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SEPARATOR.

APPLICATION FILED JULY 21, 1910.

1,049,217. Patented Dec. 31, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

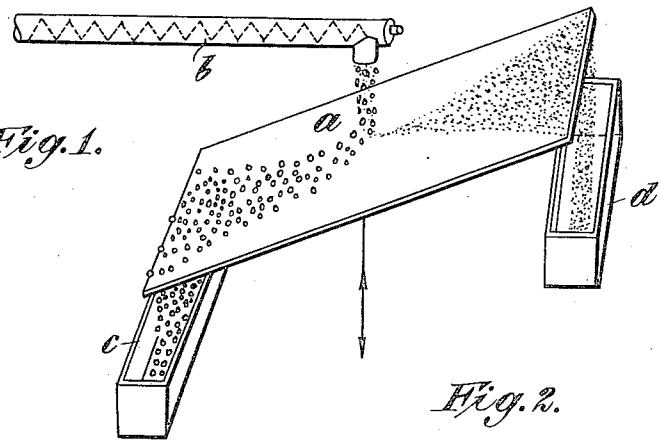
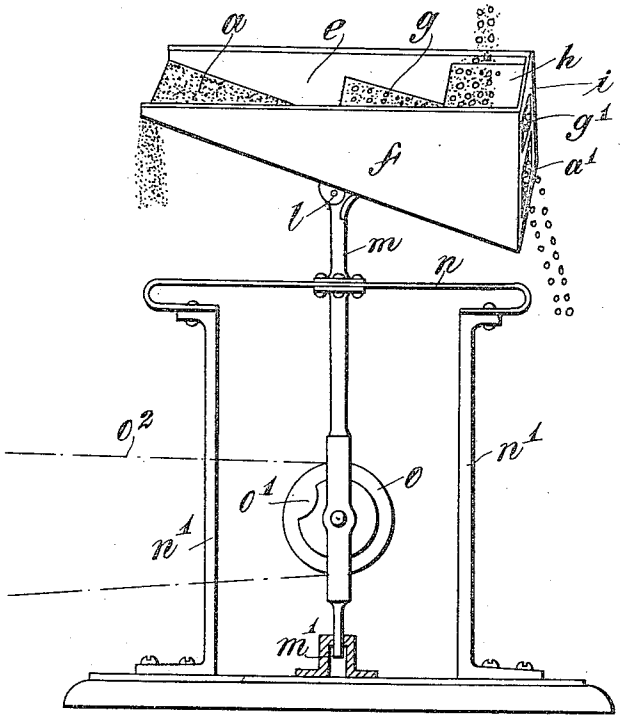


Fig. 2.



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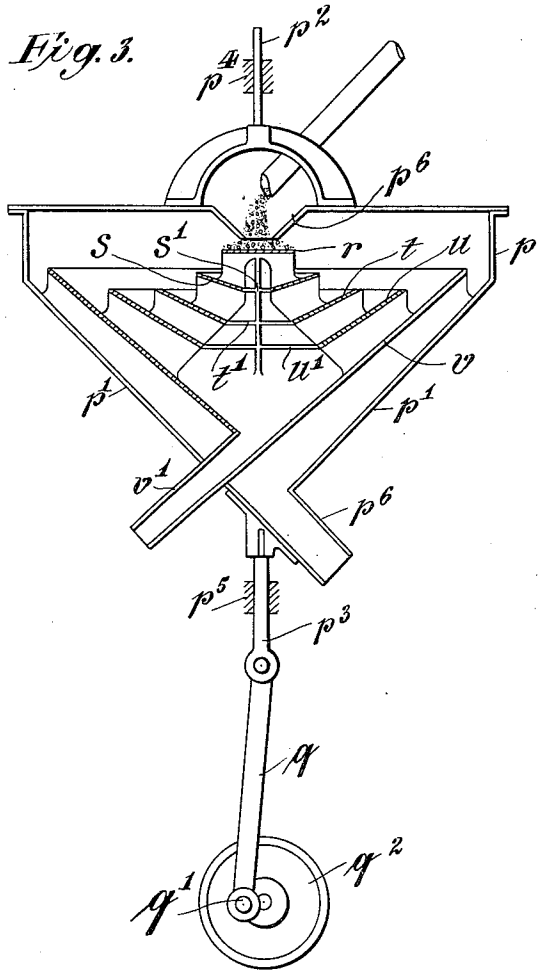
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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SEPARATOR.

