

R. S. KENT.

APPARATUS FOR DRYING FINELY DIVIDED MATERIAL.

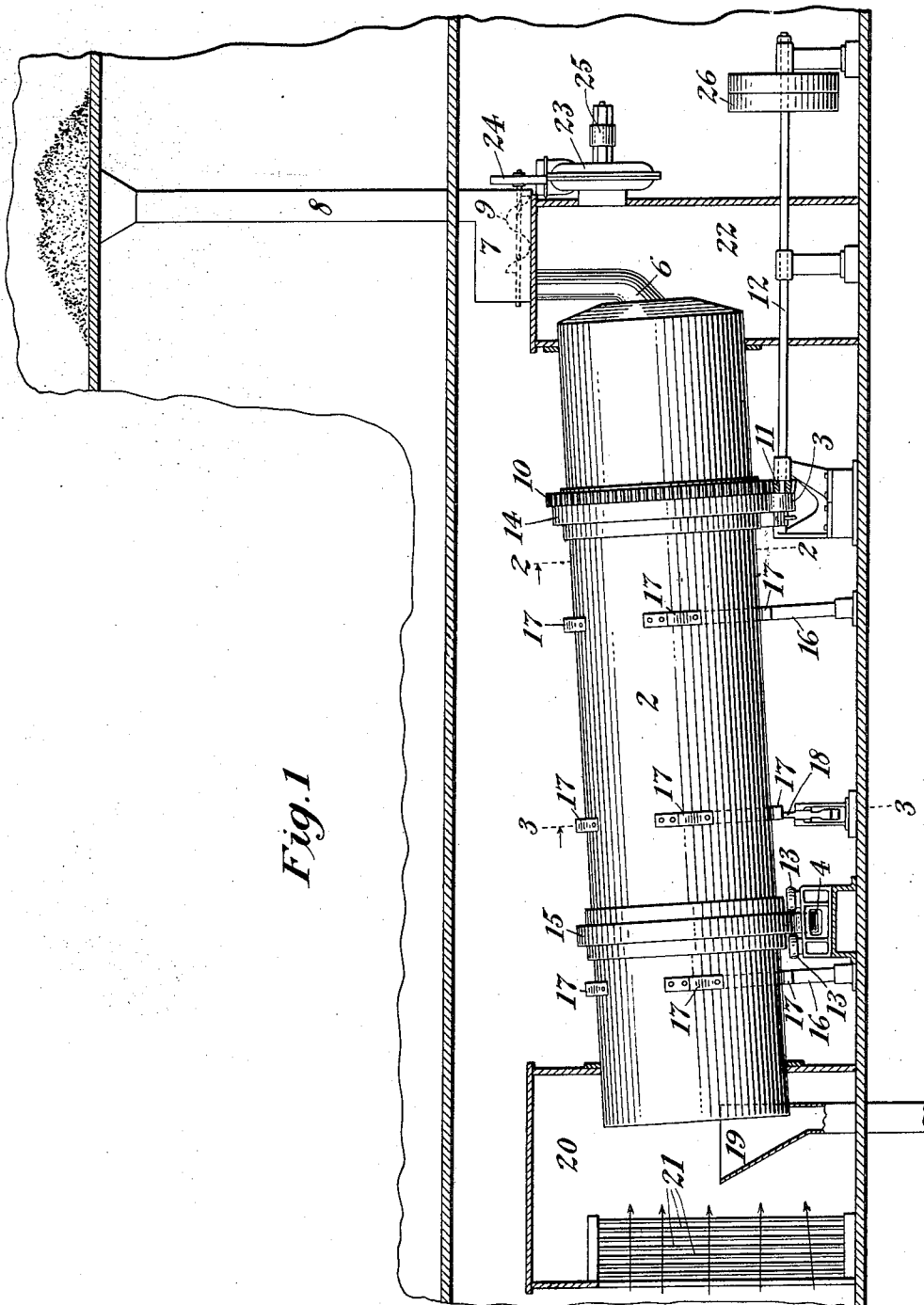
APPLICATION FILED MAY 14, 1908.

Patented Mar. 2, 1909.

