O. S. SLEEPER.

APPARATUS FOR DRYING LIQUIDS.

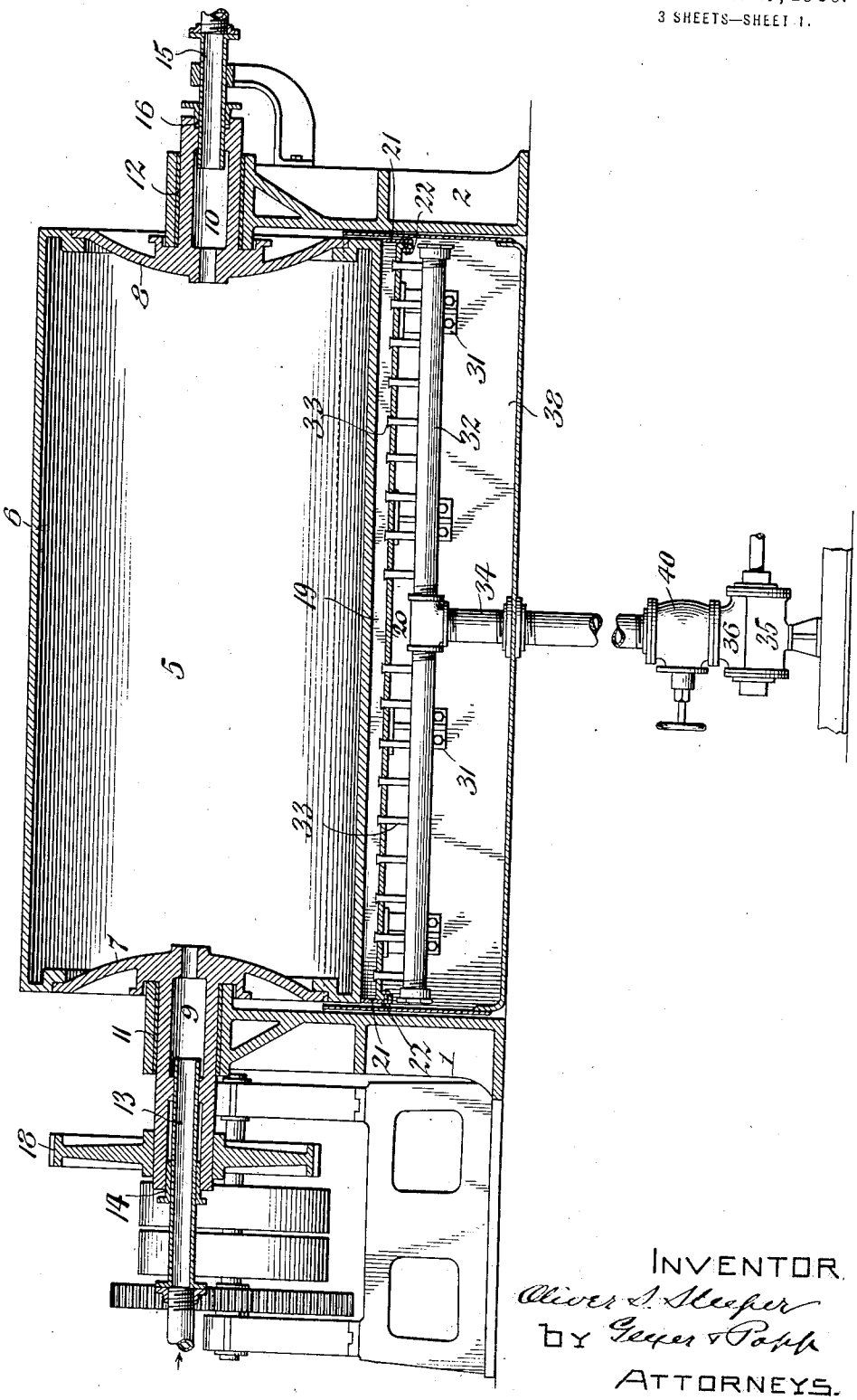
APPLICATION FILED APR. 25, 1916.

