

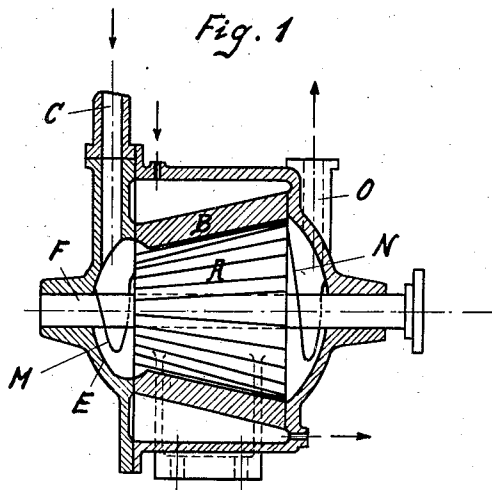
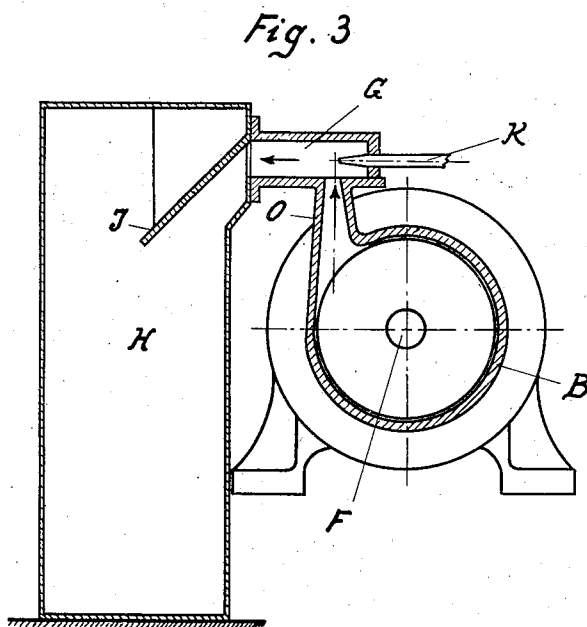
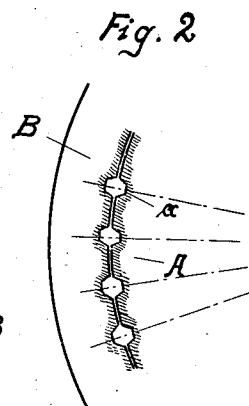
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W. OSTERMANN

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COLLOID MILL

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Inventor:
Walter Ostermann
by *[Signature]*
Attorney.

UNITED STATES PATENT OFFICE

WALTER OSTERMANN, OF OSCHERSLEBEN, GERMANY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TRAVIS PROCESS CORPORATION, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF DELAWARE

COLLOID MILL

Application filed May 6, 1924, Serial No. 711,390, and in Germany May 18, 1923.

My invention refers to the comminution of solid substances by mechanical means and relates to a high speed mill of the so-called "colloid" type wherein the material to be treated is subjected while in a liquid vehicle to an intense disintegrating action for the purpose of securing fine comminution, dispersion, homogenization, or the like.

Powders of colloidal fineness have hitherto been obtained as a rule by chemical treatment. It has already been tried to reduce solid substances to colloidal fineness by mechanical means, but these means as hitherto used have not resulted in an economical and perfect reduction of the size of the particles, such as required. Mechanical comminution is effected by aid of several kinds of mills, more especially centrifugal mills and disintegrators. The substances to be comminuted to colloidal fineness are ground in such a mill for several hours in the presence of electrolytes, which are designed to act as dispersing means, and, in certain cases, also of protective colloids. It has, however, been found that these mills have only a low efficiency, a very long time being consumed in grinding and moreover these mills require a very large consumption of power which is out of proportion to the quantity of substances comminuted per unit of time. Moreover, the suspensions thus obtained contain only a very small percentage of colloids, as a rule not above 1%, much of the disintegrated substance remaining in a more or less coarse state.

