O. S. SLEEPER.

METHOD OF DRYING LIQUIDS.

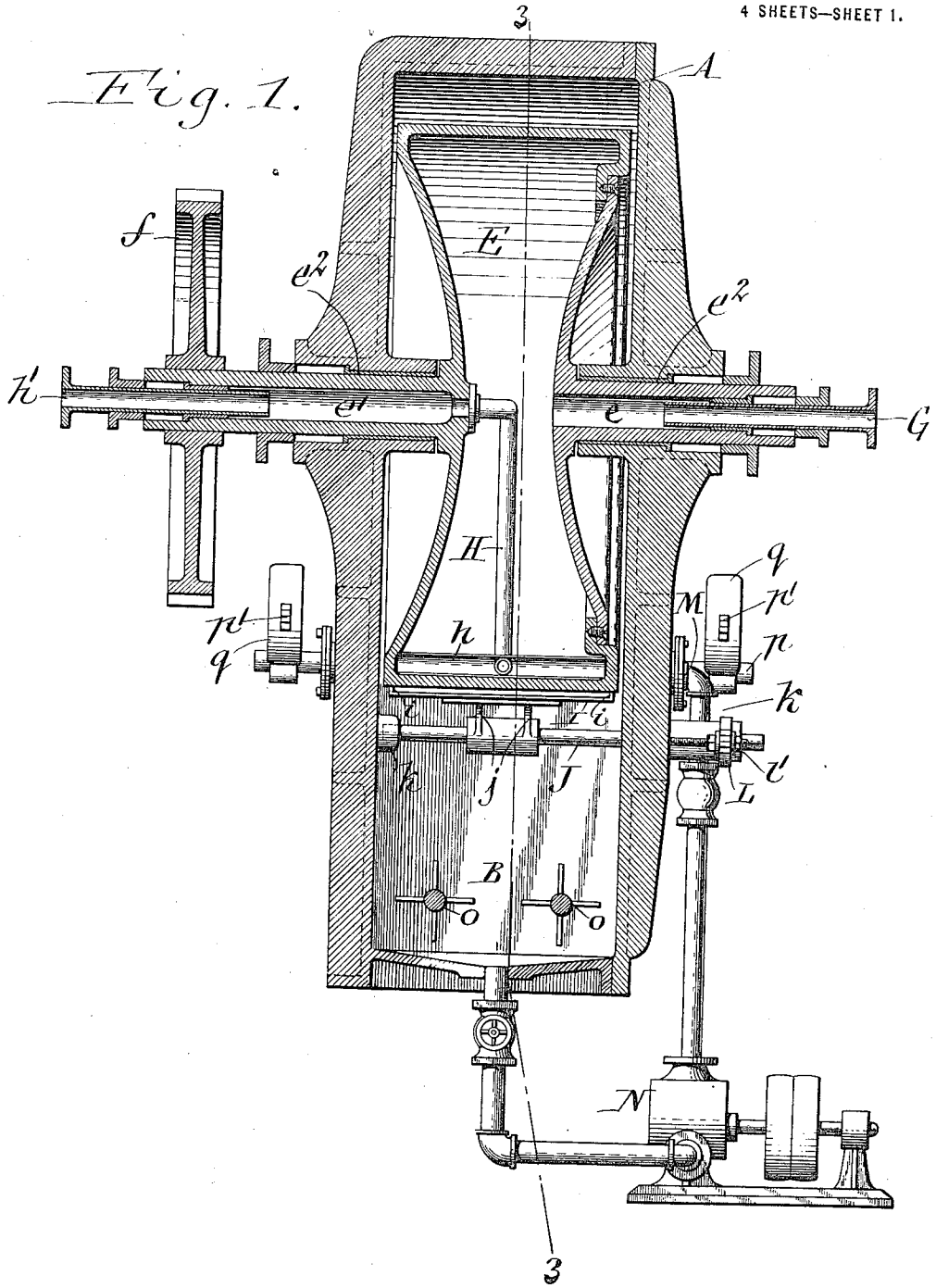
APPLICATION FILED DEC. 1, 1908.

