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METHOD OF MIXING OR GRANULATING OF PULVERULENT AND PLASTIC MATERIALS OF ALL KINDS

Filed Aug. 8, 1935

Serial No.

35,394

2 Sheets-Sheet 1

Fig. 1.

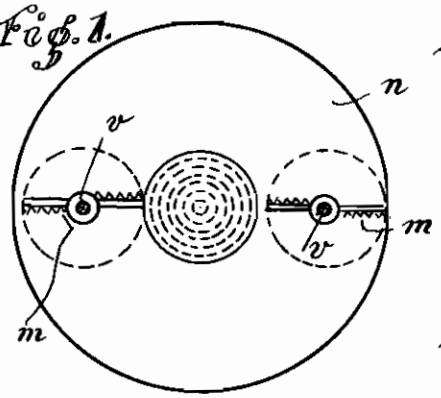


Fig. 2.

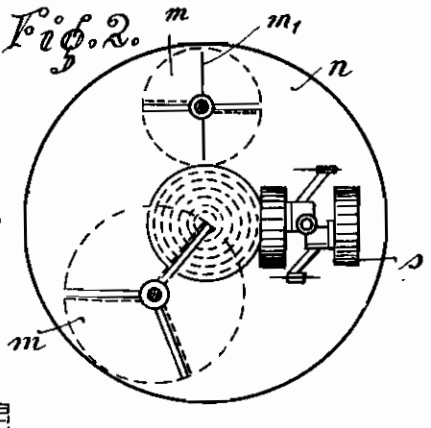
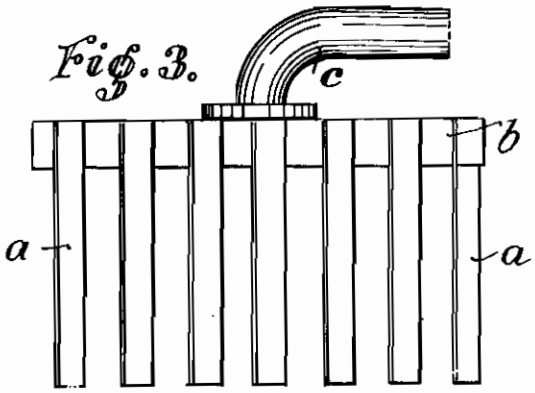


Fig. 3.



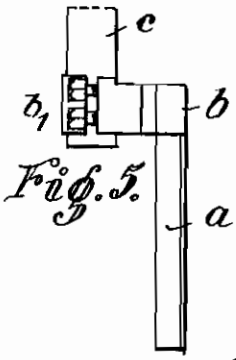


Fig. 5.

Fig. 4.

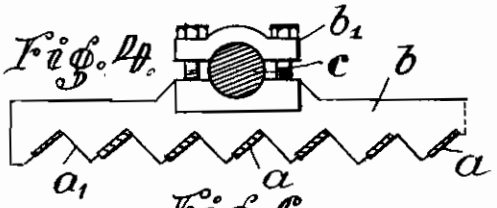


Fig. 8.

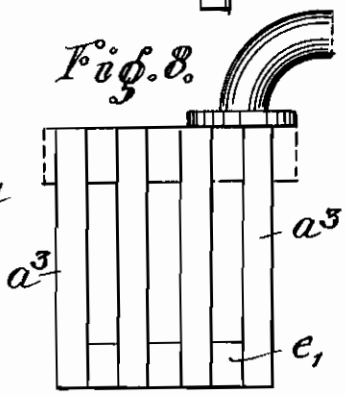


Fig. 6.

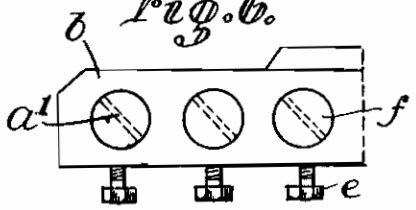


Fig. 7.

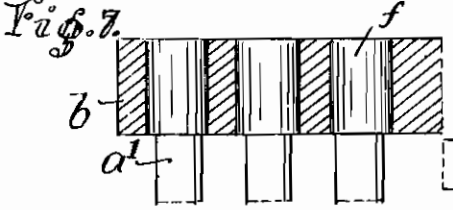


Fig. 9.

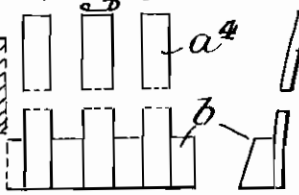


Fig. 10.

