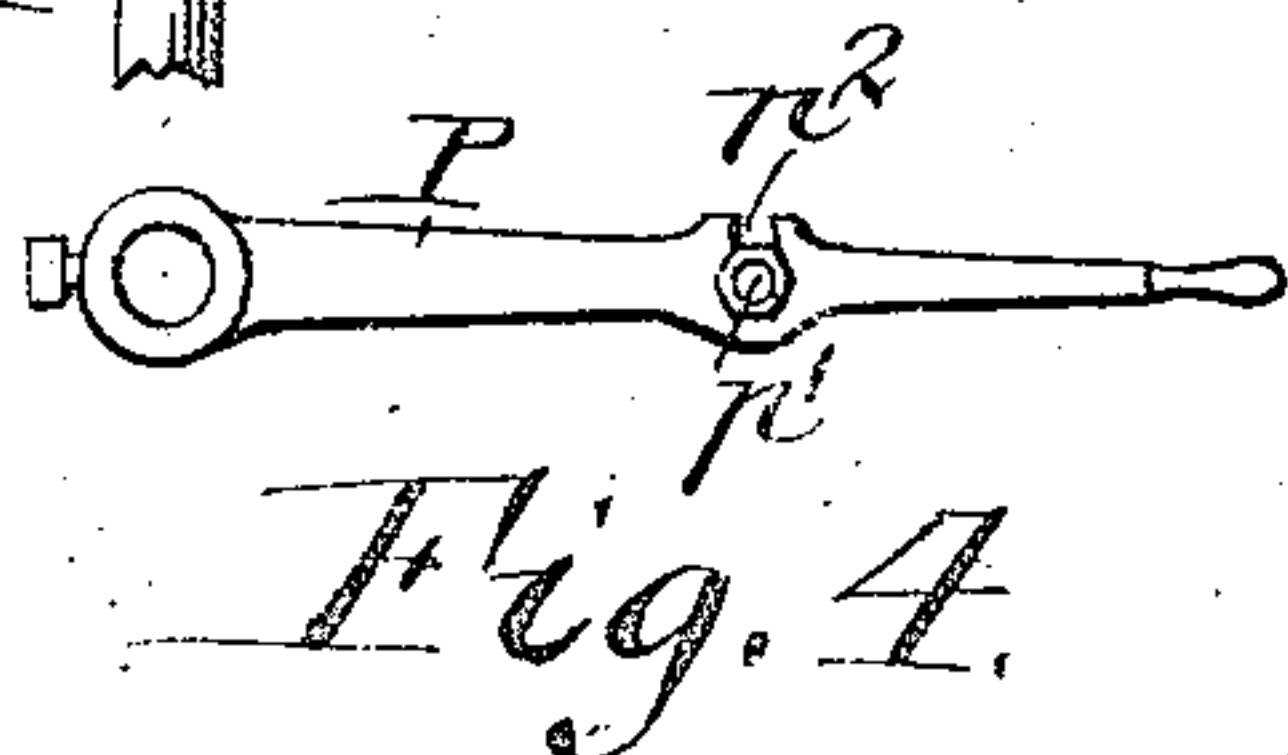
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3 SHEETS—SHEET 2.