1,146,965.

Patented July 20, 1915.

4 SHEETS—SHEET 1.

Fig. 1.




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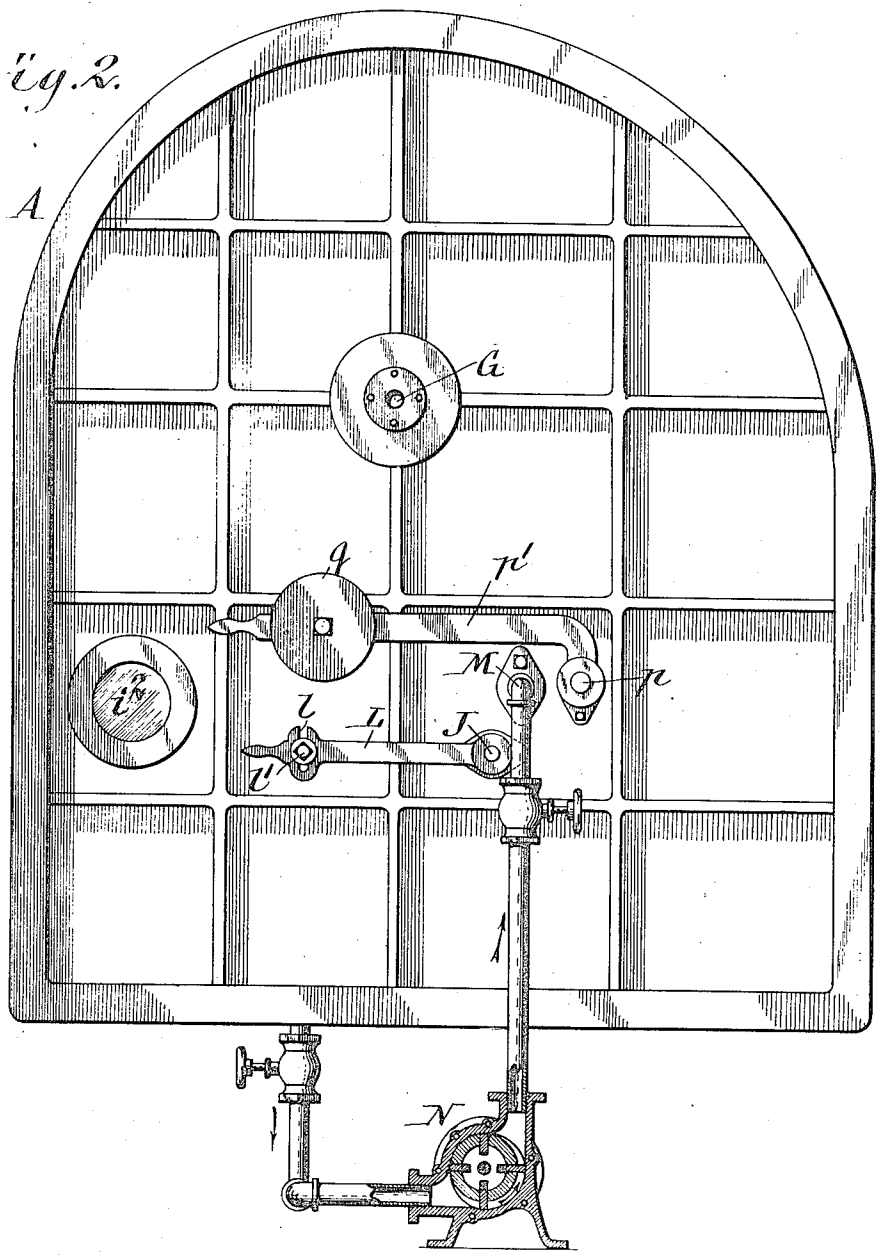
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4 SHEETS—SHEET 2.

