

Jan. 29, 1935.

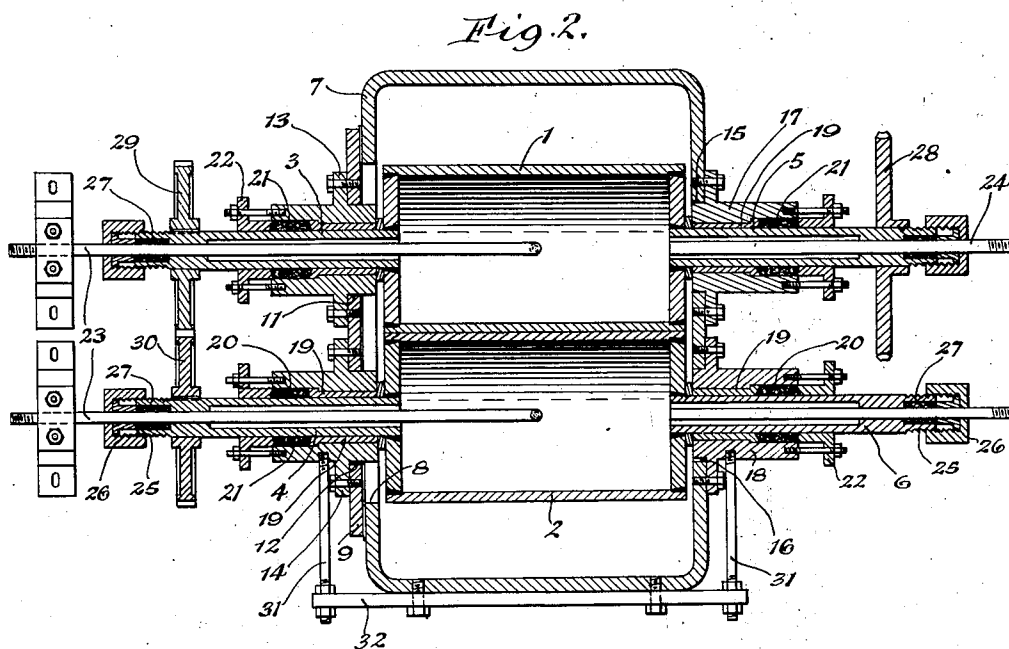
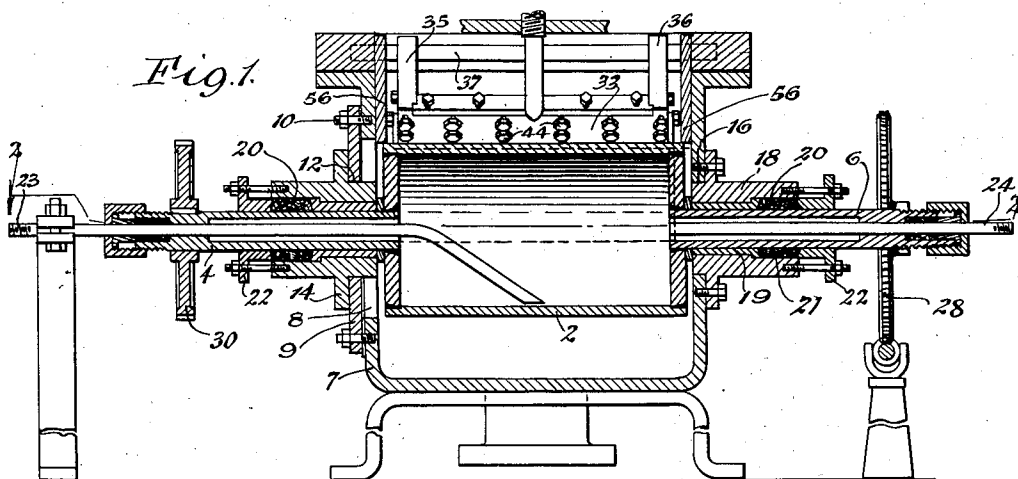
R. O. WOOD

1,989,255

ROTARY DRUM DRIER

Filed Nov. 3, 1930

2 Sheets-Sheet 1



Inventor
ROBERT O. WOOD

by

Fahs Lilly
Attorney

Jan. 29, 1935.