The further treatment of this mass is also unsatisfactory, the liquid discharging from the mill being caused to pass through a centrifugal apparatus of complicated design serving for effecting the separation of the colloids from the coarser particles. The particles suspended in the liquid must then be reduced to the state required in each case by drying.

These difficulties are obviated according to the present invention by first mechanically comminuting the substances, which have been suspended in a suitable liquid, in a mill, such as that hereinafter described, without adding any dispersing agents or protective col-

loids, until they have been reduced to colloidal fineness. The liquid having the colloidal substances suspended therein is then supplied by means of an atomizer directly into a drying apparatus of some well known kind in which the colloidal substances are at once converted into a dry powder.

In the drawing affixed to this specification and forming part thereof a device embodying my invention is illustrated diagrammatically by way of example. In the drawing

Fig. 1 is an axial section of the mill of my invention, while

Fig. 2 is a cross section drawn to a larger scale, showing the alternate teeth and channels provided in the rotor and casing of the mill.

Fig. 3 is a vertical cross section showing the mill, atomizer and drying apparatus.

Referring to the drawing, A is a rotor made of high grade steel and provided with straight-lined or helical channels *a* (Fig. 2) of curved or angular cross section. B is the stationary casing or so-called stator surrounding the rotor and which has similar channels and teeth and is cooled by water or the like. The rotor and stator can be conical, as shown in the drawing, or cylindrical in shape, the conical shape being preferable, inasmuch as in that case the mill can be adjusted very finely. The alternate teeth and channels provided in these members serve to impart an intense disintegrating action upon the material in the mill and with the rotor rotating at the rate of 3000 revolutions or more per minute so completely comminute the material supplied into the mill that it is reduced to a state of colloidal fineness. This disintegrating action is made up of a high speed heating of the film of liquid by passing teeth edges, of a shearing action upon the film by cooperating teeth surfaces, and of a churning action upon the liquid in cooperating channels. The tube C supplies the liquid containing the suspended material into the chamber E in tangential direction. That portion of the chamber which adjoins the rotor has the shape of a funnel. On the rotor shaft F a helical feeding member M is mounted which forces the material fed into the

chamber to enter the space confined between the rotor and the stator casing. The comminuted material escapes at the other end of the rotor, another helical blade N being mounted at this end, which serves for feeding the comminuted material into a tubular socket O extending tangentially of the circumference of the casing and which may be shaped after the manner of a nozzle. As shown in Fig. 3, a nozzle chamber G is mounted on top of the socket O and a nozzle K, which may be supplied with hot compressed air, extends into this chamber at right angles to socket O, the jet of hot compressed air serving for throwing the colloidal solution against an inclined baffle plate I mounted in the upper part of the drying chamber H. The compressed air nozzle K acts in two ways: It serves for atomizing the colloidal suspension escaping from the socket O, the combination of parts thus acting as an injector, whereby the mill itself is partly relieved and the consumption of power is reduced. On the other hand, the atomization effected by the jet of hot compressed air escaping from nozzle K cooperates with the baffled plate I in further reducing the size of the particles of the substance suspended in the liquid, and the finely atomized liquid entering the drying chamber is acted upon by heat or the like, whereby the substances suspended therein are reduced to a dry powder of colloidal fineness. This combination of fine disintegration with subsequent atomization and drying is the subject of my issued Patent No. 1,718,184.

