May 1, 1934. H. E. NEUBAUER 1,957,146

ROTARY DRUM DRIER

Filed Nov. 1, 1930 4 Sheets-Sheet 1

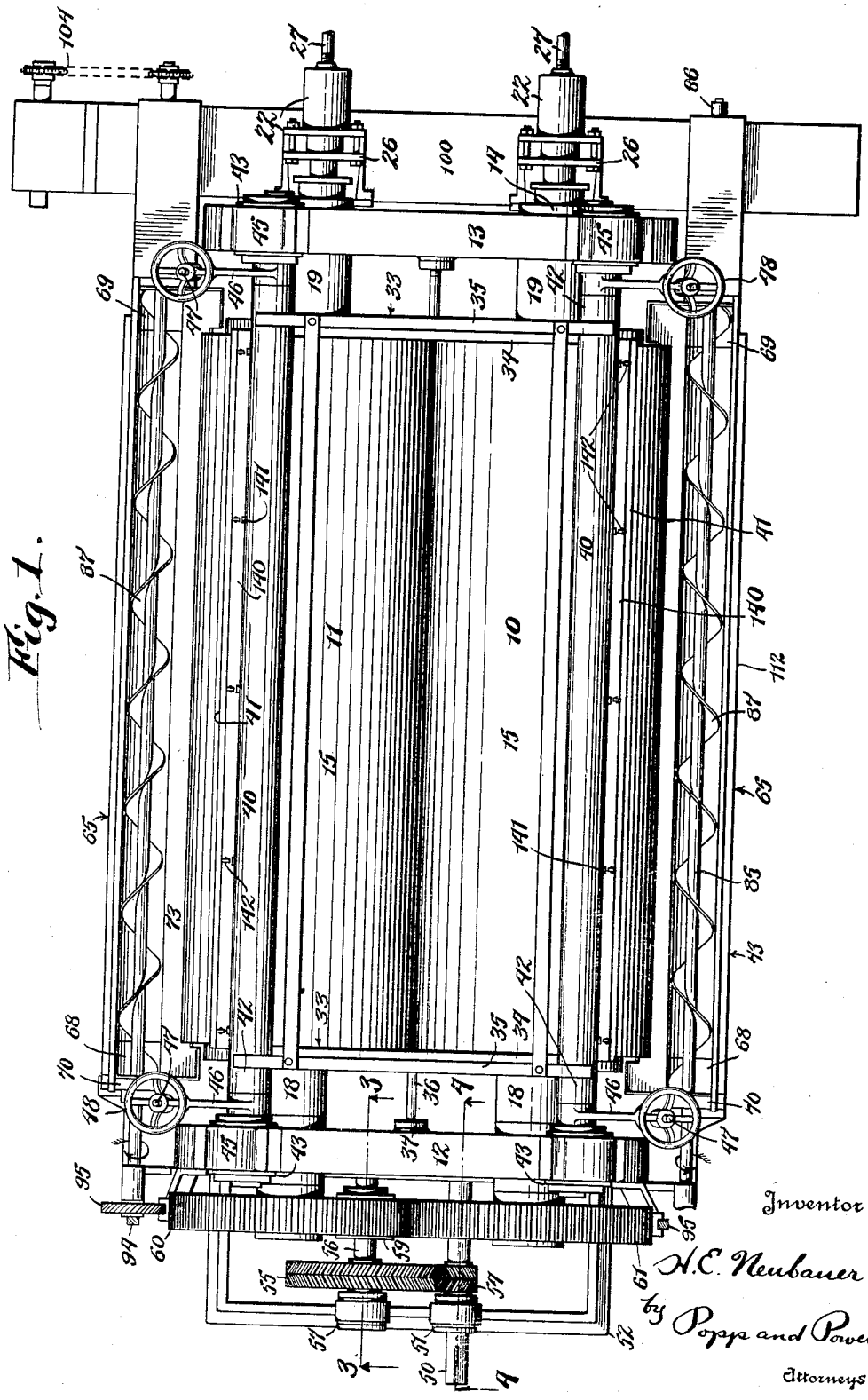


Fig. 1.

