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PROCESS FOR PRODUCING MICA POWDER

Filed Nov. 30, 1928

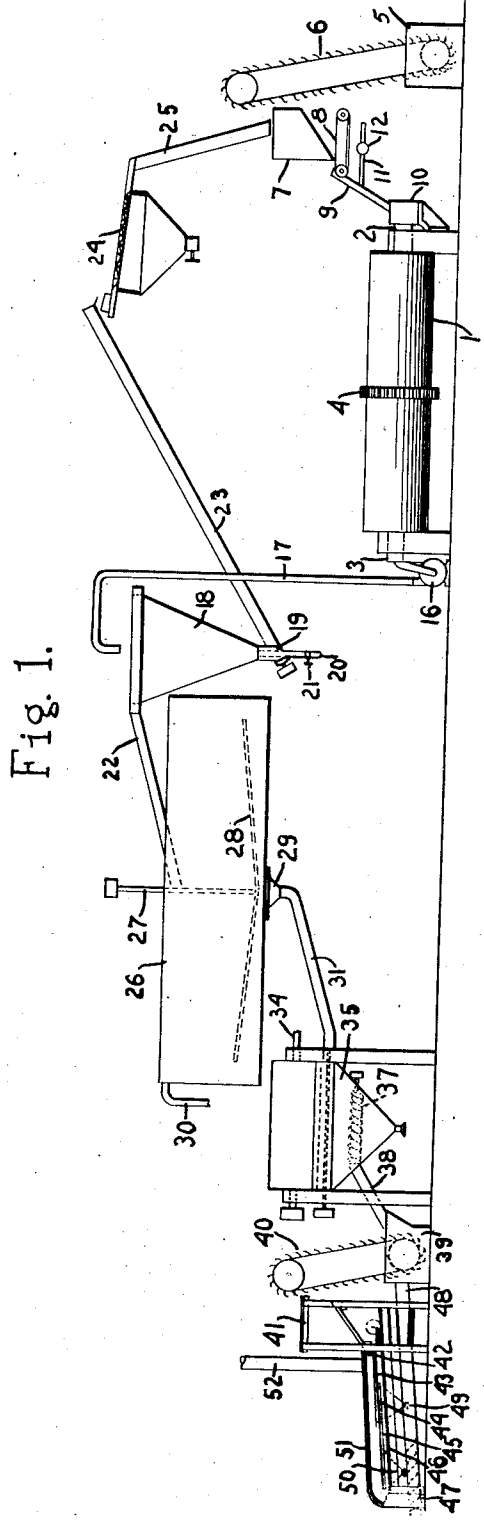


Fig. 1.

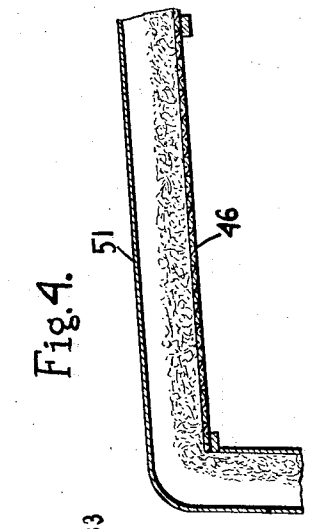


Fig. 4.

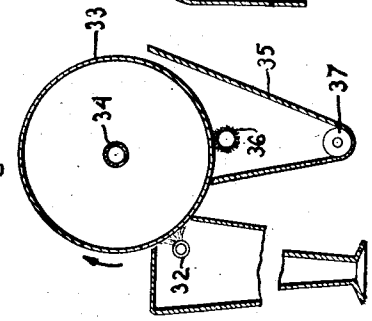


Fig. 3.

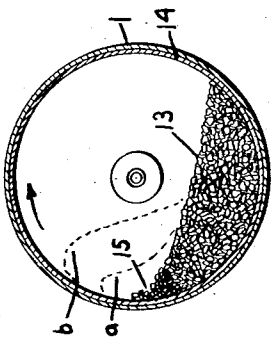


Fig. 2.