3 SHEETS—SHEET 1.

914,052.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

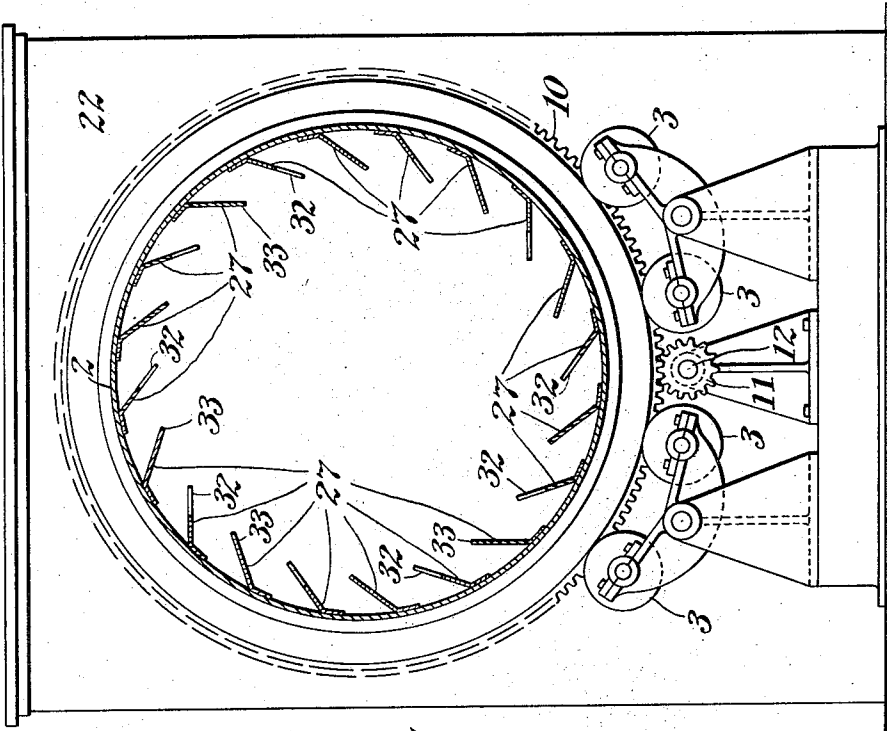
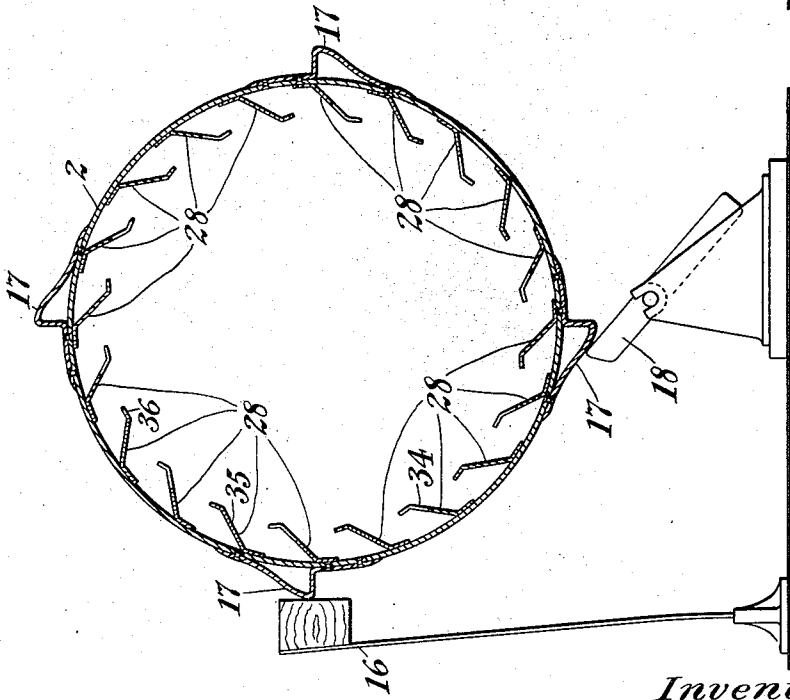


Fig. 3



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3 SHEETS—SHEET 3.