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ROTARY DRUM DRIER

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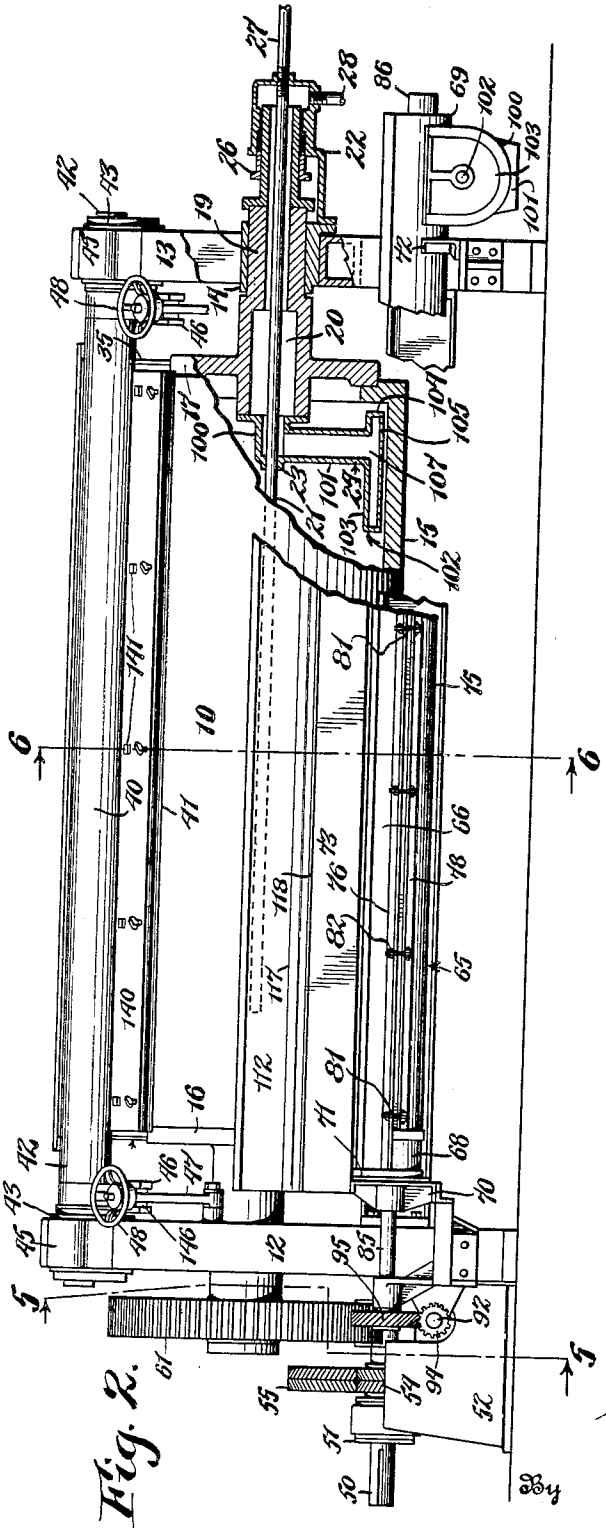


Fig. 2.

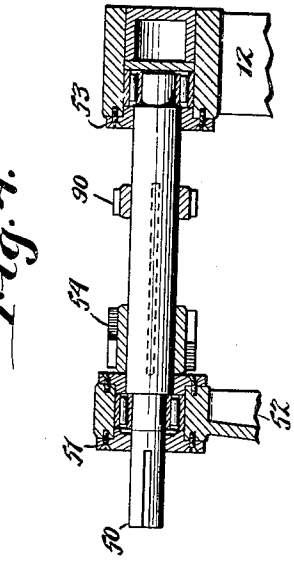


Fig. 4.

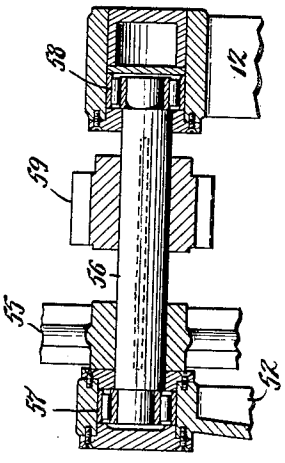


Fig. 3.