1,331,389.

Patented Feb. 17, 1920.

3 SHEETS—SHEET 1.

Fig. 1.



INVENTOR.

Oliver S. Sleeper

by Geyer & Popp

ATTORNEYS.

O. S. SLEEPER.

APPARATUS FOR DRYING LIQUIDS.

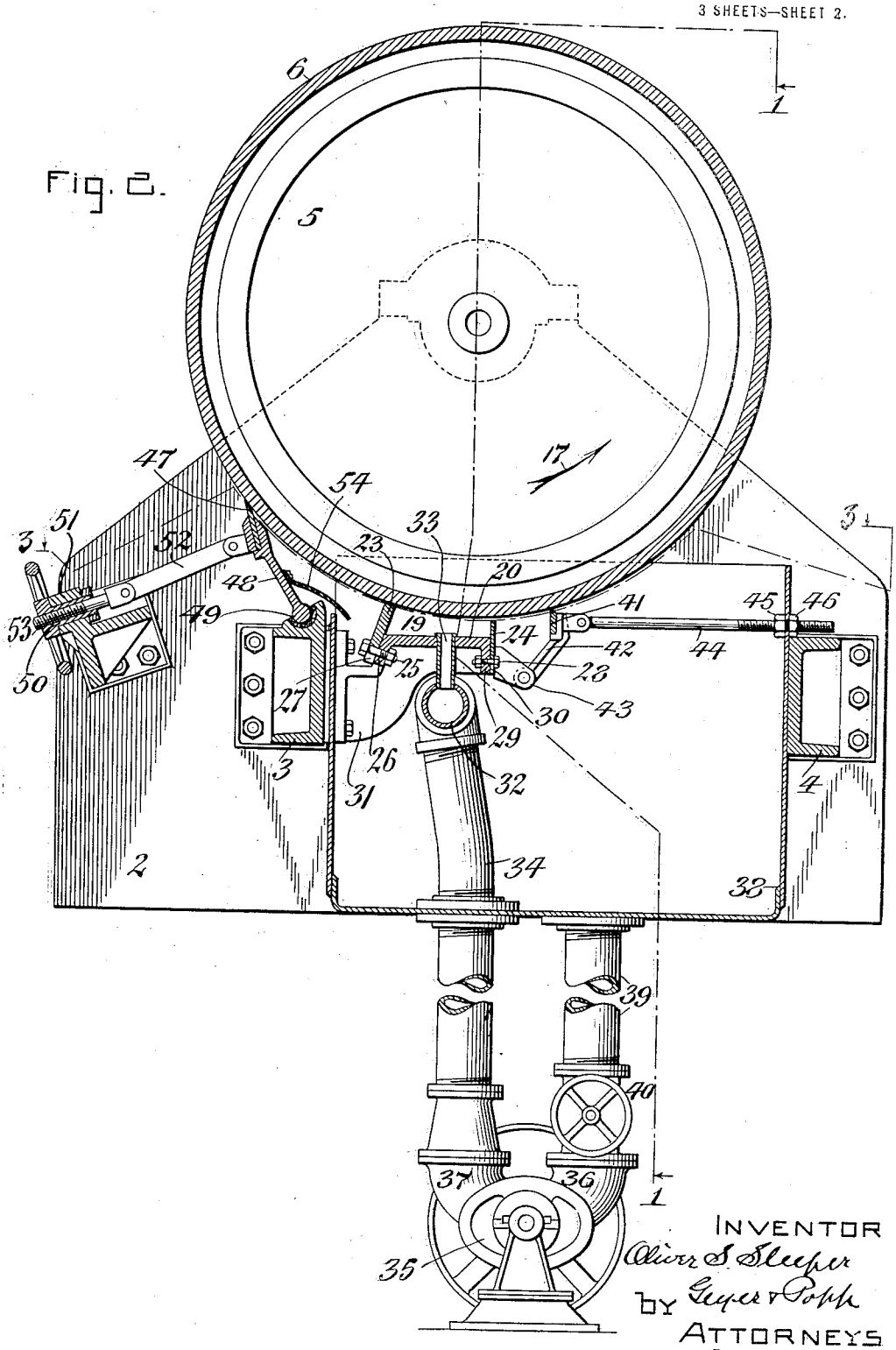
APPLICATION FILED APR. 25, 1916.