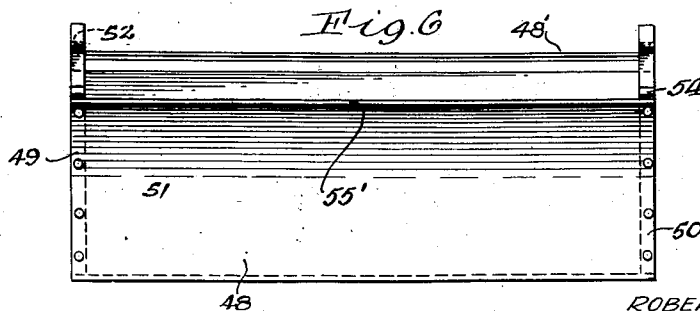
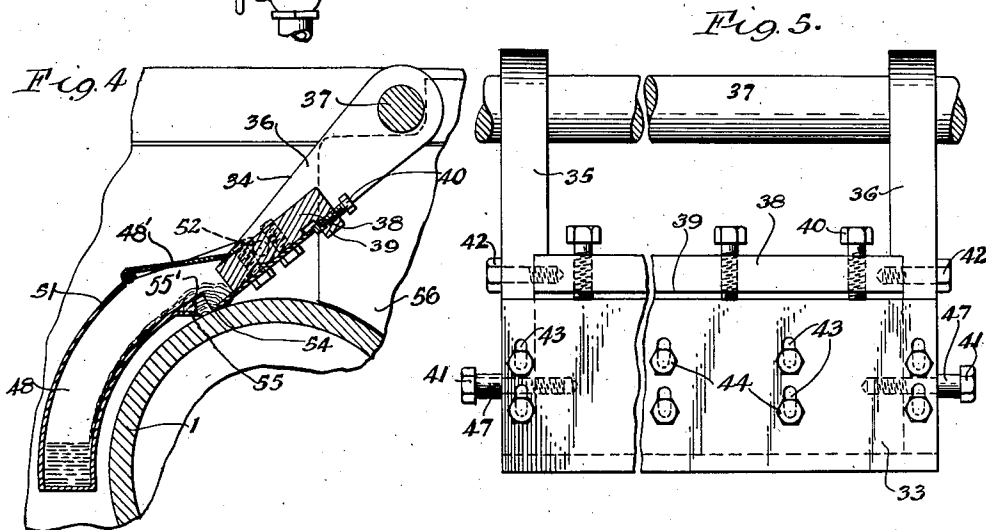
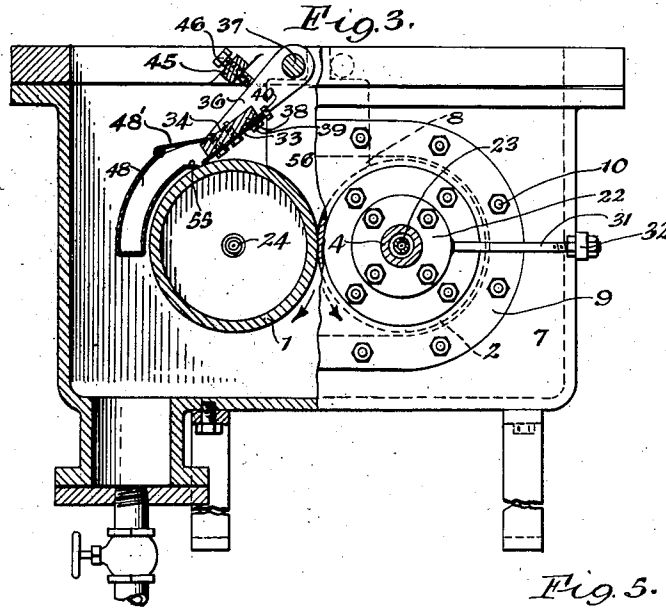
R. O. WOOD

1,989,255

ROTARY DRUM DRIER

Filed Nov. 3, 1930

2 Sheets-Sheet 2



by

Inventor
ROBERT O. WOOD
John S. Sibley
Attorney

UNITED STATES PATENT OFFICE

1,989,255

ROTARY DRUM DRIER

Robert O. Wood, Hamburg, N. Y., assignor to National Aniline and Chemical Company, Inc., New York, N. Y., a corporation of New York

Application November 3, 1930, Serial No. 493,134

14 Claims. (Cl. 159—12)

This invention relates to rotary drum driers or evaporators of the interiorly heated type, and comprises certain improvements in construction and design as will hereinafter be pointed out.

