July 13, 1926. 1,592,343

M. B. CHURCH

MULTIPLE GRINDING APPARATUS

Filed Oct. 17, 1924

Fig.2.

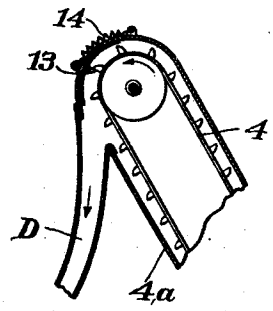
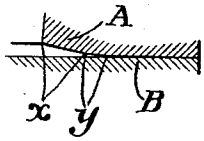


Fig.1

Fig.3.



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UNITED STATES PATENT OFFICE.

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MULTIPLE-GRINDING APPARATUS.

Application filed October 17, 1924. Serial No. 744,274.

The invention is designed to produce by grinding alone a more finely divided mineral commodity than has been produced heretofore. Some features of the present apparatus are the same substantially as those disclosed in application for Letters Patent of the United States filed by me May 10, 1921, No. 468,398.

The means for carrying the invention into effect is shown in the accompanying drawing in which—

Fig. 1 is a vertical sectional view of an apparatus embodying my invention.

Fig. 2 is a detail view and

Fig. 3 is a sectional diagrammatic view of a portion of the mill stones.

In these drawings A is the upper mill stone which may be fixed in position in any ordinary way. B is the under runner stone. 1 is a substantially air tight casing in which the mill stones and the main portion of the apparatus are enclosed.

The under runner stone A is pivoted or balanced upon the upper end of a vertical spindle 2^b which has a bearing at its lower end carried by the lighter bar 8 which is connected to a rod 2^d capable of being vertically adjusted by a hand wheel so that the vertical spindle 2^b can be adjusted vertically to adjust the lower runner stone relative to the upper stone.

The spindle carries fixed thereto the armature 2^a of an electric motor the field coils of which are supported in a suitable casing or housing 2 suitably supported from the frame work. In the vertical adjustment of the spindle the armature moves with it. The adjustment is within comparatively narrow limits and the armature under all adjustments remains within the influence of the field magnets 2^c.

Suitable means as an air pump is provided at 6 operated by an electric motor, all within the casing by which the air pressure may be varied within the casing, suitable outside controlling devices being within reach of the attendant by which the motor of the air pump may be controlled. The apparatus may work under substantially atmospheric pressure or under more or less vacuum according to the will of the operator.

The material to be treated is fed to the eye of the upper fixed stone A by a flexible bin or bins made of canvas and indicated at 3, 3^a. This bin may be made of two sections or two independent bins may be employed.

Means are provided by which when one bin is being filled the other bin is feeding into the mill and the drawing shows means by which the lower end of one tapered bin as 3^a will be lodged in the eye of the upper fixed stone while the lower end of the other tapered bin 3 is folded up and closed.

This means may assume various forms but in the particular embodiment of the invention illustrated this means consists of cords *a* one for each bin extending from the outside of the casing through the same and over pulleys *b* to the lower ends of the tapered canvas bins.

In the position of the parts shown as soon as the bin 3^a which is feeding becomes empty its lower end is withdrawn from the eye of the stone by drawing upon the proper cord *a* and this act will double up the lower end of the bin so that it will be closed at this point and be in condition to retain the material which is fed thereinto until by slackening on its cord the lower end of the bin now filled is allowed to seat itself in eye of the stone. It will be seen that the bin 3 is in the process of being filled and its lower spout is withdrawn from the eye of the stone and is doubled or folded up to close the lower end for the filling operation. By pulling on the cord attached to the bin 3^a the spout or lower end of this will be drawn from stone and then by slackening on the cord attached to the other bin the lower end of this under the weight of the material will unfold and seat itself in the eye of the stone. The bin or bins are suitably supported at their upper ends to the framework as at *f* and depend from these supporting points and are flexible throughout.

The material is fed into the bins by a spout D of flexible material as canvas which receives its supply from an elevator 4. This spout can be shifted to discharge first into one bin or bin section and then into the other for which purpose cords *d*, *e* are attached thereto, extending to the outside of the casing. The two positions of this spout are shown in full and dot and dash lines. The elevator 4 may be enclosed in a canvas en-

closure indicated diagrammatically at 4^a. The lower end of the elevator runs in a chamber C which receives the material initially from a filling hopper 9 controlled by a gate 10 or from the mill stones, as multiple grinding proceeds, through a spout 11. A gate is provided at 12 by which the finished material may be discharged from the said chamber C into containers when by the multiple grinding the material has reached the proper degree of fineness.

The apparatus may be used with or without the enclosing casing to suit conditions under which operation must take place.

The adjustment of the mill stones and the running of the armature are controllable from the outside of the casing.