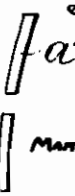


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Fig. 11.

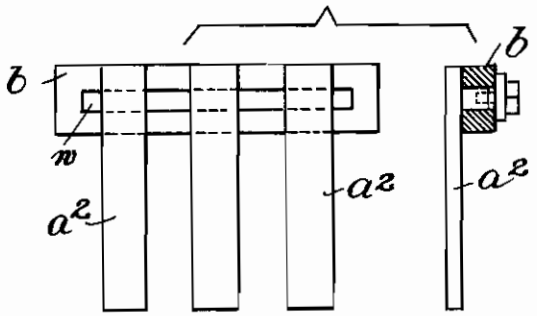


Fig. 12.

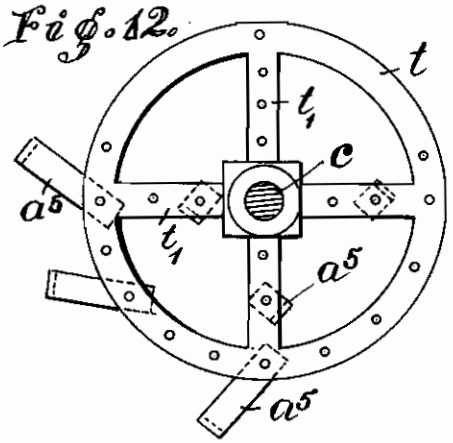
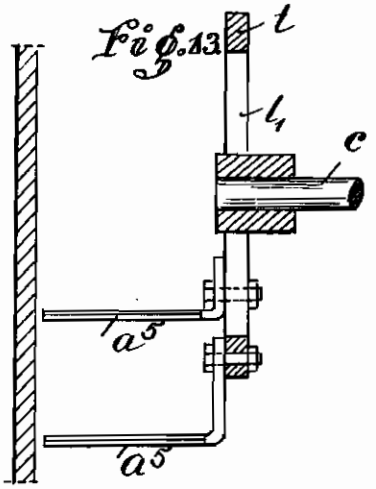


Fig. 13.



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ALIEN PROPERTY CUSTODIAN

METHOD OF MIXING OR GRANULATING OF PULVERULENT AND PLASTIC MATERIALS OF ALL KINDS

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Application filed August 8, 1935

This invention relates to a method of mixing or granulating of pulverulent and plastic materials of all kinds, in an intermittent or continuous operation.

The gist of the method of mixing or granulating is that the material is cut, worked, combed repeatedly, stirred, and moved in many directions, in a mixing machine with tools resembling rakes, forks, or knives, arranged eccentrically to the axis of the mixing machine. The tools which move eccentrically with respect to the centre of the mixing disk, are moved in circular lines which form loops in the material and, by the repeated rolling-over of the string-like portions of the material, impart intense movement to the content of the mixer, effecting thereby a repeated and thorough working and mixing of the material, without requiring any operation resembling that of a pug mill.

According to the invention, the material which may be, for instance, dry or moist, pulverulent or viscous, is spread on a rotary, flat and reciprocating or stationary support, for instance, a disk or a mixing bowl, and treated with the rake, fork, or knife like tools.

Various kinds of moist clay may be mixed rapidly and at a small power demand. For viscous material, knives are preferred since they demand little power at high velocity.

The material may be mixed and held in motion positively until it has been rolled into granular condition in many directions on the support by the rake like tools. Homogeneous material is mixed with a binder and with hygroscopic materials which per se do not cooperate, at a proportion sufficient for the granulation of the material, or the material is moistened.

Since the angular position of the tools with respect to the mixer axis varies continuously, the formation of globules is comparatively rapid if moisture enough has been added.

Materials which can be treated are clay and other plastic substances, with or without addition of color, artificial manure, thermoplastic substances, refractory materials, etc., of any desired composition and corresponding percentage of moisture, are mixed thoroughly in a single operation and shaped to globules.

Furthermore, for granulating the material, it may be mixed with substances increasing its strength, such as solution of water glass, adhesives, waste sulphite lye, hygroscopic salts, for instance, calcium chlorate, magnesium chlorate, cements, or the like, or with liquids other than water, for instance, salt solutions, hydrocarbons, oils, tars, or the like. The materials and additions are mixed in the mixing device in which also occurs the granulation. As mixing and granulation occur in the same machine, and in a single operation, the time required for performing it is shortened quite considerably.