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ROTARY DRUM DRIER

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4 Sheets-Sheet 3

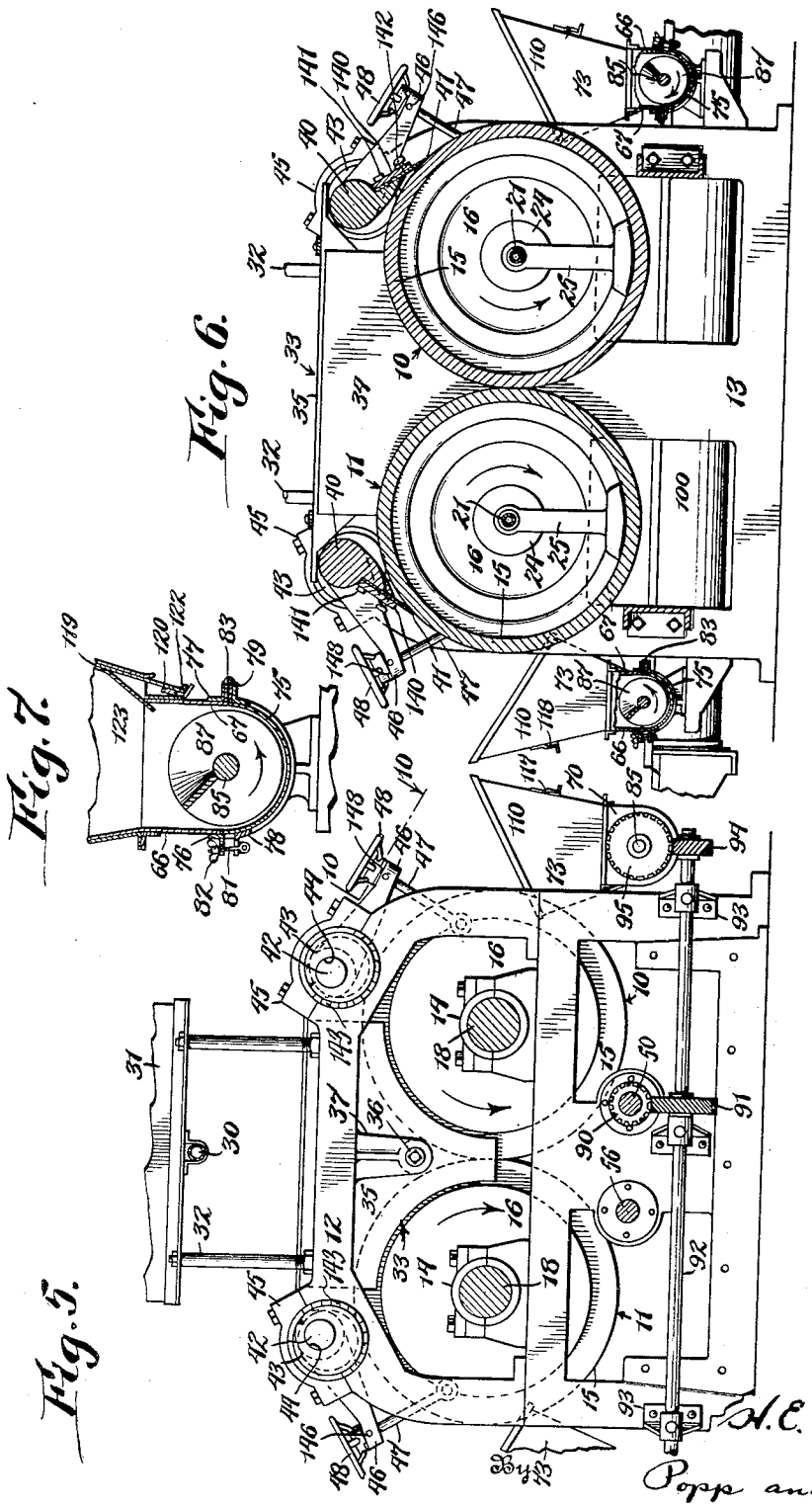


Fig. 5.



Fig. 6.



Fig. 7.

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ROTARY DRUM DRIER

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4 Sheets-Sheet 4

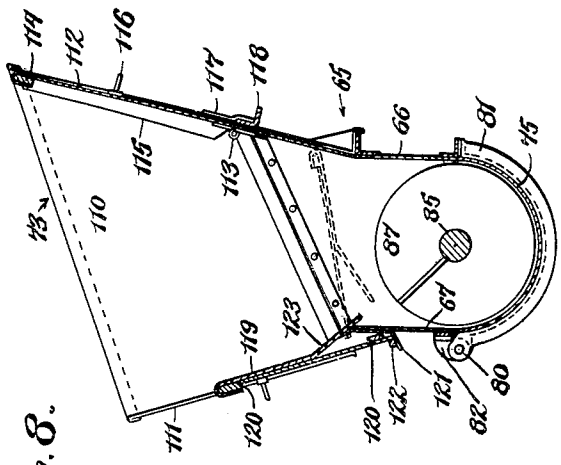


Fig. 8.

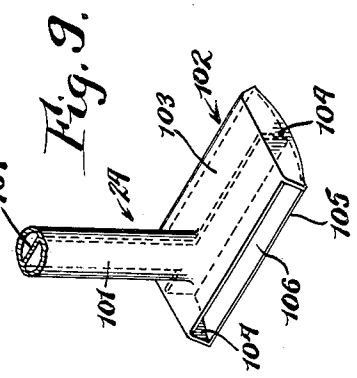


Fig. 9.



Fig. 10.

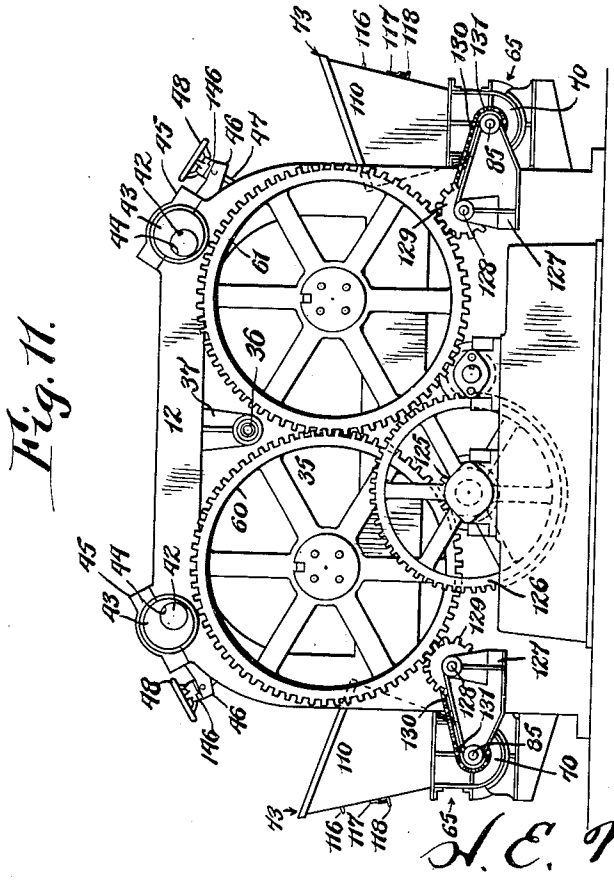


Fig. 11.

