Aug. 15, 1933. H. PLAUSON 1,923,013

APPARATUS FOR THE PREPARATION OF SEMICOLLOIDS AND UNIFORM COLLOIDS

Filed Aug. 31, 1929

Fig. 1.

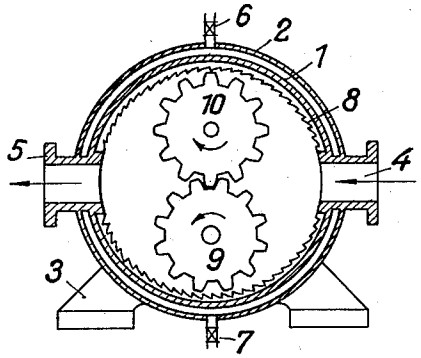


Fig. 2.

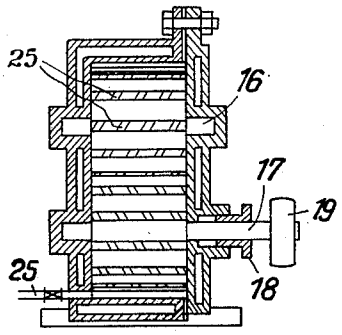


Fig. 3.

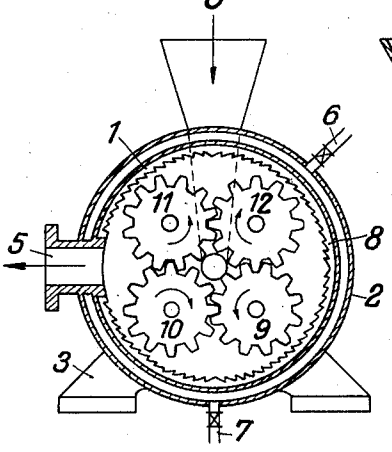


Fig. 4

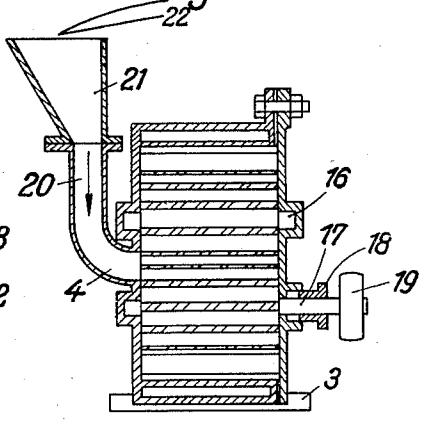


Fig. 5.

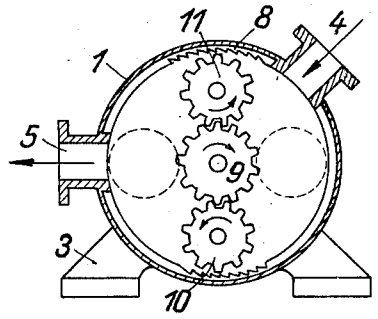
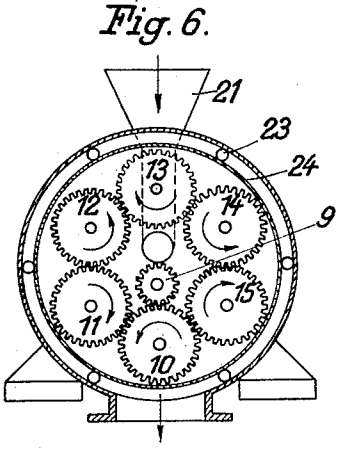


Fig. 6.



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APPARATUS FOR THE PREPARATION OF SEMICOLLOIDS AND UNIFORM COLLOIDS

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5 Claims. (Cl. 83—22)

My invention relates to apparatus for the preparation of semi-colloids and uniform colloids.

All hitherto known colloid mills and processes of making colloids therein depend either on percussion or on grinding of the solid material in a liquid or dispersant in which it is insoluble.

Percussion is generally carried out while the dispersant is fed along with the material to be ground, in the direction of the hammers, or in some cases across the direction of impact. In both cases, the angle of impact i. e. the angle between the disintegrating surface and the direction of flow of the material to be disintegrated is too small, and the largest part of the energy is used in heating the dispersant and not for disintegration.