Fig. 2.




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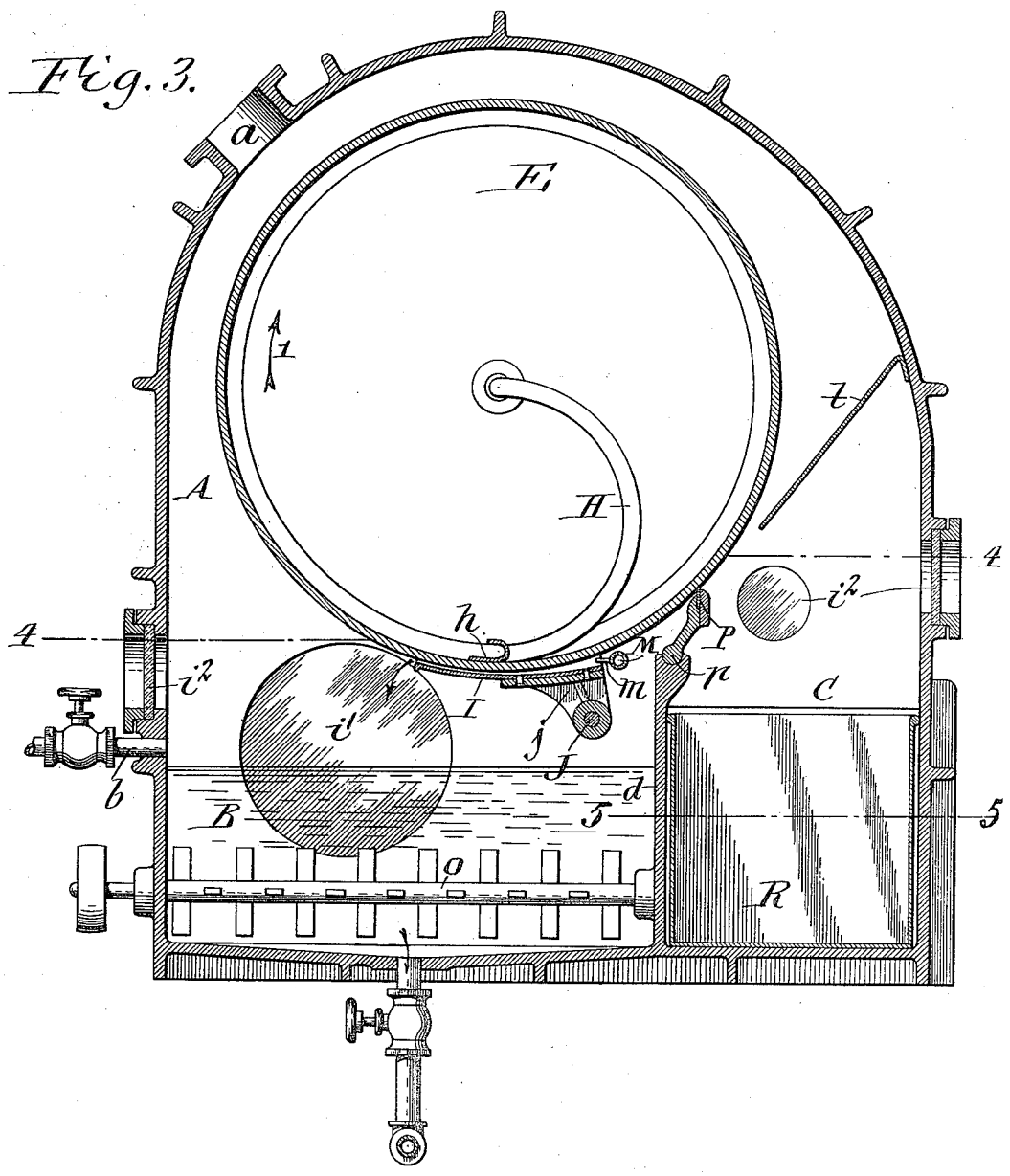
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Patented July 20, 1915.

