July 8, 1952 L. S. OVERTON 2,602,498

EVACUATED DRUM DRYING MACHINE

Filed Sept. 3, 1948 3 Sheets-Sheet 1

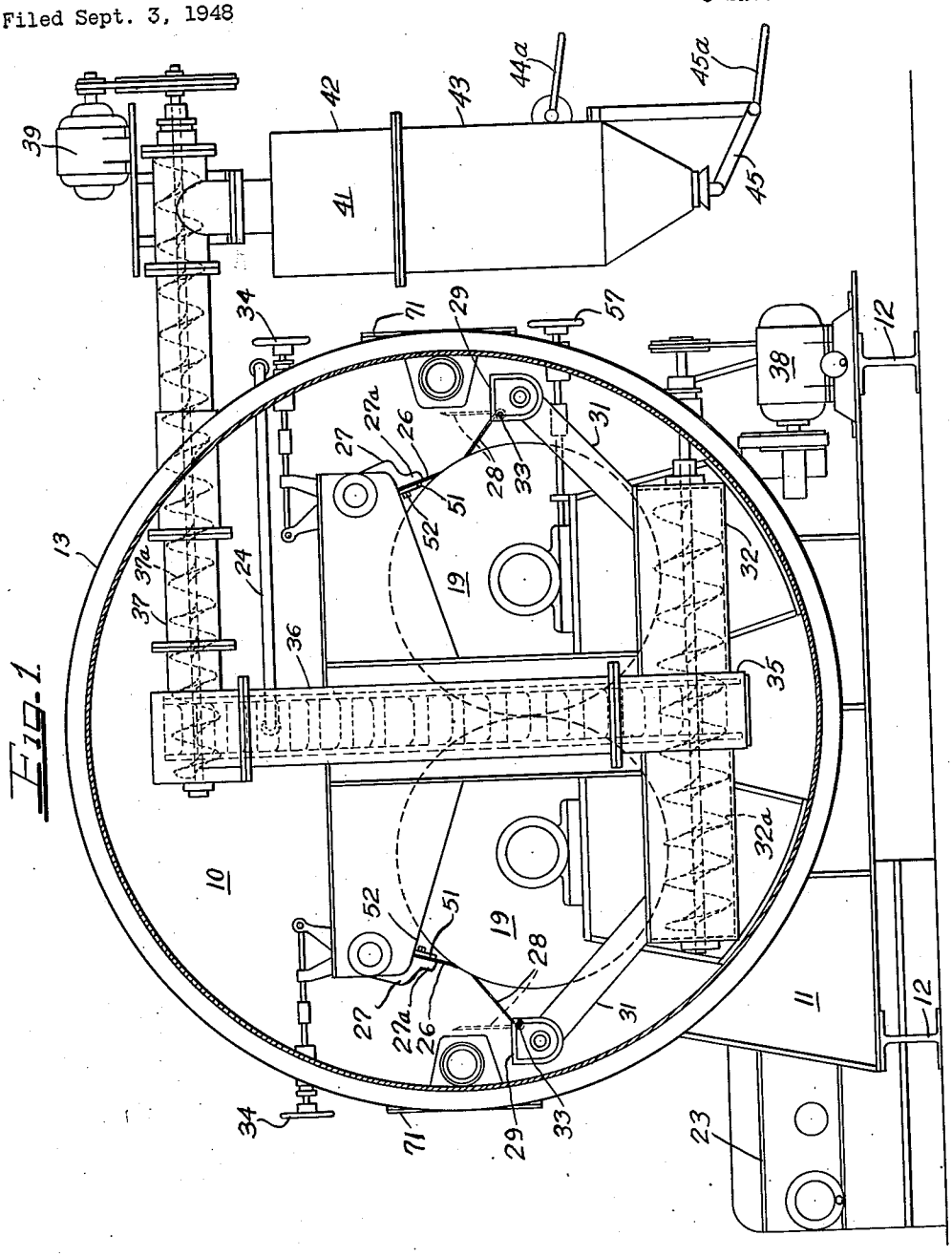


Fig. 1

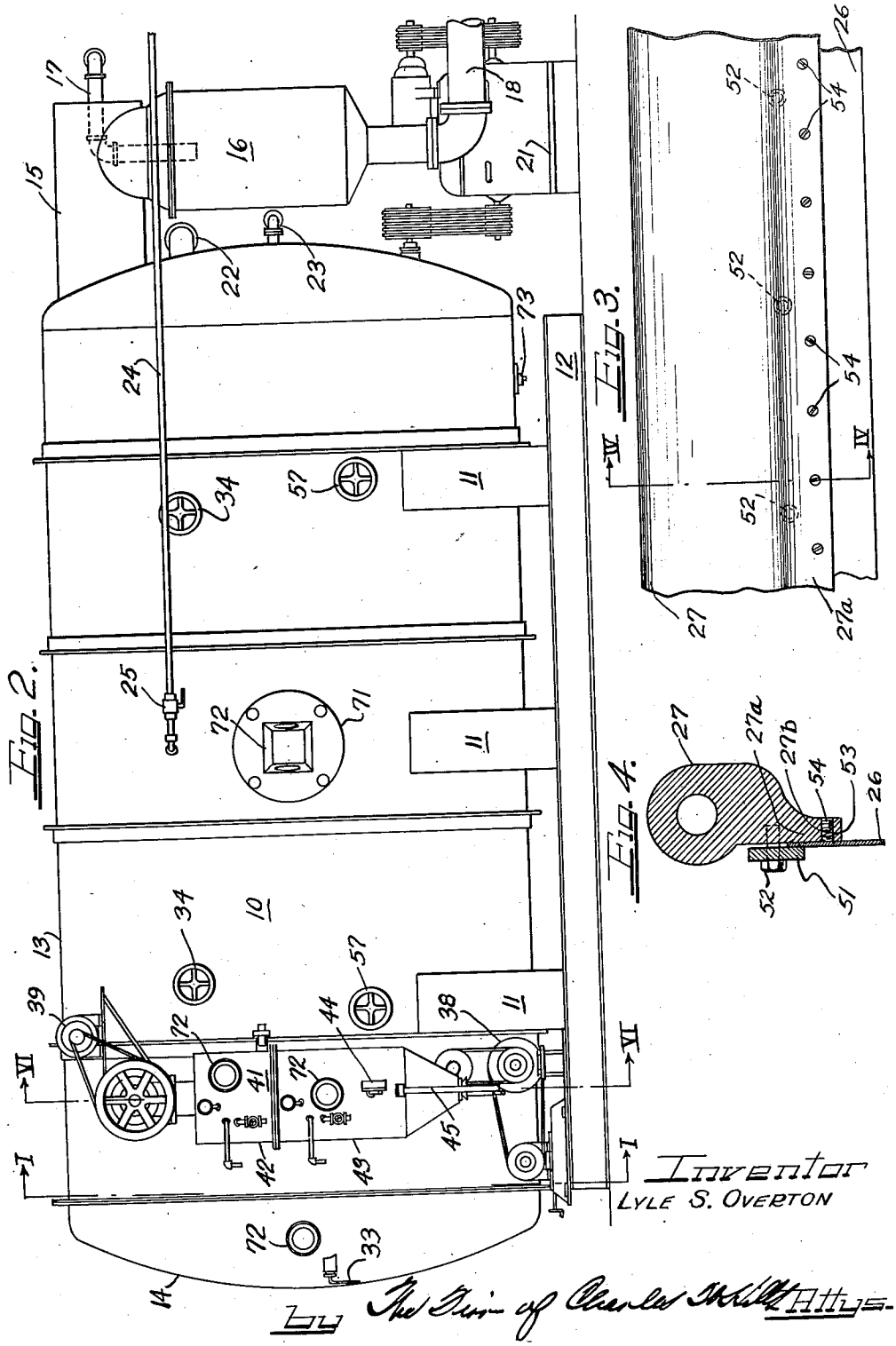
Inventor
LYLE S. OVERTON

By The Firm of Charles Hieken Attys.

July 8, 1952 L. S. OVERTON 2,602,498

EVACUATED DRUM DRYING MACHINE

Filed Sept. 3, 1948 3 Sheets-Sheet 2



July 8, 1952 L. S. OVERTON 2,602,498

EVACUATED DRUM DRYING MACHINE

Filed Sept. 3, 1948 3 Sheets-Sheet 3

Fig. 6.

