May 17, 1949. W. L. McGEHEE 2,470,315

MULTIPLE STAGE PULVERIZING AND DEHYDRATING TUBE MILL

Filed April 29, 1944 2 Sheets-Sheet 1

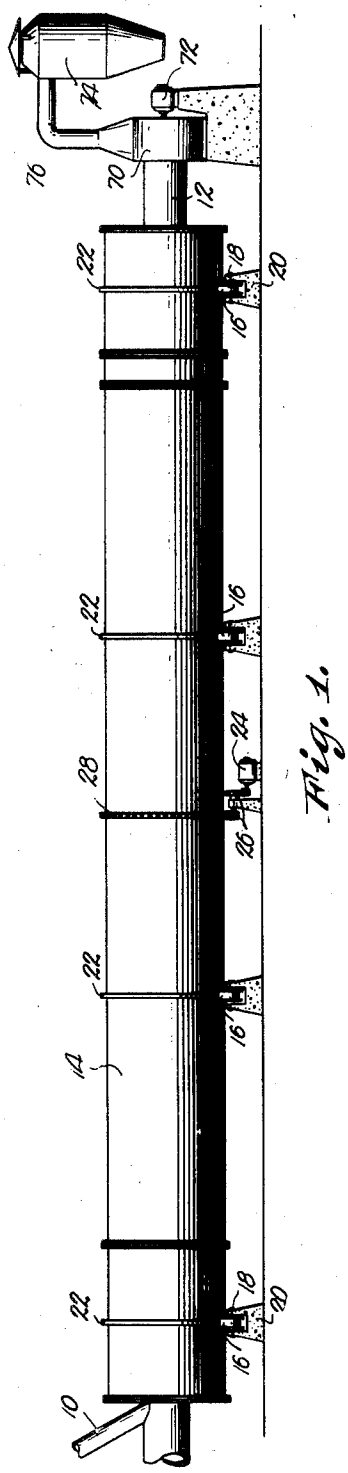


Fig. 1.

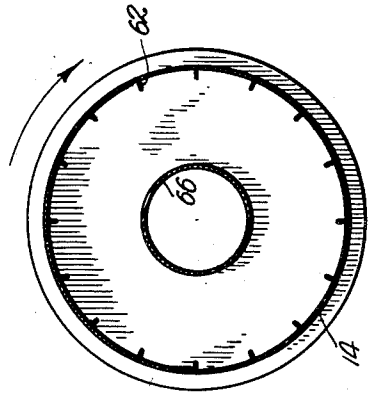


Fig. 7.

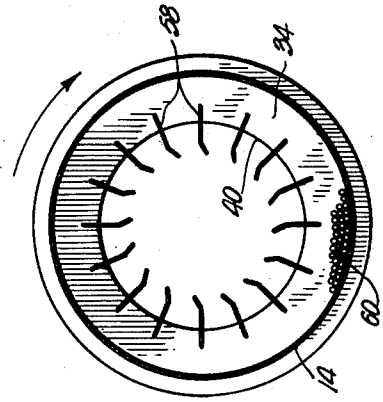


Fig. 6.

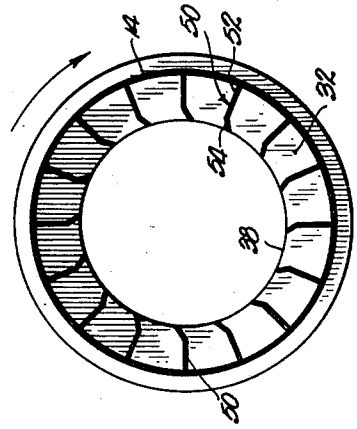


Fig. 5.

