

J. S. FASTING.
GRINDING AND SIFTING APPARATUS.
APPLICATION FILED NOV. 13, 1907.

964,629.

Patented July 19, 1910.

6 SHEETS—SHEET 1.

FIG. 1.

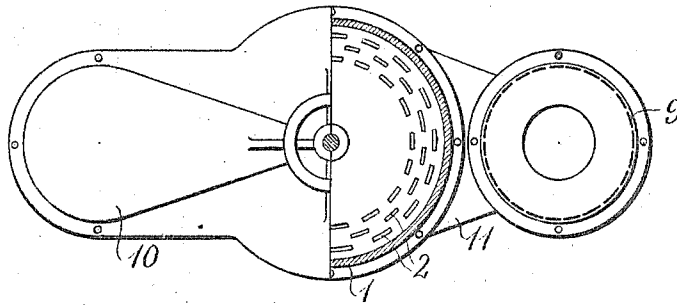
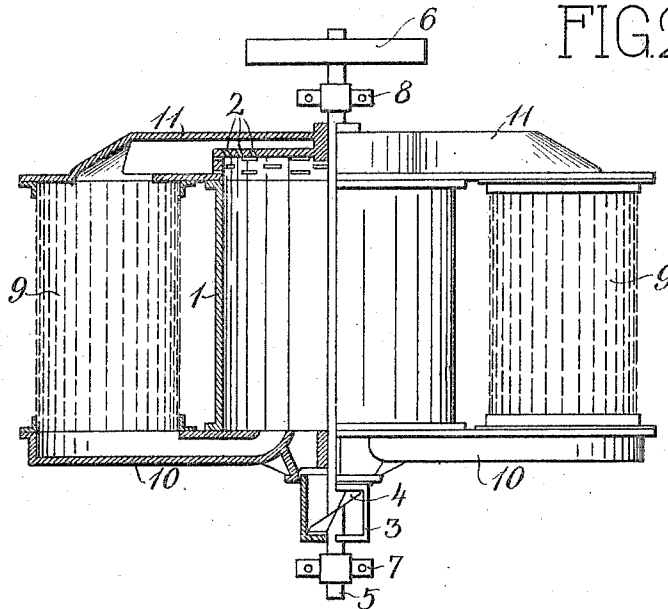


FIG. 2.



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6 SHEETS—SHEET 2.

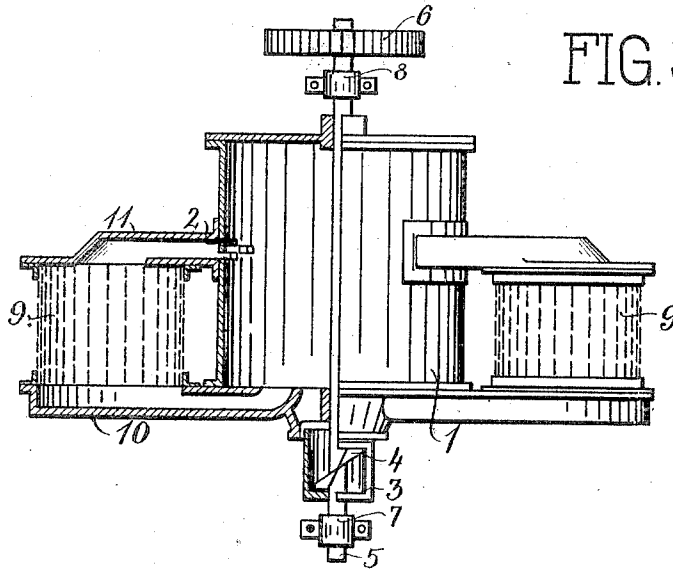


FIG. 3.

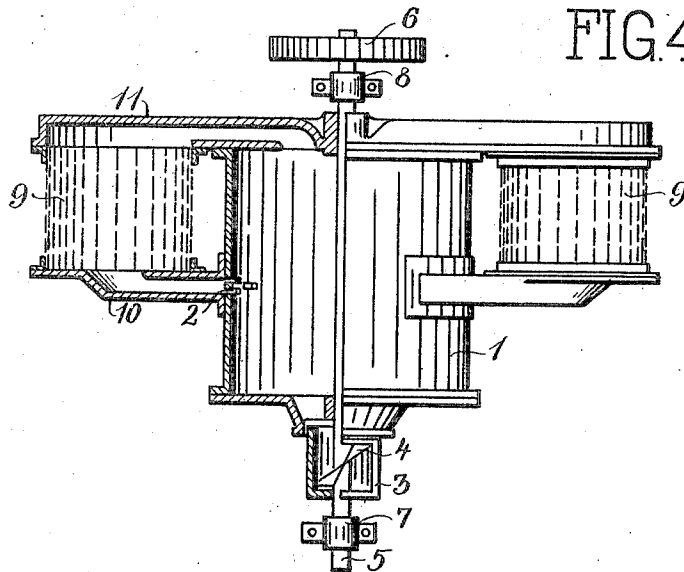


FIG. 4.