Fig. 5

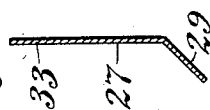


Fig. 6

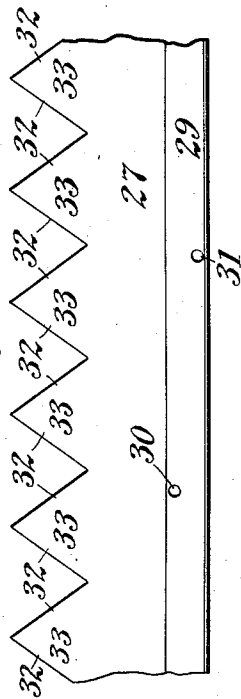


Fig. 4

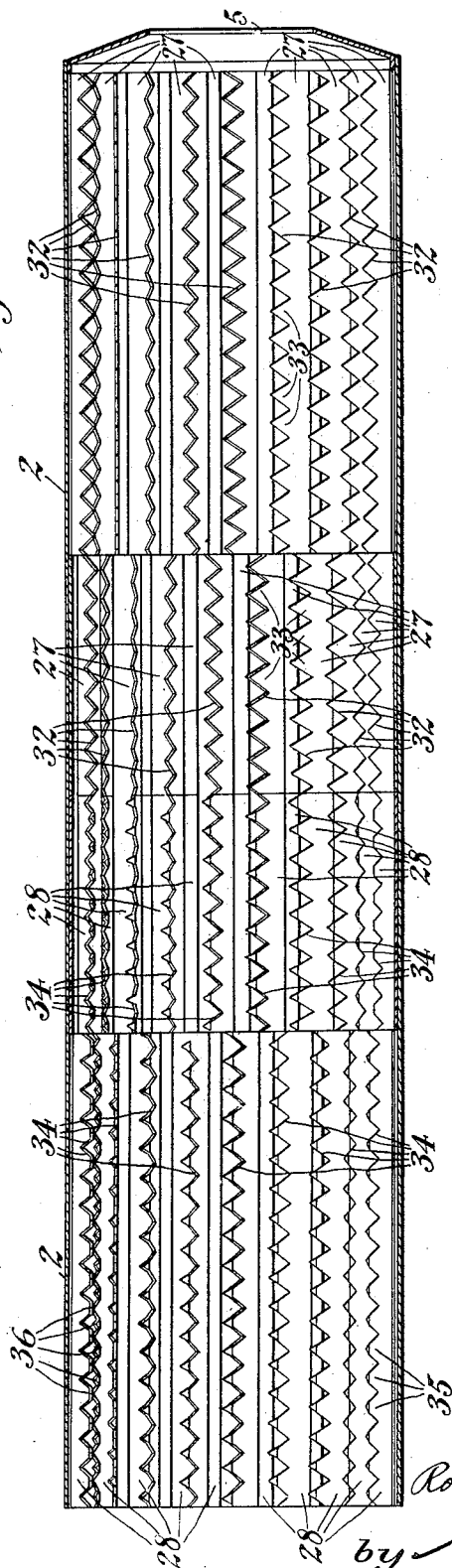


Fig. 8

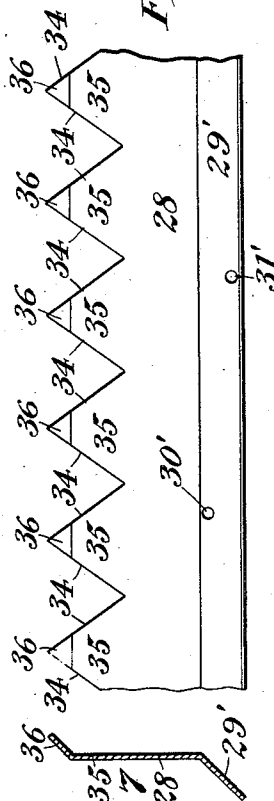
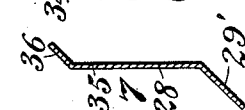


Fig. 7



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UNITED STATES PATENT OFFICE.

ROBERT SAYRE KENT, OF BROOKLYN, NEW YORK.

APPARATUS FOR DRYING FINELY-DIVIDED MATERIAL.

No. 914,052.

Specification of Letters Patent.

Patented March 2, 1909.

Application filed May 14, 1908. Serial No. 432,834.

To all whom it may concern:

Be it known that I, ROBERT SAYRE KENT, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Apparatus for Drying Finely-Divided Material, of which the following is a specification.