The millstones may be of the buhr type or metal discs may be used. The grinding is performed a multiple of times. The machine has the capacity to repeatedly run the material through the mill stones. The elevator takes the material of one grinding and delivers it into the bins for the next grinding operation. No bolting, screening, floating or other separating means are employed as a part of the apparatus, and my process does not contemplate any treatment of the material by bolting, screening or otherwise separating finer from coarser material subsequent to its discharge from the apparatus, because the whole of the material is reduced by my multiple grinding to a fine state of subdivision. Such material as alabastine, a composition of calcined alabaster and glue which I patented in 1875 in wet form and later in dry form adapted for use by adding cold water may be ground in said dry form in my present apparatus.

The mill stones employed herein are substantially the same as described in my patent of June 13, 1882. The stones are without the furrows theretofore used except at a short zone x Fig. 3 near the center opening of about four inches in width where the stone tapers from a distance of one inch from the upper face of the lower stone to a distance of $\frac{1}{8}$ inch from said lower stone. Outside of this four inch zone there is another zone at y of about two inches wide tapering down to a distance of 1/80 inch from the face of the lower stone. From this point i. e. where the separation between the stone is 1/80th of an inch the under face of the upper stone has a zone of about 7 inches which tapers from the 1/80th separation to a point where the two stones would come in contact if not separated for running. Outside of this zone, the two stones are in contact for about two inches to their skirt or edge.

The above dimensions are those followed in dressing the stone. The zone at the center will serve to break lumps or reduce the clinker.

In this grinding mill patent of 1882 applicant discloses a worm feed (now used in all plaster mills) so connected as to drive it at variations uniform with the variations, if any, in the revolution of the stones to keep the space between the stones filled. The goods being ground are thus delivered between the stones, which are run slightly apart and carried to the skirt where it falls out. In this way the grinding is accomplished by attrition or without hard pressure or obstruction incident to the action of the furrows when the said stone is used with furrows. This method also avoids excessive heat usually caused by grinding in the old way and incidentally less power is used saving most of the usual upkeep expense. Applicant's mill mentioned above patented in 1882 had the dish or opening between the stones graduated from about $\frac{1}{8}$ inch where the grinding commenced. This allowed the goods to flow out so fast by centrifugal force that the regulating feed described was required. In applicant's present apparatus which includes a flexible bin and less opening between the stones, no feeding device is required because the stones with spacing between them as described above draws from the bin as fast as required to fill the space between the stones and no more, as no more will be taken through the openings; the amount so ground, also the degree of fineness is regulated by the distance apart of the stone which is regulated by the hand screw and lighter bar 8 which lowers and raises the lower stone increasing or decreasing the opening between the stones. The flexible bin prevents the troublesome bridging of ground dry materials when in a body and when being drawn from by a mill or other means, which bridging trouble has always required a man with a hoe on watch at the top of the bin to break down the bridge when seen at the top.

By dividing this bin as shown or by placing two of the flexible bins adjacent each other with means as shown to shift the delivery and discharge of the material from one to the other bin, the whole of the contents pass through the stone during each cycle and none of it becomes bridged in the bin.

The miller will use the cords e to shake the inner loose material from the spout by jerking the cord either way. Likewise in lifting the end of the flexible bin from the stone when one delivery from the bin is being finished, he shakes this bin by means of manipulating the cord a in a similar way.

The multiple grinding is accomplished without it being necessary for the operator to enter the enclosure. When a complete change of goods is to be made the operator may go into the enclosure and shake and

whip the bins and spout until all are freed from any adhering material. In multiple grinding such as uncalcined alabaster or gypsum, the material becomes so fine that it adheres to the sides of anything with which it comes in contact. Applicant therefore provides a canvas enclosure for the elevator.

The latter has cups attached to a belt of leather or metal and these cups are likely to hold a part of the very fine alabaster when the conveyer is about to dump into the spout and I have provided a tapping device as shown at 13 by which a cup preceding the one being dumped moves a tappet against the pressure of a spring 14 until the said cup clears the tappet, whereupon the latter flies back to its normal position under the tension of its spring, and in doing so it strikes the next succeeding cup and by reason of the blow or shock displaces any fine material which would otherwise stick thereto so that this material will dump out with the main body of material being discharged from this cup and this discharge will take place into the canvas spout.

The attendant in changing from one class of material to another will rap the outside of the canvas of the elevator while the cups are running to clean the system out.

Mill stones as described herein are usually run by a twist belt or miter gears, and either of these methods causes an unsteady movement of the runner stone and as these stones are run very close together without the usual hard pressure to steady it, it is essential that the power applied should be very uniform such as is produced by the armature directly attached to the spindle upon which the under runner stone is pivoted or balanced.

Another important reason for having the armature so attached is that the mill when assembled in its usual iron portable frame can be set within an enclosure such as shown and operated from without and at different speeds.

This feature relating to the armature becomes important when I use my system for grinding Portland cement at the place of use, as where large structures are being built. Such a grinding apparatus with its driving means can be taken to the job and used in a motor truck and operated by electric power derived from a generator on the truck.