As ordinarily constructed these driers comprise two horizontal smooth faced rolls or drums, slightly separated at their peripheries and disposed on parallel axes, which revolve inversely, the drums or cylinders being interiorly heated by a suitable fluid such as steam, heated oil, etc. The liquid to be evaporated is introduced between the rolls and is prevented from flowing away by suitable retaining means. As the rolls revolve, their surfaces collect the liquid in a thin film which dries on the rolls almost immediately due to the high temperature at which the rolls are maintained. This film is then scraped off of the rolls in the course of their revolution by a knife or doctor.

Generally, in working with solids which are somewhat coherent, the film is scraped off in flakes or sheets. But in evaporating certain substances which have a tendency to dust, as for example, dyestuffs or certain food products, which have a somewhat brittle consistency, the doctor removes the film in fine particles some of which are discharged into the air at a considerable velocity. In addition to the loss of material thus entailed, these particles, especially if they form an obnoxious dust, such as is produced by dyestuffs, produce unhealthful working conditions. This condition can not be remedied by enclosing the drying rolls in a casing, for then the escaping water vapor formed in the evaporation moistens the particles removed from the rolls and produces an incompletely dried product.

According to one feature of the present invention, the doctor or scraper acts at a position on the upwardly moving surface of the roll sufficiently elevated above the axis of the roll so that the surface or tangent at the point of contact of the doctor with the roll makes an angle with the horizontal which is substantially equal to or less than the angle of repose of the material being treated. Consequently, the material which is scraped off of the roll, will accumulate on the surface of the roll adjacent the edge of the doctor and will dampen or completely suppress the tendency of the fresh particles to be expelled into the air. The accumulation of material on the surface of the roll adjacent the edge of the doctor will be assisted by the direction of rotation of the roll, which is upward at that position and consequently produces an apparent angle of repose at that point greater than the actual or absolute

angle of repose. A ledge or shelf is preferably provided adjacent the edge of the doctor which is spaced from the roll and from the doctor and upon which will be pushed the powdered material as it accumulates on the roll near the doctor, thereby increasing the accumulation of material around the edge of the doctor. From this ledge the powdered material is pushed by accumulation of material thereon down along an incline which is graded to prevent dusting, and into a container suitably closed to prevent dusting and access of steam and vapor thereto. In the preferred embodiment of the invention retainers bear against the faces of the drums to hold liquid within the confines of the drums and form narrow strip-like areas on the surface of the drums which are free from film and provide bearing surfaces for the ledge and hopper support.

For a more detailed description of the invention reference is made to the accompanying drawings showing a preferred embodiment of the invention and wherein Figure 1 is a view partly in vertical section, Figure 2 is a section taken on line 2—2 of Figure 1; Figure 3 is an end view partly in section; Figure 4 is a fragmentary view of the doctor, roll and hopper; Figure 5 is a fragmentary view of the doctor and support; and Figure 6 is an elevation of the hopper.