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John H. Shoemaker



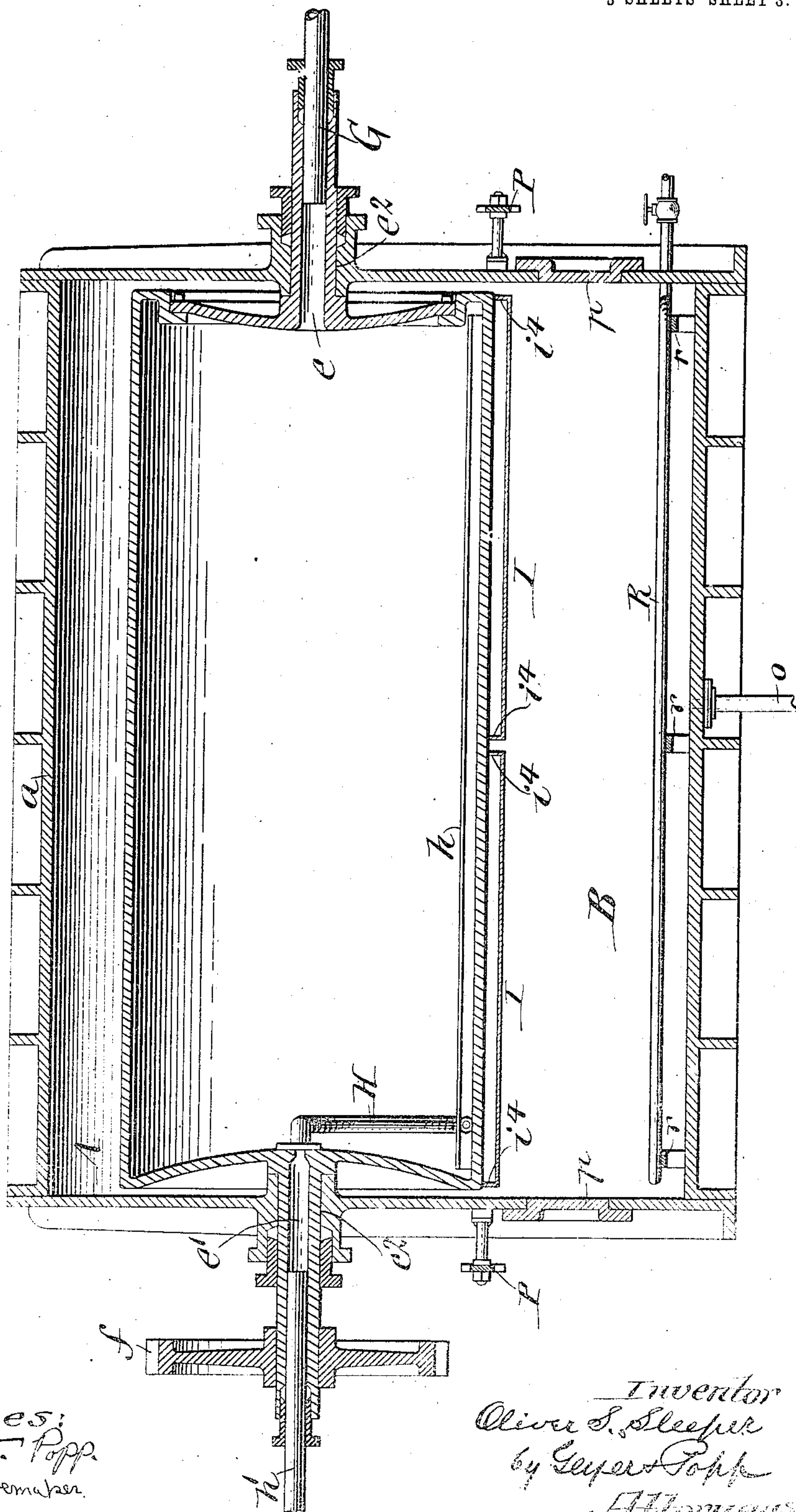
Inventor
Oliver S. Sleeper
by Geyer & Papp
Attorneys

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John H. Shoemaker.

Inventor
Oliver S. Sleeper
by Geper Popp
Attorneys

UNITED STATES PATENT OFFICE.

OLIVER S. SLEEPER, OF BUFFALO, NEW YORK, ASSIGNOR TO BUFFALO FOUNDRY AND MACHINE COMPANY, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

DRYING APPARATUS.

993,892.

Specification of Letters Patent.

Patented May 30, 1911.

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To all whom it may concern:

Be it known that I, OLIVER S. SLEEPER, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Drying Apparatus, of which the following is a specification.

This invention relates more particularly to that class of driers in which the material under treatment is dried under *vacuo* although the same is also applicable to other forms of driers.

One form of machine for this purpose as heretofore constructed comprises an internally heated drying drum which rotates vertically in a drying chamber, a pan which supports the material to be dried in position to be picked up by the underside of the periphery of the drum, a supply pipe which supplies the liquid or material to be dried into the pan at the front side thereof, a receiving chamber for the dried material arranged on the front side of the drum, and a scraper whereby the dried material is removed from the periphery of the drum on the front side thereof and directed into the receiving chamber. This construction is objectionable inasmuch as the supply pipe and scraper are so close together that the space between the same is liable to become clogged with dried material and is difficult to clean. One of the objects of this invention is to so construct and arrange the supply pan and the supply pipe that the above mentioned clogging is avoided and cleaning of the machine is facilitated and at the same time the liquid is maintained at a lower temperature and prevented from frothing or foaming while being deposited on the drying drum.

Another object of my invention is to prevent the dried material from accumulating on the scraper adjusting devices and clogging the machine.