1,049,217. Specification of Letters Patent. Patented Dec. 31, 1912.

Application filed July 21, 1910. Serial No. 573,006.

To all whom it may concern:

Be it known that I, JOHAN SIGISMUND FASTING, a subject of the King of Denmark residing in Frederiksberg, near Copenhagen, Denmark, have invented certain new and useful Improvements in Separators, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to the separation of granular materials, comprising grains or particles which are of comparatively small size but nevertheless differ in size or in specific gravity, the object being to accomplish the separation of the smaller or lighter grains from the larger or heavier grains more expeditiously and more economically than is possible with the sieves ordinarily employed for the purpose.

In accordance with the invention, the material to be treated, composed of grains or particles of different sizes, is deposited upon an inclined surface which is shaken or vibrated, preferably in a substantially vertical direction. The coarser particles of the material, or particles of greater specific gravity, as is quite obvious, will move downward on the inclined surface until they pass from the inclined surface. The finer particles, or the particles of less specific gravity, will wander upward on the inclined surface until they pass over its upper edge. The reason for this action of the finer or the lighter particles is by no means obvious and has not yet been ascertained with certainty. Nevertheless it is an assured fact that the finer or the lighter particles will wander upward on the surface and that the greater the inclination of the surface, the greater will be the proportion of the coarser or heavier particles which move downward, while the smaller proportion of the entire mass which moves upward on the plate will include only the finer or the lighter particles.

The invention will be more fully explained hereinafter with reference to the accompanying drawings in which it is illustrated, and in which—

Figure 1 is a view in perspective showing a simple embodiment of the invention without working parts. Fig. 2 is a view in perspective and in outline showing a practical embodiment of the invention. Fig. 3 is a view in vertical section, showing another practical embodiment of the invention.

In the view which is presented in Fig. 1 and is illustrative of the general character of the invention, the plate *a*, upon the upper surface of which the material to be separated is deposited, is shown as a flat, rectangular plate, inclined at an angle of about 20° from the horizontal, with its upper and lower edges horizontal. The surface of the plate is relatively smooth and unbroken, having no transverse channels or ribs to prevent the free movement of particles of matter thereon. It is assumed that the plate is vibrated rapidly in a generally vertical direction, as indicated by the double arrow below the same, by any suitable means. The material to be separated is fed by any suitable means, such as a conveyer, indicated at *b*, to a point near the middle of the plate. The coarser or heavier particles or grains of the material will pass rapidly downward on the plate and fall over the lower edge thereof into a suitable receptacle, indicated at *c*, while the finer or the lighter particles will wander somewhat more slowly upward on the plate until they pass over its upper edge into a suitable receptacle, as indicated at *d*. If the inclination of the plate *a* is changed so that it approaches more nearly the horizontal, the character of the material to be separated remaining unchanged, it will be found that some of the less coarse or the less heavy grains or particles which before passed downward on the surface of the plate will now wander upward, while if the inclination of the plate be changed so that it is more steeply inclined, it will be found that some of the coarser or the heavier grains or particles which before wandered upward on the surface of the vibrating plate will now pass downward. Adjustment of the angle of inclination of the surface of the vibrating plate therefore furnishes a means for determining the line of separation, as to the relative size or weight of the particles, between the finer or the lighter particles which are delivered at one end and the heavier or the coarser particles which are delivered at the other end. Furthermore, while the plate *a* is shown in Fig. 1 as a flat, rectangular

plate, it will be obvious that it may be otherwise formed to meet different conditions of use.