The numerals 1 and 2, designate two drying drums which are arranged on parallel axes and contact at their outer surfaces. The drums are supported on hollow trunnions 3, 5 and 4, 6, respectively. The drums 1 and 2 are enclosed within a casing 7, which has an opening 8 in one end thereof through which the rolls may be removed for replacement or repair. During operation, the opening 8 is closed by a side plate 9 which is held in position against the side of the casing by studs 10 threaded into the casing wall. A gasket interposed between the side plate 9 and side of the casing forms a liquid tight joint. The side plate 9 has an opening 11 and an elongated opening 12 therein in which are supported the bearing plates 13 and 14. On the opposite side the casing 7 has an opening 15 and an elongated opening 16 in which are supported the bearing plates 17 and 18. The trunnions 3, 4, 5 and 6 are journaled in the bearings 19, carried in the bearing plates 13, 14, 17 and 18. To prevent liquid from escaping from the casing, the bearing plates 13, 14, 17 and 18 have recesses 20 therein to receive the packing 21. Packing glands 22 are slideably secured over the trunnions 3, 5, 4 and 6 to compress the packing 21 in the recesses 20.

Steam is supplied to the drums 1 and 2 by pipes

23, and steam passes from the drums through the exit pipes 24. Since the construction of both drums 1 and 2 is identical only one need be described in detail. The trunnions 4 and 6 are exteriorly threaded at their outer ends as indicated at 25. Packing nuts 26 are threaded on the ends of the trunnions and compress the packing 27 between the interior walls of the hollow trunnions and the steam pipes 23 and 24, respectively, to provide steam tight joints.

The drum 1 is rotated by a worm driven by suitable means and coacting with the worm gear 28 secured to the trunnion 5. A gear 29 on the trunnion 3 coacts with the gear 30 on trunnion 4 to rotate drum 2 and drum 1 in opposing directions as indicated by the arrows. The bearing plates 14 and 18 are adjustable laterally to vary the distance between the periphery of the rolls by the adjusting rods 31 which bear against the bearing plates 14 and 18, and may be set at the desired spacing by locking the adjusting rods 31 to the adjustment rod support 32.

Knife blades or doctors 33 are adjustably held against the rollers 1 and 2 on supports 34. Since both knives and supports are of the same construction only one need be described in detail. The supports 34 consist of a pair of spaced side arms 35 and 36 suitably pivoted at their ends on a supporting rod 37 which is journaled in the casing 7. The other ends are joined by a knife adjusting plate 38 having a downwardly projecting bar 39 in which are seated the knife adjusting screws 40. The cap screws 41 and 42 clamp the knife adjusting plate 38 to the spaced side arms 35 and 36. The doctor 33 is slotted at 43 and is clamped to the knife adjusting plate 38 by cap screws 44 passing through the slots 43 and threaded into the knife adjusting plate. The knife supports 34 are held against pivoted displacement by a stop bar 45 in which are set the adjusting screws 46 which bear against the side arms 35 and 36 to adjust the pressure of the knife on the drum.

The screws 41 have a shoulder 47 thereon which serves as a pivotal support for the hopper or bin 48. The hopper 48 comprises two end plates 49 and 50 of generally arcuate shape, which are covered by a sheet metal covering 51 and which at their upper end are slotted at 52 to form a hook which fits under the shoulders 47 of the bolts 41. The end plates 49 and 50 have shoulders 54 formed on their lower edges to form a bearing which rests against the drum near its ends and forms a cantilever support for the hopper. The hopper is held in place by its own weight. A ledge 55 extends between the end plates 49 and 50, the edge 55' of which sufficiently clears the drum to permit the film of material thereon to pass underneath the edge without being scraped.

In operation material to be dried is supplied between the drums 1 and 2, as by supply-pipe 57 and is retained from flowing over the ends of the drums by the retaining blocks 56. Steam is supplied to the interior of the drums through pipes 23, for heating the drums. Spent steam is discharged from the drums through pipes 24. The drums are rotated in the direction of the arrows, Figure 3. The drums pick up a sheet or film of liquid as they pass through the liquid, which is quickly dried by the heated surface of the drums. The retaining blocks 56 are shown as bearing against the faces of the drums, and consequently they will form narrow strip like areas at the edges of the drums which are free

from dried film. The rotation of the drum carries the film around under the edge 55' till it reaches the knife 33 where it is scraped off as a fine powder. Because of the clear strip at the edge of the drum the dried powder which is scraped from the drum by the knife will not creep over the edge of the drum. The dried powder falls first onto the surface of the drum and accumulates on the ledge 55 until it covers the edge of the knife 33. The accumulation of material at the edge of the knife prevents the powdered particles from darting or spraying from the edge of the knife as they are separated from the surface of the drum. When sufficient material accumulates on the ledge 55 the further accumulation of material thereon pushes off the accumulated material which slides down the lower wall of the hopper into the hopper. There is little or no dusting in this operation. The shoulders 54 on the end plates 49 and 50 bear on the clear strips at the edges of the drums so that the edge 55' can be adjusted to clear the film of dried material on the drum. The hopper 48 is closed by a cover 48'.