1,331,389.

Patented Feb. 17, 1920.

3 SHEETS—SHEET 2.

Fig. 2.



INVENTOR
Oliver S. Sleeper
BY Geyer & Popple
ATTORNEYS

O. S. SLEEPER.

APPARATUS FOR DRYING LIQUIDS.

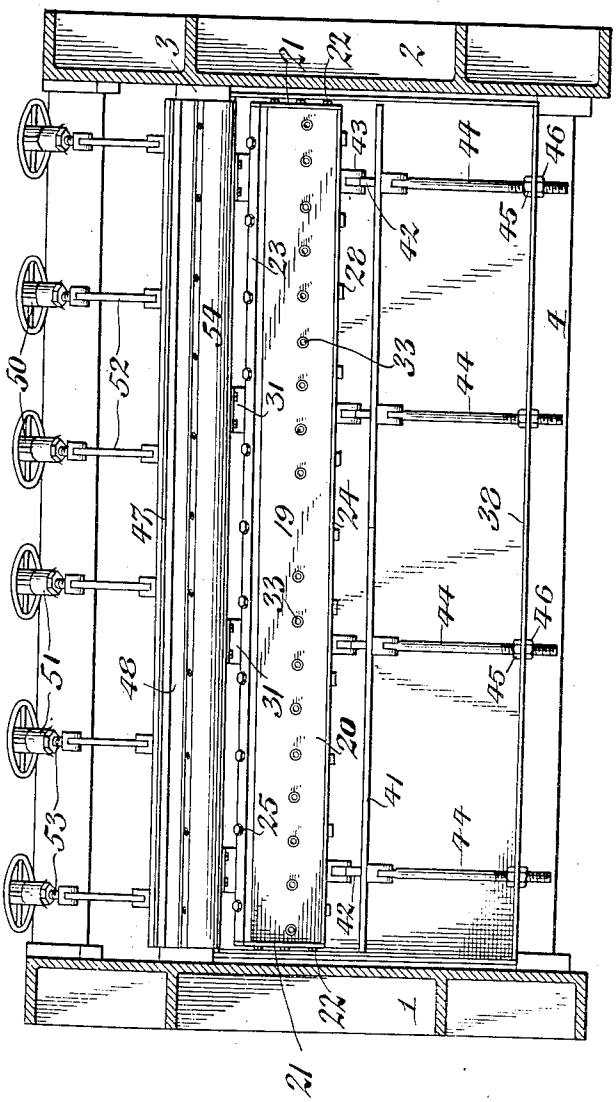
APPLICATION FILED APR. 25, 1916.

1,331,389.

Patented Feb. 17, 1920.

3 SHEETS—SHEET 3.

Fig. 3.



INVENTOR

Oliver S. Sleeper

BY Cooper & Dobbs

ATTORNEYS.

UNITED STATES PATENT OFFICE.

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

APPARATUS FOR DRYING LIQUIDS.

1,331,389. Specification of Letters Patent. **Patented Feb. 17, 1920.**

Application filed April 25, 1916. Serial No. 93,532.

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 new and useful Improvements in Apparatus for Drying Liquids, of which the following is a specification.

This invention relates to an apparatus for desiccating or drying liquids and more particularly to an apparatus whereby the drying is effected under atmospheric pressure.

