April 18, 1950 J. W. BELL 2,504,378

ROTARY DRIER

Filed Aug. 20, 1946

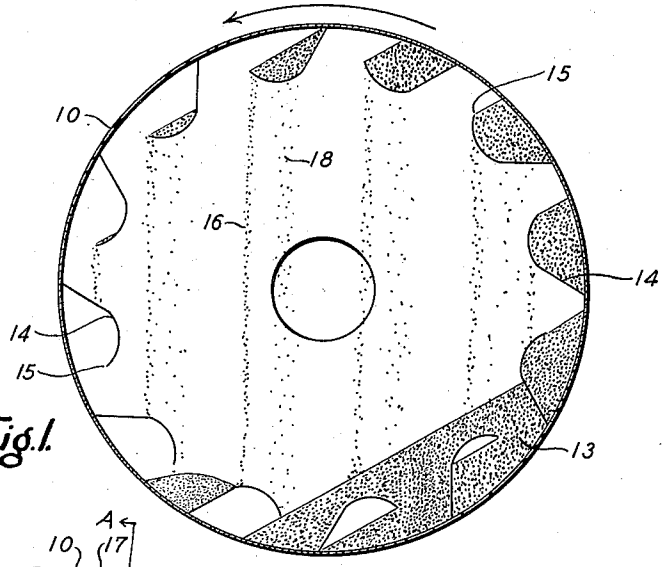


Fig. 1.

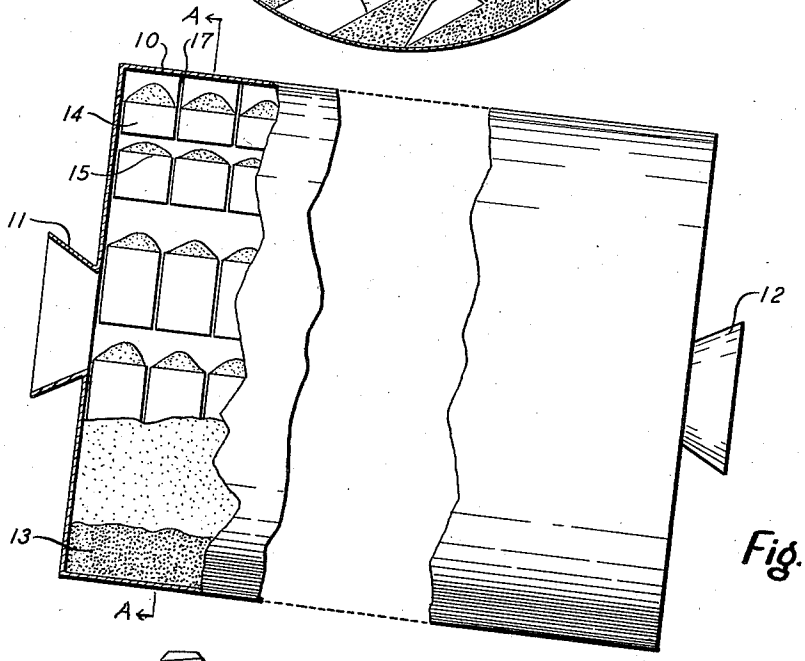


Fig. 2.

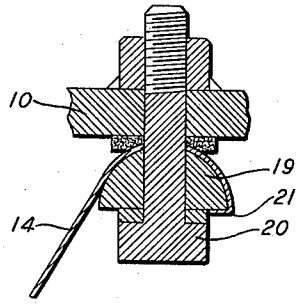


Fig. 3.

INVENTOR
John W. Bell
BY F. Gerald Stoyle
ATTORNEY

Patented Apr. 18, 1950

2,504,378

UNITED STATES PATENT OFFICE

2,504,378

ROTARY DRIER

John W. Bell, St. Catherines, Ontario, Canada

Application August 20, 1946, Serial No. 691,802

2 Claims. (Cl. 34—136)

1

My invention relates to drying apparatus and more particularly to improvements in rotary driers for drying comminuted material and the like.

