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[54] PROCESSING OF FINELY DIVIDED PARTICULATE MATERIALS

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[52] **U.S. Cl.**............................... **264/91,** 264/118

[51] **Int. Cl.**.. **B29c 15/00**

[58] **Field of Search** 264/109, 91, 101, 102, 264/118; 425/362, 367

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[57] **ABSTRACT**

A mass of finely divided material is confined in a chamber. Two rollers are arranged for rotation in the chamber in axial parallelism with one another and defined with each other a narrow longitudinally extending gap. At least one of the rollers has a circumferential wall composed of gas-permeable porous material. This one roller is hollow and arranged to communicate with a source of underpressure so that, as the roller rotates, the particulate material is attracted onto its outer surface forming a layer thereon which is subjected to substantial compaction when it passes through the gap between the two rollers. The rollers rotate in opposite direction. The compacted material is removed from the outer surface of the roller or rollers and subdivided into portions of desired size.

5 Claims, 2 Drawing Figures

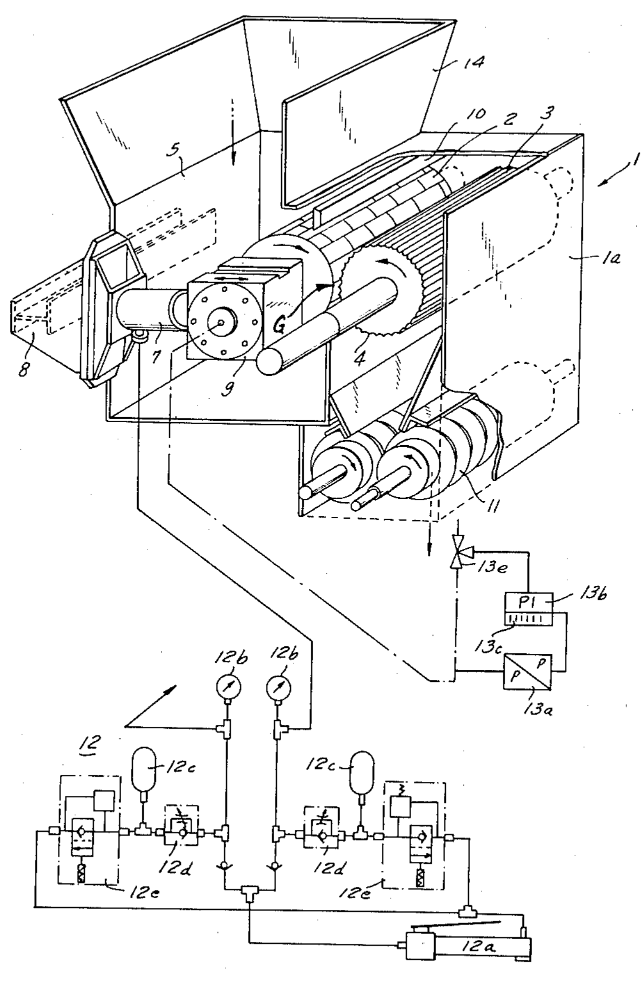
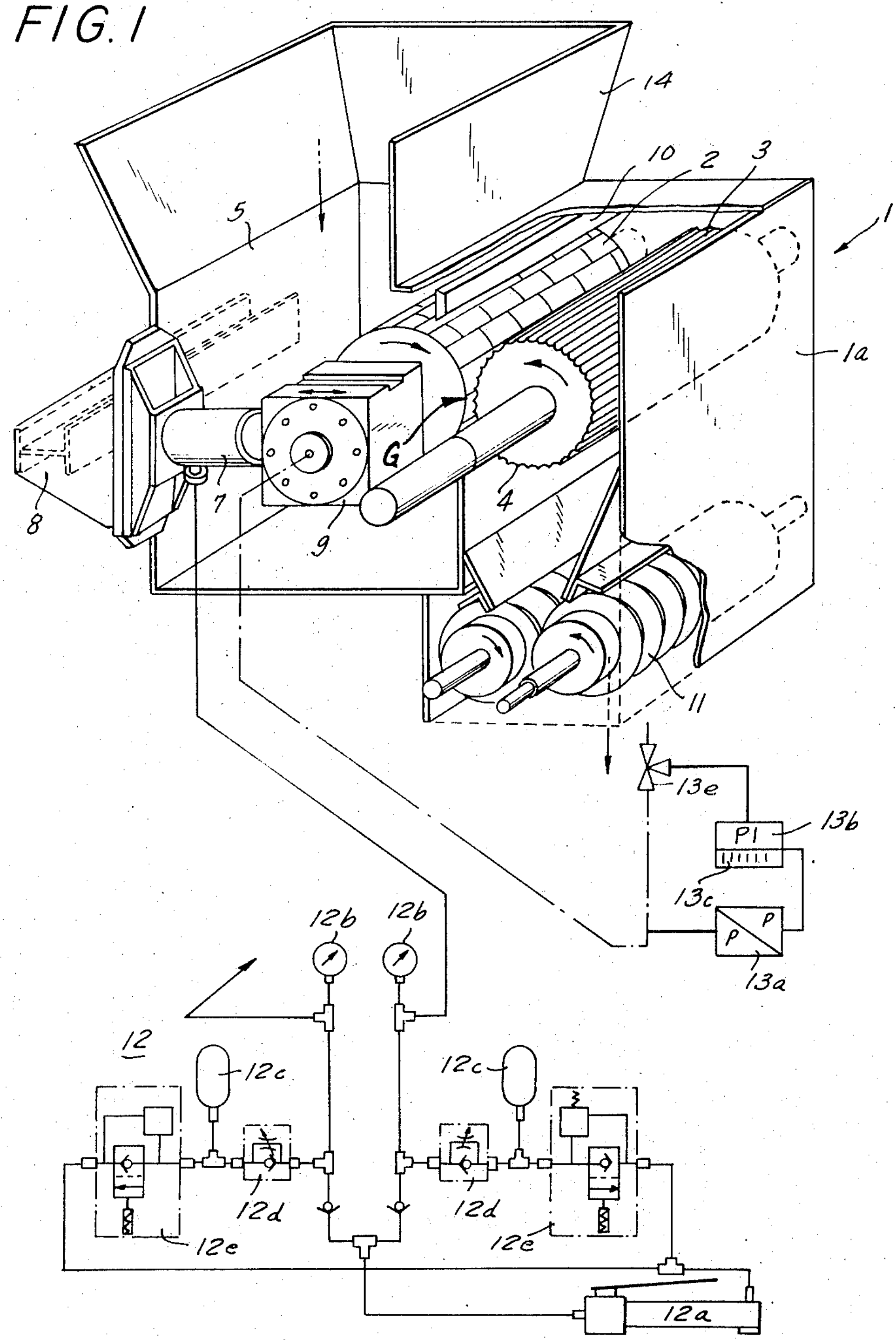