The object of this invention is to provide an apparatus for this purpose whereby the drying or desiccation of liquids may be effected uniformly and expeditiously and with a minimum expenditure of time, power, labor and heat.

In the accompanying drawings:

Figure 1 is a vertical longitudinal section, on a reduced scale, of an apparatus which is constructed in accordance with my invention for producing drying or desiccating of liquids in accordance with my invention, the section being taken on line 1, 1, Fig. 2. Fig. 2 is a vertical transverse section of the apparatus, on an enlarged scale. Fig. 3 is a horizontal section, on a reduced scale, taken on line 3—3, Fig. 2.

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

The main frame of the apparatus for practising my invention may be variously constructed but as shown in the drawings the same preferably comprises two upright standards 1, 2 arranged transversely at opposite ends of the machine and two longitudinal bars or sills 3, 4 arranged horizontally and parallel between the end standards and connected at their opposite ends with the latter.

5 represents a drying or heating drum which is arranged to rotate about a horizontal axis between the end standards and longitudinal sills of the frame and which is adapted to be internally heated and to receive the material to be dried on its exterior. In its preferred form this drum comprises a cylindrical body 6, and two heads 7, 8 arranged at opposite ends of the body and provided with outwardly projecting horizontal trunnions 9, 10 which are journaled in bearings 11, 12 at the upper ends of the standards so that the drum is capable of rotating about a horizontal axis. Although the interior of this drum may be heated in any suitable manner this is preferably effected by constructing the trunnions in the form of hollow tubes and conducting steam into the trunnion 9 by means of a stationary pipe 13 projecting through a stuffing box 14 in this trunnion while the water of condensation is carried off from the interior of this drum by means of a stationary discharge pipe 15 which projects through a stuffing box 16 arranged in the other hollow trunnion 10, as best shown in Fig. 1. The drum may be turned in the direction of the arrow 17 in Fig. 2, by any suitable means those shown in the drawings being satisfactory and comprising a gear wheel 18 secured to the trunnion at the left end of the drum and receiving power from any available source which is transmitted thereto by any suitable means.

The liquid to be dried or desiccated is preferably applied to the underside of the drum in the form of a thin film and as the latter is carried away from the point of application over the top of the drum the same is deprived of its moisture and before this dried film reaches the place where the same was deposited on the drum it is scraped from the periphery of the latter so as to leave the surface of the drum free to receive a new deposit of liquid, this operation being repeated continuously while the machine is running normally.

The means whereby the liquid to be dried is deposited on this side of the drum is preferably constructed as follows:

19 represents a liquid feeding or delivering pan which is arranged underneath the drying drum in such position that the lowermost part of this drum dips into the liquid supplied by this pan and picks up a thin film of the same during its movement over the top of the pan. In its preferred form this pan comprises a fixed bottom 20 which is arranged a suitable distance from the underside of the drum, two transverse end walls 21 which are secured to opposite ends of the bottom by means of bolts 22 and pro-

jecting upwardly into engagement with the end portions of the peripheral surface of the drum, a rear longitudinal wall 23 projecting upwardly from the rear longitudinal edge of the bottom into engagement with the underside of the drum, and a front wall or gate 24 mounted on the front longitudinal edge of the bottom and projecting upwardly therefrom toward the periphery of the drying drum but separated therefrom by a narrow outlet slit throat or passageway. The rear wall is adjustably mounted on the rear edge of the bottom so that the same may be fitted tightly with its upper edge against the periphery of the drum, this being preferably effected by means of bolts 25 arranged in a depending flange 26 on the edge of the bottom and passing through vertical slots 27 arranged in the lower edge of the rear pan wall, as shown in Figs. 2 and 3. This rear wall is preferably arranged radially with reference to the axis of the drum so that the same is not liable to produce a cramping action on the drum upon turning the latter either forwardly or backwardly while assembling the machine or while the machine is in operation or being cleaned. The gate or front wall of the pan is also arranged substantially radially with reference to the axis of the drum and the same is mounted on the bottom of the pan so as to be capable of adjustment toward and from the periphery of the drum for varying the area of the outlet throat of the pan in accordance with the character of the material which is being dried or desiccated. This adjustment, as shown in Figs. 2 and 3, is preferably accomplished by means of clamping bolts 28 arranged in a depending flange 29 on the front edge of the pan bottom and vertical slots 30 in the lower edge portion of the gate.

