

UNITED STATES PATENT OFFICE.

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METHOD OF GRINDING DIATOMACEOUS EARTH.

1,357,480.

Specification of Letters Patent.

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No Drawing. Original application filed March 6, 1918, Serial No. 220,854. Divided and this application filed May 5, 1919. Serial No. 294,638.

To all whom it may concern:

Be it known that I, JOHN E. SCHNEIDER, a citizen of the United States, residing at Wenatchee, in the county of Chelan and State of Washington, have invented certain new and useful Improvements in Methods of Grinding Diatomaceous Earth, of which the following is a specification.

This invention relates to the art of grinding or pulverizing minerals, and particularly to the art of grinding or pulverizing such minerals as diatomaceous or infusorial earth or kieselguhr, this application being a division of my application filed on March 6, 1918, for fire proof paints and coatings, Serial No. 220,854, issued as Patent No. 1,317,225, Sept. 30, 1919.

In the preparation of paints and coatings or other like material diatomaceous earth has been used, but such paints or coatings have heretofore been of little value because the air cells between the particles or diatoms cause pittings or eruptions on the surface of the paint when the latter is applied, and further because where light oil was used as a vehicle, the light oil would be absorbed or taken up within these air cells so that a very great amount of oil would have to be used with the powder, and where a mixture of light and heavy oils were used, the light oils would separate from the heavy oils. Furthermore, these air cells prevented the paint from having any great obscuring value, that is the filling formed by the earth was too transparent because of their multiplicity of air cells, and a great many coats of paint had to be applied before the desired opacity was secured.

For these reasons and others, it has been practically impossible heretofore to use diatomaceous earth as an ingredient in paints of any high class and which were intended to have a smooth surface.

I have discovered, however, that if the diatomaceous earth be ground sufficiently fine so that the air cells occluded in the mass are broken, that then this diatomaceous earth may be used with a vehicle such as oil or water to form paint, and that a paint thus made will spread smoothly without pittings or other eruptive characteristics, that the objection of lack of opacity in the paint is entirely removed, and that the paint

may be made at a relatively low cost, the quality of the paint, however, being high, and the paint being very resistive to atmospheric action and to other deleterious actions to which paint is subjected.

Now it was impossible prior to my invention to grind or pulverize the diatomaceous earth to the requisite degree of fineness such as is necessary in order to disrupt or break the air cells for the reason that when diatomaceous earth is ground for instance in a tube mill, the diatomaceous earth, no matter how dry it may be, after a certain amount of grinding, becomes sticky, or as the term is "gummy," and collects around the tube mill, packs and clogs, and cannot be ground any finer. It would seem that the air cells cause the separate particles to cohere very strongly when ground, so strongly as to prevent any further grinding because of the "stickiness" of the material. As before remarked, this occurs with diatomaceous earth having only 2% of moisture content, or which is practically dry.

I have discovered, however, that if another mineral be added to or admixed with the diatomaceous earth, either after the first grinding or initially before any grinding is had at all, this other mineral will prevent the cohering of the separate particles or their sticking to the mill wall, and hence permit a much finer grinding of the diatomaceous earth than is otherwise possible. In other words, this finely ground mineral mixed with the finely ground diatomaceous earth permits the diatomaceous earth to be still more finely ground without clogging the tube mill. I have further discovered that if the other mineral used and mixed with the diatomaceous earth be a mineral which has an unctuous quality, that is a greasy "feel," as the term is used by mineralogists, the diatomaceous earth not only may be ground to an extent which will break up the air cells, but that it may be ground much more expeditiously than is otherwise possible. Further, I have discovered that if the diatomaceous earth be mixed with a dry mineral agent not having unctuous and lubricative characteristics, and the mixture be finely ground, that it is possible, by the use of a separator, such as a "Cyclone" separator, to separate this finely

powdered, diatomaceous earth from the other agent so as to secure a pure, very finely pulverized, diatomaceous earth.