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MULTIPLE STAGE PULVERIZING AND DEHYDRATING TUBE MILL

Filed April 29, 1944 2 Sheets-Sheet 2

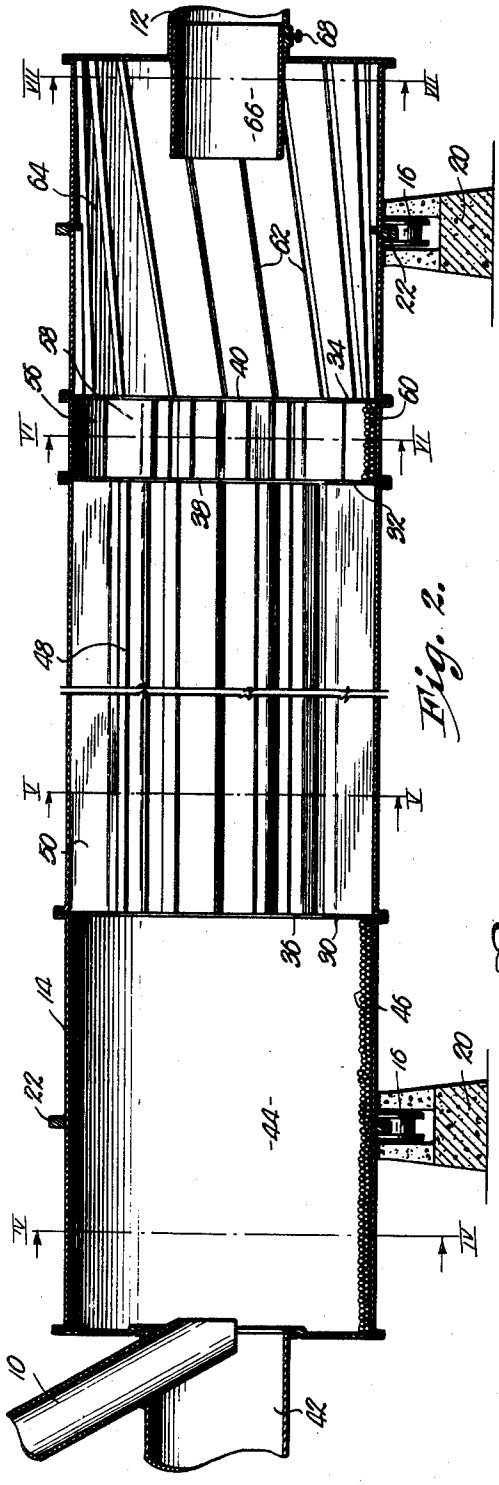


Fig. 2.

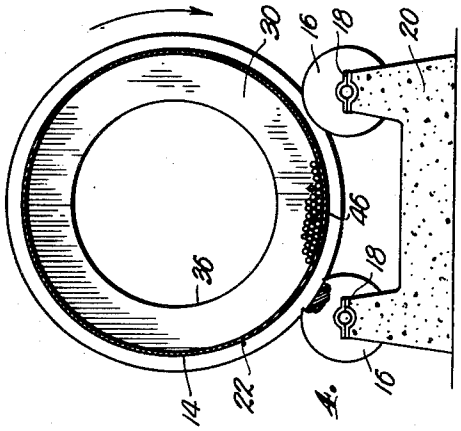


Fig. 4.

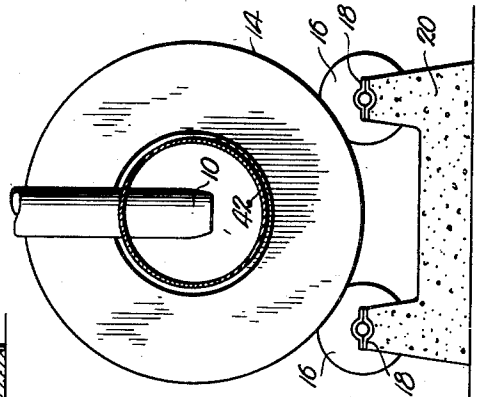


Fig. 3.

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MULTIPLE STAGE PULVERIZING AND DEHYDRATING TUBE MILL

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Application April 29, 1944, Serial No. 533,274

4 Claims. (Cl. 241—54)

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This invention relates to dehydrating equipment of the character adapted to remove moisture from such solids as lend themselves to being comminuted in the process of drying.

The primary aim of this invention is the provision of a continuous flow dehydrator, having a rotatable cylindrical body disposed horizontally and separated into a number of divisions, each capable of acting upon the material in a manner insuring thorough, efficient and rapid treatment effecting the removal of moisture.

An important aim of this invention is to provide a dehydrator of the aforementioned type, wherein one of the divisions of the cylinder is equipped with back-feeding vanes to establish a counter-flow of such material as is not thoroughly dried when it reaches a zone adjacent to the outlet pipe.

A yet further aim of this invention is to provide a dehydrator of the continuous flow type having as a portion thereof, two adjacent subdivisions, one having feed-back vanes therein, and the other having shovels and grinding balls to insure a pulverizing action on the fed-back substance and a lifting of the pulverized material to a place within the hot gases as they approach the outlet pipe.

Other objects of the invention will appear during the course of the following specification, referring to the accompanying drawing, wherein:

Fig. 1 is a side elevational view of a continuous flow dehydrator embodying the present invention.

Fig. 2 is a longitudinal central fragmentary sectional view through the dehydrator.

Fig. 3 is an end elevational view thereof.

Fig. 4 is a cross sectional view taken on line IV—IV of Fig. 2, looking in the direction of the arrows.

Fig. 5 is another cross sectional view taken on line V—V of Fig. 2.