4 SHEETS—SHEET 3.

Fig. 3.




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**1,146,965.**

Patented July 20, 1915.

4 SHEETS—SHEET 4.

Fig. 4.

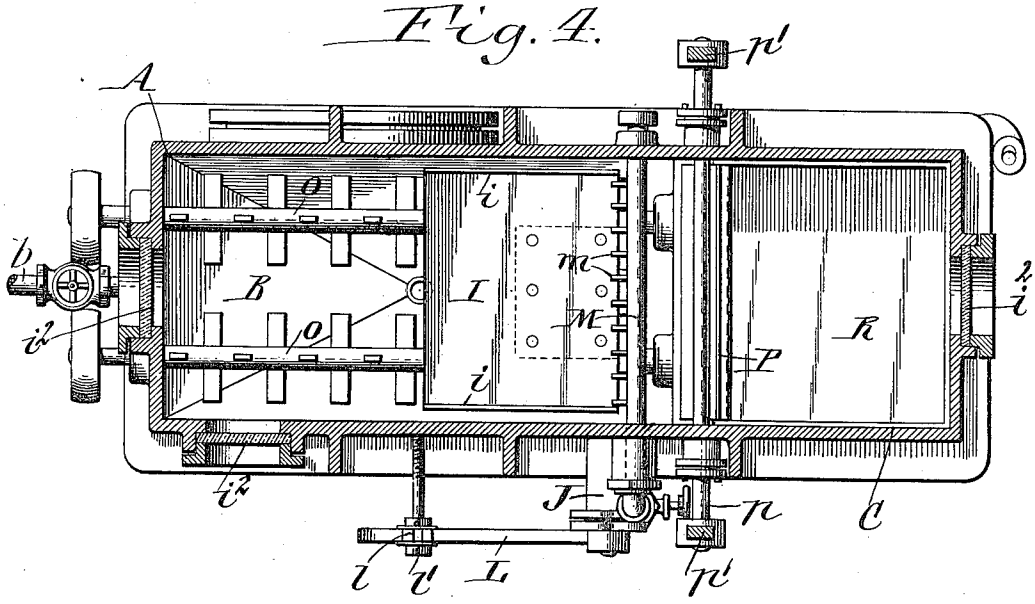
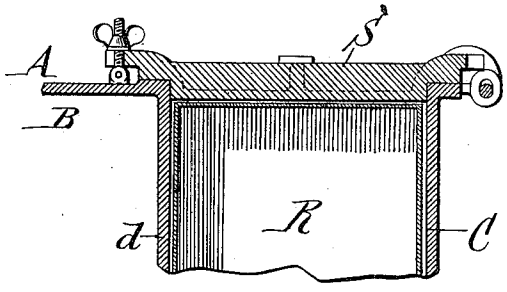



Fig. 5.




Witnesses:-
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# 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.

## METHOD OF DRYING LIQUIDS.

1,146,965. Specification of Letters Patent. Patented July 20, 1915.

Application filed December 1, 1908. Serial No. 465,519.

*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 Methods of Drying Liquids, of which the following is a specification.

This invention relates to a method of drying *in vacuo*, any liquids containing solids, emulsions, or pulps, such as dyewood extracts, white lead, glues, milk, acids, chemicals and so forth, and has the object to enable liquids to be dried more thoroughly, expeditiously and economically than has been possible by the methods and apparatus heretofore employed for this purpose.

In the accompanying drawings consisting of 4 sheets: Figure 1 is a vertical longitudinal section of a vacuum drying apparatus for practicing my improved method and embodying my improved construction. Fig. 2 is an end elevation thereof partly in section. Fig. 3 is a vertical cross section in line 3—3, Fig. 1. Figs. 4 and 5 are horizontal sections in lines 4—4 and 5—5, Fig. 3, respectively.