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UNITED STATES PATENT OFFICE

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PROCESS FOR PRODUCING MICA POWDER

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This invention relates to improvements in processes for grinding mica, and the principal object thereof is to provide a process for producing mica powder or ground mica without substantially impairing the light-reflecting surfaces of the particles thereof, and with as complete a delamination of the individual mica powder particles as possible.

Mica powder is largely used in ornamentation to provide a sparkling surface. Among many of such uses it may be mentioned that dry mica powder is blown or sifted upon the surface of certain high grade wall papers, while the latter are in a somewhat tacky condition and serves to give the wall paper a sparkling appearance.

It may also be dusted or projected upon painted, shellacked, or varnished surfaces to produce a sparkling effect.

In addition to its use in ornamentation and decoration, mica powder may also be employed for other purposes, such as, a dusting powder for moulds, particularly rubber moulds to which it is adapted because it will not unite with the rubber or rubber composition. It may also be employed to prevent adhesion between the inner tube and casing of automobile tires and may further be used for lubrication and other purposes which are well known to those skilled in the commercial arts.

By the present invention it is possible to produce mica powder of such greater degree of fineness and delamination that it may be successfully employed in many instances, where commercial mica powder has heretofore been unadapted because of its coarseness. Furthermore, the sparkle or sheen of the mica powder produced by the present process and apparatus is far superior to any which has heretofore been made because of the unimpairment of the light-reflecting surfaces of the mica powder.

Pulverization of mica to produce a mica powder without substantially impairing the light-reflecting surfaces thereof has heretofore presented great difficulty for if mineral mica is reduced to a powder by crushing, abrasion, hammering, or other usual methods, the light-reflecting surfaces of the mica particles become scratched, thereby losing their lustre and light-reflecting power.

The present invention comprises a process for producing mica powder by triturating fragmentary sheets of mica in a liquid by a rubbing action operable to delaminate the mica sheets by relative slippage of adjacent laminations thereof and at the same time reducing the powdered mica to a substantially impalpable powder, without impairing the light-reflecting surfaces of the particles thereof.

A further object of the invention is to provide a novel process for treating the triturate to remove impurities and to insure the production of a mica powder of uniform fineness.

A further object of the invention is to provide a novel method for treating the liquid-supported triturate to produce a dry mica powder, and a further object of the invention is to provide a novel method for grading the dry mica powder more rapidly than has heretofore been possible, and also with a minimum waste by preventing dispersion of the mica powder from the exposed surface of the mass being graded.

These and other objects and features of the invention will more fully appear from the following description and the accompanying drawings and will be particularly pointed out in the claims.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which,

Fig. 1 is a view, mainly in diagrammatic form, of the various pieces of apparatus employed in the process;

Fig. 2 is a transverse sectional view of the triturating drum and its contents, and illustrating the manner in which the trituration is accomplished;

Fig. 3 is a transverse sectional view of the drying drum and illustrating a manner in which the partial concentrate is projected upon the drum and the dry mica powder removed therefrom; and,

Fig. 4 is a detail longitudinal sectional view of a portion of the bolting machine and showing the novel process by which the fine material is separated from a thick layer of

mica powder passing over the bolting cloth of sufficient thickness to facilitate the passage of the finer particles through the bolting cloth while preventing dispersion of the powder from the upper or exposed surface of said layer.

The complete method may be generally described as comprising triturating fragmentary sheets of mica mixed with a liquid by a rubbing action operable to delaminate the mica sheets by relative slippage of adjacent laminations thereof, and at the same time reducing the mica to powder form, hydraulically separating the mica powder from the other portions of the triturate, partially concentrating the mica-bearing liquid, subjecting a spray of the partially concentrated liquid to the action of sufficient heat to expel the liquid, and finally bolting the dry mica powder from a mass of sufficient depth substantially to prevent disperson of the powder from the exposed surface of the mass. This process and various steps in the process, which in themselves are novel, are pointed out in the claims.

Suitable apparatus for producing the process are illustrated in the accompanying drawings. Many of the illustrated pieces of apparatus employed in the performance of the process are in themselves old as employed in other arts, but are so arranged and operated as to produce novel functions peculiarly adapted to the present process, as will hereinafter more fully appear.