In the accompanying drawings consisting of 3 sheets: Figure 1 is a vertical cross section of my improved drying apparatus. Fig. 2 is a fragmentary horizontal section in line 2—2, Fig. 1. Fig. 3 is a horizontal longitudinal section in line 3—3, Fig. 1. Fig. 4 is a detached side elevation of one of the levers or handles for shifting a liquid supplying pan within the drying chamber. Fig. 5 is a vertical longitudinal section in line 5—5, Fig. 1.

Similar letters of reference indicate cor-

responding parts throughout the several views.

A represents a vacuum or drying chamber having a semi-cylindrical top *a* and provided in its lower rear part with a liquid basin or reservoir B, and in its lower front part with a delivery spout D which is separated from the basin or reservoir by an upright partition *d*. The vapors are drawn through an outlet *a*¹ in the top of the drying chamber by means of a vacuum pump or other suitable exhausting device to produce a vacuum in the drying chamber and facilitate the drying of the liquid stock.

Horizontally and lengthwise within the drying chamber is a single vertically rotatable cylindrical heating or drying drum E which is provided with hollow trunnions *e*, *e*¹ at its opposite ends turning in bearings *e*² on the end walls of the drying chamber, thereby pivotally supporting the drum in the drying chamber.

The drying drum is turned, so that its underside moves from the front to the rear part of the drying chamber, as indicated by the arrow in Fig. 1. A gear wheel *f* secured to the trunnion *e*¹ serves as part of the means for driving the heating drum although any suitable means may be employed for this purpose.

The heating of the drying drum is preferably effected by conducting steam by means of a supply pipe G into the hollow trunnion *e* and the water of condensation is removed from the drum by a scoop *h* arranged adjacent to the bottom bore of the heating drum and connected by a pipe H with the other trunnion *e*¹ which latter joins a stationary outlet pipe *h*¹ for the water of condensation.

Underneath the periphery of the drum and above the liquid basin are arranged the means whereby the liquid to be dried is supplied to the periphery of the drum. The means for this purpose shown in the drawings comprise two pans or pan sections I, I which are arranged end to end lengthwise of the drying chamber and drum and each of which is provided with a bottom having a front part *i* which is arranged below the front part of the drum and curved concentrically therewith and a rear part *i*¹ which is arranged tangentially below the rear part of the drum, a front longitudinal flange *i*² rising from the front edge of the bottom into engagement with the periphery of the dry-

ing drum, a rear longitudinal flange i^3 rising from the rear edge of the bottom at a distance from the periphery of the drying drum, and two curved end flanges i^4 arranged at opposite transverse edges of the bottom and engaging with their front parts against the periphery of the drying drum. Each of these pans is adapted to contain a bath of the liquid which is to be dried and into which the lower part of the periphery of the drying drum is immersed, so that a film of said liquid is lifted continuously from said bath during the rotation of the drum. The means for supplying the liquid to the pans comprises two horizontal delivery pipes or pipe sections K, K which are arranged axially in line lengthwise of the drying chamber and each of which extends lengthwise through the space within one of the pans adjacent to the rear edge thereof and projects with its inner and outer ends through the adjacent parts of the end flanges of the respective pan. At suitable distances apart the pan is preferably connected with the supply pipe by brackets L. At its inner end each supply pipe is journaled in a bearing l^1 formed on a bracket L projecting forwardly from the rear wall of the drying chamber while the outer end thereof is journaled in a stuffing box M on the adjacent end wall of the drying chamber.

The liquid to be dried is supplied to each delivery pipe by means of a supply pipe N having a valve n and connected by a rotatable coupling or joint n^1 with the outer end of the respective delivery pipe. On its front side each delivery pipe is provided with a plurality of delivery openings m which are preferably arranged in a longitudinal row. The liquid escapes through the openings in the pipes K and fills the pans forming a bath in the latter through which the periphery of the drum sweeps continuously. The amount of liquid thus delivered into the pans is greater than the amount which adheres to the drum, so that the pans always remain full and present a bath of uniform depth to the drum while the surplus escapes from the pans at the rear ends thereof and drops into the basin of the drying chamber below the rear part of the drum. From this basin the liquid is again withdrawn through a return pipe o connected with the bottom of the basin and delivered into the pipes N, so that the liquid is again returned into the pans, thereby constantly circulating the undried liquid. The liquid may be thus transferred from the basin to the pans by a pump of any suitable construction.