FIG. 1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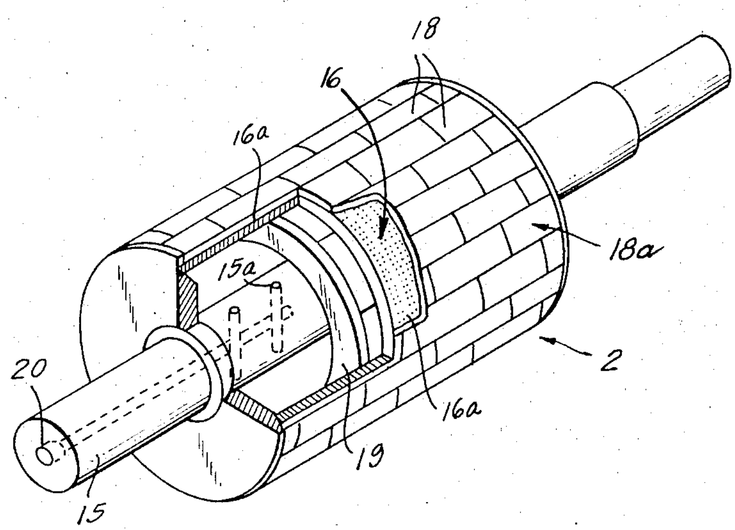

FIG. 2

PROCESSING OF FINELY DIVIDED PARTICULATE MATERIALS

CROSS-REFERENCE TO RELATED APPLICATION

This is a division of a copending application Ser. No. 874,654 now U.S. Pat. No. 3,738,785.