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Patented May 1, 1934 1,957,146

# UNITED STATES PATENT OFFICE

1,957,146

## ROTARY DRUM DRIER

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Application November 1, 1930, Serial No. 492,764

7 Claims. (Cl. 159—11)

This invention relates to a rotary drum drier and more particularly to a double drum drier in which the liquid to be evaporated is fed between two parallel rotary heated drums, passes between these drums so as to be distributed in the form of a uniform layer on each drum and the dried layers are subsequently scraped from each drum.

One of the principal objects of this invention is to arrange each knife or scraper which removes the dried layer from each drum upon an eccentric mounting so that it can be quickly, easily and accurately adjusted to any desired position along the surface of the drum or to any desired angle relative thereto, within the range of movement of the eccentric mounting. By the ready manipulation of the eccentric mounting the angularity of each knife can be readily changed to provide the maximum scraping effect, particularly as the knife or scraper wears, and the movement of the knife along the surface of the drum also permits of easily adapting the drier to different materials which may require a greater or less angle of the scraper relative to the drums to remove the dried material as completely as possible from the drum surface, leaving the drum surface substantially clean, thereby preventing any of the dried material from reducing the heat transfer between the drum and the layer of fresh liquid adhering thereto after the drum has passed the scraper. The practically complete removal of the layer of dried material from the drum surface makes it possible to operate the drums at maximum speed and obtain the highest possible capacity.

Another object is to simplify and improve the driving mechanism for the rotary drying drums particularly by providing a gear drive for the drums, the shafts and gears of which are carried exclusively by one of the end heads or standards which also carries the drying drums and the other parts of the mechanism. By this means separate bearing stands for the drive shafts are eliminated and the drier is thereby made more compact, more easily accessible and can be assembled and adjusted more easily and can be sold at a lower cost. The present dryer also proposes the use of a pair of herringbone gears which intermesh and drive a countershaft and pinion meshing with one of the large spur gears on one of the drum spindles, these large spur gears meshing together, and also proposes the mounting of shafts which carry the herringbone gears on roller bearings. The use of herringbone gears mounted in this manner to drive the drums materially decreases the wear and increases the life of the gears, reduces the friction and results in smoother operation and also provides a more compact structure.

A further purpose is to provide a drive for the screw conveyers which convey the dried product from the apparatus which consists of a cross shaft driven by a pair of helical gears from the main drive shaft, the two conveyers, one for each drum, being driven by a pair of helical gears from the cross shaft. This arrangement simplifies the drives formerly used for this purpose and also is more compact and accessible.

A still further aim is to provide hinged bottoms for the bottom of the side conveyer troughs which permits the bottoms of the troughs to be detached and dropped easily to facilitate cleaning of the conveyers and the troughs.

A further object is to provide, as an alternative construction, a chain drive for the conveyer shafts, the complete chain drive for each shaft being carried by a single bracket and each drive being driven directly by the main intermeshing gears carried by the shafts on which the two drums are mounted.

In the accompanying drawings:

Figure 1 is a top plan view of a rotary double drum drier embodying my invention.

Figure 2 is a side elevation thereof partly in section.

Figure 3 is a vertical longitudinal section taken on line 3—3, Fig. 1.

Figure 4 is a similar section taken on line 4—4, Fig. 1.

Figure 5 is a transverse section taken on line 5—5, Fig. 2.

Figure 6 is a transverse section through the drums taken on line 6—6, Fig. 2.

Figure 7 is a transverse section through one of the conveyer troughs showing the manner in which its bottom is hinged to facilitate cleaning.

Figure 8 is a cross section through one of the conveyer troughs which receives the direct material from one of the drums.

Figure 9 is a perspective view of the scoop for removing condensed water from each drum.

Figure 10 is a section taken on line 10—10, Fig. 5.

Figure 11 is a view similar to Fig. 5 showing a modified form of drive for the drums and side conveyer.

Similar reference numerals refer to like parts in each view.