The pan is supported rigidly underneath the drying drum by means of brackets 31 which are secured to the inner side of the rear longitudinal sill 3 and connected with the pan bottom on its underside at suitable intervals, four brackets being shown for this purpose in the drawings although the number may be varied according to the size of the machine.

The liquid to be dried may be introduced into the pan in a variety of ways but preferably by means which comprise a horizontal manifold 32 arranged lengthwise underneath the bottom of the pan and provided with a plurality of upright tubes or nipples 33 extending from the top of the manifold through the bottom of the feed pan, so that the interior of the manifold is connected with the interior of the pan and liquid may be supplied by this manifold to the pan. This manifold is provided with a supply pipe 34 which preferably extends from the central part of the manifold downwardly therefrom and connects with the means whereby the liquid is supplied from any suitable source. In the preferred method of supplying this liquid the same is introduced into the pan under pressure so that the liquid in the pan is pressed against the underside of the drying drum as the latter passes over the top of the pan, thereby causing the periphery of the heating drum to pick up a film of liquid which is thicker or contains more solid matter than that which would be picked up if the drum merely dipped into the liquid in the pan while the liquid is not under pressure. This pressing effect on the liquid is preferably accomplished by delivering the liquid into the pan by means of a pump 35 which has its inlet 36 connected with the source of the supply and its outlet 37 connected with the lower end of the pipe 34 leading to the manifold of the pan. The liquid which is supplied to the pan is in excess of the quantity which the periphery of the drum is capable of picking up in the form of a film, the excess of liquid escaping forwardly through the throat between the upper edge of the gate and the periphery of the drum and thereby causing the liquid to be constantly presented to the underside of the drum in the form of a flowing stream which is under pressure. The liquid escaping from the pan through the throat or outlet thereof may be disposed of in any suitable manner but preferably drops into a tank or receptacle 38 which is arranged immediately below the same and is fitted between the standards and the sills of the main frame so as to inclose the pan, its supporting brackets and the lowermost part of the drying drum, as shown in the drawings. The liquid thus deposited in the tank is withdrawn therefrom by the pump, which latter has its inlet connected by a pipe 39 with the bottom of the tank, whereby a batch of liquid to be dried is constantly circulated in the machine and different parts thereof are repeatedly presented to the underside of the drying drum until all of the liquid has been dried or desiccated on the drum. The return pipe 39 is preferably provided with a valve 40 so that the tank may be cut off from the pump when it is desired to stop the machine preparatory to cleaning the same or for other purposes. When the supply of liquid in the tank runs low due to the continuous operation of drying parts thereof this supply may be replenished from time to time as desired by the introduction of more liquid into the tank through the open front part thereof.

After the underside of the drum picks up a film of the liquid in the delivery or feeding pan the same passes over a distributing blade or bar 41 which is arranged

horizontally and lengthwise adjacent to the underside of the drum within the tank but separated from the drum a sufficient distance to permit the solid film of liquid to pass between the same while any bubbles in the film are broken and any unevenness in the surface of the film is removed so that the film after passing this distributing blade is of uniform thickness and is caused to dry evenly and uniformly on the drum. This distributing blade is preferably so mounted that it is capable of adjustment relative to the peripheral surface of the drum for which purpose this blade is mounted on the upper ends of supporting arms 42 which are pivoted at their lower ends on brackets 43 projecting forwardly from the pan bottom and horizontal adjusting rods 44 are provided which are arranged transversely of the drum and each pivotally connected at its inner end with the upper end of one of the supporting arms 42 while its outer end passes through an opening in the front wall of the tank and is adjustably secured therein by means of adjusting nuts 45, 46 applied to the threaded outer part of the adjusting rod and adapted to engage with the inner and outer sides of the respective wall of the tank, as shown in Figs. 2 and 3. By turning the screw nuts 45, 46 in the proper direction the distributing blade may be moved toward and from the periphery of the drying drum as required to produce the desired distributing operation of this blade on the film of liquid which is carried by the drum away from the pan.