BACKGROUND OF THE INVENTION

The present invention relates generally to a method of processing finely divided particulate materials, and more specifically to the processing of such materials which requires precondensing and subsequent compacting of such materials into desired shapes. The invention relates in particular to a method for effecting such processing.

In many instances the processing of finely divided particulate material, such as pulverulent or fine-crystalline and organic materials, frequently depends upon the possibility of increasing the volumetric weight of such materials without destroying or adversely influencing their specific characteristics which depend upon the fine division of such materials. This is particularly true of highly dispersed surface-active filler materials, such as silicium oxide, carbon black, aluminum oxide, aluminum silicates and calcium silicates, all material, which are used in very large quantities in various industries.

The problems involved in the processing of these materials are not insignificant. On the one hand, in their finely divided state they require relatively large amounts of space for storage and transportation, an obvious disadvantage. Furthermore, they tend to "dust" and to undergo uncontrollable caking, both of which are of course characteristics of their finely divided state which are clearly detrimental to economic handling and proper processing.

Industry has attempted to find solutions to these problems, and particularly to impart to such finely divided materials a state in which their specific characteristics — such as the ability to disperse in the case of finely divided active filler materials— are fully retained while the space required for storage and transportation is substantially reduced and dusting during filling, metering and processing is largely eliminated. It has been proposed to achieve this by transforming the finely divided materials into agglomerates of certain configuration and dimension by subjecting them to mechanical pressure. This has been found to be practical in a continuous operation only if the significant quantities of gases present in highly dispersed materials are first removed, becaue otherwise it is not possible to obtain agglomerates with sufficient adhesion under mechanical pressure. It has been found, for instance, that it is impossible to obtain the desired compaction and adhesion simply by passing such materials between two metal rollers which subject them to mechanical compression. Therefore, gas removal and pre-condensing has been resorted to, utilizing in known continuously operating apparatus of the type in question pressure-type conveyor screws, rollers or pairs of rollers provided with radial projections or provided on the surface of at least one roller with profiling. However, it has been found that the degassing or outgassing effect and compaction obtainable with such apparatus, which for the actual compaction utilizes a pair of pressure rollers, is inadequate compared to the complexity and expense of the apparatus involved.

A further approach which has been tried is to deposit the material to be compacted onto hollow rollers, so-called filter rollers, whose circumferential wall is gas-permeable and whose interior is subjected to under-pressure. The gas is thereby withdrawn from the deposited material and the material is supplied by the filter rollers to the compacting gap between a pair of pressure rollers. Various modifications have been proposed for this basic approach but in each case the gap between the pressure rollers — in which the material is subjected to compaction— is fixed. This approach is limited in its applicability because it permits only the production of compressed blanks, as the compacted bodies made from the compacted finely divided particulate materials will hereafter be called for the sake of convenience, without specific form and only within a rather broad range of grain sizes. A further disadvantage is that the compacted blanks obtained in this manner have a widely varying breaking resistance, a fact which is of particular disadvantage if the compacted blanks are of filler material which is intended for certain applications, for instance for use in rubber mixtures, because with the mixing procedure used in the production of rubber mixtures the compacted blanks can be broken down only partially to the original grain size. The result of this is an inadequate dispersal of the filler material and the resulting typical formation of pockets and cavities in the vulcanized goods.

In addition certain materials, for instance light reinforcing filler materials such as SiO_2, can be compacted only to a bulk density of approximately 250 g/l in the apparatus known from the prior art and utilizing the so-called filter rollers, because the low mechanical strength of the fabrics used for the circumferential walls of the filter rollers makes it impossible to utilize higher compacting pressures. This is quite aside from the fact that even at these lowered operating pressures the fabrics must be very frequently replaced.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to overcome the aforementioned disadvantages.