The two drums 10 and 11 and the other parts of the drier are carried by two end heads or

standards 12 and 13. These end heads or standards 12 and 13 can be of any suitable form to support the various bearings which carry the drum spindles, conveyers and their drive shafts and gears but are preferably made in sections consisting of a lower base section and a removable upper section the removal of which permits of readily removing the drums. Each of the drums 10 and 11 has its spindles journaled in bearings 14 carried by the end standards or heads 12 and 13 and each drum consists of a cylindrical shell 15 and a pair of end heads 16 and 17 which are secured to the ends of the cylindrical shell 15 and are extended to provide spindles 18 and 19 journaled in the bearings 14. Each of the spindles 19 which is carried by the end standard or head 13 is hollow and has a longitudinal passage 20 extending therethrough, this passage 20 receiving a steam supply pipe 21 which projects into each drum and terminates near the opposite end thereof. Each of the steam pipes 21 is secured at one end to a stationary external head 22 which is carried by the bearing 14 and at its other end is supported by a bearing 23 of a rotary drain scoop 24 which is secured to the inner end of the spindle 19. The external stationary head 22 is provided with a gland 26 to insure a tight joint between this head and the end of the spindle 19. A steam supply line 27 connects with each of the external stationary heads 22 and with the steam pipes 21 and an exhaust pipe 28 communicates with the interior of the external stationary head 22. With this arrangement it is apparent that steam enters each drum through the steam line 27 and steam pipe 21 where it discharges into the drum at the end adjacent the spindle 18. This steam maintains each drum 10 and 11 at the desired temperature to effect drying of the layer of liquid on its external surface and in doing so condenses. The condensed steam is removed by the drain scoop 24 provided in each drum, each of these drain scoops being preferably constructed as follows:

Each of the rotary drain scoops 24 is designed to scoop the condensed water from the drum as it sweeps through the lower part of its rotation, and lift this water and discharge it into the passage 20 of the spindle 19 on which it is mounted. For this purpose, as best shown in Figs. 2 and 9, each drain scoop 24 includes a hollow head 100 which is fitted over the inner end of the corresponding spindle 19 and also forms the bearing 23 for the steam inlet pipe 21. Turning integrally with this hollow head 100 is a laterally projecting hollow arm 101 which at its lower or outer end carries an elongated horizontal scoop head 102 which extends longitudinally of the drum. Each scoop head 102 consists of a top wall 103, end walls 104 and a bottom wall 105 which is rounded to conform to the curvature of the interior of the drum, leaving openings 106 at its opposite sides to admit the condensate as the scoop head 102 sweeps to the bottom of its stroke. In order to carry such condensed water from the interior of the scoop head 102 to the spindle 19, a central partition 107 is provided which forms a central interior dividing wall lengthwise of the scoop head 102 and extends up into the hollow arm 101. It is therefore apparent that when the scoop head moves through the bottom of its stroke, any condensate on the bottom of the corresponding drum is swept into the opening 106 on the advancing side of the scoop head and as the scoop head 102 and arm 101 are elevated, this water flows down along the partition 107 to the opposite end of the hollow arm 101 where it enters the passage 20 in the corresponding spindle 19 and flows out through the drain 28. It will be noted that this arrangement insures both the admission of steam through the pipes 21, 27 for heating and the removal of the condensate through the scoop 24 and at the same time the gland 26 prevents the leakage of steam to the outside.

By providing the scoop 24 with an opening 106 on each side and dividing the same by a longitudinal partition 107 this scoop will operate to pick up water from the inside of the drum upon rotation of the latter in either direction, thereby eliminating the necessity of making a right pattern for drums turning toward the right and a left pattern for drums turning toward the left and avoiding the possibility of an error in using the wrong kind of scoop in a certain drum.

The feeding of the liquid to be evaporated is effected by an overhead pipe 30 which is arranged directly over the place at which the drums come together and extends the full length of the drums and is provided with suitable orifices so that the liquid is distributed uniformly over the surfaces of both of the drums. This overhead pipe is shown as hung from a vapor hood 31 which is shown as supported from the end heads or standards 12 and 13 by legs 32 and is connected with a stack (not shown) so that the air is drawn from above the drier for ventilation and the removal of undesirable gases and vapors near the drier.

The body of the liquid to be dried is retained between the drums by a pair of end abutments 33 each of which consists of a block 34 of wood supported by a sheet metal holder 35 and held against the end of the two drums by a rod 36 carried by a hanger 37 forming part of each end head or standard. By bearing against the ends of the shell 15 of each drum, these abutments prevent the liquid to be evaporated from flowing over the ends of the drum and being lost.

The drums are revolved in opposite directions and are spaced a slight distance apart so that the liquid layers spread upon the two drums are spread or pressed between the rolls and formed into uniform layers on the two drums. As these layers travel around on the heated surface of the shells 15 of each drum they are heated and dried. The dried layer is then scraped off each drum by a knife or scraper which is preferably constructed and mounted as follows:

Each of the scrapers consists of a holder 40 having trunnions 42 at its opposite ends. To this holder and preferably arranged radial to its movement about the axis of its trunnions, a blade 41 is removably mounted, this blade having a sharpened lower longitudinal edge, as best shown in Fig. 6. This blade 41 is flat and is backed by an upper metal backing plate 140 which extends the full length of the blade 41 and the corresponding drum, both the blade and the backing plate 140 being held by a plurality of screws 141 which extend through these members at spaced intervals along their length and screw into the holder 40 so as to hold these members in position on the holder. It is desirable to be able to vary the curvature of the sharpened edge of the blade and for this purpose, the lower edge of each backing plate 140 overhangs the blade 41 a substantial degree and is provided adjacent its lower edge with a row of set screws 142 the ends of which engage the upper side of the blade. If the blade edge should be wavy so that it fails to

bar 122 which is suitably secured to the flange 121 to the inner side of the hopper wall 119, a flange 123 is secured, this flange extending over the edge of the trough wall 67 and directing the dried material falling into the trough 65. The hopper wall 119 is limited in its outward movement by the retaining flanges 111 on the end walls 110 of each trough and the height of each wall 119 is so proportioned that it can be lifted out and set across the upper side of the trough 65 as indicated by dotted lines in Fig. 8. This is done to protect the trough 65 and a possible quantity of dried material therein from being wet down while the drums are being washed.

