Jan. 22, 1957 G. C. VINCENT 2,778,498

SEPARATION OF MATERIALS

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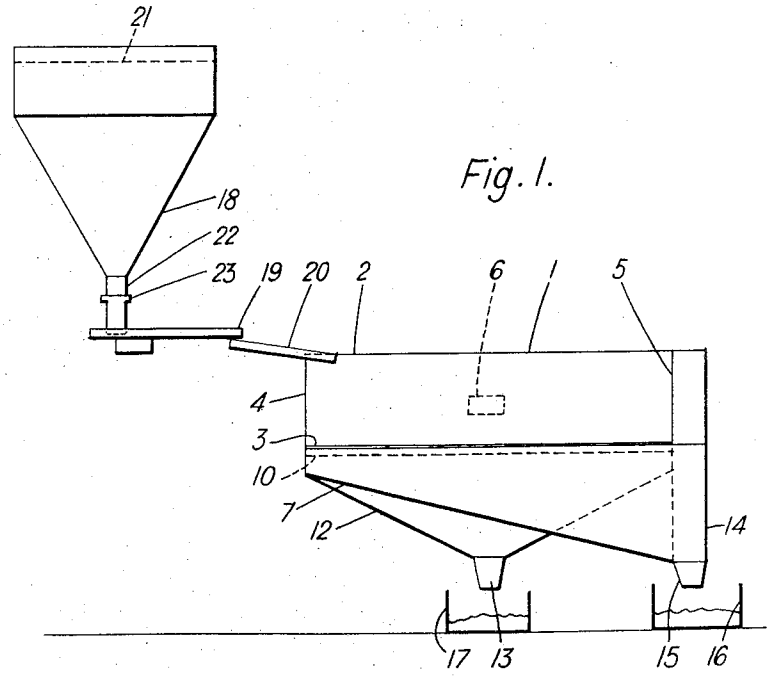


Fig. 1.

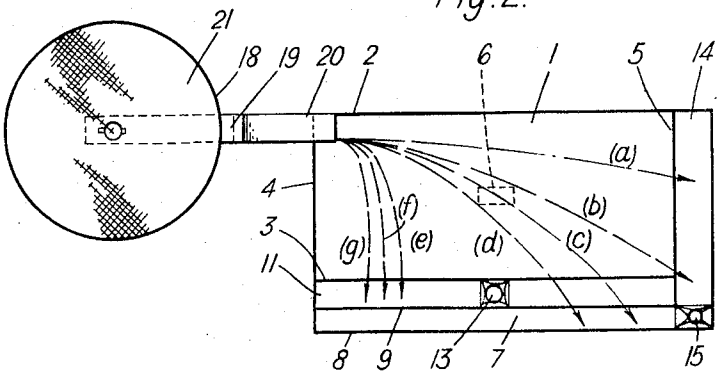


Fig. 2.

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SEPARATION OF MATERIALS

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2 Claims. (Cl. 209—118)

The present invention relates to the separation of materials and particularly to the separation of whole spheroidal solid particles from mixtures with broken and/or irregular shaped particles of similar material.

According to the present invention there is provided a process for the separation of whole spheroidal solid particles from mixtures with broken and/or irregular shaped particles which comprises feeding the mixture on to an inclined plane at an upper part thereof with a velocity having a component across the plane and maintaining the plane in transverse vibration, whereby the whole spheroidal particles are caused to roll downwardly across the plane with sufficient momentum to carry them across a gap at the lower edge of the plane into a collecting receptacle and the broken and/or irregular shaped particles are caused to slide down the plane and to drop through said gap into another collecting receptacle.

Preferably the mixture of whole spheroidal solid particles with broken and/or irregular shaped particles is fed to the vibrating inclined plane at or near the top thereof in such a manner that the particles have a velocity component across the plane so that the whole spheroidal solid particles are caused to roll in downwardly curved paths across the plane while the broken and/or irregular shaped particles, due to their greater frictional resistance and inability to roll, slide more directly, under the influence of the vibrations of the plane, to the lower edge of the plane.

It will be understood that some of the whole spheroidal particles will fortuitously be less impeded than others while the mixture is being fed on to the plane and in consequence will trace out less downwardly curved paths. Since, however the broken and/or irregular shaped particles slide more directly to the lower edge of the plane, it is convenient to arrange the plane of a width which is sufficient to accommodate the spread of the broken and/or irregular shaped particles and of the major portion of the whole spheroidal particles and to provide receptacles at one or both inclined edges of the plane, depending on the position at which the mixture is fed thereto, in order to collect the minor portion of the whole spheroidal particles which trace out the least downwardly curved paths and will pass off the plane at either of its inclined edges.

It will also be understood that the actual dimensions and inclination of the plane will depend upon several factors, for example the size range of the particles in the mixture to be separated, the manner of feeding and the point at which the mixture is fed on to the plane and the frequency and amplitude of the vibration of the plane.