A more particular object of the invention is to provide a method of processing finely divided particulate materials which is not subject to the disadvantages outlined before.

A concomitant object of the invention is to provide such a method which enables continuous operation and the production of compacted blanks of specific desired shape and size with a defined narrow range of breaking resistance and increased bulk density.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in the novel method which, briefly stated, comprises confining a mass of finely divided material adjacent the gas-permeable circumferential wall of a rotatable roller having a hollow interior. The roller is thereupon rotated and subjected in its interior to partial vacuum so as to attract the material by suction to the exterior of the circumferential wall of the roller for forming a continuous layer of the material thereon. Another roller is rotated in axial parallelism with the rotatable roller and with such a spacing from the exterior of the same as to define with the latter a gap wherein the layer is subjected to compacting.

The roller having the gas-permeable circumferential wall, hereafter for the sake of convenience called for the filter roller, may rotate partially or completely in the material to be compacted, and the same is true of the other roller. The thickness of the layer may be maintained constant by removing excess attracted material from the layer before increments of the layer enter into the gap between the two rollers. In accordance with the invention, one of the two rollers is biassed towards the other with a biassing force which is preferably maintained at constant level. The other roller may also be a filter roller or it may be a roller having a known gas-impermeable circumferential wall. In any case, the layer is compacted on passage of the gap between the two rollers so as to be reduced by at least one half of its original volume and is deformed — by profiling provided on the circumferential wall of at least one of the rollers— into compacted blanks of desired shape and configuration and defined range of breaking strength.

It is desired and advantageous according to the present invention that the dwell time of the material of the layer, that is of the material of which each successive increment of the layer is composed which enters into the gap between the two rollers, be below approximately 5 seconds, a time value which of course depends upon the roller circumference and the speed of rotation of the rollers.

In accordance with the invention it is not necessary that two rollers be provided having a gas-permeable or porous circumferential wall, or that even two rollers of the same type be rotated oppositely one another. However, for granulating purposes it is desirable and preferable that one of the two rollers has a profiled surface of circumferential wall. Depending upon the profiling, compacted blanks of certain configuration are obtained, for instance granules, little rods, tablets and the like. For instance, if the profile is half-moon shaped, then the compacted blanks will be similarly configurated. These compacted blanks may then be reduced to the desired dimensions in a cutting device of known construction, for instance in a so-called rotary disc breaker. Because of the profiling on at least one of the rollers, at least two dimensions of the resulting product are already established before the cutting device acts upon the compacted blanks.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partially sectioned diagrammatic perspective view of an apparatus for carrying out the method according to the present invention; and

FIG. 2 is a partly sectioned somewhat diagrammatic perspective view illustrating one embodiment of a roller for use in the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1, the apparatus for carrying out the novel method comprises a housing **1** having two transversely spaced walls **1***a*. Mounted in the housing **1** is a filter roller **2**, for instance of the type which will be discussed more specifically with reference to FIG. 2. The roller **2** is hollow, and arranged for rotation in axial parallelism with the roller **2** is the roller **3** rotating in the direction opposite to the roller **2**, as indicated by the arrows respectively associated with the two rollers. The circumferential wall of the roller **3** is not gas-permeable, and the roller **3** is therefore not designated as a filter roller as is the case with the roller **2**. Instead, the circumferential wall of the roller **3** is provided on its exterior with a fluted longitudinal profile **4**, shown in cross-section.

According to the invention the dimensions of the housing **1** are so selected that the spacing between the filter roller **2** and the housing walls **1***a* in direction normal to the longitudinal axis of the filter roller **2** is substantially greater than the gap G between the rollers **2** and **3**.

The shaft **15** about which the filter roller **2** rotates is hollow and a suitable source of suction may be connected with it in order to obtain partial vacuum in the interior of the filter roller **2**.

A pressure measuring transducer **13***a* and a PI regulator **13***b* which is coupled with an indicator device **13***c*, permit regulation of the value of underpressure applied to the interior of the filter roller **2**, via a valve **13***e*.