To permit of ready cleaning of the troughs, each trough is provided between the permanent bottoms 68 and 69 at its ends with a half round hinged bottom 75 which can be dropped down. As best shown in Fig. 7 a pair of angle irons 76 and 77 are welded to the side plates 66 and 67 and corresponding angle irons 78 and 79 are welded to the upper outer sides of the removable half round bottom 75. The angle irons 77 and 79 are connected by a suitable number of hinges 80 which permit the bottom 75 to swing downwardly and the outer angle irons 76 and 78 are fastened by pivoted bolts 81 having wing nuts 82, these bolts and wing nuts being secured to the angle iron 78 and being received in slots in the angle iron 76 so that these angle irons can be removably fastened together. It is apparent that by loosening the wing nuts 82 and swinging the bolts 81 outwardly the bottom 75 can be dropped and the interior of each trough cleaned as well as the screw conveyer arranged therein. In the form of drop bottom shown in Fig. 8, one leaf 81 of each hinge 80 forms a cradle for the bottom 75 and the other leaf 82 of each hinge 80 is secured to the side plate 67 in any suitable manner.

These screw conveyers each consist of a shaft 85 which is journaled at one end in the bracket 70 and at the other end in the opposite end head 86 of each trough and has welded thereto a screw conveyer blade 87 which is arranged to convey the dried material toward the end head or standard 13.

The driving mechanism for these side conveyers includes a helical pinion 90 on the main drive shaft 50, which meshes with a helical gear 91 fast to a cross shaft 92. This cross shaft 92 is journaled in bearings 93 carried by the standard or end head 12 and at its opposite ends carries helical pinions 94 each of which meshes with a helical gear 95 on each of the screw conveyor shafts 85. With this arrangement it is apparent that the turning of the main drive shaft 50, through the helical pinion 90, helical gear 91, cross shaft 92, pair of helical pinions 94 and pair of helical gears 95 drives each screw conveyor to move the dried material scraped from the drums into the troughs 65 toward the end head or standard 13. The use of a single cross shaft connected by helical gears with the main drive shaft and with the screw conveyer shafts provides a very simple, inexpensive, durable and compact drive for the side conveyers as compared with the chain and gear drives heretofore in use.

Each of the side conveyers discharges into a cross conveyer which includes a covered trough 100 having its ends connected to the outlet ends of the side conveyer troughs 65 and having a discharge spout 101 which can be located at any place along the cross conveyer or the material may be discharged from the end of this trough instead of through the spout 101. The dried material received from the side conveyers 65 is conveyed to the discharge spout 101 by a screw conveyer 102 which has its ends journaled in the end heads 103 of the cross conveyer trough. The cross conveyer is driven from the shaft 85 of one of the side conveyers 65 through a chain drive 104 and beveled gears or in any other suitable manner.

In Fig. 11 is illustrated a modified form of drive for the conveyer screws 87 in the side conveyer troughs 65. In this form the intermeshing gears 60 and 61 which are fixed directly to the spindles 13 of the drums 11 and 10 are driven in any suitable manner as by a pinion 125 fast on a shaft which is driven by a gear 126. Attached to the machine frame adjacent each gear 60 and 61 is a bracket 127 which at one end supports the corresponding shaft 85 of the screw 87. At the opposite end of the bracket 127 a shaft 128 is journaled which carries a gear 129 and a sprocket. The sprocket is connected by a chain 130 with a corresponding sprocket 131 on the screw shaft 85. With this modified form of the invention, the side screw conveyors 87 are driven directly from the corresponding large gear wheels 60 and 61 by a chain drive which is carried in its entirety on a bracket supported by the machine frame.

It is apparent from the foregoing that the liquid to be dried upon being fed by the pipe 30 upon the heated drums 10 and 11 is carried away between these drums in the form of films of liquid which adheres to the drum surfaces, the thickness of the films being regulated by the space between the drums. These films are dried upon the drums by the heat therein and upon engaging the scrapers or knives 40 the dried films are removed from the drums and fall into the side conveyer troughs 65. The screw conveyers in these troughs carry it to the cross conveyer trough 100, the screw conveyer 102 which carries it to the discharge spout 101, or out of the end of this last mentioned trough.