After the film on the drum passes the distributing blade the same moves upwardly with the front side of the drum thence downwardly with the rear side thereof during which time the same is completely dried or desiccated. When the part of the drum which carries the dried material is adjacent to the rear wall of the tank and the feed pan the dried liquid is scraped from the periphery of the drum preparatory to depositing a new film on the drum. The removal of the dried material from the drum is preferably accomplished by means of a doctor or scraper which is constructed in the form of a blade 47 and which engages with the lower rear part of the drum and causes the dried material to be removed from the drum and discharged into a suitable receptacle arranged adjacent thereto. This scraping blade is mounted on the upper end of a vertically swinging rock arm 48 which is pivotally supported at its lower end by means of a knuckle joint 49 on the upper side of the rear sill 3, as shown in Fig. 2. This scraper blade may be adjusted with reference to the periphery of the drum by any suitable means those shown in the drawings being satisfactory for this purpose and comprising a plurality of hand operated screw nuts 50 mounted to turn in bearings 51 on the main frame but incapable of longitudinal movement, a plurality of shifting rods 53 each of which has a threaded outer end engaging with the threads of one of the adjusting screw nuts, and a plurality of links 52 each pivotally connected at its outer end with one of the adjusting screws and at its inner end with the outer side of the scraper blade.

Any small particles of dried material which may drop off from the drum after the same passes the scraper blade are prevented from falling into the space between the inner side of this blade and the outer side of the rear wall of the tank by means of a guard or guide 54 which is preferably constructed in the form of a plate secured to the inner side of the scraper blade and overhanging the upper edge of the rear tank wall, as shown in Fig. 2. This guard or guide guides or directs any material which drops off from the drum adjacent to the inner side of the scraper blade and causes the same to be discharged into the contents of the tank where it will again be picked up and circulated with the remaining material.

In this apparatus the drying or desiccation of material on the drum is effected under atmospheric pressure so that considerable economy in the cost of constructing the machine is possible owing to its greater simplicity as compared with a machine of this character in which the drying is effected *in vacuo*.

In the operation of this machine the liquid to be dried is continually presented to the underside of the drum under mechanical pressure and in the form of a continuously flowing stream which drum moves constantly and presents new surfaces to said stream into which its successive parts dip and pick up a thin film of this liquid by adhesion. Owing to the fact that the liquid is supplied to said drum in excess of the picking up capacity of the drum such excess liquid which is not picked up by the drum drops from the latter into the tank while the liquid which is picked up by the drum is dried thereon under atmospheric pressure and by reason of the heat applied internally to the drum. The dried material is also removed continuously from the drum preparatory to depositing a new coat of material on the drum.

This machine is comparatively simple in construction considering the function which it performs, the same can be produced at comparatively low cost, it has a very large capacity and all of its parts are easy of access so that they can be readily cleaned from time to time or adjusted when necessary.

I claim as my invention:

A drying apparatus comprising two end standards provided at their upper ends with

bearings, a longitudinal bar connecting said standards, a drying drum arranged above said bar and journaled in said bearings, and a pan adapted to support the liquid to be dried against the underside of the drum comprising a bottom, end walls engaging the drum, a rear wall engaging the drum and adjustable vertically on the rear edge of said bottom and a front wall arranged close to said drum and adjustable vertically on the front edge of said bottom, and brackets arranged on said bar and connected with said bottom.

OLIVER S. SLEEPER.