In the carrying out of my invention, I may use ordinary diatomaceous earth mixed with a certain per cent., as for instance, 50% of quartz sand, and submit both the sand and the diatomaceous earth to a pulverizing action in the usual tube or pebble mill. In this case, I believe that when the sand has become finely pulverized, it acts to separate the individual diatoms or particles of the diatomaceous earth, that is the very fine particles of powdered sand will become interposed between the very fine particles of powdered diatomaceous earth, and that thus the pulverizing or grinding process may be continued to cause a still finer pulverizing of the mixture, without any tendency on the part of the mixture to clog within the tube mill so that when the product is finally delivered from the mill, it is powdered so finely that the individual diatoms are broken and the air cells disrupted. I have referred above to quartz sand, but this is purely illustrative, as other agents of the same character and not having a greasy "feel," might be used. It is to be understood that the quartz sand or other agent may be mixed with the broken and unground diatomaceous earth as they come from the mines, and then the mixture submitted to the grinding action before referred to, or the agent may be ground to a powder and then mixed with the diatomaceous earth which has been ground in the tube mill to the extent before mentioned where it would clog the mill, and then this mixture of ground diatomaceous earth and sand may be submitted to a re-grinding or further grinding, which will further pulverize it to the requisite degree of fineness; that is to a condition where it will pass through a screen having from 160 to 200 meshes to the inch.

As above stated, I may use an agent for mixing with the earth, which agent is not unctuous or slippery, or has not a greasy "feel." Preferably, however, I mix the diatomaceous earth with a reducing agent having a slippery "feel," that is an agent whose particles have a greasy or unctuous "feel" when rubbed or touched, such as certain varieties of hornblende, asbestos, or talc, gypsum, and the like.

I do not wish to be limited to the use of any particular agent having this character, but I have found that a variety of hornblende known commonly as amphibole is of particular value as this agent because of its cheapness, as it has not heretofore been considered to have any value.

In the production of insulating paints or coatings up to the present time, chrysotile, a fibrous variety of serpentine, has been considered as the only material having any

value. Amphibole, trimolite, actinolite, pargasite, etc., and other minerals of the hornblende group in certain deposits are highly crystallized, while in other localities these deposits are practically free of crystallization. I may use as an agent to be mixed with the diatomaceous earth any variety of hornblende, whether asbestos, amphibole, trimolite, etc., without regard to the crystallization. Deposits containing a relatively high crystallization should be reduced to a relatively high degree of fineness, whereas deposits containing but a relatively small percentage of crystallization need not be so finely reduced. Thus, deposits having a crystallization of about 40% must be reduced to a degree of fineness where the particles will pass through a screen having 200 meshes to the inch, but where deposits have a relatively small degree of crystallization, they need only be reduced to a condition where the particles will pass through a screen having 160 meshes to the inch. While preferably I use asbestos of one form or another as a reducing agent, as it may be termed, I may use talc, that is to say magnesium silicate.

The reducing agent and the infusorial earth are placed in a tube or pebble mill and ground or pulverized so finely that the diatoms are crushed and the occluded air cells disrupted. This is permitted by the fact that the asbestos fibers or the particles of talc have a slippery quality, that is these fibers have a greasy or unctuous feeling when rubbed or touched. These fibers or particles not only prevent the adherence of the individual diatoms to each other by the particles of the reducing agent being interposed between the diatoms or particles, but they seem in a way to lubricate the diatomaceous particles so that they will slip readily upon each other and slip upon the walls of the tube mill, thus absolutely preventing any adherence of the mixture to the walls or to the balls used for grinding and preventing all packing of the mixture so that balls will grind the mixture to an impalpable powder. As an example showing how much more finely the diatomaceous earth may be ground when ground with this reducing agent, I may state that diatomaceous earth taken from a deposit at Quincy, in the State of Washington, reduced to the greatest fineness possible by an ordinary tube mill without admixture with any reducing agent, will weigh about 23 pounds per cubic foot. When, however, the diatomaceous earth is mixed with hornblende, the finely pulverized material will weigh about 80 pounds per cubic foot. It is thus plain that the diatomaceous earth has been much more finely ground than was possible before grinding to such an extent that the air cells in the diatomaceous earth have been broken up. As an-

