

Sept. 27, 1938.

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2,131,128

APPARATUS FOR GRANULATING FRIABLE MATERIAL

Filed Dec. 16, 1935

Fig. 2.

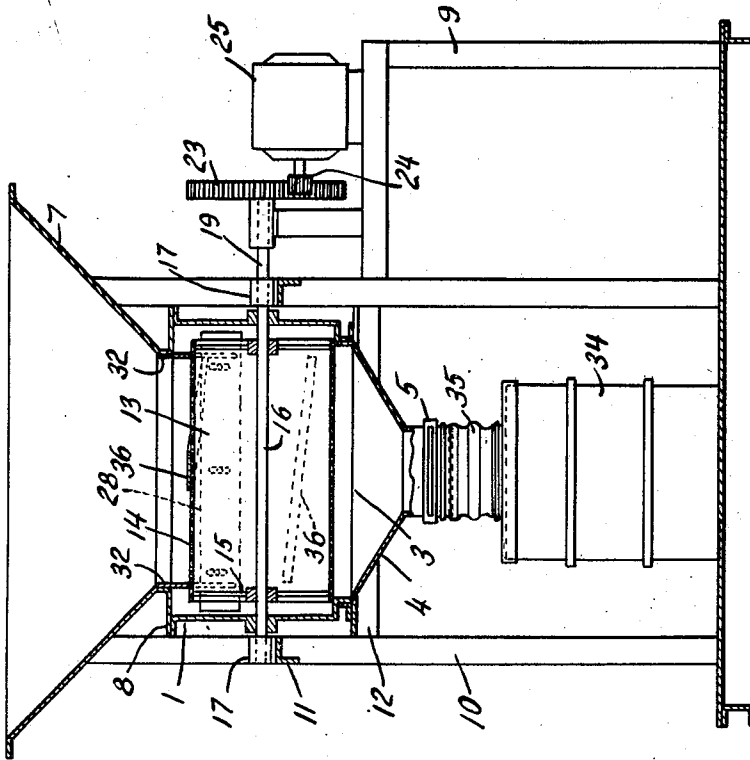
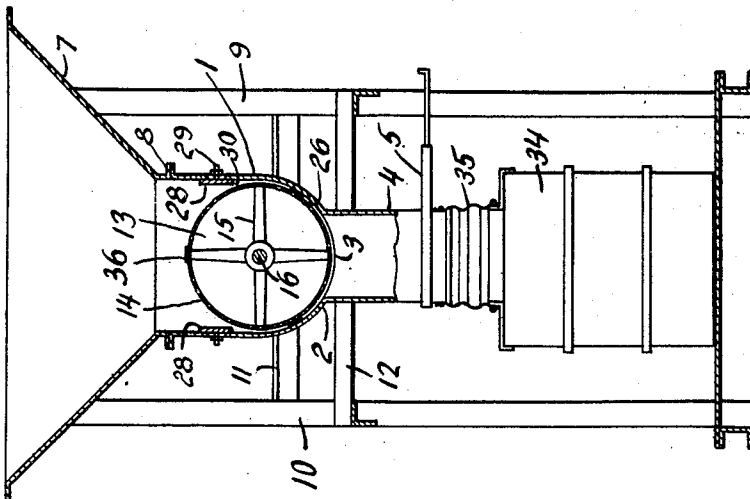


Fig. 1.



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2,131,128

APPARATUS FOR GRANULATING FRIABLE MATERIAL

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Application December 16, 1935, Serial No. 54,697

4 Claims. (Cl. 83—93)

This invention relates to apparatus designed particularly for simultaneously breaking and sifting friable materials to produce grains of substantially uniform size which are substantially free from fines and dust.

Many materials which have a friable, foraminous or honeycomb structure, as for example, dyestuffs such as the sulfur colors, indigo and the like, are advantageously marketed in the form of relatively large grains of substantially uniform size free from fines or dust. These grains have heretofore been produced by crushing the material in the usual type of grinding mill in which there is invariably formed a large amount of fines, followed by the screening or sifting of the crushed material to separate the fines from the grains of desired size. This procedure, it will be noted, requires at least one grinding and one sifting operation and involves considerable formation of dust with its attendant losses and annoyance.

One object of this invention is to provide a method for simultaneously breaking and screening friable materials to produce particles of substantially uniform size without the formation of substantial amounts of fines or dust and which method reduces the handling of the material to a minimum.

Another object of this invention is to provide apparatus for practicing the aforesaid method, in which apparatus friable material is broken into grains by impact and particles or grains of the desired size removed from the zone of impact as they are formed, so that dust formation is minimized.

In accordance with this invention the material to be broken is fed to a foraminous or openwork screening surface in which the area of the openings of a predetermined size, depending upon the desired size of the grains, is substantially greater than the area of the solid surface in which the openings are disposed. The material on the screening surface is then contacted with a breaker arm, causing breaking of the material into substantially uniform grains which fall through the openings in the screening surface preferably directly into a container in which they are stored for shipment or use. The formation of substantially uniform grains while minimizing dust or production of fines may be attributed to the feature of my invention involving the support of the friable material on the screening surface by wire or extremely narrow solid areas defining the openings, while the friable material is subjected to impact to break the same.