This invention relates to apparatus for drying finely divided material, and particularly to an apparatus for drying moist granulated sugar, and the principal object of the invention is to provide means for pouring or spilling such material in such a manner that the material is exposed more fully than heretofore to the air or other drying medium through which it falls.

The principal feature of the apparatus employed for carrying into effect the present invention is a conveyer movable in such a manner as to pour or spill finely-divided moist material over an edge of considerably greater length than the straight edge over which such material is usually delivered. The conveyer is preferably in the form of a drum pivoted for rotation about an axis, and the edge over which the material is spilled is, in the preferred construction, irregular or zigzag and formed in a flight or flights running lengthwise of the drum and secured thereto, preferably inside the same. With a circuit of flights so constructed, each flight forms with the drum a material-conveyer or bucket movable about the axis of the drum, and when the drum is rotated these conveyers spill their charges successively from the long irregular or zigzag edges of the flights in such a manner as to form streams or showers of material of great length as compared with the length of the drum and presenting to a drying medium a correspondingly great surface from which moisture may be abstracted by such medium.

Other features of the invention will be hereinafter described and are illustrated in the accompanying drawings, in which:

Figure 1 is a sectional side elevation of a drying apparatus embodying the present invention and adapted particularly for the drying of granulated sugar; Fig. 2 is a cross-section of the same on an enlarged scale, the section being taken in line 2—2, Fig. 1, and shows the type of flights used at the receiving end of the apparatus; Fig. 3 is a cross-section of Fig. 1, taken in line 3—3 of

said figure, and also on an enlarged scale, and shows the flights used near the center of the drum; Fig. 4 is a substantially central longitudinal section of the drum, the same being also illustrated on an enlarged scale; Figs. 5 and 6 are respectively a cross-section and a side elevation of a portion of one of the flights used near the receiving end of the drum, and Figs. 7 and 8 are similar views of a portion of one of the flights employed near the discharge end of the drum.

Similar characters designate like parts in all the figures of the drawings.

In carrying my invention into effect I may make use of any suitable drying apparatus capable of operation in the manner hereinbefore described, but prefer to employ one of substantially the type illustrated in the drawings. These drawings represent a well-known type of granulator for drying moist finely divided sugar, the apparatus being suitably modified to adapt my invention thereto.

In the construction shown in Fig. 1, 2 illustrates a material conveyer or granulator of a well-known type, supported near its ends on roller bearings, such as 3 and 4, at a slight angle to the horizontal for the purpose of assuring the movement of material from the upper to the lower end of the drum. At the receiving end thereof is an opening 5 into which projects a spout 6, through which moist sugar in a finely divided state is delivered to the drum. This spout connects with a chamber 7 which is connected in turn with a supply-pipe 8 leading from a storage floor or bin above the apparatus proper. Within the chamber 7 a force-feed device, such as a screw-conveyer 9, may be placed for the purpose of positively feeding the moist sugar into the spout 6. Near the upper end of the drum provision is made for continuously rotating it, the means shown for the purpose being a large external bevel gear 10 and a driving bevel pinion 11 suitably supported and carried by a driving-shaft 12. Near the lower end of the drum provision is made for preventing endwise movement of said drum, rolls, such as 13, coacting with the lower of the two external rings 14 and 15, on which the drum is supported, being employed for this purpose. At suitable points in the length thereof means are provided for striking the drum sharp blows for preventing material within

the drum from adhering thereto, there being three sets of these devices, which are termed "knockers," employed for this purpose. Each of these "knockers" 16 coacts with 5 suitable quick-let-off cams, such as 17, on the outside of the drum. A hold-back pawl, such as 18, coöperates with the cams of one set for the purpose of preventing improper movement of the drum. At the lower end 10 of the drum the dried material delivered therefrom passes into a discharge hopper or spout 19, from which it may be delivered in the usual manner into barrels. The discharge end of the drum is surrounded by a 15 large chamber 20, through one wall of which the drum projects and in which it turns freely. Through this chamber the drying medium, usually hot air, is delivered into the drum and circulates therethrough in a 20 direction opposite to that in which the sugar passes through the drum. Suitable heating-coils are shown at 21 for the purpose of raising the temperature of the current of air to the proper point. At the opposite end of 25 the drum a chamber 22 somewhat similar to that illustrated at 20 is shown. The drum 2 projects into the chamber 22 and turns freely therein. The heated air which circulates through the drum passes out through 30 the opening 5 therein and is carried off by an exhaust-fan, such as 23. Driving pulleys, such as 24, 25 and 26, are shown on the shafts of the screw-conveyer 9, the exhaust-fan 23 and the bevel-pinion 11, for the purpose of operating these parts. These driving 35 pulleys may be rotated in any suitable manner, preferably from a common counter-shaft or source of power (not shown).

