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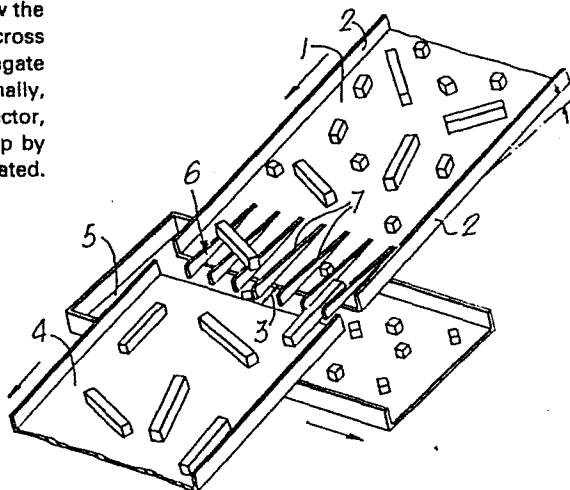
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54 Classifying particles.

57 Apparatus for classifying a mixture of particles comprises an inclined surface 1, and a collector 4 separated by a uniform gap 3 from the lower edge of the inclined surface and aligned with that surface, a receiver 5 located below the gap 3 and a series of guides 6---6 uniformly spaced across the width of the lower end of the inclined surface. Elongate particles of sufficient length are either aligned longitudinally, in which case they bridge the gap and pass to the collector, or else ride up the guides to be carried across the gap by them. In this way the elongate particles can be eliminated.



CLASSIFYING PARTICLES

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This invention relates to the classification of particles, more specifically to classifying a mixture of particles comprising a majority of particles which have an aspect ratio not exceeding 2:1 and a nominal particle size of y and a minority of elongate particles having a length in excess of $2y$ to separate the elongate particles therefrom.

An important way of making particulate material is to comminute sheet material by means of a granulator of the kind comprising a rotor with at least one blade co-operating with at least one fixed blade to comminute the material repeatedly until the resulting particles are small enough to pass through a screen bounding the working zone.

It will be apparent that material will initially be cut from the sheet in long narrow strips and that many further cuts will be required to reduce the strips to substantially isotropic particles. If the openings of the screen are smaller than the cross-section of the initial strip, the particles will be unable to escape from the working zone until a reasonably isotropic state is achieved, but then a high proportion of very small particles is produced and unnecessary energy is expended. If on the other hand the screen opening is bigger than the cross-section of the initial strip, a small proportion of particles with lengths significantly in

excess of the screen openings will escape because they happen to approach a screen opening end-on, and, if allowed to remain, these elongate particles may cause major difficulties in the use or subsequent processing of the particles.

In accordance with the invention, apparatus for classifying a mixture of particles comprising a majority of particles which have an aspect ratio not exceeding 2:1 and a nominal particle size of y and a minority of elongate particles having a length in excess of $2y$ to separate the elongate particles therefrom comprises an inclined surface down which the individual particles of the mixture can slide; a collector spaced by a gap of width y from the bottom edge of the inclined surface and lying in or below a projection of that surface; a series of guides each spaced from its neighbour or neighbours in the series across the width of the inclined surface by a distance not less than y nor greater than $2y$ and extending at least part-way across the gap and each providing a ramp surface inclined in the same direction as the inclined surface but at a smaller angle to the horizontal, whereby those elongate particles which are not aligned to pass in the direction of their length between two adjacent guides to bridge and pass over the gap to the collector are lifted from the inclined surface and carried to the collector while the particles of the majority fall through the gap.

Preferably the apparatus includes means for vibrating at least the inclined surface down which all particles can slide.

5 Preferably the collector is an inclined surface down which the elongate particles can slide after clearing the gap. Also, a receiver can be located below the gap and may also be an inclined surface down which those particles which fall through the gap can slide.

10 The invention also includes a method of classifying such a mixture of particles comprising sliding the individual particles of the mixture down an inclined surface towards a lower edge thereof to encounter a series of guides each spaced from its neighbour or neighbours across the width of the inclined surface by a distance not less than y nor greater than $2y$
15 and, extending beyond the lower edge of the inclined surface, and each providing a ramp surface inclined in the same direction as the inclined surface but at a smaller angle to the horizontal so that

20 (a) the particles of the majority are deflected (if necessary) to pass between the guides;

 (b) some of the elongate particles become aligned to pass in a direction of their length between the guides; and

25 (c) the remainder of the elongate particles are supported by the ramp surfaces of at least two neighbouring guides and pass over them;

and receiving substantially all the elongate particles in a collector spaced by a gap of width y from the bottom of the inclined surface and lying in or below a projection of that surface while the particles of the majority fall
5 through the gap.

It also includes particles classified by such a method.