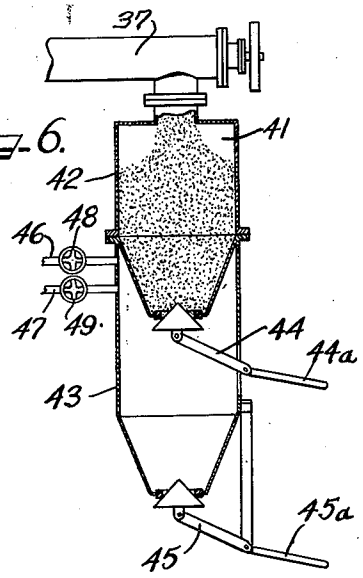


Fig. 7.

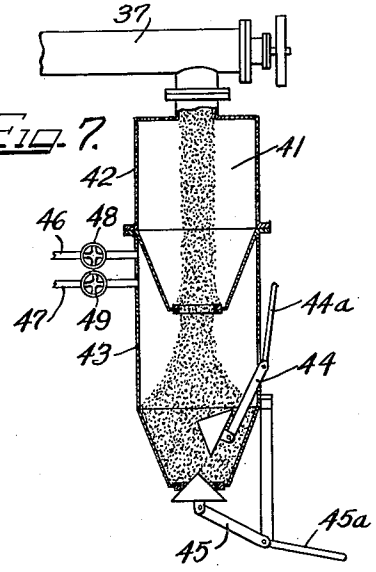


Fig. 8

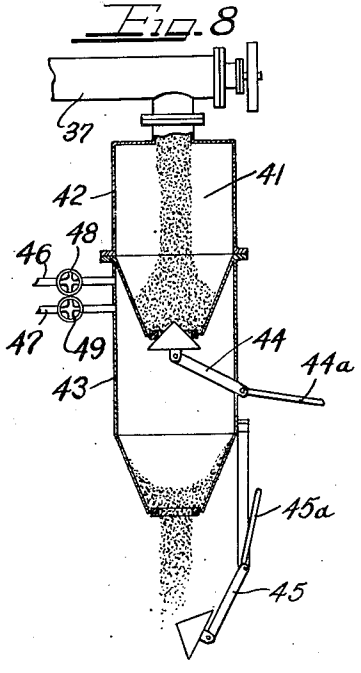
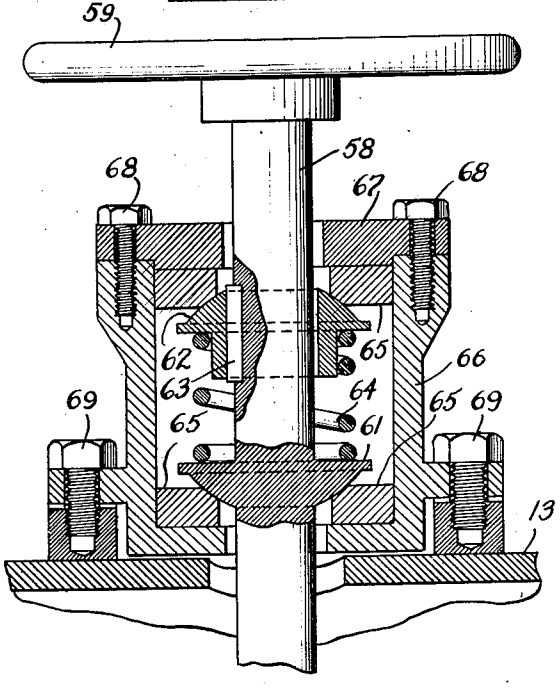


Fig. 5.



Inventor
LYLE S. OVERTON

by The Firm of Charles Hieber Attys.

Patented July 8, 1952

2,602,498

UNITED STATES PATENT OFFICE

2,602,498

EVACUATED DRUM DRYING MACHINE

Lyle S. Overton, Dowagiac, Mich., assignor to Overton Machine Company, Dowagiac, Mich., a corporation of Michigan

Application September 3, 1948, Serial No. 47,649

3 Claims. (Cl. 159—12)

1

This invention relates to a vacuum type drum drying machine. More specifically, the invention relates to a vacuum drying machine in which the dried material may be removed without breaking the vacuum and in which adjustment of the moving parts may be made from suitable control outside the machine.

It is an object of this invention to provide a vacuum drying machine capable of continuous operation.

Another object of the invention is to provide a drum drying machine with a doctor blade in which proper tension is maintained by the use of springs.

Another object of the invention is to provide a vacuum drying machine from which boiled or decomposed solid material may be rejected without stopping operation or breaking the vacuum.

A further object of the invention is to provide a vacuum drying machine in which all controls are located outside the vacuum chamber.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which disclose preferred embodiments of the invention.