A typical form of drier for the drying of comminuted or powdered material consists of an elongated rotating cylinder into which the material to be dried is fed and in which it is subject to a current of warm air blown through the cylinder. Commonly the cylinder is mounted with its axis slightly inclined and the material is continuously fed through an opening at the high end and is continuously expelled at the other end. To expose the material to the drying effect of the current of air, it is customary to provide scoops on the inner cylindrical wall whereby as the cylinder rotates the material is picked up by the scoops from the mass of material at the bottom and is later spilled from the scoops at a further period of their rotation.

The object of my invention is to provide a drier having an improved construction and arrangement of scoops whereby an improved exposure of the material to the current of air is obtained, with consequent increase in the drying capacity of the apparatus.

A further object of my invention is to provide a drier having material distributing scoops which are self-cleaning.

Other objects and advantages of my invention will become apparent from a consideration of the following detailed description of a specific embodiment thereof in which Fig. 1 is a sectional view transversely of a drier cylinder taken along the line AA of Fig. 2; Fig. 2 is a longitudinal view of a drier cylinder, shown broken for convenience of illustration and with the left hand end in section; and Fig. 3 is a view on an enlarged scale of a detail.

Referring to the drawings, 10 represents a drying cylinder which is of considerable length, but in Fig. 2 is shown broken away for convenience of illustration. The cylinder will be mounted for rotation by any suitable means of known type which has not been illustrated as the particular means forms no part of my invention. The cylinder is mounted at a slight incline and a feed inlet 11 is shown at the axis of the upper end. A suitable outlet for dried material is indicated at 12 at the lower end of the cylinder. The direction of rotation of the cylinder is indicated by the arrow shown above the cylinder in Fig. 1. During operation, material to be dried is fed in the inlet 11 and gradually works its way to the outlet 12 where it is discharged. During its

2

passage through the cylinder, it is picked from the accumulation 13 of material in the bottom of the cylinder by scoops 14 which spill it into a current of warm air which may be passed through the cylinders either with the flow or in counterflow thereto. A series of rows of flights or scoops 14 are symmetrically spaced circumferentially on the inner wall of the cylinder, twelve rows being shown. As can be best seen in Fig. 2, each row of scoops consists of a plurality of individual scoops 14 of relatively short length compared to the length of the drier. The spaces 17 separating the individual scoops 14 of a row are of sufficient width to permit the passage of the particular type of material being operated on. The scoops 14 are made of spring metal of a composition adapted to resist corrosion by the moist material being dried and of a gauge thin enough so that the scoop when loaded will tend to oscillate and have a configuration as shown in Fig. 1. They are mounted with one end anchored to the cylindrical wall 10 and with the other end 15 free. As the drum rotates the scoops 14 enter the accumulated material 13 in the bottom of the drum at the left-hand side and pick up a full charge of material. As the scoops emerge from the material 13 and progress in their travel, they continuously spill the material over their ends 15. Due to the scoops being of thin gauge spring material anchored only at their wall end and are otherwise unsupported they tend to vibrate or oscillate through a narrow range about the clamped end as an axis and the period of vibration varies with the degree of loading. As the scoops are supported separately they vibrate independently of one another. The scoops are bent in a smooth curve so that the material bearing surface is free from sharp bends, the free ends thereof are reverted towards the cylinder wall whereby some material is retained therein for the greater part of the upper half of their travel. The material in the scoops is also spilled through the slots 17 between the scoops 14 and this spilling will continue as long as there is material in the scoop due to the continuous readjustment of the position of the material in the scoop in its travel. As stated the slots between the adjacent scoops are wide enough to permit the passage of a particular size of particles of material to be dried. They are, however, as shown in Fig. 2 relatively narrow compared to the width of the scoop whereby the flow of material therethrough from the sides of the piles of material in the scoop is regulated. The regular flow of material through the slots between the scoops is

assisted by the relative movement of adjacent scoops due to their independent vibration. The relative movement of the scoops also acts to prevent the clogging of these slots by the damp granular material. It will thus be seen that the material to be dried is uniformly spilled into the current of drying air across the whole width of the cylinder. The material spilling from the free ends 16 of the scoops form a plurality of curtains of falling material, indicated at 16 in Fig. 1, extending lengthwise of the cylinder, and the material spilling through the slots 17 form a plurality of curtains of falling material indicated at 18 in Fig. 1 and extending transversely of the cylinder and the air current. It will be apparent that for a given size of drier that the addition of the large number of curtains of falling material located across the path of the drying medium, increases to a great extent the surface area of material exposed to the drying gas over that of the conventional type of scoops in which the slots are not present. It will be apparent that the increased drying efficiency afforded by the presence of the curtains of falling material lying transversely of the air flow over a similar structure without the transverse curtains will permit a drier of given drying capacity to be constructed of shorter length with the consequent saving in initial cost and with the advantage of requiring less floor space and less driving power.