Slide bearings **9** journal the shaft **15** of the filter roller **2**, permitting movement of the latter in the direction towards and away from the roller **3**. Biassing devices **7**, which here are illustrated as being of hydraulic type but which could be mechanically or pneumatically operated, act upon the bearings **9** and bear upon a support structure which is located exteriorly of the wall **1***a* of the housing. A hydraulic pump **12***a* provides the necessary biassing force whose value is registered on the indicators **12***b*. If a pressure increase takes place in the system as a result of changes in the size of the gap between the rollers **2** and **3**, caused by increased thickness of the layer of material as it enters the gap **6** or by other factors, the roller **2** can yield and fluid escapes into the two reservoir bulbs **12***c* which are provided. Two pressure relief valves **12***d* are provided intermediate the reservoirs **12***c* and the biassing devices **7** in order to assure that the applied "isodynamic pressure" is so reduced only after it reaches a certain level. If the manually operated hydraulic pump **12***a* is replaced with an electrically operated pump, then a maximum-minimum or limit switch **12***e* must be provided for effecting automatic regulation of the desired biassing pressure.

A hopper **14** communicates with the interior space **5** in the housing **1** for introducing into the space **5** the finely divided particulate material which is to be compacted. When a partial vacuum is applied to the interior of the rotating filter roller **2**, the particulate material is attracted to the outer surface of the circumferential wall of the filter roller **2** to form a layer thereon which then passes into and through the gap between the rollers **2** and **3**. It is desirable to provide an adjustable and shiftable doctor blade **10** above the filter roller **2** for removing material from the attracted layer in excess of a predetermined thickness, in order to provide for as much thickness equalization of the attracted layer as possible before the same enters into the gap G between the rollers **2** and **3**. The compacted material, having the configuration imparted to it by the profiling **4**, falls out of the gap G between the rollers **2** and **3**, and downstream of the gap G it is cut to desired lengths by the cutting device provided, here illustrated as a known disc breaker or rotary disc breaker **11.**

FIG. **2** illustrates a specific embodiment of a filter roller for use in the apparatus according to the present invention. Reference numberal **15** identifies the hollow shaft a portion of which is provided with bores **15***a*. There are provided two end walls of disc-shape which are gas-tight with the hollow shaft **15** at the opposite axial sides of the region in which the bores **15***a* are provided. There is further provided an inner circumferential wall **16** of cylindrical configuration which is provided with a plurality of small bores or other apertures **16***a*. The wall **16** is fluid-tightly connected with the end walls, for instance by welding, and in the same manner the walls may be connected with the shaft **15.**

Provided on the exterior of the inner circumferential wall **16,** is an outer circumferential wall **18***a* composed of a plurality of plates **18** of sintered material, for instance metallic sintered material, synthetic plastic sintered material or ceramic sintered material. These plates **18** abut one another and, insofar as they are composed of weldable material, are welded to the inner circumferential wall **16** as well as to one another where they abut. However, screw means may also be provided for securing the plates **18** to the inner circumferential wall **16.** The inner circumferential wall **16** is provided with interior radial reinforcing ribs **19** for increasing the strength and stability of the roller, but helically convoluted ribs or axially extending ribs may also be provided, or any combination of the three. Reference numeral **20** identifies the inlet opening of the hollow shaft **15** at which partial vacuum may be applied.

It has been found that the production of compacted blanks with defined range of break resistance is facilitated by maintaining a constant level of biassing pressure of the rollers **2** and **3** towards one another. In order to obtain only small fluctuations of this range it is advisable to mount one or both of the rollers in the manner shown in FIG. **1,** that is in such a manner that the width of gap G can change automatically in dependence upon the thickness of the layer carried by the filter roller, or the compaction of the material in the gap G, or other factors, thereby assuring that the compacting and compression is always effected with identical mechanical pressure. Furthermore, such a construction of course reduces the possibility of breakdown of the apparatus.

The level of this "isodynamic pressure" depends in each individual case upon the particulate material to be compacted, its moisture content and the degree of compacting which is desired. In the case of white filter materials, such as silicium dioxide, the moisture content is for instance desirably not below 1 percent.