It is also apparent that the mounting of the knives or scrapers in the eccentric bushings 43 permits of readily adjusting both the position of each knife along the drum and also its angularity by merely loosening the eccentric bushings 43 and turning the bushings to effect the desired positioning or angularity of the knife; the use of the cross shaft 92 with helical gears connecting it with both of the side conveyer shafts 85 and with the drive shaft 50 on the chain drives shown in Fig. 11, also provides a simple, strong and compact drive for the side conveyers, the mounting of all of the drive shafts on the end head or standard 12 eliminates all separate bearing stands; the arrangement of the driving mechanism for the drums 10 and 11, particularly with the use of roller bearings and herringbone gears, eliminates friction and reduces wear as well as providing a more compact and simplified structure and the provision of drop bottoms in the side conveyer troughs permits their ready cleaning and repair.

I claim as my invention:

1. In a rotary drum drier, a rotary drum, means for applying the material to be dried to said drum, a knife for scraping the dried material from said drum and having trunnions, a bushing supporting said trunnions, means for supporting said bushing for rotary movement and means for holding said bushings in any position, said trunnions being arranged off-center relative to said bushings whereby upon turning said bushings said knife is adjusted relative to said drum.

2. In a rotary drum drier, end heads, a rotary drum carried by said end heads, means for ap-

scrape the dried material from a portion of one of the drums, the set screws 142 at the corresponding part of the blade 41 are tightened down so that the blade is straightened and the dried material uniformly removed from all portions of the drum.

The trunnions 42 are each received in an eccentric bushing 43, the bores 44 receiving the trunnions 42 being off center so that upon turning the bushings 43 an eccentric motion is imparted to the trunnions. Each of the bushings 43 is firmly clamped in a lower half bearing formed directly on the corresponding end head or standard 12 or 13 by an upper half bearing 45 which clamps the eccentric bushing in place and prevents its getting out of adjustment. For convenience in regulating the degree to which each eccentric bushing is turned, a series of graduations 143 can be provided either on the bushing or its holder. To provide the necessary pressure of the knives or scrapers upon the drums, a bifurcated or forked arm 46 projects laterally outward from each end of each knife or scraper and, between the forks of this arm 46 a yoke 146 is pivoted to swing about a horizontal axis transverse of the arm 46. Between the arms of this yoke is arranged the upper threaded end of a rod 47 which is pivoted to the corresponding end standards 12 or 13 and is provided at its upper end with a hand wheel 48 which screws down on the threaded end of the rod 47. The hub of the hand wheel 48 bears down on the yoke 146 so that upon screwing the hand wheel 48 down, pressure is applied to the arm 46 and this pressure forces the edge of the knife or scraper 41 against the periphery of the adjacent drum. In order to provide a quick release of this pressure, the opposing faces of the hub of the hand wheel 48 and the yoke 146 are of cam form to provide abrupt shoulders 148 so that when the salient parts of the cam faces are in engagement, the hand wheel 48 and rod 47 can be drawn outwardly and free of the yoke 146 and arm 46.

Upon loosening the screws 46, the eccentric bushings 43 can be turned and it is apparent that by turning the eccentric bushings 43 the knives or scrapers 40 can be moved up or down the surface of the drums and that turning the bushings 43 also changes the angularity of the sharpened edges 41 of the knife relative to the peripheries of the drums so that wear of the sharpened edges 41 can be compensated for, and so that said angularity can be regulated to give the maximum scraping effect for different materials and remove the dried material as completely as possible. This eccentric adjustment also permits of having the knives resharpened, and when the knives are replaced, they can be adjusted to have the original angle with respect to the drum even though this angle is changed in resharpening.

The means for driving the drums 10 and 11 in opposite directions are preferably constructed as follows:

The numeral 50 represents the main drive shaft which is adapted to be driven in any suitable manner and is journaled at one end in a roller bearing 51 carried by the extended base 52 of the end head or standard 12 and by a roller bearing 53 also carried by this end head or standard 12. These rollers bearings 51 and 53 can be of any well known and approved construction. Keyed on the main drive shaft 50 is a herringbone pinion 54 which meshes with a herringbone gear 55 keyed to a countershaft 56. This countershaft is also journaled in a roller bearing 57 carried by the extended base 52 of the end head or standard 12 and at its opposite end by a roller bearing 58 also carried by this end head or standard 12, these roller bearings being of any usual and well known construction. The countershaft 56 also has keyed thereto a spur gear pinion 59 which meshes with a large spur gear wheel 60 carried by the spindle 18 of the drum 11. This large spur gear wheel 60 meshes with an equal sized large spur gear wheel 61 which is fast to the spindle 18 of the other drum 10. It is therefore apparent that upon turning the main drive shaft 50, this motion will be transmitted to rotate the drums 10 and 11 in opposite directions and at equal speeds through the herringbone pinion 54, herringbone gear 55, countershaft 56, spur gear 59, large gear 60 fast to the spindle 18 of the drum 11 and large gear 61 fast to the spindle 18 of the other drum 10. It will be noted that by journaling the drive shafts directly on the standard or end head 12 or its extended base 52 that all separate bearing stands are eliminated and that by the use of the herringbone gears 54 and 55 and by mounting the drive shafts in roller bearings, the friction is reduced and the drier can be operated at greater efficiency.