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6 SHEETS—SHEET 3.

FIG. 5.

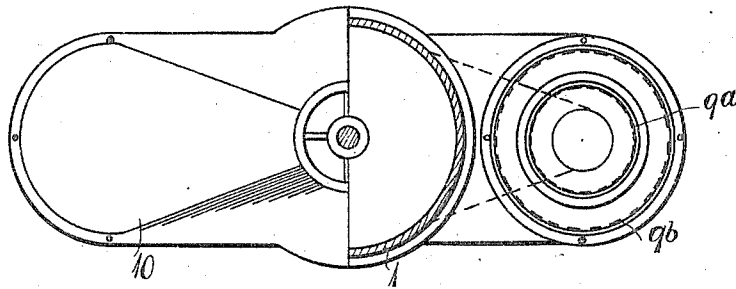
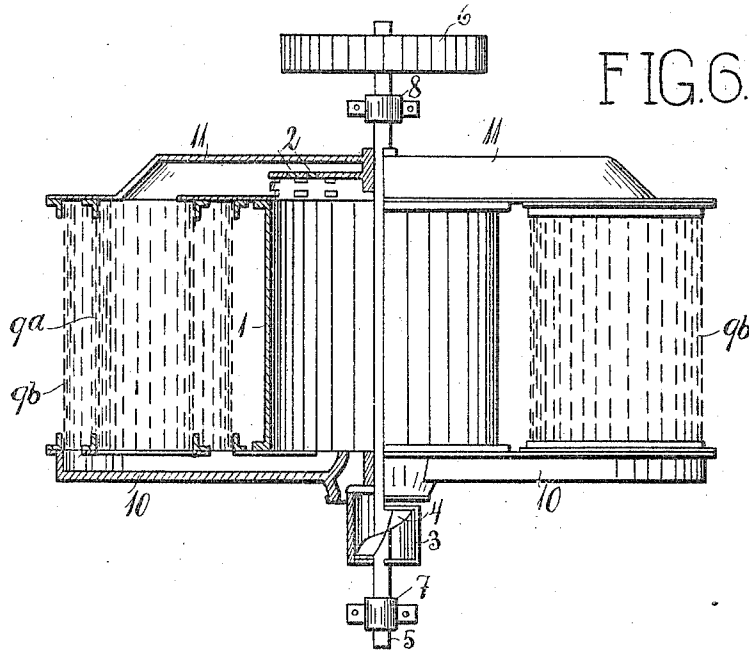


FIG. 6.



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6 SHEETS—SHEET 4.

FIG. 7.

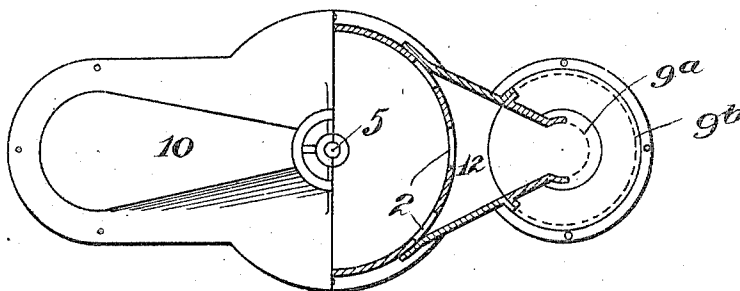
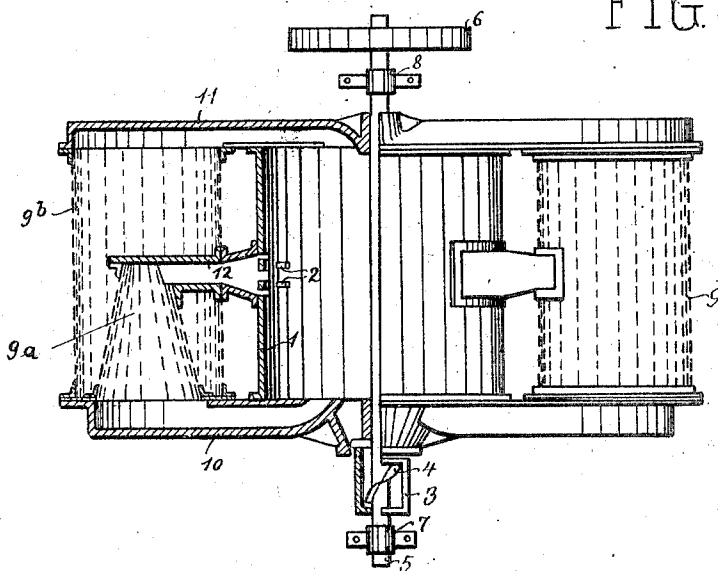