The grinding or pulverizing apparatus illustrated herein comprises a revolving tube or drum 1 having at one end a hollow inlet shaft 2 and at its opposite end a hollow outlet shaft 3 with suitable means, such as a central gear 4, for rotating the drum from usual mechanism not shown. Fragmentary sheets of mica are placed in the hopper 5 and carried by an elevator 6 to a hopper 7 which delivers the fragmentary mica upon an endless belt 8 which in turn delivers the same to a chute 9 leading to a hopper 10 which communicates with the hollow inlet shaft 2 of the drum.

Liquid, such as water from a suitable source, is delivered to the chute 9 by a pipe 11 having a valve 12 by means of which the quantity of water thus delivered may be regulated. Desirably the mixture which is delivered to the drum comprises approximately forty-five per cent by weight of mica and fifty-five per cent by weight of water, but, of course, the relative proportions thereof may be varied as conditions may require.

The drum 4 is of the usual tube mill type having a tube of plate iron which is partially filled with a mass of substantially non-abrasive, preferably spheroidal, weights 13, see Fig. 2.

Any suitable weights or "balls" may be used. Preferably flint pebbles are employed and the drum provided with a lining of silex 14, or other hard non-abrasive material. It will, however, be understood that other suitable weights and lining may be employed, such as rubber balls and a rubber lining, or wooden balls or other wooden devices and a wooden lining, or any other substantially non-abrasive material which will accomplish the purposes herein described and avoid staining the ground material.

The important feature of the present invention is to produce a trituration of the material by a rubbing action between the fragments of the material itself and between the weights and the material which will cause relative slippage of adjacent laminations of the mica sheets, so that the same will be separated without substantially abrading the surfaces of the sheets or the particles to which the sheets are reduced during trituration, as distinguished from usual methods of abrasion which seriously defaces the light-reflecting surfaces of the particles, and from crushing impact or other grinding means which partially or wholly destroys the light-reflecting surfaces of the sheets and the particles thereof.

The rubbing triturating action is accomplished in the present invention by rotating the drum at a slow speed which will serve to carry the mass within the drum upwardly with the rotation of the drum until the uppermost portion 15 of the mass, see Fig. 2, reaches a position in which the weights or balls will flow downwardly and during the progressive rotation of the drum will provide a continuous circulation during which the movement of the weights or ball relatively to each other and to the fragmentary mica sheets, together with the movement of the mica sheets relatively to each other and to the balls, will produce the desired delaminations of the sheets by slippage of adjacent laminations upon each other and the pulverization of the laminations without scratching or otherwise impairing the minute light-reflecting surfaces of the particles of mica powder.

The presence of water, or other suitable liquid, particularly if supplied in proper proportion to the amount or weight of mica, is largely instrumental in effecting such delamination.

It may be stated that if the drum is rotated at too great a speed, the weights or balls will be carried up along the surface of the ascending portion of the wall of the drum and caused to cascade in a path generally indicated by the dotted line (*a*) in Fig. 2, and such cascading will produce such an undesirable impact of the weights upon the mica sheets as to abrade, shatter, or otherwise reduce the light-reflecting properties of the faces of the minute particles, while if the drum is rotated still more rapidly the weights will be carried farther up the side

of the drum and projected along paths of the general form illustrated by the dotted line (*b*) in Fig. 2, in which case the impact of the weights upon the material will s ill further impair the light-reflecting surfaces of the mica powder.

It has been found in practice that a desirable speed of rotation of the drum is such as to produce a maximum sliding action which occurs just under the speed of rotation at which the cascading action begins; for example, in a tube mill having a diameter of five feet, the desired action takes place at a speed of approximately ten revolutions per minute which is approximately one-third the speed at which such a tube mill is usually rotated for pulverizing mica and similar minerals such as cement in which the material is subjected to the impact of cascading or projected balls.

It will thus be seen that a novel principle of trituration is employed in the present invention than that which has heretofore been employed in the operation of tube mills for pulverizing fragile and hard substances.