Upon contact of the friable material with the breaker arm, breaking along the lines of support takes place, the resultant grains falling through the openings with little or no dust formation taking place due to grinding or crushing of this material between solid surfaces. From another aspect, as the area of the solid portion of the screening surface in comparison to that of the openings therein is comparatively small, there is substantially little solid surface on which material rests when contacted by the breaker arm where dust or fines may form due to pulverization, or powdering, which necessarily takes place when friable material is pounded or compressed while confined between solid surfaces.

The apparatus preferably employed for practicing the process of this invention comprises a screening and breaking member, the surface of which is adapted to move in close proximity to one or more breaker bars or arms. The openings in the screening member and the space between the breaker bars and the surface of the drum are of such dimensions that particles of the desired size will pass therethrough. The grains of substantially uniform size formed upon contact of the material on the screening member with the breaker bar fall through the openings and are removed from the zone of impact without being subjected to crushing.

In the preferred embodiment illustrated on the drawing the invention is shown incorporated in a combined screening and breaking apparatus having a rotatable screening member, and the present description will be confined to the present illustrated embodiment of the invention. It will be understood, however, that the novel features and improvements are susceptible to other application, for example, the breaking and screening member may be in the form of a disk instead of a cylinder, with the breaker bar disposed above the disk rotating in a horizontal plane. Hence the scope of this invention is not confined to the embodiment herein described.

The embodiment shown is preferable as compared with the alternative apparatus because of the self-cleaning character of the former. For example, any material which adheres to the surface of the drum when it is in the uppermost position automatically falls therefrom when it reaches its lowermost position during rotation. Consequently, there is no necessity for stopping operations in order to clean the drum as would be the case in the alternative apparatus.

In the drawing Fig. 1 represents an end elevation, partly in section, of combined screening and

breaking apparatus embodying this invention; Fig. 2 represents a front elevation, partly in section, of the apparatus of Fig. 1.

Referring to the drawing, reference numeral 1 indicates a housing of rectangular shape having a semi-cylindrical bottom 2, provided with an opening 3, leading into a conduit or chute 4, preferably formed as an extension of the housing 1. A valve 5 controls flow through conduit 4. Positioned at the top of the housing 1 is a hopper 7 which may be secured in fixed relation to the housing by the supporting framework 9. This framework may comprise upright channel bars 10 and cross-bars 11, 12, bolted or otherwise secured to form a supporting framework for the apparatus.

Disposed within the housing 1 is a rotatable drum 13, the surface 14 of which is preferably constructed of wire screening. Radially extending arms 15 support the surface of the drum in fixed relation to the axial shaft 16 journaled in bearings 17 on the framework 9. The arms 15, as appears from Fig. 2, are disposed near the opposite ends of the drum, leaving unobstructed the surface area of the drum therebetween. One end 19 of shaft 16 has keyed thereon a gear 23 driven by gear 24 keyed to the armature shaft of the electric motor 25. It will be understood that any suitable drive for the drum 13 may be employed.

The screening and breaking drum 13 is preferably disposed within the housing 1 so that the lower portion thereof rotates within the semi-cylindrical bottom 2 as indicated in Fig. 1, leaving a clearance 26 between the surface of the drum and the semi-cylindrical side walls of the housing. This clearance is preferably not greater than the desired size of the grains. The perforations in the surface of the drum are such that particles or grains of the desired size may pass there-through. To minimize dust formation, it is important that the ratio of the area of openings to the area of solid surface defining the openings be relatively large and the solid surface be in the form of thin wires or narrow strips on which the friable material rests, i. e., the friable material makes substantially line contact with the solid surface. The particular ratio employed between the area of the solid surface and the area of the openings depends upon the size of the drum used and the size of the particle desired. For instance for a drum having an 18 inch diameter, and a desired grain size between about $\frac{1}{8}$ inch and about one inch, the area of the solid surface is preferably between about $\frac{1}{2}$ and about $\frac{2}{3}$ of the area of the openings.

Adjustably attached to the inner walls of the housing 1 are breaker bars or arms 28. These bars may be metal plates extending the length of the cylinder. They may be affixed to the housing 1 by bolts 29 passing through openings in the walls of the housing so that the plates may be raised or lowered to position the lower breaking edge as desired. Edges 30 of the breaker bars may be of any desired shape, i. e., serrated or smooth, and preferably are positioned parallel to and at a distance from the surface of the drum slightly greater than the dimensions of the desired size of grains, so that such grains which do not fall through the openings in the drum as it rotates pass between the breaker bars and the surface of the drum through the clearance 26 into the chute 4. If desired rib members or cleats 36 disposed diagonally on the surface 14 of the drum 13 and suitably secured thereto as by bolting, may be employed to feed the friable material against the breaker bars 28, the breaker bars being posi-

tioned to provide clearance between them and the rib members 36 as the drum rotates. In the drawing three such rib members are shown. However, as many such members may be used as desired.