The optimum break resistance of the compacted blanks made from a given particulate material depends upon the intended use and can readily be determined by empirical means. For instance, it has been found that SiO_2 granulates produced in accordance with the present invention have adequate transport stability and maximum dispersion characteristics in a test rubber mixture if a break resistance to breaking force between 100 and 500 pond (p) is obtained in the compacted blanks, measured with the hardness tester according to German Auslegeschrift No. 1,374,254. The term "breaking force" is intended to mean the force in ponds (1 pond equals 1 gram) which is necessary to abruptly crush a granulate of 2 – 3 mm grain size.

The dispersion characteristics of SiO_2 compacted blanks made in accordance with the present invention may for instance be determined in a test mixture colored with ferrous oxide red. In this case, the test mixture is introduced into a mixer of the internal type and under identical circumstances one bath of test mixture has admixed therewith silicium dioxide granulate made according to the present invention whereas another batch has admixed therewith for comparison purposes a silicium dioxide powder. After the two batches are mixed a simple optical comparison indicates if and to what extent dispersion has been improved. It has been found, surprisingly, that if the breaking strength of the compacted silicium dioxide blanks is set to between 200 and 250 ponds, the dispersion in the text mixture is substantially better than in the test mixture to which the silicium dioxide powder was added.

For instance, if the original finely divided particulate material is a SiO_2 powder with primary particle sizes smaller than 50 μ and with a bulk density of approximately 100 g/l, then a SiO_2 granulate according to the present invention and having breaking strength values between 200 and 250 ponds may be produced under approximately the following circumstances:

roller pressure	approximately 0.1 – 0.5 t/cm
roller gap	approximately 1 – 6 mm, up to approximately 4 mm play in direction normal to the roller axes
dwell time in the gap	approximately 0.01 – 0.1 sec.
partial vacuum applied to filter roller	approximately 0.3 – 0.95 kg/cm²
gas permeability of the filter roller surface	approximately 6 m³/cm² × *h*

If the roller diameter is for instance 200 mm and the length of the rollers is 300 mm, the production amounts to approximately 250 kg/h granulate having a bulk density of approximately 330 g/l. During the transportation of the particulate material on the surface of the filter roller into the roller gap G, that is prior to the compacting which takes place in the roller gap G itself, a precompacting or precompressing to a bulk density of approximately 250 g/l is obtained in this case.

If for instance one of the rollers has a half-moon shaped longitudinal profile in its outer circumferential surface with dimensions of 6 × 2 mm, then a finished granulate with approximately the following screen analysis is obtained by breaking the rod-shaped SiO_2 compacted blanks falling out of the gap between the rollers in a conventional rotary disc breaker and subjecting them subsequently to screen removal of the fines smaller than 0.5 mm;

Particle Size mm	%
3 – 5	30
2 – 3	35
1 – 2	25
0.5 – 1	10

Enlarged photographs taken of the individual sieve or screen fractions of the finished granulate showed that the form obtained for the compacted blanks during compaction in the gap G between the rollers is readily visible in case of the fraction 3 – 5 mm, and that it is still readily identifiable in case of the fraction 2 – 3 mm.

This means that the identifiably shaped granulate quantity amounts to 65 percent, that is the total of the fractions 3 – 5 mm and 2 – 3 mm.

It will be appreciated that unlike the embodiment illustrated in FIG. **1**, it is possible to mount the filter roller **2** for rotation but not for shifting movement, and to mount the roller **3** for such shifting movement. However, the embodiment illustrated in FIG. **1** is preferred.

It is advantageous in accordance with the present invention that the pores of the material of which the outer circumferential wall **18***a* of the filter roller is composed be so dimensioned that at a predetermined operational load of the suction device a partial vacuum of constant value exists in the interior of the filter roller, irrespective of whether the filter roller is partly or completely immersed in the material to be compacted.

If, as illustrated in the embodiment of FIG. **1**, a rotary disc breaker is arranged below the gap G between the rollers **2** and **3**, then it is advantageous that the cutting edges of the rotary discs of the breaker extend in planes transversely to the elongation of the gap G. This is particularly advantageous if the apparatus for carrying out the present method produces compacted blanks in profiling which extends longitudinally of the rollers.