The above objects are accomplished by the apparatus of this invention which comprises in combination a gas-tight receptacle, means for evacuating the receptacle, rotatable cylindrical drums inside the receptacle, means for introducing liquid to the surface of the rotatable drums, means for rotating and heating the cylindrical drums, doctor blades for removing dried solid material from the rotatable drums, collectors for picking up the solid material scraped from the drums by the doctor blades and transferring the material to a conveyor which in turn transfers it to a double hopper unloader. As will more fully appear hereinafter, the doctor blades have a spring means for maintaining tension against the rotatable drums; the collector means may be swung out of position in the event the solid material coming over on the drum is not of suitable quality; and the unloader is arranged for continuous operation of the machine without breaking the vacuum. All moving parts within the vacuum chamber are controlled by suitable switches, wheels and levers on the outside of the apparatus.

On the drawings:

Figure 1 is a transverse cross-sectional view, with parts in end elevation, of the apparatus taken along the line I—I of Figure 2;

Figure 2 is a side elevational view of the machine;

2

Figure 3 is an enlarged fragmentary elevational view of the doctor blade and mounting for assembly;

Figure 4 is a sectional view taken along the line IV—IV of Figure 3;

Figure 5 is a partial cross-sectional view of a seal arrangement for preventing leakage with the vacuum chamber without interfering with operation of a rotatable control shaft projecting through the casing of the machine;

Figures 6, 7 and 8 are cross-sectional views of the unloader taken generally along the line VI—VI of Figure 2 but showing the various positions of the dumping valves.

As shown on the drawings:

In Figures 1 and 2 numeral 10 designates a vacuum tank receptacle equipped in accordance with this invention. Receptacle 10, which is gas-tight, rests on supporting members 11 which are in turn maintained by I-beams 12. Receptacle 10 consists of body 13 and end plates 14. Vapor take-off 15 (Figure 2) extends from the end of receptacle 10 to a condenser 16. Water coming through an inlet conduit 17 condenses vapor in condenser 16 by direct contact. A vacuum pump (not shown) is attached to a conduit 18 and serves to evacuate receptacle 10.

Referring particularly to Figure 1, numeral 19 designates cylindrical drier drums which may be rotated by power unit 21 (Figure 2). The drums 19 cooperate to define a nip trough therebetween and are internally heated by steam introduced through pipe 22 (Figure 2) which is connected to a steam source (not shown). Condensate from steam pipe 22 is returned through conduit 23 (Figure 2). Numeral 24 designates the inlet pipe for feed of liquid to be dried to the nip trough between the drums controlled by shut-off cock 25.

In Figure 1, the illustrated left-hand drum 19 rotates clockwise and the right-hand drum 19 rotates counterclockwise to collect liquid from the nip trough and maintain a film thereon which has a thickness gauged by the nip between the rolls. The films of material on the surfaces of these drums are dried and scraped off of the drums by doctor blades 26 in holder bars 27. The dried film material from the scraper is deposited on inclined plate apron 28 from which it passes to troughs 29 equipped with screw conveyors to move the material to chutes 31 at the front end of the tank. The chutes discharge into trough 32.

Each plate apron 28 is hinged along its lower edge to the adjacent trough 29 and may be swung outward from drums 19 by manipulation of a control lever 33 (Figure 2). As shown in dotted lines in Figure 1, the outward positions of the

plate collectors 28 will provide a gap between the drums 19 and the troughs 29 so that undesired material scraped from the drums by the scrapers 26 will not enter the troughs to contaminate the desired product. The outside operating levers for the collectors thereby give the operator full control over the acceptance or rejection of any portion of the product scraped from the drums without breaking the vacuum in the tank 10.

The pressure of doctor blades 26 on drums 19 may be altered by means of control wheels 34 which actuate screw linkages to rock the holder bars 27 in their pivot mountings. The means whereby such linkages are maintained in vacuum tight relation with the interior of receptacle 10 will be more fully discussed hereinafter with reference to Figure 5.

The material which discharges through the chutes 31 is collected in the trough 32 and moved by a screw conveyor 32*a* thereon toward the transverse central portion of the front end of the tank 10. It is convenient to have hammermill 35 reduce the solid material to fine powdery form at this point. The material may then be raised by elevator 36 to a conduit 37 containing a screw conveyor 37*a* located near the top of the vacuum chamber. Both screw conveyors 32*a* and 37*a* are driven by electric motors located outside the vacuum chamber as designated by numerals 38 and 39, respectively. The screw conveyor 37*a* transfers the solid material through conduit 37 to an unloader 41, the operation of which may be more fully understood by reference to Figures 6, 7 and 8.