As appears from Fig. 2, hopper 7 is provided with baffles 32 which tend to confine the material delivered from hopper 7 to the area of the screening surface 14 disposed between the baffles. The lower ends of the baffles 32 are preferably semi-circular in shape so as to conform with the shape of the drum and are disposed above the drum a distance equal to or slightly less than the desired size of the grains. Baffles 32 prevent grains of particles which are larger than the desired size from passing around the ends of the drum.

In order to collect the grains as they are formed, a receptacle 34 may be positioned beneath chute 4. A removable hose or extensible member 35 is provided for placing the chute 4 in communication with the container 34.

In operation, breaker bars 28 may be adjusted so that they are spaced a suitable distance from the surface of the drum corresponding to the desired size of grains and the drum rotated at any desired speed, say 23 R. P. M. in the case of the drum having an 18 inch diameter. The large lumps of friable material, i. e., indigo, introduced via hopper 7, fall onto the moving perforated surface of the cylinder or drum where a sifting action takes place whereby the particles which are already of the desired size pass through the openings without being subjected to any crushing action. The larger masses of material are carried against the breaker bar 28 at the right of the apparatus viewing Fig. 1, if the drum is rotated clockwise. If rotated counter-clockwise the lumps would be carried against the breaker bar 28 at the left of the apparatus viewing Fig. 1. It will be understood the use of two breaker bars as shown permits any desired direction of rotation, or oscillation, of the drum so that the material is carried first against one bar and then against the other, etc. The drum may be rotated continuously or intermittently as desired.

As the material reaches the surface of the drum those particles of a size smaller than the openings therein fall through these openings without being subjected to a breaking or crushing action. Larger particles are carried by the drum into contact with the breaker bar and are thus broken into grains of desired size. The grains fall through the openings in the drum and through the space between the breaker bar and the drum or the cleats thereon and are thereby removed from the zone of impact substantially as they are formed. Normally the hopper 7 is maintained filled with the material to be crushed. If, however, the material has a tendency to pack, the amount of material in the hopper may be reduced to avoid any possibility of bridging.

From the interior of the drum the grains pass through the openings in the base portion thereof through opening 3 and conduit 4 into storage drum 34.

Grains are thus produced substantially uniform in size and free from fines or dust so that as produced they are a marketable product, that is to say, the grains fed to drum 34 may be shipped as such and do not require a further sifting operation to remove dust.

It will be understood that it is not intended to limit this invention to the embodiment thereof

above described, but that changes may be made therein without departing from the scope of the invention.

I claim:

5 1. Apparatus for breaking friable material to produce substantially uniform grains of predetermined size, comprising a housing, a rotating cylinder having a wire screening surface, disposed within said housing, leaving a clearance 10 between the side walls of the housing and the screening surface not greater than the desired size of grains, the openings in said screening surface being slightly larger than the desired size of grains, a breaker bar on said housing positioned 15 so that the edge thereof is separated from the screening surface a distance slightly greater than the desired size of the grains, means for supplying friable material to said screening surface, means for rotating said screening surface to 20 carry the friable material into contact with said breaker bar, and means for collecting the desired sized grains.

25 2. Apparatus for breaking friable material to produce substantially uniform grains of predetermined size free from dust and fines, comprising a rotating cylinder having a wire screening surface, means for feeding said friable material to the upper exterior surface of said cylinder, a breaker bar substantially parallel to the 30 surface of said cylinder and spaced therefrom a distance in accordance with the size grains desired, said bar being adjacent the upper half of said cylinder whereby friable material fed to said drum will be initially sifted by gravity, and the residual material, conveyed by the cylinder 35 to the breaker bar, will be broken and then sifted into the cylinder by gravity.

3. Apparatus for breaking friable material to produce substantially uniform grains of predetermined size free from dust and fines, comprising a rotating cylinder having a wire screening surface, means for feeding said friable material 5 to a restricted section of the upper exterior surface of said cylinder, a breaker bar positioned substantially parallel to the surface of said cylinder and at a distance therefrom in accordance with the size of grains desired, said bar being 10 adjacent the upper half of said cylinder and adjacent said restricted section in the direction of rotation, whereby material fed by said means will be initially sifted and residual material conveyed by said cylinder to said breaker bar will be broken 15 by said bar and sifted by gravity into said cylinder.

4. Apparatus for breaking friable material to produce substantially uniform grains of predetermined size free from dust and fines, comprising 20 a rotating cylinder having a wire screening surface, means for feeding said friable materials to the upper exterior surface of said cylinder, a breaker bar substantially parallel to the surface of said cylinder and spaced therefrom a distance 25 in accordance with the size grains desired, said bar being adjacent the upper half of said cylinder, whereby friable material fed to said drum will be initially sifted and the residual material conveyed by the cylinder to the breaker bar 30 will be broken and then sifted into the cylinder by gravity, and a bar mounted on the exterior of said rotating cylinder to assist in conveying said material to said breaker bar.

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