The present invention also includes the provision of apparatus for carrying out the separation, said apparatus comprising in combination an inclined plane, means for continuously vibrating the plane, a receptacle at the lower edge of the plane arranged in spaced relation thereto to define a gap between said edge of the plane and the receptacle and a further receptacle below the gap so

defined, and, if desired, a further receptacle adjacent to one or both inclined edges of the plane, together with means for feeding the mixture of solid particles on to the plane with a velocity having a component across the plane. The apparatus may be constructed of any suitable material, for example sheet steel or aluminum or even wood.

In the construction of the apparatus it is desirable for at least the upper portion of the side of the receptacle which defines the gap at the lower edge of the inclined plane to be adjustable both horizontally and vertically so that the height of its upper edge relative to the lower edge of the inclined plane and its distance therefrom may be arranged to allow unobstructed flow of the whole spheroidal particles from the plane into the receptacle while preventing broken and/or irregular shaped particles from falling into it. The vertical adjustment is preferably arranged to allow of the upper edge of said side of the receptacle to incline downwards towards the inclined edge or edges of the plane remote from the point at which the mixture is fed on to the plane.

One form of the apparatus according to the present invention is illustrated in the two figures of the accompanying schematic drawing in which Figure 1 is an elevation and Figure 2 is a plan view.

Referring to the drawing, the numeral 1 denotes an inclined plane defined by an upper edge 2, a lower edge 3 and and inclined edges 4 and 5. An electro-magnetic vibrator, denoted by numeral 6, is attached to the underside of the plane at about its mid-point.

The numeral 7 denotes a receptacles having front wall 8 and back wall 9, the vertical extent of the latter being limited as indicated in Figure 1 by the dotted line 10. Although shown limited by the lower edge 3 of the inclined plane 1 in Figure 1 of the drawing, the front wall 8 of the receptacle 7 may if desired be extended above this level.

Referring particularly to Figure 2 of the drawing, the receptacle 7 is arranged in spaced relation to the lower edge 3 of the inclined plane 1 to define the gap 11, in which is arranged the receptacle 12 (shown in elevation in Figure 1) having an outlet at 13. It will be understood that the back wall 9 of the receptacle 7 forms in part a common division wall between the receptacles 7 and 12. A further receptacle 14 is provided at the inclined edge 5 of the plane, said receptacle 14 being arranged with an outlet at 15 which is common to it and to receptacle 7.

The ancillary parts of the apparatus comprise a feed hopper 18, a vibrating tray feeder 19, and an inclined chute 20 which is conveniently of semi-circular section. The feed hopper 18 is provided with a coarse mesh grid 21 for removing undesired large particles from the mixture charged to the hopper and with an outlet pipe 22 having a screwed sleeve 23 for controlling, by vertical adjustment thereof, the rate of flow of the mixture to the vibrating tray feeder 19.

The numeral 16 denotes a suitable container for receiving the spheroidal particles which are discharged from the outlet 15 of the receptacles 7 and 14. The numeral 17 likewise denotes a container for receiving the separated broken and/or irregular shaped particles which are discharged from the receptacle 12 through the outlet 13.

When the plant is in operation the whole spheroidal particles trace out paths such as those indicated in Figure 2 of the drawing by the letters (*a*), (*b*), (*c*), (*d*) while the broken and/or irregular shaped particles traces out paths such as those indicated by the letters (*e*), (*f*), (*g*).

It has been found that alumina-silica catalyst beads of substantially spherical shape ranging in nominal size from

1/16" to 1/4" diameter and containing about 25% of broken beads with many of the broken fragments larger than many whole beads, may be successfully treated by the process and apparatus of the present invention to recover more than 75% of the total with at least 94% whole beads by using an inclined plane of sheet aluminum 4 feet wide by 2 feet long, said plane being inclined at an angle of 7° to the horizontal and secured at the upper and lower 4 foot edges and vibrated at a frequency of 10 cycles per second with an amplitude of 0.005 inch by means of an electro-magnetic vibrator located on the underside of the plane at about the middle point; the feed of particles at a steady rate of 13 pounds per hour being passed on to the plane, at an upper point of one inclined edge, in a direction across the plane from a chute inclined at an angle of 30° to the horizontal.

I claim:

1. Apparatus for separating whole spheroidal solid particles from mixtures with broken particles which comprises in combination an inclined plane, means for continuously vibrating the plane, a receptacle at the lower edge of the plane arranged in spaced relation thereto to define a gap between said edge of the plane and the receptacle and a further receptacle below the gap so defined together with means for feeding the mixture of solid particles on to the plane with a velocity having a component across the plane.

2. Apparatus as claimed in claim 1 in which a further receptacle is provided adjacent at least one inclined edge of the plane.

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