The unloader 41 consists of two superimposed hoppers, the upper one 42 emptying into the lower one 43. The hopper 42 is opened upon release of a valve mechanism 44 and the hopper 43 is opened upon release of a valve mechanism 45. A conduit 46 from a source of vacuum (not shown) is provided to evacuate hopper 43, and vacuum in the hopper is controlled by a valve 48. A conduit 47 containing a valve 49 also communicates with hopper 43 and may be open to the air or may be connected to an inert gas such as carbon dioxide or nitrogen.

The various positions of the valve mechanisms 44 and 45 (Figures 6, 7 and 8) illustrate the operation of the unloader. In Figure 6, hopper 42 is under vacuum existing in the tank 10 while hopper 43 is under atmospheric pressure. Vacuum in the hopper 42 plus the valve linkage holds valve 44 in closed position. In order to empty hopper 42 without loss of vacuum from tank 10, valve 49 is closed and valve 48 is opened in order to place hopper 43 under vacuum. This evacuation of hopper 43 plus the valve linkage holds valve 45 in closed position. As soon as the pressure on both sides of the hopper 44 are substantially equal, the weight of the solid material in the hopper 42 opens hopper valve 44 and the solid matter passes down to hopper 43, as illustrated in Figure 7. Atmospheric pressure on valve 45, plus the valve linkage, will support the weight of the material in hopper 43. When hopper 42 is emptied, hopper valve 44 is closed by actuation of the handle 44*a*, and vacuum valve 48 is closed. Valve 49 is then opened to bleed air or inert gas into hopper 43. The pressure of the air or inert gas then acts to maintain hopper valve 44 in closed position, and since the air pressures on both sides of hopper valve 45 are substantially equal, the weight of the solid material then opens valve 45 as illustrated in Figure 8. Hopper valve 45 is then closed by manipulation of handle 45*a* and the cycle is ready to be repeated. Thus, the machine may be operated to continually discharge its product into hopper 42 without breaking the vacuum seal and the product can be intermittently discharged in batches of controlled size to fill bags, barrels or the like containers.

While the positions of the blade bars 27 can be easily controlled from outside the tank 10 by manipulation of the hand wheels 34, these bars are quite rigid and do not compensate for variations in blade pressures along their lengths caused, for example, by uneven wear and variations permitted by manufacturing tolerances. In order to effect and maintain uniform loading along the lengths of the doctor blades 26, the blade mountings disclosed in Figures 3 and 4 are used. As illustrated therein, the blade 26 is clamped between the lip 27*a* of the bar 27 and a rigid lock bar 51 attached to the lip 27*a* by a series of cap screws 52 in equally spaced relation. As shown in Figure 1, the bar 51 underlies the upper portion of the blade 26 while the lip 27*a* overlies this portion and an adjacent blade portion not covered by the bar. In order to uniformly load the blade 26 against the drum 19, small coil springs 52 seated in holes 27*b* in the lip 27*a* are adjustably loaded by plugs 54 threaded within holes to locally load the blade. These springs act on the uncovered portion of the blade in spaced relation from the portion covered by the lock bar 51.

These springs 53 are positioned about two inches apart along the length of the lip 27*a*, and the plugs 54 are adjusted by a screw driver to load the springs so that the blade will act uniformly on the drum. Since the springs can expand to continuously exert a load, the uniform loading will be continued even after wear develops.

Tension on rotating drum 19 may be altered from outside receptacle 10 by manipulation of wheels 57 (Figures 1 and 2). Control wheels 57 and other control wheels, as well as power operated shafts, pass through bearings such as that illustrated by Figure 5. As shown in Figure 5, numeral 58 designates a rotatable shaft which may be rotated by force applied to wheel 59. If it is desired to have shaft 58 power driven, wheel 59 may be exchanged for a pulley. Disk 61 is rigidly attached to shaft 58 and disk 62 is slidably attached to shaft 58 by means of key 63 so as to be capable of longitudinal movement. A compression spring 64 disposed around the shaft between discs 61 and 62 exerts a pressure to force both disks 61 and 62 against carbon ring seal members 65. These carbon ring seal members 65 are disposed in a housing 66 closed by a top plate 67. Top plate 67 is secured to the housing 66 by means of screw members 68. The housing 66 is secured to the body member 13 by means of screw members 69.