The parts just described are all of well-known construction and are embodied in 40 drying apparatus in everyday use in sugar refineries.

In apparatus of this type as heretofore constructed it has been customary to make 45 use of a drum having one or more sets or circuits of internal flights forming with the inner wall of the drum sets or circuits of buckets or conveyers for receiving finely divided material, such as moist sugar, and 50 carrying it part way around a circuit as the drum is rotated, and spilling it in showers from points near the upper side of the drum. The moist material has usually been spilled from flights having straight edges and in 55 practically solid or uninterrupted sheets extending from end to end of the drum. During the rotation of the drum, which is continuous and in one direction, many of these sheets of moist material fall or are spilled at 60 substantially the same time from the upper edge of the drum in nearly parallel paths, the material in its fall being subjected to the action of a current of heated air or other gaseous medium passing through the drum 65 from the lower to the upper end of the same.

During its fall through this heated gaseous current the moist material is partially dried, it being subjected to the drying action over and over again by being repeatedly picked 70 up by the buckets or pockets formed by the flights at the lower side of the drum, and carried up to the upper side of the drum and spilled therefrom. As this operation is repeated the material is more and more thoroughly dried, and is also gradually fed from 75 the upper toward the lower end of the drum, from which it is finally delivered in a practically dry state.

I have found that the time required to dry finely divided moist material in an apparatus 80 of the type heretofore used may be very greatly reduced by exposing to the action of the drying medium surfaces of moist material of greater area than are exposed to such medium in apparatuses in which the moist 85 material is caused to fall or spill from flights having straight edges. Any suitable means may be employed for increasing the surface of a falling stream in an apparatus of this kind exposed to the action of a drying medium, 90 but in the preferred construction I make use of flights having spilling edges of considerably greater length than a straight line connecting the terminal points of each of such edges, the object of this being to increase 95 the length of the falling stream, measured lengthwise of the drum. By making these spilling edges irregular, particularly when the spilling line is zigzag, with deep re-entrant angles and sharp angular projections, the length of the stream falling from the edge of a flight may be made approximately twice as long, measured lengthwise of the drum, as the drum itself. It will be evident that when at each turn of the drum the 105 length of each falling stream is thus greatly increased, the area of moist material exposed at each moment to the action of the drying medium is correspondingly increased, and that the drying of material passing through 110 the drum is very much more quickly effected than is the case when the streams of material are spilled from flights having straight edges forming streams or showers of approximately the same length as the drum. 115

I have illustrated at 27 and 28 flights of two different types which may be employed to advantage in my improved drying apparatus. The flight 27 is a long narrow strip of metal having at one of its long edges an attaching member 29 disposed at an obtuse angle to the body of the flight and containing rivet-holes, such as 30 and 31, preferably staggered with respect to each other, the flights being secured to the walls of the drum 125 by rivets or other suitable securing means, preferably in such a manner as to form acute-angled pockets or conveyer-buckets. At the opposite long edge thereof the body portion of the flight 27 has an irregular or zigzag 130

spilling edge 32 formed by substantially equilateral teeth 33 separated by correspondingly shaped tooth spaces. This type of flight permits the spilling of a stream from the edge 32 thereof of nearly twice the length of a stream spilled from a flight having a straight edge. The flight 28 is similar to the flight 27, having a corresponding attaching member 29' with rivet-holes 30' and 31'.