It is well known that Portland cement when kept in store deteriorates and even when carefully stored, but kept for say as long as three months, the authorities require that the whole stored quantity be tested in sections, to guard against any part of it having become deteriorated, and this deterioration takes place soon after it is ground fine for use when stored under unfavorable conditions, say when ground for use under government standards i. e. of a fineness where 78% will pass through a 200 mesh screen, but with applicant's mill, if operated in the multiple grinding way, the cement is reduced much finer than the 200 mesh, and it has been found that cement ground exceedingly fine is much more effective but that it deteriorates rapidly and sets too rapidly, requiring the addition of more raw gypsum usually used for retarding the setting, and the gypsum when ground exceedingly fine is more effective, as when ground with the cement by my multiple process.

It will therefore be seen that it is impossible, without grinding the clinker at the time it is used, to absolutely avoid there being weak portions in the structure from deterioration of some portion of the cement.

The cement when in crushed clinker form as it would be taken into one of these multiple grinding mills does not deteriorate with age. Grinding of the clinker at the time of use insures against any portion of the cement being used after deterioration.

As a result of this multiple grinding, a more finely divided product is produced than ever heretofore attained. The finest in ordinary practice is made by bolting or floating the material after it is ground or between successive grindings. Therefore the whole product of a rock or mineral natural formation is not reduced to one mass of very fine material. Therefore in practice no product has ever been made reduced finer than 200 mesh, that is, passing a screen of 200 wires to the inch.

Tests of this new multiple ground product have been made and reported to be as fine as 85% through 2000 mesh if such a screen could be produced.

The lower spout ends of the members of the duplex canvas bin 3, 3^a are of a diameter to fill the eye of the stone and this will avoid tendency for it to lift out of the eye.

Any suitable form of signal may be employed to notify the attendant when the members of the duplex bin are ready to be changed by withdrawing one and inserting the other into the eye of the stone, though the operator can, with experience, determine this closely by a time interval.

I claim:

1. In combination in a multiple grinding machine, grinding means, and a duplex flexible bin to discharge material into said grinding means, alternately from the members of said duplex bin and means for controlling said discharge, substantially as described.

2. In combination in a multiple grinding apparatus, a fixed upper stone, an under runner stone, and a flexible tapered bin in two sections, each section having a spout to

enter the eye of the upper stone individually and means for removing one spout from the said eye and for introducing the other spout into said eye, substantially as described.

3. In combination in a multiple grinding apparatus, a fixed upper stone, an under runner stone, a duplex flexible bin in two sections, said sections tapering downwardly and each having its lower end adapted to enter the eye of the fixed stone and means for closing the spout of one section, while the other spout is delivering material through said eye, substantially as described.

4. In combination in a multiple grinding apparatus, a fixed upper stone, an under runner stone, a duplex flexible bin having a plurality of compartments with a spout from each for delivering the material into the eye of the fixed stone, and means for delivering material first into one compartment of the bin, and then into the other, substantially as described.

5. In combination in a multiple grinding apparatus, a fixed upper stone, an under runner stone, a duplex flexible bin having a plurality of compartments with a spout from each for delivering the material to the eye of the fixed stone, and means for delivering material first into one compartment of the bin and then into the other, said means including a shifting spout.

6. In combination with the grinding mill, a flexible duplex bin to deliver material thereto, and means for storing material in one section of the bin while the other is delivering its contents, substantially as described.

7. In combination with the grinding means, a flexible duplex bin to deliver material thereto, means taking material as delivered from the grinding means and storing it temporarily in one section of the bin while the other section is discharging into the grinding means, and for thereafter filling the latter section while the first mentioned section is discharging into the grinding means, substantially as described.

8. In combination, grinding means, a duplex flexible bin for delivering the material thereto from its sections alternately, elevator means for taking the material from the grinding means and a shifting spout for delivering the material into one section of the duplex bin while the other section is emptying its contents into the grinding means, said spout being flexible and an enclosure for the elevator consisting of flexible material, substantially as described.

9. In combination grinding means, a flexible duplex bin for delivering material thereto, an enclosure for the apparatus, and means extending to the outside of the enclosure for controlling the delivery of material from the sections of the duplex flexible bin whereby one section will be emptying its contents into the grinding means, while the other section is receiving a store of said material and means for delivering material into the duplex bin under the control of the operator outside the enclosure, substantially as described.

10. In combination with a fixed upper mill stone, a horizontal under running mill stone, a spindle upon which the said mill stone is balanced at the upper end of said spindle, an armature mounted directly on the spindle below the under running stone, an air-tight enclosure for the mill stones, armature and spindle and means for adjusting the spindle with the armature up or down, while running within the magnetic field, the lower balanced stone being thereby adjusted relative to the upper fixed stone, said adjusting means extending from said spindle to the outside of the said air tight enclosure.

11. The hereindescribed product consisting in a mineral ground in bulk and substantially all of a fineness of 2000 mesh.

In testimony whereof, I affix my signature.

MELVIN B. CHURCH.