As the liquid or wet material to be dried is carried upwardly on the rear side and downwardly on the front side of the drum the heat within the latter causes this material to dry on the periphery of the drum. Just before the rearwardly moving under-

side of the drum reaches the liquid supply devices the dried material is removed from the periphery of the drum and discharged into the spout, chute or conduit D by means of a scraper S which is pivoted on the upper end of the partition d in front of the liquid supplying devices and yieldingly held with its upper free edge in engagement with the periphery of the drum by a plurality of adjusting devices each of which comprises a shifting rod s extending transversely across the spout D and through the front wall of the drying chamber and pivotally connected at its rear end with the scraper, an adjusting yoke T having a screw connection with a bracket t on the outer side of the drying chamber, and a spring t^1 interposed between said yoke and a shoulder on the shifting rod.

As the streams of liquid issue from the delivery openings in the pipes K the same are directed forwardly into the space between the pans and the underside of the drum and opposite to the direction of rotation of the lower part of the drum which is receiving a new film of the liquid to be dried. The liquid streams in their forward movement strike the front flanges of the pans which latter again deflect the streams toward the rear flanges thereof. By this means the liquid is retained in the pans for a longer period than would otherwise be the case, thereby avoiding frothing or foaming of the liquid in the pans and causing the same to be presented in the form of a dense bath to the drum whereby it is possible for a thicker film of liquid to adhere to the drum and thus increase the capacity of the machine accordingly. Furthermore, by delivering the liquid into the pans opposite to the direction of movement of the adjacent part of the drum, the liquid may be kept colder and thus facilitate its adhesion to the drum, this being particularly desirable for very thin liquids containing a comparatively small amount of solid matter which is to be recovered by this machine.

When it is desired to clean the pans the front ends thereof are swung downwardly and rearwardly away from the underside of the drum by turning the supply pipes K in the proper direction, these pipes at this time operating as shafts for this purpose, thereby rendering all parts of the pans accessible to the operator for thoroughly cleaning the same. Entrance into the drying chamber for thus cleaning the pans and other parts within the drying chamber is effected through one or more openings or manholes which are preferably formed in the end walls of the drying chamber below the drum and which are normally closed by covers p .

The pans are moved into their operative or into their cleaning positions by means of hand levers P each of which is secured to the outer end of one of the supply pipes K and

is held against movement together with the respective pan when in its operative position by means of a clamping bolt p^1 arranged on the exterior of the drying chamber and receiving a slot p^2 in said lever, as shown in Figs. 3 and 4. By thus pivoting the pans and also delivering the liquid into the same at their rear ends the liability of clogging the space between liquid supplying devices and scraper is avoided, thereby permitting the machine to run without interruption from this cause.

When it is desired to use only part of the drier, as is the case when drying a small batch of material, only one of the supply pans need be employed during which time the other pan may be turned downwardly into an inoperative position.

In order to keep the liquid in the basin cool a refrigerating medium such as water is conducted through a coil of pipes R which are arranged in the basin and which are supported on benches or racks r , as shown in Figs. 1 and 6.

The dried material which is removed from the periphery of the drum is conducted by the spout into a receiving chamber U the upper end of which communicates with the lower end of said spout.

In the absence of any provision to prevent it the dried material which is removed from the drum in the form of large pieces or sheets is liable to lodge on the shifting rods s of the scraper adjusting devices and sometimes clog the delivery spout. To prevent this, means are provided whereby the material tending to lodge on the scraper shifting rod is disintegrated and caused to drop through the spout into the receiving chamber. The preferred means for this purpose which are shown in the drawings comprise a horizontal beater shaft V which is arranged lengthwise above the spout and the scraper shifting rods adjacent to the scraper and drum and journaled at its opposite ends in bearings or stuffing boxes in the end walls of the drying chamber and a plurality of beaters, fingers or pins w projecting laterally from the beater shaft into the spaces between the scraper shifting rods. Upon turning the beater shaft by means of a driving belt passing around a pulley w^1 at one end thereof, or by other means, the dried material which is removed from the drum in the form of large films, flakes, sheets or pieces is pulverized or broken up into small pieces, so that it has no tendency to lodge on any shelf, shoulder or obstruction in its path, thereby avoiding clogging of the machine.

When the receiving chamber has become filled to the desired extent with the dried material the machine is stopped and the dried material is removed through the opening at one or both ends of the receiving

chamber which openings are normally closed by doors W .

The space between the front of the drum and the drying chamber above the scraper and disintegrator is preferably partly obstructed by an inclined dust guard w which is mounted on the drying chamber and thus prevents any of the dried material in the form of powder or dust from being carried out of the receiving chamber to the vapor outlet and lost.