The material for the porous outer circumferential wall of the filter roller is a suitable sinter material, such as sinter metal, sintered synthetic plastic or sintered ceramic. It is of course not necessary that the outer circumferential wall consist of the plate-shaped portions illustrated in FIG. **2**, but this enhances the stability.

It is advantageous, but not absolutely necessary, that the spacing of the filter roller from the bottom wall of the housing **1** be at least equal to half the roller diameter, and that the lateral spacing between the filter roller and the housing wall be equal to at least one roller diameter. The doctor blade mentioned before may be adjustably mounted so as to be movable towards and away from the circumferential wall of the filter roller, and it may also be so mounted that its angle with respect to the circumferential wall can be adjusted.

The pores of the porous material of the outer circumferential wall of the filter roller may have a diameter of approximately 0 – 200 μ, preferably between 0 – 35 μ. The thickness of the outer circumferential wall should be at least approximately 1 mm. When a partial vacuum of 0.01 – 1.0 kg/cm^2 is applied, the gas permeability of the outer circumferential wall of the filter roller may be in the region between approximately 0.1 and 7 m^3/cm^2 x *h*.

The roller **2** for utilization in the apparatus of FIG. **1** has certain very definite advantages over the rollers used in known apparatus, namely a long life irrespective of whether it is rotated at low or high rotational speeds, resistance to much higher pressure than are possible with the known constructions, and retention of its shape, that is resistance to being deformed so it is out-of-round in cross-section.

The following examples will further aid in an understanding of the invention.

EXAMPLE 1

In an apparatus according to FIGS. **1** and **2** compacted blanks of highly dispersed surface active silicon dioxide were produced. The starting material, obtained by precipitation from an aqueous silicate solution, had the following characteristics:

Specific gravity	1.9 – 2.0
Bulk density	80 – 110 g/l
Vibratory weight	160 – 200 g/l
BET-surface	240 m^2 g
Primary particle diameter	16 μ

The apparatus utilized an isodynamically biassed filter roller and a non-adjusted rotatable non-gas permeable counter roller having half-moon shaped longitudinal profiling. Both rollers were 300 mm long and had a diameter of 100 mm. The outer circumferential wall of the filter roller was 5 mm thick and consisted of sinter metal "Siperm R" (Remanit) having a maximum pore width of 35 μ. The profile of the counter roller had the dimensions of 6 × 2. Arranged below the gap G between these rollers was a rotary disc type breaker with a spacing between the disc of 3 mm.

Prior to operation of the device the housing was filled via the hopper to approximately two-thirds with the pulverulent material to be compacted, a roller pressure of 0.35 t/cm^2 was set and a partial vacuum of 0.6 kg/cm^2 was applied to the filter roller. The doctor blade **10** arranged above the filter roller was set at a distance of 15 mm from the circumferential wall of the filter-roller. Thereupon, both rollers and the disc type breaker were simultaneously started. The rotation of the rollers was so regulated that the medium dwell time of the material to be compacted in the gap G between the rollers was approximately 0.15 sec. The width of the gap G was approximately 1 mm. The movements of the filter roller in direction normal to the axes of the two rollers, which occurred during the compacting operation, were in the range of between 1 – 3 mm.

The bulk density of the precompacted particulate material forming a layer on the filter roller **2** prior to entering into the gap G was 255 g/l. The output obtained was approximately 260 kg/h granulate having a bulk density of 330 g/l. The breaking strength of the compacted blanks was between 200 and 250 ponds.

After screening and classification to particle sizes between 0.5 – 5 mm, only a fine smaller than 0.5 mm amounting to 15 percent was left.

Sieve analysis on a laboratory sieve or screen of commercially available type showed the following values in the final product:

Particle Size mm	%
> 5	0.4
3 – 5	30.9
2 – 3	31.3
1 – 2	21.8
0.5 – 1	11.7
< 0.5	3.8

The granulate portion having an identifiable shape (fractions 5, 3 – 5 mm and 2 – 3 mm) corresponded to 62.6 percent of the total.