FIG. 8.



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6 SHEETS—SHEET 5.

FIG. 9

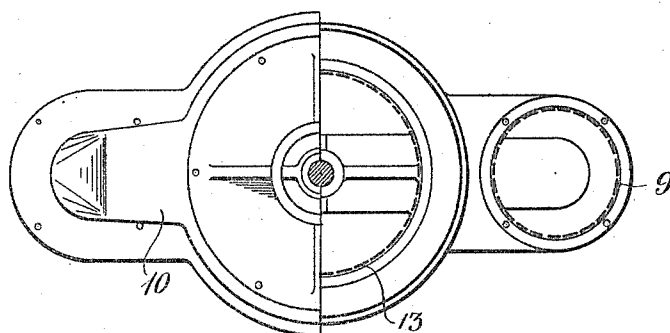
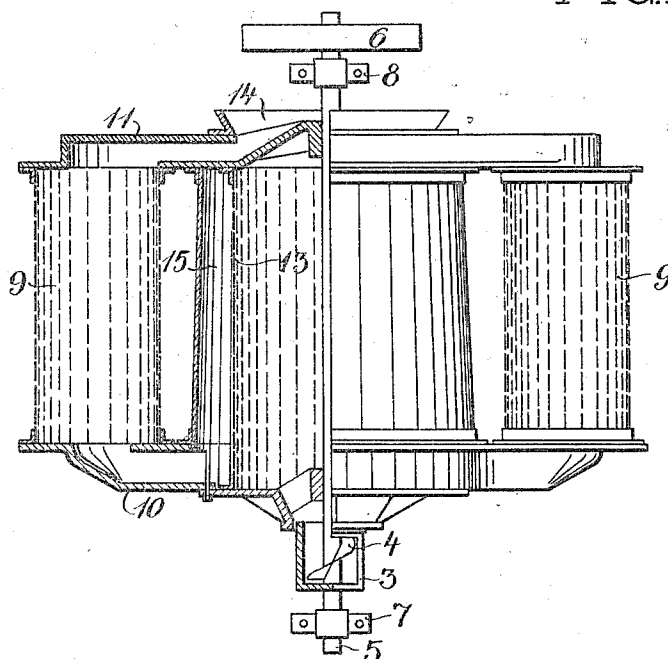


FIG. 10.



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6 SHEETS—SHEET 6.

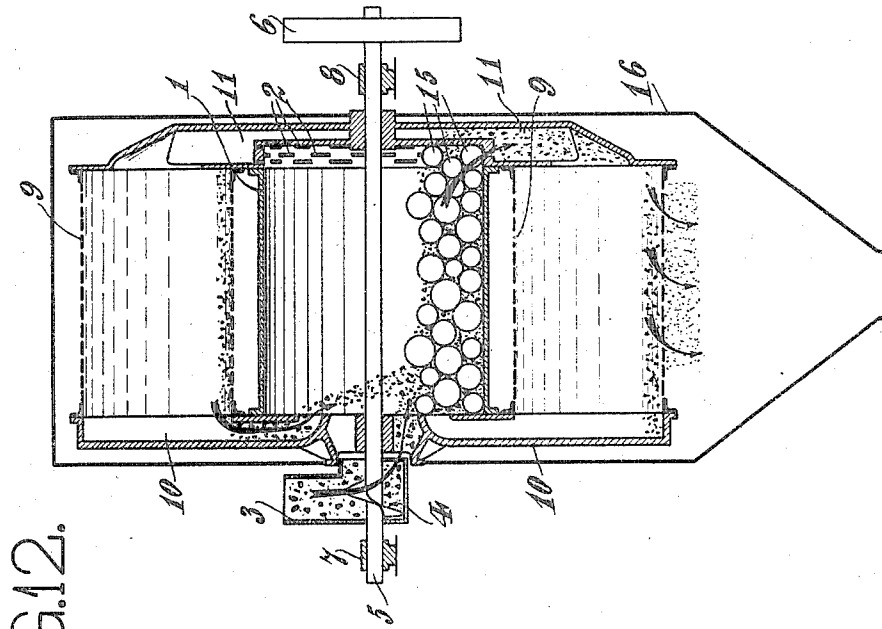


FIG. 12.