The knife 33 is supported by the bar or rod 37 so that the thrust which the knife edge receives is almost in line with the knife edge and supporting bar 37. The knife can be adjusted to exert the required pressure on the drum by turning the set screws 46 in or out of the bar 45.

It will be obvious that changes in the construction shown in the accompanying drawings can be made without departing from the scope of the invention as defined in the appended claims.

Having described my invention what I claim as new and desire to protect by Letters Patent is:

1. In an apparatus of the character described, the combination comprising an upwardly moving inclined heated surface, means for supplying material to be dried in the form of a film on said surface, a doctor positioned above the surface and in contact therewith to remove the film therefrom in the form of a powder, the position of the doctor and the surface being such that at the line of contact of the surface and doctor the surface forms an angle with the horizontal less than the angle of repose of the powder, and a shelf adjacent the said surface and doctor, positioned below said line of contact for receiving excess accumulation of powder from the surface thereby assisting in covering the edge of said doctor.

2. In a rotary drum drier the combination comprising an internally heated drum, means for supplying liquid material to the drum to be dried in a film on its outer surface, a doctor positioned above the surface and in contact therewith for removing dried material therefrom in the form of a powder, the relative position of the doctor and the drum being such that the tangent to the surface of the drum at the line of contact of the doctor and drum forms an angle with the horizontal less than the angle of repose of the powder, a shelf spaced from the drum and adjacent the edge of the doctor for receiving the excess of powder which accumulates on the roll, and means separating said doctor and the material removed thereby from the atmosphere surrounding said drum.

3. In a rotary drum drier the combination comprising an internally heated drum, means for applying liquid material to the drum to be dried in the form of a film thereon, retainers bearing against the surface of the drum near its edges

for holding the liquid material within the confines of the drum, said retainer forming clear strips on the surface of the drum, a doctor for removing dried material from the drum, and a shelf for receiving dried material removed from the drum mounted adjacent the edge of the doctor and having bearings which rest upon said clear strips.

4. In a rotary drum drier the combination comprising an internally heated drum, means for applying liquid material to the drum to be dried in the form of a film thereon, retainers bearing against the surface of the drum near its edges for holding the liquid material within the confines of the drum, said retainers forming clear strips on the surface of the drum, a doctor positioned in contact with the drum for removing dried material therefrom, a pair of end plates mounted on said doctor and having bearings formed thereon which rest on the clear strips, and a shelf supported by said end plates to receive the dried powdered material.

5. In a rotary drum drier the combination comprising a rotatable heated drum, means for supplying liquid material to the drum to be dried in the form of a film thereon, a doctor positioned in contact with the drum and having an edge for removing dried material from the drum, a hopper having an edge formed to provide an outer shelf for receiving dried material removed from the drum, and means for mounting said hopper with the shelf adjacent the edge of the doctor but spaced from the drum, whereby dried material removed from the drum is retained so as to cover said edge of the doctor.

6. In a rotary drum drier the combination comprising a rotatable heated drum, means for supplying liquid material to the drum to be dried in the form of a film thereon, a doctor positioned above the surface and in contact therewith for removing the film therefrom in the form of a powder, the position of the doctor and drum being such that the tangent to the surface of the drum at the line of contact of the doctor and drum forms an angle with the horizontal less than the angle of repose of the dried powdered material, and a ledge spaced from the drum and mounted adjacent the edge of the doctor for receiving the powder, said ledge having bearings resting on said drum.