Particles produced by such a method may be used as the feed material for a continuous friction
10 actuated extrusion machine and the invention includes this use.

The invention will be described, by way of example, with reference to the drawing which is a perspective sketch of the essential part of one form of
15 classifying apparatus in accordance with the invention.

The apparatus shown in the drawing includes an inclined surface 1 with a gradient of about 20 and with upstanding side-walls 2. Separated by a uniform gap 3 from the lower edge of the inclined surface 1 and aligned
20 with that surface is a collector 4 in similar form. A receiver 5 of any convenient form is located below the gap 3. A series of guides 6----6 is uniformly spaced across the width of the lower end of the inclined surface 1. These take the form of flat plates upstanding
25 perpendicularly from that surface and are separated from each other and (in the case of the end guides) from the side-walls 2 by a distance equal to about 1.5 times the

width of the gap 3. Each guide projects about three-quarters of the way across the gap 3 and provides a ramp surface 7 which is level at its upper end with the surface and is inclined in the same direction as the surface 1 but at an angle of about 10° to the horizontal. The whole apparatus is resiliently mounted and is continuously vibrated with an amplitude of 0.5 mm during use.

In a particular example, the width of the gap 3 was about 6 mm. This apparatus was fed with copper granules, most of which had all three independent dimensions in the range 3-5 mm but a small proportion were up to several centimetres long, at a rate low enough for the particles to travel separately down the inclined surface.

Substantially all particles up to about 10 mm long and some up to 13 mm long were channelled between the guides and then, on reaching the end of the inclined surface 1, fell through the gap 3 to the receiver 5.

Substantially all elongate particles over about 13 mm long which were channelled between the guides bridged the gap 3 and passed to the collector and thence to recycling, as did some particles with lengths in the range 10 to 13 mm. Those elongate particles which did not become aligned to pass in the direction of their length between the guides rode up the ramp surfaces 7 and were carried over the gap 3 to the collector and to recycling.

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The particles passing through the gap 3 to the receiver were better suited for use in a friction-actuated extrusion process than material granulated by the type of machine described until the maximum particle size falls below 10 mm.

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CLAIMS

1. Apparatus for classifying a mixture of particles comprising a majority of particles which have an aspect ratio not exceeding 2:1 and a nominal particle size of y and a minority of elongate particles having a length in excess of $2y$ to separate the elongate particles therefrom, the apparatus comprising an inclined surface down which the individual particles of the mixture can slide; a collector spaced by a gap of width y from the bottom edge of the inclined surface and lying in or below a projection of that surface; a series of guides each spaced from its neighbour or neighbours in the series across the width of the inclined surface a distance not less than y nor greater than $2y$ and extending at least part-way across the gap and each providing a ramp surface inclined in the same direction as the inclined surface but at a smaller angle to the horizontal, whereby those elongate particles which are not aligned to pass in the direction of their length between two adjacent guides to bridge and pass over the gap to the collector are lifted from the inclined surface and carried to the collector while the majority of the particles fall through the gap.
2. Apparatus as claimed in Claim 1 including means for vibrating at least the inclined surface.
3. Apparatus as claimed in Claim 1 or Claim 2 in which the collector is an inclined surface down which the elongate particles can slide to keep the gap clear.

4. Apparatus as claimed in any one of the preceding claims further comprising a receiver for the particles of the majority located below the gap.

5. A method of classifying such a mixture of
5 particles comprising a majority of particles which have an aspect ratio not exceeding 2:1 and a nominal particle size of y and a minority of elongate particles having a length in excess of $2y$ to separate the elongate particles therefrom, the method comprising sliding the individual
10 particles of the mixture down an inclined surface towards a lower edge thereof to encounter a series of guides each spaced from its neighbour or neighbours across the width of the inclined surface by a distance not less than y nor greater than $2y$ and, extending beyond the lower edge of
15 the inclined surface, and each providing a ramp surface inclined in the same direction as the inclined surface but in a smaller angle to the horizontal so that

(a) the particles of the majority are deflected (if necessary) to pass between the guides;

20 (b) some of the elongate particles become aligned to pass in a direction of their length between the guides, and

(c) the remainder of the elongate particles are supported by the ramp surfaces of at least two
25 neighbouring guides and pass over them;
and receiving substantially all the elongate particles in a collector spaced by a gap of width y from the bottom

of the inclined surface and lying in or below a
projection of that surface while the particles of the
majority fall through the gap.

6. Particles classified by the method claimed in
5 Claim 5 or by means of the apparatus claimed in any one
of Claims 1 to 4.

7. The use as feed material for a continuous
friction actuated extrusion process of particles
classified by the method claimed in Claim 5 or by means
10 of the apparatus claimed in any one of Claims 1 to 4.

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