Owing to the accessibility of all parts of this drying apparatus the same can be thoroughly cleaned, so that it is absolutely sanitary, thereby rendering the same especially adapted for drying food products although it is equally well adapted for drying other materials in the form of liquids, solutions or emulsions, or materials in suspension such as lead, dyes, colors and paints, &c.

I claim as my invention:

1. A drying apparatus comprising a drying chamber, a vertically rotating drum arranged in said chamber, a scraper engaging with the drum, and a liquid supply pan independent of said chamber arranged below the drum and having a bottom, a front flange, a rear flange, and two end flanges, said front and end flanges engaging the periphery of said drum while said rear flange is out of engagement therefrom.

2. A drying apparatus comprising a drying chamber, a vertically rotating drum arranged in said chamber, a scraper engaging with the drum, a liquid supply pan independent of said chamber arranged below the drum and having a flange at one longitudinal edge which engages the periphery of the drum, and a supply pipe arranged adjacent to the opposite longitudinal edge of the pan and having outlet openings on the side facing said flange.

3. A drying apparatus comprising a drying chamber, a drum arranged within the chamber and rotating, so that its underside moves from the front to the rear side of said chamber, a scraper engaging with the periphery of the drum on the lower front side thereof, a liquid supply pan arranged below the lower rear part of said drum and having an upright flange at its front edge which engages with the periphery of the drum, and a longitudinal supply pipe arranged at the rear edge of the pan and having outlet openings on its front side which direct the streams of liquid toward said front flange.

4. A drying apparatus comprising a drying chamber, a drum arranged within the chamber and rotating so that its underside moves from the front to the rear side of said chamber, a scraper engaging with the periphery of the drum on the lower front side thereof, a liquid supply pan arranged below the lower rear part of said drum and

having an upright flange at its front edge which engages with the periphery of the drum, and a longitudinal supply pipe arranged at the rear edge of the pan and having outlet openings on its front side which direct the streams of liquid toward said front flange, said pan being pivoted to swing about the axis of said pipe.

5. A drying apparatus comprising a drying chamber, a drum arranged within the chamber and rotating so that its underside moves from the front to the rear side of said chamber, a scraper engaging with the periphery of the drum on the lower front side thereof, a liquid supply pan arranged below the lower rear part of said drum and having an upright flange at its front edge which engages with the periphery of the drum, a longitudinal supply pipe connected with the rear part of said pan and provided with openings on its front side through which the liquid to be dried is directed toward said front flange, and bearings in which said pipe is journaled.

6. A drying apparatus comprising a drying chamber, a drum arranged within the chamber and rotating so that its underside moves from the front to the rear side of said chamber, a scraper engaging with the periphery of the drum on the lower front side thereof, a liquid supply pan arranged below the lower rear part of said drum and having an upright flange at its front edge which engages with the periphery of the drum, a longitudinal supply pipe connected with the rear part of said pan and provided with openings on its front side through which the liquid to be dried is directed toward said front flange, bearings in which said pipe is journaled, a shifting lever connected with said pipe externally of the drying chamber, and a fastening device for holding said lever in its normal position.

7. A drying apparatus comprising a drying chamber, a drum rotating vertically in said chamber, a scraper engaging with said

drum, two liquid supply pans arranged end to end below the drum and adapted to support the liquid to be dried in position to be engaged by the periphery of the drum, and means for moving said pans independently toward and from the drum.

8. A drying apparatus comprising a drying chamber having a delivery spout, a drum rotating vertically in said chamber, a scraper adapted to remove the dried material from said drum and direct the same into the spout, and means for disintegrating the material removed from the drum arranged adjacent to the latter.

9. A drying apparatus comprising a drying chamber having a delivery spout, a drum rotating vertically in said chamber, a scraper adapted to remove the dried material from said drum and direct the same into the spout, and means for disintegrating the material removed from the drum comprising a shaft arranged adjacent to the scraper and provided with laterally projecting beaters.

10. A drying apparatus comprising a drying chamber having a delivery spout, a drum rotating vertically in said chamber, a scraper adapted to remove the dried material from said drum and direct the same into the spout, means for adjusting said scraper comprising shifting rods extending over said spout, and means for disintegrating the dried material which is removed from the drum by said scraper comprising a horizontal shaft arranged lengthwise above said spout and adjusting rods and adjacent to said scraper and drum, and a plurality of beaters projecting laterally from said shaft into the spaces between said shifting rods.

Witness my hand this 18th day of August, 1909.

OLIVER S. SLEEPER.

Witnesses:

THEO. L. POPP,
E. M. GRAHAM.