June 2, 1959 E. W. SCHNEIDER 2,889,118

COMMINUTING MACHINE

Original Filed Dec. 5, 1950 2 Sheets-Sheet 1

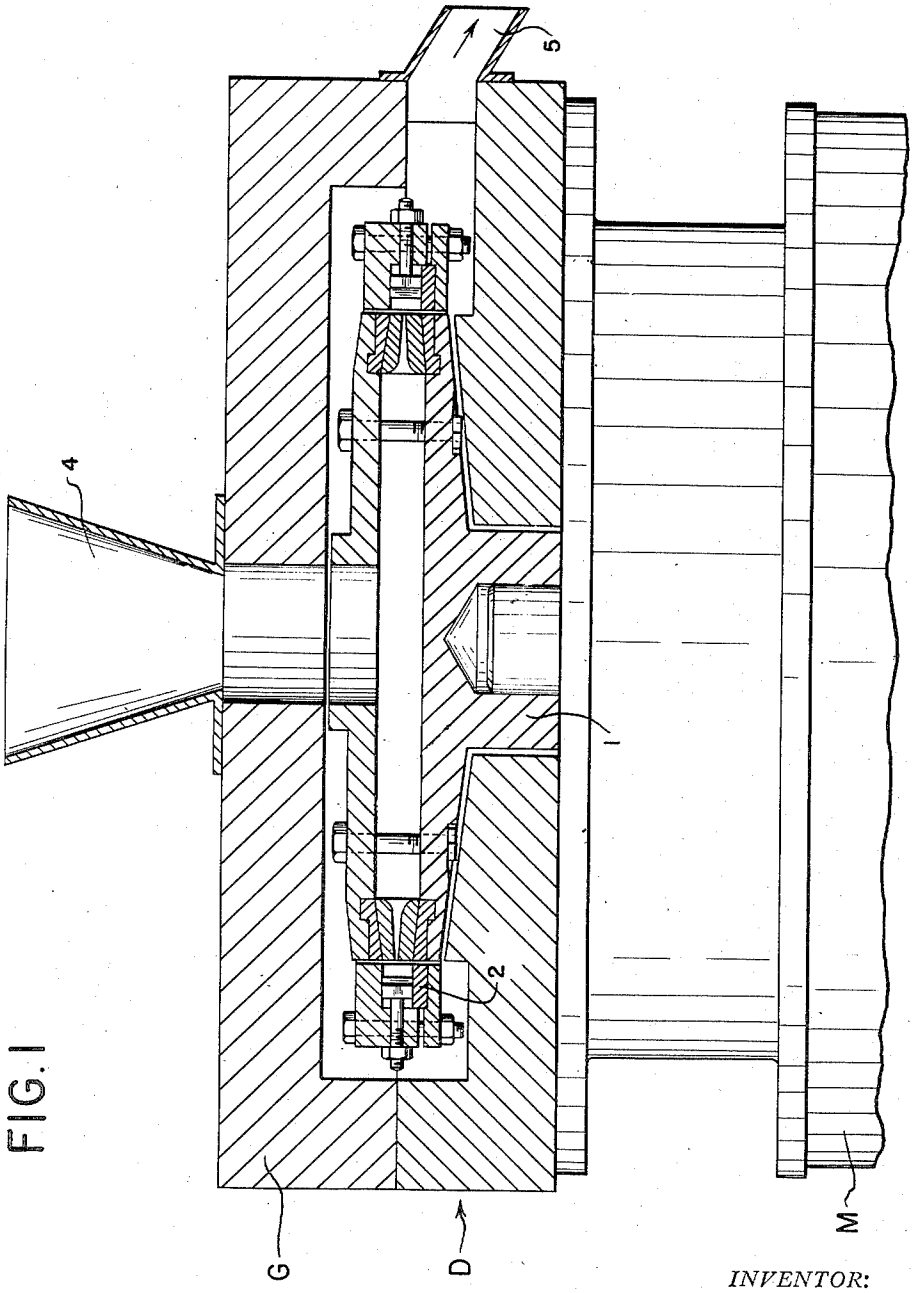


FIG. 1

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FIG. 2

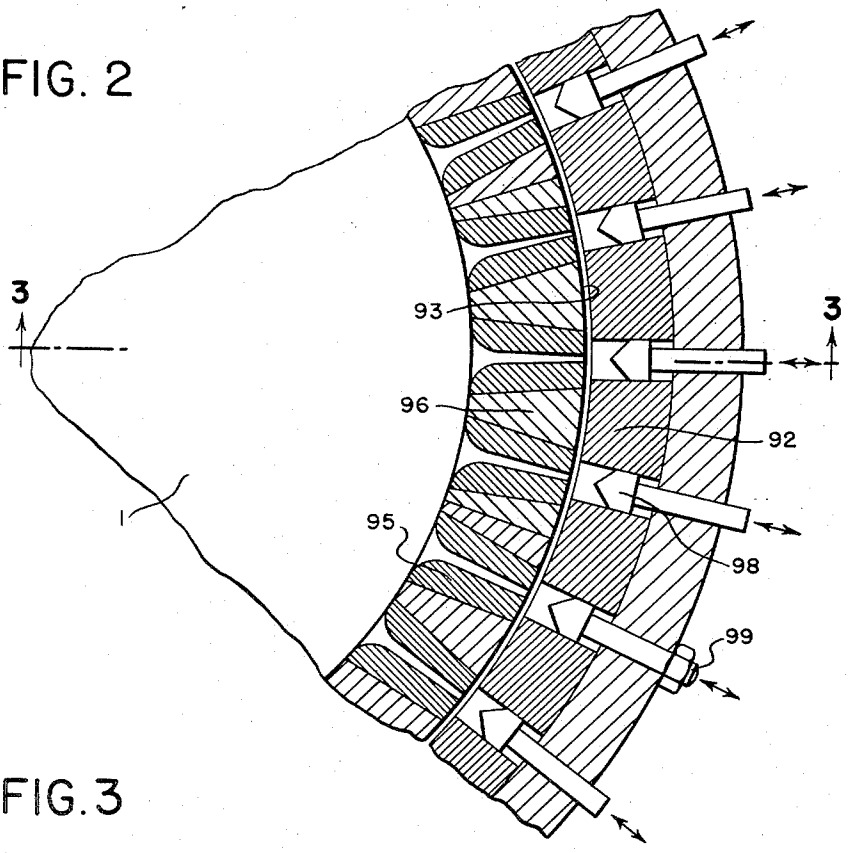
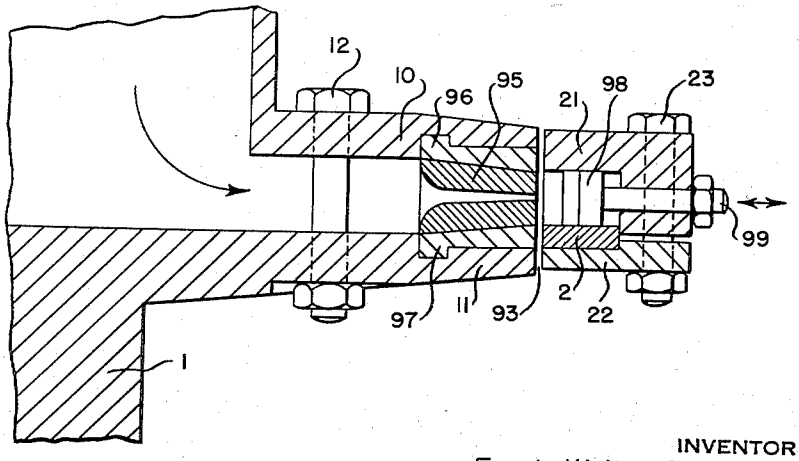


FIG. 3



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COMMINUTING MACHINE

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Original application December 5, 1950, Serial No. 199,186, now Patent No. 2,738,930, dated March 20, 1956. Divided and this application May 16, 1955, Serial No. 511,341

2 Claims. (Cl. 241—46)

This application is a division of the copending application of the same applicant Serial No. 199,186, filed December 5, 1950, now Patent No. 2,738,930.