The use of a single machine for mixing and granulating is particularly important in the case of plastic substances, which undergo a chemical conversion and become dry rapidly by chemical binding of the liquids they contain. The mixing operation must not be interrupted during the short period, and at the rapid granulation, and mixing and granulation must not be performed in separate machines.

Thermoplastic materials, for instance Leuna nitre which melts at 140°, can also be granulated by the method according to the invention. As the granulated materials solidify rapidly, it is necessary that the velocity at which the mixing tools, or the rotary disk, or both, rotate, should be increased substantially.

The grain size of the granulated material is regulated by the operation of the mixing machine, i. e., by varying the velocity at which the support rotates by speeding up or slowing down, or by shortening or lengthening the period of treatment for the same number of revolutions per minute.

The grain size can also be regulated by varying the adjustment of the combs or fork prongs at the mixing tools, i. e., by placing the prongs higher or lower, or by varying the angular position of the prongs with respect to each other, or by varying the interstices between the prongs.

Furthermore, the size of the granulate globules can be regulated by varying the moisture content or the adhesive strength of the mixture to be granulated.

Larger globules which may form upon the granulation, are broken up by the rotating fork prongs, and by prolonged rotation of the disk while when small globules form, the agglomeration is accelerated and favored by longer duration of the treatment, i. e., by rotation of the support for a longer period.

The machine can be charged with material to a comparatively high level without the formation of lumps which cannot be moved, in front of the tools, and cause trouble, because the rake like tools do not shift the material, as full wings or blades would do, but move through the material, cut it up, and subdivide and repeatedly overturn the material.

In Figs. 1–13, the mixing device for performing the method is shown in several embodiments.

Figs. 1 and 2 illustrate diagrammatically and in plan view a mixing disk with rake like tools.

Fig. 3 shows a rake like tool in elevation.

Fig. 4 is a plan view of the tool shown in Fig. 3.

Fig. 5 is an end elevation of the tool shown in Fig. 3.

Figs. 6 and 7 show a tool with adjustable rods and knives.

Figs. 8–10 show modifications of the rake-like tool.

Fig. 11 shows, by way of example, the transverse adjustment of the bars or knives.

Figs. 12 and 13 show a circular holder for a set of knives.

Referring now to Fig. 1, n is a rotary mixing disk which may have a central discharge opening, and v are rotary shafts arranged eccentrically to the axis of the disk n, to which shafts the rake, comb or knife-like tools m are secured.

If, as in the case of fire clay, further kneading and compression of the material is required, kneading and mixing tools s with solid blades are provided besides the rake-like tools m, as shown in Fig. 2. Between the tools m, arms m_1 with blades or scrapers may be provided.

Figs. 3–5 show a tool in which a holder b is secured to an arm c which is movable and may be springy. The holder b and a clip b_1 which is adapted to be screwed on, are equipped each with a circular depression into which the arm c engages. Narrow bars or knives a are arranged on the holder b, and rigidly connected to the holder, or mounted for adjustment transversely or vertically. The prongs a may also be arranged in serrations a_1 which resemble the teeth of a saw.

The transverse adjustment of the knives a appears from Fig. 11. The holder may be provided with a slot w in which the knives a are mounted for adjustment with a block z and equipped with set screws.

Figs. 6 and 7 show a device in which the ends of the bars or knives a are adjusted by turning about their longitudinal axis so that the bars or knives can be held at any desired angle to the material, and the effective area of the bars or knives varied. Bores for the reception of the cylindrical ends f of the bars a are provided in the holder b and the adjusted bars are held by set screws e.

Fig. 8 shows a tool in which the ends of bars a are connected by a transverse bar e_1 which detaches the material from the bottom of the mixing reservoir or bowl, the detached material flowing through the interstices between the bars a and being broken up and aerated, if required.

Figs. 9 and 10 show a rake with upright prongs or bars a which are slightly curved. The fork holder proper b which moves over the mixing disk like a scraper, detaching and lifting the material, so that it flows through between the prongs a in broken-up condition, is arranged at the lower end of the rake.

Figs. 12 and 13 show an example of a circular holder for a set of knives. The holder comprises an annular or frame-like body t with arms t_1 and a boss for securing it on the arm c.

The knives a, any number of which may be arranged at any desired pitch, are mounted adjustably on the frame or body t, and on the spokes t_1 so that the position of the knives can be altered as required for placing their cutting edges in position to cut the material or the knives act more or less with their sides, detaching and breaking up small strips.

The holder may rotate at high velocity and in this case its knives perform a very long cut. It is also suitable for breaking up liquids, i. e., for emulgation.

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