Arranged outside of each of the drums 10 and 11 and arranged to catch the dried material scraped off from these drums by the scrapers or knives 40 is a conveyer trough indicated generally at 65. Each of these troughs includes two side sheet metal plates 66 and 67 which are joined at their ends by permanent half round bottom sections 68 and 69 which can be either integral with the sides 66 and 67 or made separately and welded or otherwise secured thereto. These troughs extend the full length of the drums 10 and 11 and some distance beyond the standard or end head 13 and each is supported by a bracket 70 at one end having a half round angle iron 71 forming a cradle for the trough and a bracket 72 at the opposite end which forms a cradle for that end of the trough. Each of the brackets 70 and 72 is secured to the corresponding end head or standard 12 or 13. To catch all of the scraped dried material a hopper 73 is provided at the top of each trough. This hopper 73, as best shown in Figs. 2 and 8 consists of end walls 110 which can be removably or permanently attached to the ends of each trough 65 or its supports and at the outer vertical edge of each of these end walls an inwardly projecting retaining flange 111 is provided. To the upper edge of each trough plate 66 remote from the drum, is hinged an outer side wall 112 of the hopper 73, the hinges 113 being on the inside of the trough and hopper. This hinged outer side wall is made of sheet metal suitably reinforced at its edges by a bar 114 and flanges 115 and is provided with handles 116 by means of which it can be conveniently swung about its hinges. The outward movement of the hopper wall 112 about its hinges is limited by a stop plate 117 which is secured to the hopper wall 112 and projects beyond its pivotal or hinge connection to engage an angle iron 118 on the trough and thereby prevent the hopper wall 112 from swinging outwardly beyond the position shown in Fig. 8. The hinged connection of the wall 112 permits it to swing inwardly and protect the trough 65 from falling water when the drums are being washed.

The opposite side wall 119 of the hopper 73 is also made of sheet metal reinforced by bars 120 and its lower edge bears against a flange 121 provided on the side of the hopper wall 67 adjacent the drum and is held on this flange by a retaining

plying the material to be dried to said drum, a bushing carried by each of said end heads, a clamping member adapted to clamp said bushing in any position of its rotation relative to its end head, a knife adapted to scrape the dried material and having trunnions at its ends at the side remote from the scraping edge, said trunnions being received in off center openings provided in said bushings whereby upon turning said bushings said knife is moved along said drum and to any desired angle, and pressure means for holding said knife against said drum.

3. In a rotary drum drier having a rotary drum, means for applying the material to be dried to said drum, means for removing the dried material from said drum, and means for introducing steam into said drum, means for removing the condensate from said drum comprising a hollow arm arranged in said drum and rotating therewith, one end of said arm being arranged coaxially with said drum and communicating with a passage leading to the exterior of said drum and the other end carrying a scoop having openings arranged on opposite sides of the scoop and arranged to form a condensate collecting lip on opposite sides of a line extending longitudinally of said drum whereby in either direction of rotation of said drum said scoop picks up the condensate from the inner surface of said drum.

4. In a rotary drum drier having a rotary drum, means for applying the material to be dried to said drum, means for removing the dried material from said drum, and means for introducing steam into said drum, means for removing the condensate from said drum comprising a hollow arm arranged in said drum and rotating therewith, one end of said arm being arranged coaxially with said drum and communicating with a passage leading to the exterior of said drum and the other end carrying a scoop having openings arranged on opposite sides of the scoop and arranged to form a condensate collecting lip on opposite sides of a line extending longitudinally of said drum whereby in either direction of rotation of said drum said scoop picks up the condensate from the inner surface of said drum and a central partition in said arm and scoop whereby the condensate so picked up is caused to travel along said partition and be discharged at the inner end of said arm.

5. In a drum drier, a supporting frame, a rotary drum, means for applying the material to be dried to said drum, a knife blade for scraping the dried material from said drum, a holder for said knife blade and adjustable means for rotatably mounting said knife holder in said frame including an eccentric having its axis arranged parallel with the axis of said drum whereby said eccentric can be rotated to move said knife circumferentially along said drum and also to alter the angle of said knife blade relative to said drum.

6. In a drum drier, a supporting frame, a rotary drum, means for applying the material to be dried to said drum, a knife blade for scraping the dried material from said drum, a holder for said knife blade, a rotatable carrier mounted in said frame and rotating about an axis parallel with the axis of said drum, a holder for said knife blade and means for pivotally mounting said knife holder in said carrier with its axis parallel with and to one side of the axis of said carrier whereby said carrier and knife holder are adapted to be rotated to move said knife circumferentially along said drum and also to alter the angle of said knife relative to said drum.

7. In a drum drier, a pair of stationary end heads, a rotary drum carried by said end heads, means for applying the material to be dried to said drum, a knife blade for scraping the dried material from said drum, a holder for said knife blade, a rotatable carrier coaxially mounted in each end head and rotating about an axis parallel with the axis of said drum, a holder for said knife blade and means for pivotally mounting the opposite ends of said knife holder in said carriers with its axis parallel with and to one side of the axes of said carriers whereby said carriers and knife holder are adapted to be rotated to move said knife circumferentially along said drum and also to alter the angle of said knife relative to said drum.

HERMAN E. NEUBAUER.