This invention relates to machines for the production of finely divided mixtures, such as emulsions, suspensions or dispersions.

The invention is directed more particularly to dispersion machines of the type of the so-called colloid mills, in which previously comminuted material is very finely divided in an appliance consisting of a toothed wheel which rotates at a high velocity in an internally toothed casing with only small clearance. The material to be operated on may be introduced in an already broken up state or in large pieces, in which latter case it is preliminarily treated in a preliminary comminuting machine which is built into the machine casing as a preliminary stage.

The primary object of the invention is the provision of an improved machine for the production of very finely divided mixtures, by which the material to be comminuted, which may be of different form, material composition or internal tenacity, more particularly toughness, is divided up into minute particles of substantially the same, colloidal order of magnitude.

A further object of the invention is to produce an improved very finely comminuting machine of such construction that the dividing up of the material to be comminuted into particles of a substantially equal, colloidal order of magnitude will be carried through with less expenditure of time and energy than has hitherto been possible with the known colloid mills.

A further object of the invention consists in creating an extremely fine dispersion machine which, even with small constructional dimensions and relatively small driving energy, gives extremely fine dispersion results and is therefore suitable for use as a small machine in the workshop, the laboratory, the kitchen and so forth.

Further features of the invention and the advantages obtainable by them will be gathered from the following description in conjunction with the accompanying drawings, in which the invention is more particularly explained.

In the drawings, in which the same or similar parts bear the same references,

Fig. 1 is an elevation of one constructional form of an extremely fine dispersion machine according to the invention, in which those parts of the machine, in which the fine dispersion takes place, are shown in section;

Fig. 2 a plan view, partly in section, of the dispersing machine of Fig. 1, showing the nozzles arranged in the rotor and cutting edges displaceably arranged in the casing, which for the sake of clearness are shown in plan view; and

Fig. 3 a part section of the machine on line 3—3 of Fig. 2.

The minutely dispersing machine according to Fig. 1 comprises the driving motor M in the form of an ordinary upright motor and the dispersion device proper D,

the casing G of which is fixed on the motor flange in the usual way, for instance by means of screw bolts. The rotor 1 of the dispersion device is connected to the shaft of the motor M directly or through a suitable, constant or regulable step-up or step-down gear. Between the motor shaft and the rotor 1 disconnecting or overload couplings may be provided. Such gear and coupling arrangements are well known in the art and are therefore not shown in detail. In the casing G of the dispersion device an insertion part 2 is provided, which acts as the carrier of the stationary part of the dispersing system or systems. On the upper side of the dispersion machine is the hopper 4 for the material to be treated and at the periphery of the casing G is the outlet branch 5 for the finished product. In the constructional form according to Fig. 1 the rotor 1 rotates within the stationary part 2 of the dispersion system.

Figs. 2 and 3 show in enlarged plan and elevational sectional views the comminuting machine of the invention generally illustrated in Fig. 1. In this constructional form nozzles 95 are provided in the rotor in the form of separate constructional parts which consist of a material which is highly resistant to wear, such as hard metal or the like, and have a slightly conical external shape. These separate nozzles are mounted in groups, for instance by threes, in fitting conical bores of an annular segment 96 which, as will be seen from Fig. 3, is provided with flanges 97 and by means of these flanges is held between the upper part 10 and the lower part 11 of the rotor 1 by means of screw bolts 12. The subdivision of the nozzle carrier 96 into annular segments facilitates the making of the conical bores from the interior of the ring and is therefore only carried so far as is suitable for the purpose. The annular segments are preferably sawn out of a complete ring. Whilst this entails a loss of material, this can be entirely or partially compensated for by one or more intermediate metal sheets. In the latter case there will be a reduction in the diameter of the ring and consequently a change which can be effected in the distance between the nozzle opening and the face of the tooth system 92 in the stator 2. In this way the width of the working gap 93 of the dispersing system can be altered in any desired way. The slightly conical external form of the inserted nozzles has the result, that the nozzles, when in operation, automatically suck themselves firmly into the bores under the influence of centrifugal force.