Similar letters of reference indicate corresponding parts throughout the several views.

In practising my improved method of drying liquids the liquid to be dried is presented in the form of a shallow stream to a heated member which is movable *in vacuo* so that a thin film of the liquid is picked up by said member. The material which dries on the heated member is removed therefrom preparatory to applying a fresh coat of undried liquid on the heated member. The liquid to be dried is supplied to the stream in excess of the amount which is capable of adhering to the heated member and the surplus escapes from the tail of the stream. This surplus is caught at the tail of the stream and again fed to the same at the head thereof so that a constant circulation takes place of the liquid to be dried.

By this means the stream is always of a uinform depth to properly coat the heated member,—thereby insuring uniformity in the product.

Although my invention may be practised by means of an apparatus of different constructions that shown in the drawings is suitable for the purpose and is constructed as follows: A represents the vacuum or drying chamber which has a semi-cylindrical top while its lower part is constructed to form a liquid supply basin or reservoir B and a product receiving chamber C, said liquid basin and receiving chamber being arranged side by side and separated by an intervening upright wall or partition *d*, as shown in Figs. 3, 4 and 5. At the top of the drying chamber the same is provided with a vapor outlet *a* which is connected with a vacuum pump or other exhausting device for withdrawing the vapors from the interior of the drying chamber and facilitating the drying of the liquid stock under treatment.

Lengthwise within the vacuum chamber is arranged a hollow cylindrical heating or drying drum E which is rotatable in the direction of the arrow 1 in Fig. 3 and which is journaled by means of hollow trunnions *e*, $e^1$ arranged on opposite ends or heads of the drum and turning in bearings $e^2$ in the adjacent walls of the vacuum chamber. The rotation of the drum may be effected by a driving mechanism comprising a gear wheel *f* secured to the trunnion $e^1$, as shown in Fig. 1, but any other suitable means may be employed for this purpose.

The drying drum is preferably heated by steam which is conducted into the same by means of a stationary supply pipe G entering one of the hollow trunnions. The water of condensation is discharged from the drum by a scoop *h* arranged lengthwise adjacent to the bore thereof and connected with the other hollow trunnion by a backwardly curved pipe H connecting the channel of the scoop with the inner end of the respective hollow trunnion. Into the outer end of the latter a stationary delivery pipe $h^1$ projects which serves to carry away the water of condensation.

The liquid to be dried may be introduced into the reservoir in any suitable way for instance by a supply pipe *b*, as shown in Figs. 3 and 4.

Adjacent to the lowermost part of the periphery of the drying drum and above the liquid basin is arranged a feed pan whereby a shallow stream of the liquid to be dried is supported so that the underside of the drum dips into the same. This pan comprises a curved bottom I and two curved flanges or ribs *i* arranged transversely at opposite transverse edges of the bottom. In

the normal position of the pan the bottom thereof is arranged concentric relatively to the drum and its longitudinal front and rear edges are elevated above the intermediate part while the flanges *i* bear against the periphery of the drum, thereby forming a shallow channel or passage between the drum and pan through which the stream of liquid flows from the front longitudinal edge to the rear longitudinal edge of the pan. The liquid is prevented from escaping at the transverse edges of the pan bottom by the flanges *i*, thereby avoiding the deposit of any liquid on the ends of the drum where its removal when subsequently dried would be difficult and also prevent the machine from being cleaned easily. Access may be had to the interior of the drying chamber through a man hole in a wall of the drying chamber which is normally closed by a cover $i^1$ and the operation of the parts may be observed from the exterior by means of windows $i^2$ which are suitably arranged in the walls of the drying chamber for that purpose. The pan is capable of being moved toward and from the drum so as to permit of exposing its upper side for inspection and cleaning. For this purpose the same is mounted at its front longitudinal edge by means of an arm *j* on a horizontal rock shaft J which is journaled lengthwise below the pan in bearings *k* on the adjacent end walls of the vacuum chamber. The pan is moved into and out of its operative position by means of a handle L secured to one end of the shaft J outside of the drying chamber and held in place when the pan is in its operative position by means of a notch *l* on the handle which receives a clamping screw $l^1$ on the outer side of the drying chamber, as shown in Figs. 2 and 4.