The rate at which the fragmentary sheets of mica and water are fed into the tube mill should be such as to permit the reduction of the material in the discharge end of the tube to a semi-liquid mass which flows through the hollow shaft at the outlet end of the tube. This semi-liquid mass desirably is delivered to a pump 16 by which it is elevated through a pipe 17 and discharged into a hydraulic classifier or separator 18. The hydraulic separator may be of a usual type comprising a conical receptacle having at its lower end a cylindrical extension 19 through which water under pressure is supplied from a pipe 20 having therein a regulating valve 21. The water is introduced into the pipe 20 at such rate as will cause a continuous overflow from the upper end of the receptacle 18 into a suitable conduit or chute 22 and the finer mica powder will be carried over with this overflow.

The fineness of the powder thus separated or classified may be determined by regulation of the amount of water supplied through the pipe 20. The heavier portions of the triturate, which fall to the bottom of the classifier 18, may be withdrawn through a suitable discharge tube into a conveyer 23 which preferably leads to a concentrating apparatus 24 which serves to separate foreign materials from the particles of mica and the former then desirably are delivered through a chute 25 to the hopper 7 from which they are returned to the tube mill.

The classified mica powder, which is discharged from the classifier 18 through the chute 22, desirably is delivered to a thickener or concentrator which may be in the form of a cylindrical tank 26 which desirably is provided with a central rotating shaft 27 having at its lower end laterally and upwardly extending arms 28 and a central outlet 29 for the partially concentrated material. The tank is also provided near its upper edge with an outlet 30 for the discharge of the clear water produced by the settling of the mica particles. A slow rotation of the shaft 27 and the arms 28 aids the settling or concentration of the mica powder at the central portion of the bottom of the tank. Alum, or other suitable chemicals, may be introduced into the thickener or concentrator for the purpose of speeding up the settling of the mica powder and thereby to obtain a thicker partial concentrate and also to produce a clearer water overflow.

The partially concentrated material and water in which it is suspended passes through a delivery pipe 31 to suitable mechanism for expelling the water to provide a dry powder.

A novel means for rapidly drying the mica powder is illustrated in the accompanying drawings in which the pipe 31 communicates with a spray pipe 32 which extends longitudinally of and is located in proximity to a drying drum 33. The drying drum desirably has a hollow shaft 34 through which steam is introduced at a sufficient pressure, and consequently temperature, to heat the surface of the drum to the required temperature.

The mica powder laden water is projected or sprayed upon the surface of the drum in he form of a thin film which adheres to the drum and the drum is rotated at such slow speed that during less than a complete rotation of the drum the heat will expel all of the moisture from the mica powder and the powder deposited in a suitable receptacle 35.

Removal of the mica powder from the drum may be insured by a revolving brush 36 or other doffing means.

Any suitable means may be provided for delivering the mica powder from the hopper 35, such as a screw conveyer 37 as illustrated in Figs. 1 and 3. The dry mica powder thus delivered from the drum is of usual commercial fineness and may be packaged for shipment. The present invention, however, comprises a novel grading of the mica powder to provide maximum uniformity.

In the embodiment of the invention illustrated in the accompanying drawings the mica powder is delivered by the screw conveyer 37 to a chute 38 which leads to a hopper 39 from which the mica powder is carried upwardly by an elevator 40 and delivered to a hopper 41 of a bolting machine. The mica powder is delivered from the hopper of the bolting machine to a distributing roller 42 which spreads it in a thick layer of substantially uniform depth upon an inclined reciprocating bolt.

The bolt as illustrated herein comprises two similar sections, the upper of which is provided with a sheet metal plate 43 from which the mica powder flows over a bolting

cloth 44 and from the bolting cloth 44 to a flat metal plate 45 by which it is directed to a second bolting cloth 46. The material passing over the end of the bolting cloth 46 is delivered to a hopper 47 from which it is returned by a suitable conveyer, such as a screw conveyer 48 to the hopper 39 from which it is carried by the elevator 40 to the hopper 41 of the bolting machine. Thus the material, which is discharged from the end of the bolt is re-bolted until all of the fine mica powder contained in it has passed through the bolting cloth. The fine powder which passes through the bolting cloths 44 and 46 is collected in hoppers 49 and 50 respectively. The bolting cloth may be of any desired fineness, such for example as from one hundred to two hundred mesh per square inch.

The bolting screens desirably are enclosed in a casing 51 and all other parts of the mechanism for treating the dry powder also desirably are enclosed in a suitable casing not shown.