In the constructional form according to Figs. 2 and 3 the tooth system 92 in the stator comprises a tooth supporting annular body 2, an angle shaped cover ring body 21 and an opposing ring 22, which parts are connected together by bolts 23 to form a unit which is mounted in the casing G in a suitable manner (not shown).

Through the gaps between the teeth of the annular body 2 and the covering ring 21 a plurality of chambers is formed, which are open towards the nozzles 95. In each of these chambers is a body 98 with a cutting edge, the shaft 99 of which extends through the covering body 21 and can be adjusted as regards its position from the outside by means of a known kind, for instance a securing nut.

The material to be treated, for instance a liquid mixture to be emulsified, enters from the hopper 4 Fig. 1 through the outlet between the rotor parts 10 and 11 into the nozzles 95, through which it flows under the influence of centrifugal force with great velocity. As long as the nozzle 95 is opposite the end surface of a tooth 92 in the stationary casing part 2, the material can only flow under considerable obstruction through the narrow working gap 93 into the material outlet passage and thence into the outlet branch 5 Fig. 1. As soon as the nozzle 95 comes into the region of a gap between teeth, the obstruction

pressure in the nozzle will diminish. Consequently the admission nozzles **95** act in the manner of a cavitation pipe which is throttled and opened in the rhythm of the change of chamber and effect a very fine division of the material flowing through. The outflowing material at the same time strikes against the cutting edge **98**, against which it is again finely divided. At the moment of a nozzle **95** passing a gap between teeth, occupied by one of the edges **98**, a dispersion system is created, which in the sense of a liquid pipe consists of a nozzle and a cutting edge. As, however, in the region of the gaps between segments the nozzle jet in spite of the presence of the cutting edge and even in consequence of the subdivision of the chamber effected by the cutting edge is reduced in pressure in the double rhythm, the dispersion system according to Figs. 2 and 3 has a double effect, namely simultaneously that of a high frequency cavitation pipe and that of a liquid pipe, whereby the fine comminution of the material is substantially assisted. This system is adjusted to the most favourable effect by a suitable adjustment of the distance between cutting edge and nozzle. Instead of the holding nut shown in Figs. 2 and 3 other suitable adjusting devices may be used, such as are known per se in the art. Preferably all the knife edges of the dispersion system will be simultaneously displaced in the radial direction. Such adjusting arrangements for the simultaneous radial displacement of machine parts or working appliances are known per se in the art and for the sake of simplicity therefore not specially illustrated. For instance, the knife edges can be supported in oblique slots of an annular support which can be turned by hand or automatically in dependence on the properties of the material.

I claim:

1. A comminuting machine comprising a rotor and stator mounted for relative rotation in an axis, said rotor having spaced members at least one of which is centrally apertured for the admission of a material to be comminuted to the space therebetween, said rotor further having a ring-shaped array of radially extending nozzles arranged at the outer limit of said members, said stator having a ring-shaped array of segmental members radially closely spaced from the ends of said nozzles and peripherally spaced by slots, and means including an axially extending cutting edge disposed in each of said slots with said cutting edge directed radially inward of said arrays.

2. A comminuting machine comprising a central rotor and peripheral stator mounted for relative rotation in an axis, said rotor including spaced members at least one of which is apertured to admit a material to be comminuted to the space between said members for radially outward motion therebetween, said rotor further including a circular array of nozzles supported between said members at the peripheral edge thereof and through which material admitted between said members must pass to emerge from between said members, said stator including a plurality of segments having cylindrical inner walls, said segments being supported with said walls in closely spaced relation to the exterior surface of said nozzles and with a circumferential space between adjacent of said segments, means closing said spaces at the axial limits of said segments, and means including an axially extending cutting edge supported between each pair of adjacent ones of said segments with the cutting edge of said means directed radially inward of the array of said segments.

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