The particular manner of operation of the mill which is the subject of the present invention is a continuous one. No clearances are formed, such as exist in other mills, whereby part of the material might evade the disintegrating action of the cooperating members A and B of the mill. The material to be disintegrated is continually kept in motion and dead corners and angles are avoided. The helical feeding blade M forces all the material to enter the mill. The injector-like effect produced by the nozzles O and K produces a reduced pressure or suction effect in the disintegrating chamber which also assists the circulation of the material. By the instantaneous atomization and drying of the material after it has been ground the finished product is produced in the quickest way without any dispersing agents and protective colloids being required, inasmuch as the conversion of the liquid suspension into a dry powder is effected directly and instantaneously. In consequence thereof, no centrifuging apparatus is required and the grinding process is carried through in a short time. Highly concentrated suspensions can be acted upon in this mill, the concentration merely depending upon the section of passage of the nozzles.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:—

1. An apparatus for homogenizing or emulsifying materials comprising members relatively movable at a high speed having cooperating faces between which the materials are fed for treatment, the faces of both members being provided with alternating channels and teeth arranged in a direction generally transverse to the movement of one of said members, the teeth of both members having flat faces spaced with a slight clearance therebetween, and the channels of both members being carried in cross-section and relatively disposed so that when the members are relatively moved at a high speed the materials fed between the members are subjected to the film beating action of passing teeth edges, to the film shearing action of cooperating teeth surfaces, and to the repercussive churning action of cooperating channels.

2. An apparatus for homogenizing or emulsifying materials comprising a pair of members having closely adjacent, non-contacting, cooperating faces relatively movable one past the other at a high speed between which the materials are fed for treatment, each of said faces being provided with alternating continuous channels and continuous teeth arranged in a direction generally transverse to the movement of one of said faces, said teeth having flat surfaces and said channels being curved in cross-section so that when the faces are relatively moved at a high speed, the materials fed between the faces are subjected to the film beating action of passing teeth sides and edges, to the film shearing action of cooperating teeth surfaces, and to the churning action of cooperating channels.

3. An apparatus for homogenizing or dispersing materials which comprises a member having a frusto-conical rotor surface rotatable at a high speed and having alternate teeth and channels arranged in a direction generally transverse to the movement of said surface, and a member having a frusto-conical stator surface surrounding said rotor surface in closely adjacent, non-contacting, cooperating relationship therewith and having alternate teeth and channels arranged in a direction generally transverse to the movement of said rotor surface, the teeth on both said surfaces terminating in respectively opposed flat faces which form edges with the sides of their respective teeth, and said channels having their sides sloping inwardly towards the channel bottom, whereby materials fed between the surfaces relatively moving at a high speed are subjected to a film shearing action between the cooperating terminal faces of the teeth, to a film beating action by pass-

ing teeth sides and edges and to a churning action by cooperating channels.

4. An apparatus for the comminution of materials in a liquid medium which comprises a pair of members having closely adjacent, non-contacting, concentric surfaces of revolution relatively movable at high velocity between which the liquid containing the materials to be comminuted is fed for treatment, and a rotatable helical vane disposed axially of said members and surrounded by but substantially spaced from the outer of said members for centrifugally impelling the liquid material outwardly and forwardly and into the narrow gap between said surface.

5. An apparatus for the comminution of materials in a liquid medium which comprises a cylindrical rotor surface rotatable at high velocity, a casing member having a cylindrical stator surface surrounding said rotor surface in closely adjacent, non-contacting coaxial relationship therewith, a rotatable helical vane mounted axially of said rotor at one end thereof and substantially spaced from said casing for centrifugally impelling the liquid material outwardly and forwardly and into the gap between said surfaces, and a rotatable helical vane mounted axially on said rotor at the opposite end thereof and substantially spaced from said casing for centrifugally expelling the liquid material discharger from said gap.

6. An apparatus for the comminution of materials in a liquid medium which comprises a rotor member rotatable at high velocity, a casing member surrounding said rotor member in closely adjacent, non-contacting relationship therewith, said casing and said rotor member generally defining a narrow working gap in which the liquid material is subjected to a comminuting action, said casing being contoured to gradually converge towards said rotor in the manner of a funnel from the end of said rotor to a point on said rotor at a distance from the end thereof whereby said gap is widest at its mouth, and a rotatable helical vane mounted axially of said rotor and substantially spaced from said casing for centrifugally impelling the liquid material outwardly and forwardly towards the inlet end of said gap.

In testimony whereof I affix my signature.
WALTER OSTERMANN.