The liquid to be dried is delivered into the pan at the head edge thereof by a horizontal longitudinal delivery pipe M arranged adjacent to this edge of the pan and provided with one or more delivery nozzles *m* which project laterally over the head edge of the pan bottom. The delivery pipe is supported on the end walls of the drying chamber and preferably receives its supply from the basin or reservoir in the lower part of the drying chamber. The liquid may be carried from the reservoir to the delivery pipe by any suitable means but preferably by a rotary force pump N which has its inlet connected with the reservoir while its outlet is connected with the delivery pipe M. This pump should be placed a sufficient distance below the reservoir so that the liquid in the latter will flow by gravity into the pump and thus enable the same to carry the liquid to the delivery pipe which it otherwise could not do owing to the counteracting effect of the vapor exhausting device which is connected with the drying chamber.

During the operation of the drier the pump N is operated so that the quantity of liquid which is withdrawn from the reservoir by the pump and delivered by the nozzles to the feed pan maintains a constant stream over said pan from the head to the tail thereof which completely fills the space between the bottom of the pan and the periphery of the drum. This stream is in excess of the amount of liquid capable of adhering to the periphery of the drum as the latter sweeps through the same so that the drum always dips into the liquid a uniform extent and the surplus escapes from the tail of the pan and drops into the reservoir below the same to be again put in circulation by the pump. By this means a uniform coat of liquid is obtained on the drum at all times which results in a product of uniform quality.

In order to prevent the solid particles in the liquid from settling in the reservoir the latter is provided with one or more agitators or stirrers *o* which may be constructed and operated in any suitable manner. As the film of liquid is carried away from the pan, the same is dried on the drum owing to the heat of the steam therein and before the dried material reaches the pan the same is scraped from the periphery of the drum by a scraper or blade P which engages the periphery of the drum in front of the liquid feeding devices. As shown in the drawings this scraper is mounted on a horizontal shaft *p* which is journaled lengthwise at the upper edge of the partition *d* and pressed constantly for holding the scraper yieldingly in engagement with the drum by one or more weight arms $p^1$ connected with the scraper shaft outside of the drying chamber and each provided with a weight *q*, as shown in Figs. 1, 2 and 4. The dried material which is removed from the drum by the scraper is directed by the same into the product receiving chamber C which latter preferably contains a box R for the reception of the dried material. This box is inserted in the receiving chamber and removed therefrom through an opening in one of the end walls of the drying chamber which opening is normally closed by a cover S.

The space in the drying chamber immediately above the receiving chamber is partly obstructed by a dust guard *t* which extends from the inner side of the drying chamber to within a short distance of the periphery of the drum and thus prevents the suction of the exhaust device from carrying the dust or fine particles of dried material out of the receiving chamber.

I claim as my invention:

The herein described method of drying liquids which consists in presenting the liquid to be dried in the form of a continuously flowing shallow stream to the underside of a heated circular drum which latter

moves constantly and presents new surfaces to said stream of liquid into which its successive parts dip and pick up a thin film of this liquid by adhesion, said liquid being supplied to said drum in excess of the picking up capacity of the drum and the excess liquid not picked up by the drum being delivered into a main body of liquid and returned continuously from said main body to said stream, and the liquid picked up by the drum being dried thereon and removed continuously from the surface thereof preparatory to receiving a new coat of liquid, and said stream and body of liquid and the dried material being constantly *in vacuo*.

Witness my hand this 30th day of November, 1908.

OLIVER S. SLEEPER.

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