If desired a dust collector, such as are used in flour mills and elsewhere, may communicate with such casing through a suitable pipe 52.

The operation of the bolt embodying the present invention differs radically from usual bolting machines in which the material to be bolted is passed over the bolting cloth in a thin layer for the purpose of removing practically all of the fine material which will pass through the bolting cloth during the time such layer is passing over it. In the present invention a thick layer of mica power is passed over the bolting cloth. The weight of this layer serves to hold the mica of the under face thereof firmly upon the bolting cloth and aids greatly in forcing the fine mica through the bolting cloth. The greater bulk of the material of the layer passes over the end of the bolt and is returned to the hopper of the bolting machine in the manner above described and again passes over the bolt. By reason of this construction and operation it is found that the speed of bolting or screening is very greatly increased without modifying the uniformity of the bolted product.

The mica powder is passed over the bolting cloth and the plates leading thereto in a layer of sufficient thickness to enable its weight to cause the under surface of the layer to lie continuously in engagement with the bolting cloth and plates and to prevent the tossing of the material and consequent dispersion of the mica powder from the upper surface of the layer as distinguished from usual screening operations in which the fine material is passed in a thin sheet over the screening material and is so tossed by the vibration of the screen as to cause a considerable scattering or dispersion of the fine material.

It is found in practice that the mica powder produced by the process and apparatus above described is superior to mica powder heretofore produced in respect to the preservation of the light-reflecting surfaces of the particles of mica, and the greater fineness and uniformity of the product. By virtue of the more efficient delamination, the mica powder produced by the process and apparatus herein described is of very much lighter weight per cubic foot and consequently is of much greater value when used for decorative, ornamental, and other purposes as above described.

It will be understood that variations in the process and in construction of the illustrative apparatus for performing the process disclosed herein may be made within the spirit and scope of the following claims.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. The process of producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises triturating fragmentary sheets of mica in a liquid by a rubbing action and without substantial impact or abrasion operable to delaminate said sheets by relative slippage of adjacent laminations thereof.

2. The process of producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises subjecting fragmentary sheets of mica, in the presence of liquid, to rubbing trituration without substantial impact of a mass of relatively hard, substantially non-abrasive, moving weights operable to delaminate said sheets by relative slippage of adjacent laminations thereof.

3. The process of producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises mixing fragmentary sheets of mica and a liquid with substantially non-abrasive spheroidal weights and causing a continuous circulation of the mass to produce a rubbing trituration without substantial impact operable to delaminate said sheets by relative slippage of adjacent laminations thereof.

4. The process of continuously producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises mixing fragmentary sheets of mica with a flowing stream of liquid and subjecting the mixture to rubbing trituration without substantial impact of a mass of hard, substantially non-abrasive, spheroidal weights flowing transversely of the general direction of flow of the stream of liquid.

5. The process of continuously producing mica powder, without substantially impairing the light-reflecting surfaces of the par-

ticles thereof, which comprises mixing fragmentary sheets of mica with a flowing stream of liquid and subjecting the mixture to rubbing trituration of a mass of hard, substantially non-abrasive, spheroidal weights flowing transversely of the general direction of flow of the stream of liquid and hydraulically separating the mica powder from the heavier particles of the triturate.

6. The process of continuously producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises mixing fragmentary sheets of mica with a flowing stream of liquid and subjecting the mixture to rubbing trituration without substantial impact or abrasion, hydraulically separating the mica powder from the heavier particles of the triturate, partially concentrating said mica powder, producing a spray of the partial concentrate, and evaporating the water from the solid material of said spray.

7. The process of continuously producing mica powder, without substantially impairing the light-reflecting surfaces of the particles thereof, which comprises mixing fragmentary sheets of mica with a flowing stream of liquid and subjecting the mixture to rubbing trituration without substantial impact or abrasion, hydraulically separating the mica powder from the heavier particles of the triturate, concentrating the mica powder, drying said powder and bolting the same from a layer of sufficient depth substantially to prevent dispersion of said powder over the exposed surface of said layer.

In testimony whereof, I have signed my name to this specification.

JOHN DAVENPORT.