The dispersion ability of the granulates was tested in a red colored test rubber mixture free of vulcanizing additives. A Brabender-Plastograph was used as dispersion apparatus.

TEST MIXTURE AND DISPERSION CONDITIONS

Components	Quantities g	ml	Vessel volume ml	Utilization %	RPM	Temp. °C	Mixing time min.
Butyl rubber (*)	28	28	50	90	50	100	10
Iron oxide batch (**)	5	5					
Kp 140 (***)	1.7	1.7					
Granulate	20	10					
	54.7	44.7					

(*) Polysarbutyl 301 (Polysar Co., Belgium), type non-staining, isopren content of 1.6 Mol-%; Mooney-viscosity ML 8 : 85 (at 212°F)
(**) Consisting of 100 parts polysarbutyl 301 and 50 parts iron oxide red
(***) Softener (Tributoxyethylphosphat) Manufacturer: Food Machinery and Chemicals Corporation, New York.

The mixtures thus obtained were subsequently passed at 95°C and at a gap setting of 1 mm three times through a laboratory two-roller frame and then rolled out to a thickness of 5 – 8 mm. The quantity of dispersion was thereupon determined under a light microscope, based upon top-lighted photographs of microtome cuts taken of the rolled-out skin. No pockets or similar irregularities were found. Surprisingly, the degree of dispersion obtained with the SiO_2 granulates produced according to the present invention was even distinctly better than that obtained in text mixtures which were made with pulverulent starting material.

EXAMPLE 2 (COMPARISON TEST)

The starting SiO_2 material used in the Example 1 for producing granulates was pressed with a known apparatus of comparable dimensions. Precompression took place via a vertically operated screw and compacting took place in the gap G between two oppositely rotating metal rollers whose circumferential walls were provided with wave-shaped serrations. In order to be able to at all obtain a granulate breaking strength on the order of 200 pond it was necessary to pass the SiO_2 repeatedly through the gap G between the rollers. The production output was only 50 kg/h. The granulate dispersion in the test mixture produced in accordance with Example 1 was significantly poorer than that of the test mixture utilizing the pulverulent starting material. It was a particular disadvantage that the fines 0.5 mm obtained on classification in the range between 0.5 – 5 mm was 50 percent after the first compacting, and could be reduced to approximately 15 percent only by repeated compacting.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in processing finely divided particulate materials differing from the types described above.

The invention is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A method of compacting finely divided particulate material, comprising:

a. feeding a mass of said particulate material against a gas-permeable circumferential wall of a rotatable hollow first roller;

b. rotating an exteriorly profiled second roller in axial parallelism with said first roller at such spacing from the same as to form therewith a gap;

c. rotating said first roller and subjecting the interior thereof to a partial vacuum so as to attract said particulate material by suction to the exterior of said circumferential wall for forming thereon a continuous circumferential layer;

d. allowing said first roller to move toward and away from said second roller in dependence upon the thickness of said layer on said first roller in said gap so as to allow the width of said gap to vary also in dependence upon the thickness of said layer on said first roller in said gap; and

e. yieldably biasing said first roller towards said second roller during the movement of said first roller toward and away from said second roller, with a biasing force which remains constant during such movement of said first roller towards and away from said second roller and during any variations in the width of said gap which are caused thereby, whereby to compact said continuous circumferential layer in said gap with said constant biasing force and convert it into a compacted layer which has a substantially uniform density throughout.

2. A method as defined in claim **1**, wherein the rotation of said rollers is effected in such a manner that the dwell time of successive increments of said layer in the space defined between said rollers at most approaches substantially 5 seconds.

3. A method as defined in claim **1**, wherein said second roller forms the compacted layer into compacted blanks; and further comprising the step of removing said compacted blanks from said first roller.

4. A method as defined in claim **3**; and comprising the step of subdividing the compacted blanks into sections of desired dimensions.

5. A method as defined in claim **4**, wherein the step of subdividing comprises severing said compacted blanks to form sections of desired dimensions.

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