Fig. 6 is a cross sectional view taken on line VI—VI of Fig. 2; and

Fig. 7 is a still further sectional view taken on line VII—VII of Fig. 2.

The drying of feeds such as alfalfa and the dehydration of other substances capable of being entrained in a travelling stream of air, may be accomplished through the employment of the dehydrator shown in the accompanying drawings.

The length of the cylinder and the nature of its sub-divisions is such as to insure thorough removing of moisture as the material being treated passes from the feed chute 10 to the outlet pipe 12.

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The hollow cylinder 14 into which feed chute 10 directs the material and from which outlet pipe 12 removes the dried, comminuted material, is mounted upon rollers 16, rotatably journalled in bearings 18, mounted on foundations 20.

Rollers 16 are flanged to receive annular tracks 22 and as the cylinder 14 rotates about its longitudinal axis, endwise, displacement is precluded.

Power is imparted to cylinder 14 through the medium of a conventional electric motor 24 that drives a train of gears 26, one of which is in mesh with the ring gear 28 circumscribing the cylinder 14 adjacent its longitudinal central portion.

In practice, the cylinder is substantially 60 ft. in length and 6 ft. in diameter. It is separated into a number of divisions through the medium of annular partitions 30, 32 and 34 respectively. These partitions are ring-shaped and extend inwardly a short distance from the annular inner surface of cylinder 14. The width of these said partitions 30, 32 and 34 should be substantially 12 in. to provide an opening 36 through partition 30, an opening 38 through partition 32, and an opening 40 through partition 34.

The first division nearest the inlet conduit 42 for hot gases or products of combustion, is designated by the numeral 44 and is a preheating chamber having a length of substantially 8 ft. In some instances, balls 46 are used to insure a comminuting action or a breaking up of such materials as are starchy or sticky. A preheating of the material occurs in this chamber 44, and since the pressure or velocity of the incoming products of combustion are relatively great in this chamber, the material being treated is carried into the main drying compartment 48 as it is reduced in weight. A reduction of surface moisture here permits a build-up of material on lifters 50.

This main drying compartment is substantially 16 ft. in length and under certain conditions, must have radial lifters 50. These lifters 50 are shown in section in Fig. 5, and each comprises a radial portion 52 that terminates in an inclined marginal, innermost end 54 that precludes the escape of material from each lifter until after the lifters have reached the uppermost point in their path of travel.

As the material is lifted and dropped by gravity across opening 38 in partition 32, it is moved toward the outlet pipe 12 and into the classifying and drying section 56, wherein is positioned a number of radial shovels 58, formed and dis-

posed as clearly illustrated in Fig. 6. These shovels have their outer ends spaced inwardly from the face of the wall of cylinder 14 to provide room for balls 60.

This classifying and drying section 56 is substantially 18 in. in width and confined between partitions 32 and 34. The balls 60 and shovels 58 therein cooperate with a series of inclined vanes 62 in the air-flotation and back-feeding chamber 64. These vanes 62 cause a counterflow of such material as will lie against the wall of the rotating cylinder, and since this material contains moisture to a sufficient amount to preclude its being blown through outlet pipe 12, it customarily needs further grinding or comminuting. When the material is moved rearwardly or in a direction counter to the flow of the products of combustion through cylinder 14, it is directed into classifying section 56 and there retreated and dropped by shovels 58 across the opening 40 to be entrained in the hot gases, and thereafter carried to outlet pipe 12, unless the action of gravity removes the material to a point where it may again be acted upon by vanes 62.

The moisture content of the material passing through outlet pipe 12 may be determined by the position of adjustable pipe 66, telescoped with outlet pipe 12 and held in a predetermined set condition by set bolt 68. When pipe 66 is moved outwardly to dispose a lesser amount of its length in chamber 64, the material escaping from the dehydrator is drier than when the pipe 66 is moved inwardly to the position illustrated in Fig. 2. In this position, the material withdrawn from the dehydrator has a higher moisture content than when the pipe 66 has its inner end closer to the end wall of cylinder 14.

Feed chute 10 has its outlet end at the zone of juncture between the hot gas inlet conduit 42 and the end of the cylinder so that material entering cylinder 14 through feed chute 10, will not have an opportunity of settling in preheating chamber 44 without being dispersed by the blast of heated gases entering conduit 42.

Outlet pipes 12 and 66 are preferably made to be 28 in. in diameter and inlet conduit 42 should be substantially the same diameter to insure effective throughput of material being treated. A suction fan 70 in connection with pipe 12, is operated by motor 72 and this fan 70 is connected to a cyclone separator 74 through the medium of a conduit 76, in conventional manner.