The bearing of Figure 5 is easily fabricated since close tolerances are not necessary. The pressure of disk member 61 against the carbon ring seal 65 forms a gas-tight bearing and the rounded countour of the disk member 61 enables shaft 58 to seat itself naturally due to the pressure of spring 64.

In order to facilitate maintenance manholes 71 have been provided as shown in Figures 1 and 2. Sight glasses designated by numeral 72 have been provided in various parts of the apparatus.

Drain plug 73 is located at the base of the apparatus as shown in Figure 2.

From the above description it may be seen that this invention provides a continuous vacuum drying machine in which all moving parts are controlled from outside the vacuum chamber and in which the desired solid material may be collected and removed and the undesired solid material may be selectively rejected without breaking the vacuum. This machine is particularly useful in drying milk without giving the dried milk powder a boiled or cooked flavor since lower drying temperatures can be used due to the maintained vacuum.

It will be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwith than necessitated by the scope of the appended claims.

I claim as my invention:

1. A vacuum drying apparatus comprising in combination, a gas-tight receptacle, means for evacuating said receptacle, a rotatable drum inside said receptacle, means for heating said rotatable drum, means for introducing fluid onto said rotatable drum, an elongated scraper blade for removing solid material from said rotatable drum, a conveyor in said receptable spaced from said blade and drum, a swingable apron below said blade for receiving solid material removed by said scraper blade from said drum and for transferring the solid material to the conveyor, a rod connected to said apron extending to the outside of said recepatcle, a handle on said rod for rotating the rod to swing said apron toward and away from said drum to selectively transfer material to said conveyor and to prevent such transfer, and means for removing solid material from said receptacle.

2. In a vacuum drum drying apparatus having a rotatable drier drum, the improvements which comprise a rockably mounted holder bar disposed in proximity to the surface of said drum and extending along the length of the drum, means operable from outside of said apparatus for swinging said holder bar, a scraper blade, a clamping bar cooperable with said holder bar to clamp said blade therebetween with one elongated lateral edge of said blade projecting beyond said bars, a plurality of closely spaced spring means carried by said holder bar outwardly from the clamping bar to act on said blade at spaced intervals along the length thereof, an adjusting device for each spring carried by said holder bar to selectively load the spring for resiliently urging said blade against said drum to maintain equal scraping conditions along the length of said blade, an apron mounted alongside said drum below said blade to receive material scraped from the drum by said blade, a conveyor receiving material from said apron, a pivot mounting for said apron, and means extending to the outside of said apparatus and connected to said apron for swinging the apron away from the drum to prevent transfer of material to said conveyor.

3. A vacuum drying apparatus comprising a gas-tight receptacle, a rotatable drier drum disposed in said receptacle, means for rotating said drum, means for introducing a film of liquid material onto the periphery of said drum, a scraper blade peripherally displaced from said last mentioned means for removing solid material from the drum, a conveyor disposed beneath said drum for receiving gravity flow of solids from said blade, a swingable plate apron disposed between said conveyor and said blade, and handle means extending exteriorly of said receptacle and connected with said swingable plate apron for actuating said apron to alternate positions including a first position adjacent said blade for conveying material from said blade to said conveyor, and a second position spaced from said blade to interrupt said communication between said blade and said conveyor.

LYLE S. OVERTON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
711,719	Ekenberg	Oct. 21, 1902
879,490	Rasmussen	Feb. 8, 1908
960,857	Eggert	June 7, 1910
1,200,117	Johnson et al.	Oct. 3, 1916
1,249,177	Oppenhauser	Dec. 4, 1917
1,408,483	Stephens	Mar. 7, 1922
1,501,513	Boberg	July 15, 1924
1,501,514	Boberg	July 15, 1924
1,566,358	White	Dec. 24, 1925
1,726,751	Miles	Sept. 3, 1929
1,933,819	Miles et al.	Nov. 7, 1933
2,102,607	Baker	Dec. 21, 1937
2,250,852	Bertelsen et al.	July 29, 1941
2,314,316	Schlesman	Mar. 16, 1943
2,325,203	Hayes	July 27, 1943
2,326,512	Andrews	Aug. 10, 1943
2,338,606	Voorhees	Jan. 4, 1944

FOREIGN PATENTS

Number	Country	Date
349,337	Germany	Feb. 28, 1922