In the embodiment of the invention represented in Fig. 2, the plate *a* is shown as forming the inclined bottom of a box-like structure, between the sides *e* and *f* of which is placed another inclined plate *g*, the upper edge of which stands about over the middle of the plate *a*, and a horizontal plate *h* dropped slightly below the upper edges of the sides and end *i* of the box-like structure, with its left hand edge about over the middle of the plate *g*. The material to be separated is deposited on the plate *h* by any suitable means and is distributed over its left hand edge upon the plate *g*, on which it undergoes a preliminary separation, the coarsest of the material passing downward and over the lower edge of the plate *g*, whence it is discharged, as at *g'*, while the less coarse material passes over the upper edge of the plate *g* and is deposited upon the plate *a*, where it is again separated, the coarser material passing downward over the lower edge of the plate *a*, as at *a'*, while the finer material passes upward over the upper edge of the plate *a*. As a convenient means for vibrating or shaking the plates and also for permitting the angle of inclination thereof to be adjusted, the box *a*, *e*, *f*, is mounted, with a clamping joint *l* which permits angular adjustment of the box, on a rod *m* which is supported by a spring *n* and is guided at its lower end, for vertical movement, by a suitable guide *m'*. The spring *n* is supported by a suitable frame *n'* and on the rod *m* is mounted a rotatable pulley *o* provided with an eccentric weight *o'*, the pulley being rotated rapidly by a belt o^2 from a suitable source. This arrangement produces a rapid vibration or shaking of the box in a vertical direction with a consequent separation of the material on the plates *a* and *g* in the manner already described.

In another embodiment of the invention, shown in Fig. 3, a circular shell or casing *p* having a conical under part *p'*, is mounted upon rods p^2 and p^3 which are movable vertically in suitable guides p^4 and p^5. The rod p^3 is connected by a link *q* with a crank pin *q'* on a disk q^2, which is suitably supported and may be rotated rapidly by any convenient means. The material to be separated is delivered through a funnel p^6 in the top of the casing *p* upon a horizontal, circular plate *r* from the edge of which it falls upon a frusto-conical plate *s* having in its bottom an opening *s'*. The finer material which wanders upward on the plate *s* falls over its edge upon a frusto-conical plate *t* which also has in its bottom an opening *t'*. From the upper edge of the plate *t* the finer material in like manner falls upon a frusto-conical plate *u*, having in its bottom an opening *u'*, and from the plate *u* the finer material falls upon a conical plate *v* which has at its lower point a discharge chute *v'* through which all of the coarser material which moves downward on the plates *s*, *t*, *u* and *v* and through the openings *s'*, *t'*, and *u'*, is delivered from the separator. The finer material which eventually passes over the upper edge of the plate *v* falls upon the outer conical wall *p'* of the shell or casing and is finally delivered from the separator through a discharge chute p^6. As will be observed by examination of the drawing, the plates *s*, *t*, *u* and *v* have successively a steeper inclination, so that the coarser material is well separated from the finer material, the two grades of material being eventually delivered separately from the apparatus. Reference is made above to coarser material only, but it will be understood that this form of apparatus operates, as does the form shown in Fig. 2, as well to separate heavier particles from lighter particles as to separate coarser particles from finer particles.

It will be understood that various other arrangements of inclined plates, whether flat, curved or warped, adjustable or fixed, and vibrated or shaken in any suitable manner by any suitable means, may be made to meet varying conditions of use without departing from the spirit of the invention which is not restricted to any particular arrangement.

I claim as my invention:

1. An apparatus for separating granular materials comprising a plate having an inclined unbroken surface and mounted for reciprocation bodily in a substantially vertical direction, and means for vibrating or shaking the plate in a substantially vertical direction to separate said material by the vibration of said plate alone.

2. An apparatus for separating granular materials comprising a plurality of inclined plates with unbroken surfaces and with the upper edge of each higher plate over the middle portion of the next lower plate and means to vibrate or shake said plates bodily in a substantially vertical direction.

3. An apparatus for separating granular materials comprising a plurality of inclined plates with unbroken surfaces and with the upper edge of each higher plate over the middle portion of the next lower plate and means to vibrate or shake said plates bodily in a substantially vertical direction, the several plates having different inclinations.

4. An apparatus for separating granular materials comprising a plurality of inclined plates with the upper edge of each higher plate over the middle portion of the next lower plate and means to vibrate or shake said plates, each plate below the uppermost

having a steeper inclination than the one above it.

5. The method of separating granular or pulverulent material that consists in unobstructedly supporting said material at an inclination to the horizontal and imparting substantially vertical rapid impulses to the same to cause a part of said material to creep upwardly upon its support and a part of said material to move downwardly thereon.

This specification signed and witnessed this 21st day of June A. D., 1910.

JOHAN SIGISMUND FASTING.

Signed in the presence of—
HERMAN RÉE,
JULIUS LEHMANN.