The temperature of the gases entering conduit 42 should be substantially 700° F., to the end that dehydration of such substances as alfalfa may be effectively accomplished after the full length of cylinder 14 has been traversed. The temperature at the outlet pipe 12 will be about 180° F., but since these figures are examples to show the temperature differential between the ends of the cylinder, and further since the character of the material being treated may require a variation in the temperature of the flue gases introduced through pipe 42, it is necessary to determine requirements in this respect before operating the dehydrator.

Balls 46 and 60 may not always be needed, and therefore, the mention thereof is to indicate that in many instances they may advantageously be used in chambers 44 and 56. Light, flaky substances are sometimes treated without the use of radial lifters 50 in compartment 48 and their use, therefore, is not essential sofar as the function of the specially formed divisions of the cylinder designated by the numerals 56 and 64.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A continuous flow dehydrator of the character described, comprising a rotatable cylinder having its longitudinal axis disposed horizontally; means for rotating the cylinder; a hot gas inlet conduit axially disposed at one end of the cylinder; an outlet pipe axially positioned through the other end of the cylinder; means for feeding material to be dehydrated into said cylinder adjacent said hot gas inlet conduit; a suction fan in communication with the outlet pipe to create a current of gas through the cylinder from the inlet conduit to the outlet pipe; and a plurality of partitions setting off a series of divisions within the cylinder, each of said partitions being an annulus and extending radially inwardly from the wall of the cylinder, whereby to present an opening for the passage of the material being dehydrated, from one division of the cylinder to the next, the division at the end of the cylinder having the outlet pipe therethrough having longitudinally inclined vanes therein disposed to feed material in a direction counter to the direction of flow of hot gases through the cylinder and against the proximal partition, said vanes forming a number of open-sided, elongated stalls in direct communication throughout their lengths with the interior of the said cylinder and the current of hot gases passing through the latter.

2. A continuous flow dehydrator of the character described, comprising a rotatable cylinder having its longitudinal axis disposed horizontally; means for rotating the cylinder; a hot gas inlet conduit axially disposed at one end of the cylinder; an outlet pipe axially positioned through the other end of the cylinder; means for feeding material to be dehydrated into said cylinder adjacent said hot gas inlet conduit; a suction fan in communication with the outlet pipe to create a current of gas through the cylinder from the inlet conduit to the outlet pipe; and a plurality of partitions setting off a series of divisions within the cylinder, each of said partitions being an annulus and extending radially inwardly from the wall of the cylinder, whereby to present an opening for the passage of the material being dehydrated, from one division of the cylinder to the next, one of said divisions having a number of grinder balls and a plurality of radially disposed shovels between the partitions forming that division, said shovels each having their outer ends spaced from the inner annular surface of the cylinder wall to allow free movement of the balls along the inner face of the wall of the cylinder and between the partitions forming the division containing the balls, said shovels each having its inner marginal portion forwardly angled out of the major plane of the shovel to retain the lifted material thereon until the remaining portion of the shovel passes a vertical position at the uppermost part of its path of travel.

3. In a continuous flow dehydrator of the character described, a horizontally disposed cylinder having an inlet and an outlet opening, said openings being axially disposed at opposite ends of the cylinder; a plurality of annular partitions having openings on the axis of the cylinder to set off a number of divisions in the cylinder, means for feeding material to be dehydrated into said cylinder adjacent said inlet opening and means for directing a current of hot gases through the cylinder from the inlet opening to the outlet open-

ing; a series of inwardly-directed, radial, longitudinally-inclined vanes secured to the inner wall of said cylinder and disposed in one of the divisions adjacent to the outlet opening to cause reversal of flow of some of the material being treated after the same has travelled through a portion of length of the cylinder and then dropped between the vanes, said vanes forming open-sided stalls in direct communication with the interior of the cylinder, the vanes terminating at the innermost ends thereof adjacent a proximal partition for dumping said reverse flow material into another of the divisions.

4. In a continuous flow dehydrator of the character described, a horizontally disposed cylinder having an inlet and an outlet opening, said openings being axially disposed at opposite ends of the cylinder; a plurality of annular partitions having openings on the axis of the cylinder to set off a number of divisions in the cylinder, means for feeding material to be dehydrated into said cylinder adjacent said inlet opening and means for directing a current of hot gases through the cylinder from the inlet opening to the outlet opening; a series of inwardly-directed, radial, longitudinally-inclined vanes secured to the inner wall of said cylinder and disposed in one of the divisions adjacent to the outlet opening to cause reversal of flow of some of the material being treated after the same has travelled through a portion of length of the cylinder and then dropped between the vanes, said vanes forming

open-sided stalls in direct communication with the interior of the cylinder, said one division having the vanes therein being provided with an outlet pipe projecting thereinto from the outlet opening of the cylinder to a point between the ends of the said one division, said vanes extending the full length of the said division.

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