Moreover, the impact action between flat plates or round bars is small, mainly because only a rubbing action is obtained by the percussion and only a small direct percussive action.

In colloid mills which work on the grinding principle, the energy consumed is too great for practical use.

Moreover, this system is applicable only to coarse disintegrations and not to fine colloidal substances, since these contain too much metal from the grinders.

According to the present invention a colloid mill has been devised, which overcomes as far as possible the above described difficulties, and which gives greater yields of fine colloids for an equal amount of time and energy, which is applicable to thin liquid as well as to pasty colloids, and also to two and three phase colloids and emulsions, and allow various substances to be converted into semi colloids in the dry way.

According to the invention, instead of a single percussive or grinding action, two actions namely percussive and crushing or squeezing actions are applied in one operation.

This object is attained by the provision of a plurality of cog wheels adjacent to a toothed breaking-up surface so that the liquid and the material to be disintegrated are thrown by centrifugal action against the latter and ground by the former.

The angle of impact is the angle between the tangent to the toothed surface at the point of impact and the direction of impact of the liquid.

The toothed surface may be stationary, or it may be the surface of another cog wheel or wheels.

By the crushing by means of cog wheels, large amounts of energy are saved, as compared with grinding a further advantage being that the dispersion liquid or medium and protective colloid if such be present, can be projected against the breaking-up surface, and thereby the yield of the subsequent percussive operation can be raised.

With the above machine a greater impact action as compared with the hitherto known colloid mills is obtained, since here the angle of impact is so chosen that the direction of impact is not in the direction of percussion but in the opposite direction, or at a certain angle thereto.

It has been found that if the hammer and anvil are made of cog wheels in different combinations and of different patterns, it is possible in one apparatus and in one operation to carry out both principles, namely percussion and crushing with unexpected advantage. A colloid mill with cog wheels according to the above principle can be constructed in different ways.

On the accompanying drawing on which I have shown, by way of illustration, several embodiments of an apparatus for practicing my invention, Fig. 1 is a sectional view of one form of apparatus, Fig. 2 a cross-section through the same taken at right angles to that of Fig. 1, Fig. 3 a similar view of Fig. 1 showing a modification, Fig. 4 a cross-section through the same taken at right angles to that of Fig. 3; Figs. 5 and 6 are similar views as Fig. 1 showing further modifications.

The simplest construction is shown in

Example 1 (Figures 1 and 2)

In a round cylindrical casing 1 are provided two cog wheels 9 and 10. The wall of the casing consists also of an exchangeable toothed wheel 8 with teeth preferably of the same pitch as those of the cog wheels. The axle 17 of the cog 9 passes through a stuffing box 18 on the outside of the casing and is rotated by an electromotor or by means of a belt pulley 19.

Since the second cog is rotatably mounted inside the casing and engages with the teeth of the other wheel, it is therefore also rotated (the ends of the axle of this gear wheel may bear tightly against the wall of the housing but are free to rotate) as in gear wheel pumps.

The liquid or substances to be operated upon (since the gear wheels are placed in the centre of the cylindrical casing and divide the casing into two halves) are introduced on one side

through 4 and must pass through the gearing. If the cog wheels in the colloid mill were not constructed in the manner about to be described, a very small output would only be possible, since the substance and/or the dispersion liquid could flow only between the spaces of the gearing to the escape orifice.

According to a further feature of the present invention therefore the output of the solid or liquid materials is increased by grooves 25 being cut transversely, or at a certain angle, in the teeth of the gear wheels.

By the use of an apparatus of the above kind with more or less oblique or zig-zag grooves transverse to the gearing, the full value of the new colloid mill is reached.

The mill may be provided with a heating or cooling jacket 2 with inlet and outlet pipes 6 and 7.

Example 2 (Fig. 5)

A modification is obtained by the use of three gear wheels 9, 10, 11 instead of two, preferably provided with transverse grooves.

The third gear wheel 9 may then be disposed in the center and can be either of the same size or preferably larger than the other two.

The other two gear wheels are driven from the third while the general construction of the machine is the same as in Example 1. The axes of the three cogs need not be in the same vertical plane.

The above two types are very useful for the preparation of emulsions, lacquers, pastes and soft substances in general.