other example, it may be stated that if 25 barrels of diatomaceous earth be ground in an ordinary tube mill, it will give about 23 barrels of pulverized diatomaceous earth, but if 25 barrels of diatomaceous earth and 25 barrels of a reducing agent, such as fine sand, talc, or asbestos, is mixed with the diatomaceous earth, the mixture ground as before stated, the 50 barrels of mixture will produce only about 30 to 32 barrels of very finely pulverized earth and asbestos or sand. Where sand is used, however, the production of 30 barrels of finely pulverized mixture will take about an hour, whereas where a slippery or unctuous mineral agent is used, such as asbestos or talc, it will only take about a quarter of an hour to produce 30 barrels. It will be obvious, therefore, that in the majority of cases it is best to use this unctuous mineral reducing agent, particularly inasmuch as a heretofore useless variety of hornblende or asbestos may be used for this purpose, having such short fibers as to render it valueless for other purposes. Another reason for preferably using the unctuous mineral agent is that quartz is relatively heavy and hence when mixed with oil or other vehicle, will tend to settle and the paint has to be kept constantly stirred. This is not the case where relatively light mineral agents are used which will float in the liquid and maintain the component parts in suspension.

Where it is desired to secure a pure and very finely pulverized diatomaceous earth, then I preferably mix the diatomaceous earth with an agent which does not have the unctuous qualities heretofore referred to, for instance thoroughly dried gypsum or thoroughly dried sand. In this case, after the mixture has been pulverized to such a degree that the air cells of the earth are broken and disrupted, the mixture is carried to a "Cyclone" separator, or a separator acting on a like principle, wherein a blast of air sucks or blows the lighter particles from the heavier particles. Inasmuch as this form of separator and its manner of operation is well known, it is not believed to be necessary to describe the separator or its action more in detail.

The minerals reduced to proper fineness, I have found are not only useful in the making of cold water paints, flooring compositions, etc., but are extremely valuable in the making of oil paints, and under certain formulas give an even greater obscuring power than lead and zinc, and that mixed

together with lead and zinc, they have been proved by actual tests to have a surprising covering power.

The powder being of extreme fineness and being extremely light in weight, secures a very great saving in the cost of manufacture of paints. One pound of this powdered material will cover as many square feet of surface as eight pounds of lead and zinc. It is, therefore, easily seen that a high grade paint can be manufactured with this powdered filler at a considerably reduced cost.

The very finely powdered diatomaceous earth and the very finely powdered reducing agent mixed therewith may be used, as before remarked, for the production of a fine grade of water paint, oil paint, and other coatings.

It will be understood that I do not wish to be limited to the use of a mineral having an unctuous quality to the touch, nor to any particular mineral having this slippery or unctuous quality. Broadly speaking, it is within my invention to use any mineral for admixture with the diatomaceous earth which has a greasy "feel" and which is capable of being finely crushed and which, in consequence of its being finely crushed, ground or pulverized, will not settle or mix with a fluid medium.

I claim:—

1. A method of finely pulverizing diatomaceous earth whose particles have a tendency to stick or clog when pulverized beyond a certain degree of fineness, consisting in mixing with the diatomaceous earth a mineral agent which will prevent the diatomaceous earth from sticking or clogging while being ground to an exceeding degree of fineness, and submitting the mixture to a very fine pulverizing action.

2. A method of finely pulverizing diatomaceous earth whose particles have a tendency to cohere, stick, or clog while being pulverized beyond a certain degree, consisting in mixing with the diatomaceous earth a lubricating mineral agent which is unctuous or slippery to the touch to thereby decrease the stickiness of the diatomaceous earth, and submitting said mixture to a very fine pulverizing action.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

JOHN E. SCHNEIDER.

Witnesses:

FREDERIC B. WRIGHT,
ROBERT A. BOSWELL.