7. In a rotary drum drier the combination comprising a rotatable heated drum, means for supplying liquid material to the drum to be dried in the form of a film thereon, a pivotally mounted knife support, a knife in said knife support for removing the film from the drum, a plurality of shoulders projecting laterally from said knife support, a plurality of end plates having bearing shoulders formed thereon for resting on said drum and having their upper ends hooked under said first mentioned shoulders to form a cantilever support therefor, and a shelf supported by said end plates adjacent the edge of the knife.

8. In a rotary drum drier the combination comprising a rotatable heated drum, means for supplying liquid material to the drum to be dried in the form of a film thereon, a pivotally mounted knife support, a knife adjustably mounted in said support for removing the film from the roll, a plurality of shoulders projecting from said knife support, a plurality of end plates having bearing shoulders formed thereon for resting on said drum and having their upper ends retained under said first mentioned shoulders, and a ledge adjacent the edge of the knife supported by said end plates

in spaced relation to said drum for accumulating dried material at the edge of the knife.

9. In an apparatus of the character described the combination comprising a rotatable heated drum, means for supplying liquid material to the drum to form a film thereon, a pivotally mounted knife support, a knife adjustably mounted in said support for removing the film from the drum in the form of a powder, a plurality of shoulders projecting from said knife support, a plurality of members having bearing shoulders thereon for bearing on said drum and having their upper ends retained by said first mentioned shoulders to form a cantilever support therefor, a ledge mounted on said members spaced from said drum and adjacent said knife edge, and a closed hopper supported by said members for receiving material from said ledge.

10. Apparatus for drying materials comprising a heated rotatable drum, means for applying material to be dried to said drum, a doctor for removing dried material from said drum, and a container for receiving material removed from said drum, separating said doctor and said material removed from said drum from the atmosphere surrounding said drum.

11. Apparatus for drying materials comprising a heated rotatable drum, means for applying material to be dried to said drum, a doctor for removing dried material from said drum, and a container for receiving material removed from said drum by said doctor, said container being substantially closed to the atmosphere about said drum.

12. In a rotary drum drier, the combination comprising an internally heated rotating drum, means for supplying liquid material to the drum to be dried in a film on its outer surface, retainers bearing against the surface of the drum near its edges for holding the liquid material within the confines of the drum, said retainers forming clear strips on the surface of the drum, a doctor positioned above the drum and in contact therewith for removing dried material therefrom in the form of a powder, the position of the doctor being such that the tangent to the surface of the drum at the line of contact of the doctor and the drum forms an angle with the horizontal less than the angle of repose of the powder, and a closed hopper for receiving powder from said doctor, said doctor comprising a pivotally mounted knife support, a knife adjustably mounted in said support, and a plurality of shoulders projecting from said knife support, and said hopper comprising side members mounted on said shoulders, and having projecting bearing surfaces for resting on said clear strips, and a ledge adapted to receive powder from said knife and retain it in contact with the edge of the knife.

13. In an apparatus of the character described, the combination comprising an upwardly moving inclined surface, means for supplying material to form a film on said surface, a doctor for removing the film from said surface in the form of a powder, said surface in the course of its upward movement passing through a position where it forms an angle with the horizontal less than the angle of repose of the powder, and means for mounting said doctor above said surface and in a plane which forms an angle with the horizontal greater than the angle of repose of the powder, the location of the doctor being such that it contacts said surface while the latter is in said position, whereby powder removed by the doctor is

discharged downward over the edge of the doctor
and rests on said surface below the doctor.

14. In a rotary drum drier, the combination comprising an internally heated rotating drum, means for supplying liquid material to the drum to be dried in a film on its outer surface, a doctor for removing dried material from the drum in the form of a powder positioned above the drum and in contact with said surface in the course of its upward movement, the position of the doctor being such that the tangent to the surface of the

drum at the line of contact of the doctor; and the drum forms an angle with the horizontal less than the angle of repose of the powder, and means for mounting said doctor in said position and in a plane which forms an angle with the horizontal greater than the angle of repose of the powder, whereby powder removed by the doctor is discharged downward over the edge of the doctor and rests on said upwardly-moving surface below the doctor.

ROBERT O. WOOD.