Example 3 (Figs. 3 and 4)

By this embodiment very hard and solid substances may be colloidized more or less finely. The construction comprises a gear wheel ring built out of an even number of gear wheels preferably provided with transverse grooves 25. At least four gear wheels of suitable size are required. All four wheels are in mesh. Of the four axles, one projects outside from the casing and is driven by a motor, the other three gear wheels being driven by engagement therewith.

The substance to be treated is fed into the hopper 21 at one side of the casing (at the opposite side to the belt pulley 19) and must pass the teeth in order to reach the discharge pipe 5 (which projects sideways from the casing).

By such a construction each particle of substance must pass through the gearing and is not only subjected to percussion but simultaneously to a crushing or squeezing operation.

Example 4 (Fig. 6)

In another modification provision is made of a ring of six cog-wheels 10–15, a gear wheel 9 being mounted eccentrically in the interior of this ring, so as to come into contact with one of the cog wheels, thus imparting rotation to all. The interior gear wheel 9 is driven from outside the housing. In this case, a sieve 24 mounted on rollers 23 is provided.

The construction of the mill may of course take many other forms.

The above described constructions are suitable not only for the preparation of emulsions, with much liquid, but also for preparing pasty masses with only 20% liquid and with the addition of a third phase consisting of gases and/or vapors.

According to the present invention, it is possible to disintegrate dry or semi moist materials in the presence of protective colloids and/or dispersion accelerating (gaseous vaporous or liquid) media to a hitherto unknown fineness.

When the ground material is treated with gases or vapors the latter are preferably introduced into the mill from the side or through the axle which is then made hollow and provided with several holes between which the gases become distributed.

The gases thus introduced can also serve to blow away the substances, if these are sufficiently finely divided.

Reservoirs can be provided for continuous working, and centrifuges for the production of homo colloids. For the latter object the substances to be colloidized are mixed with the dispersant in a vessel, led once or several times through the colloid mill by pumps, and then on the last traversal of the mill the coarse parts are removed by means of a slowly rotating centrifuge and returned to the crushing operation, while the part of homo colloidal fineness passing through the centrifuge is used directly, or passed through a centrifuge with higher rotation speed, and thus converted into a thick paste which may be dried by well-known methods.

The colloid mill according to the present invention is preferably horizontal but may also be vertical.

The gear wheels may be exchangeably mounted on the axles so as to enable them to be replaced after wear without great expense.

I claim:

1. Apparatus for producing colloidal or substantially colloidal disintegration of material comprising a substantially cylindrical casing provided interiorly with a substantially annular series of longitudinally extending teeth, a plurality of intermeshing gear wheels within said casing rotatable on axes extending longitudinally of the casing, and means for rotating said gear wheels, the casing having inlet and outlet openings disposed so that material entering the casing passes between the gear wheels in its travel to the outlet opening and thus is caused to be crushed and to be thrown outwardly by the gear wheels against the annular series of teeth for further disintegration.

2. Apparatus as set forth in claim 1 in which the teeth of the gears are provided with diagonally extending transverse grooves opening through their outer faces.

3. Apparatus for producing colloidal or substantially colloidal disintegration of material, comprising a substantially cylindrical casing provided interiorly with a substantially annular series of longitudinally extending teeth, an annular series of intermeshing gears within said casing collectively enclosing a material admission space, means for the admission of material to said space, and means for rotating the gears, the casing having an outlet opening disposed exteriorly with respect to the annular series of gears whereby the material is required to pass between the gears in its travel to the outlet opening and thus is caused to be crushed and to be thrown outwardly by the gear wheels against the annular series of teeth for further disintegration.

4. Apparatus as set forth in claim 3 in which the teeth of the gears are provided with diago-

nally extending transverse grooves opening through their outer faces.

5. Apparatus for producing colloidal or substantially colloidal disintegration of material, comprising a casing, an annular series of intermeshing gear wheels within said casing collectively enclosing a material admission space, the teeth of said gear wheels being provided with diagonally extending transverse grooves opening through their outer faces, means for the admission of material within said admission space, and means for rotating said gear wheels, said casing having an outlet opening so disposed with respect to the said annular series of gear wheels that the material is required to pass between said gear wheels in its travel to said outlet opening.

HERMANN PLAUSON.