The spilling edge, however, which is indicated at 34, is formed by substantially equilateral teeth 35 having their extreme ends turned up at 36 for a considerable distance to form scoop-like teeth. Flights having irregular spilling edges and scoop-like material-supporting surfaces may be used to advantage near the discharge end of the drum for holding back the dried material and breaking up the stream at the edge of the flight more completely and causing the stream, or the major portion thereof, to fall from a point as near the top of the drum as possible; while the straight flights 27, that is, the flights which do not have scoop-like body portions, may be used to advantage at the upper or receiving end of the drum, where the material is full of moisture and it is undesirable to use flights of such shape that they would be subject to clogging.

It will be noticed by referring particularly to Fig. 4 that the flights in the drum are arranged in a plurality of sets or circuits, the sets near the receiving end of the drum being those which have straight flights, while the sets nearest the discharge end are those which are shown as having scoop-like flights. Furthermore, it will be seen that the flights of different sets are staggered with respect to one another so as to afford greater resistance to the passage of the current of hot air or other gaseous medium therethrough, the organization of the flights of the different sets being such that while the flights of each set are disposed at sufficient distances apart to avoid interference of the different falling streams in that section with one another, the current of air passing along the surfaces of the streams will have as great a surface of moist material to evaporate in each section as is practicable, and an irregular course to follow from one end of the drum to the other. By so constructing and organizing the parts it has been found in regular commercial use of such an apparatus that in the drying of granulated sugar considerably over twenty-five per cent. (25%) of the time heretofore required to dry such sugar is saved.

What I claim is:—

1. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an acute angle to the horizontal and having a flight projecting from and lying close to the wall of the drum, said flight having a spilling edge of considerably greater

length viewed flatwise of the flight than a straight line connecting its terminal points.

2. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an acute angle to the horizontal and having a circuit of flights projecting from and lying close to the wall of the drum some of which flights viewed flatwise have irregular spilling edges.

3. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an acute angle to the horizontal and having a circuit of flights projecting from and lying close to the wall of the drum, said flights viewed flatwise having irregular spilling edges.

4. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an acute angle to the horizontal and having a circuit of internal flights projecting from and lying close to the wall of the drum some of which flights viewed flatwise have irregular spilling edges.

5. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an acute angle to the horizontal and having a circuit of internal flights projecting from and disposed at acute angles to the wall of the drum and some of which flights viewed flatwise have irregular spilling edges.

6. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the horizontal and having a circuit of internal flights projecting from and lying close to the wall of the drum, said flights viewed flatwise having irregular spilling edges.

7. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the vertical and having at different points in the length of the drum two sets of flights one set being staggered with respect to those of the other and some of said flights having irregular spilling edges.

8. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the vertical and having at different points in the length of the drum two circuits of flights the flights of one circuit being staggered with respect to those of the other and all of said flights having irregular spilling edges.

9. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the vertical and having at different points in the length of the drum two circuits of internal flights the flights of

one circuit being staggered with respect to those of the other and all of said flights having irregular spilling edges.

5 10. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the vertical and having a circuit of flights some of which have irregular spilling edges with scoop-like teeth at the
10 discharge end of the drum and some of which have irregular spilling edges with straight teeth at the receiving end of the drum.

15 11. In an apparatus for drying finely divided material, a rotary material-conveying drum mounted to turn about an axis disposed at an angle to the vertical and having at different points in the length of the drum two circuits of internal flights the flights of one circuit being staggered with respect to
20 those of the other, and the flights near the discharge end of the drum having irregular spilling edges with scoop-like teeth and the flights near the receiving end of the drum having irregular spilling edges with straight
25 teeth.

12. In an apparatus for drying finely divided material, a rotary drum mounted to turn about an axis disposed at an acute angle

to the horizontal, and means for showering said material in thin streams each of which
30 is distinct from the others and which collectively form lengthwise of the drum a substantially continuous flow-line of considerably greater length than a straight line connecting its terminal points. 35

13. In an apparatus for drying finely divided material, a rotary drum mounted to turn about an axis disposed at an acute angle to the horizontal, means for passing a gaseous
40 drying medium through the drum from one end to the other thereof, and means for showering through said drying medium a plurality of thin streams of material each of which is distinct from the others and which
45 collectively form lengthwise of the drum a substantially continuous flow-line of considerably greater length than a straight line connecting its terminal points.

Signed at New York, in the county of New York, and State of New York, this 11th day
50 of May, A. D. 1908.

ROBERT SAYRE KENT.

Witnesses:

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C. S. CHAMPION.