In the preferred manner of use the drying gas passes through the drier flowing counter to the material. In conventional rotary driers for granular material, such for example as those illustrated and discussed in an article published in the Transactions of the American Institute of Chemical Engineers vol. 38 at page 124 et seq. and at page 841 et seq., entitled "Factors influencing rotary drier performance" the material to be dried cascades from the flights in a series of curtains of falling material longitudinally of the drier and the warm air flows through the cylinder between and parallel to these curtains. A certain amount of fine dry material is carried from the drier with the air current. In the drier of my invention the transverse curtains of falling material lying in the air passage between the longitudinal curtains serve to intercept the dry fines as they are carried towards the moister material at the input end to a greater extent than would be the case if the transverse curtains were not present.

A suitable means for attaching the ends of the scoops 15 to the cylinder wall is indicated in Fig. 3. The attachment end of the scoop 14 is bent to semi-cylindrical form to correspond in curvature to the surface of a half round bar 19. A single bar 19 may engage a plurality of the scoops in a row and bolts 20 detachably secure them to the shell 10 with the curved surface clamped thereagainst. The extreme ends 21 of the scoops are bent to engage the flat side of the bar 19. The mounting above described supports the clamped end of the spring in a manner such that the tendency of the springs to weaken and break at the clamping point under vibration is minimized. As stated the scoops 14 are of spring material anchored at one end only and in operation are free to vibrate individually. This construction makes for a self-cleaning apparatus. The relative movement of adjacent scoops 14 due to the vibration prevents the slots 17 between them from clogging with material. In addition the continuous vibration together with the smooth contour of the scoops tends to prevent particles of material sticking thereto and gradually clogging them.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a rotary drier for drying granular material, a cylindrical shell with a feed opening at one end, a discharge opening at the other end, means for circulating a drying gas lengthwise therethrough, and means for elevating and releasing the material to fall in a series of longitudinal curtains and a series of transverse curtains through the drying gas comprising rows of flights circumferentially spaced about the inner surface of the cylinder wall, each row lying parallel to the axis of the cylindrical shell and comprising a plurality of aligned individual scoops spaced from one another a distance sufficient to permit the granular material to pass therebetween but close enough together to control the flow of the material therethrough as the drier rotates, clamping means securing the individual scoops at one end to the wall of the drier, said scoops being otherwise unsupported and unobstructed and made of spring metal of sufficiently light gauge so that they will oscillate through a narrow-range about their clamped end as a pivot when loaded with material, said scoops having a continuously curved material bearing surface shaped to retain some of the material throughout the greater portion of each revolution of the drier.

2. In a rotary drier for drying granular material, a cylindrical shell with a feed opening at one end, a discharge opening at the other end, means for circulating a drying gas lengthwise therethrough, and means for elevating and releasing the material to fall in a series of longitudinal curtains and a series of transverse curtains through the drying gas comprising rows of curved flights circumferentially spaced about the inner surface of the cylinder wall and shaped to pick up material and gradually spill it throughout the greater part of each revolution of the drier, each row of flights comprising a plurality of aligned individual sections spaced from one another a distance sufficient to permit the granular material to pass therebetween but close enough together to control the flow of material therethrough as the drier rotates, each section having its wall engaging end formed in a curve reverse to the curve of the body of the section, means for clamping the sections to the wall of the drier comprising a bar with a transversely curved surface co-operatively engaging the said curved end of the section, said sections made of spring metal of sufficiently light gauge so that they will oscillate through a narrow range about their clamped ends when loaded with material.

JOHN W. BELL.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,196,376	Meyer	Aug. 29, 1916
1,595,659	How	Aug. 10, 1926
2,096,049	Lissauer	Oct. 19, 1937
2,275,600	Arnold	Mar. 10, 1942

FOREIGN PATENTS

Number	Country	Date
394,574	Germany	Oct. 20, 1922