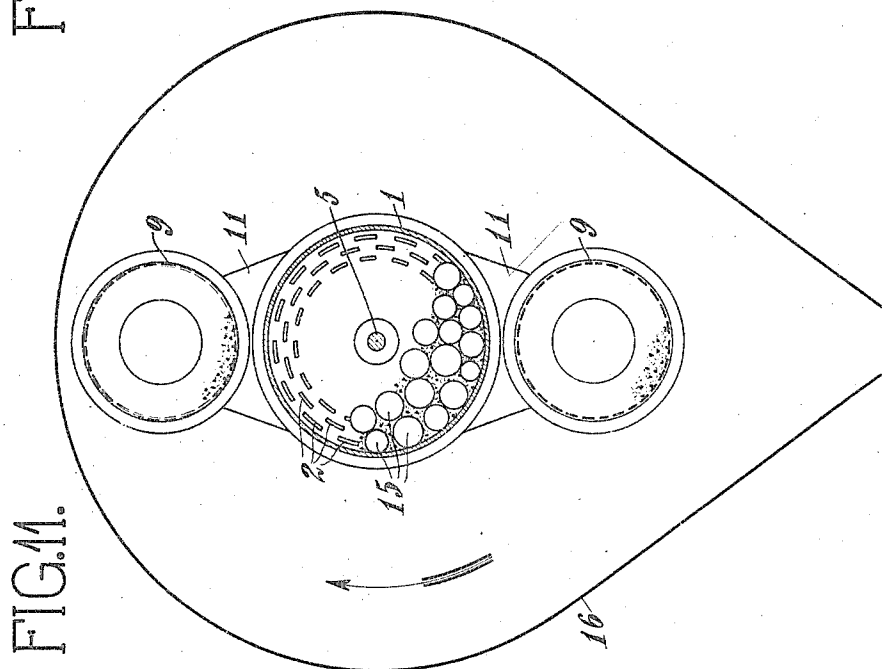


FIG. 14.

Witnesses:
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L. H. H.

Inventor
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By his Attorneys
Redding, Greely & Austin

UNITED STATES PATENT OFFICE.

JOHAN SIGISMUND FASTING, OF COPENHAGEN, DENMARK, ASSIGNOR TO ALEXANDER FOSS AND PAUL LARSEN, OF COPENHAGEN, DENMARK, DOING BUSINESS UNDER THE FIRM-NAME AND STYLE OF F. L. SMIDTH & CO., COPARTNERS.

GRINDING AND SIFTING APPARATUS.

964,629.

Specification of Letters Patent. Patented July 19, 1910.

Application filed November 13, 1907. Serial No. 401,936.

To all whom it may concern:

Be it known that I, JOHAN SIGISMUND FASTING, a subject of the King of Denmark, and a resident of No. 3 Solvej, in the city of Copenhagen and Kingdom of Denmark, have made certain new and useful Improvements in Grinding and Sifting Apparatuses, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

The object of this invention is to provide an apparatus for grinding and sifting in which various substances may be reduced in fineness in a most economical and effective manner.

The improvements relate particularly to the relative disposition of the grinding and sifting chambers and the communicating boxes or conduits between these chambers, the aim of the present arrangement being to effect the separation of the pulverized matter from the unground matter and to return the unground matter for further grinding in such a way as to increase the efficiency of operation in such machines. Moreover, the improvements comprise means for conserving the sieves and for treating material, the elements of which are very irregular in size.

In the accompanying drawings several different embodiments of the invention are shown for purposes of illustration and explanation. Each of these embodiments of the invention contains a ball grinding mill, although it will be obvious, as the description proceeds, that other forms of grinding apparatuses may be employed in practice.

In said drawings, Figure 1 is a view partly in end elevation and partly in section of one of the apparatuses, and, Fig. 2 is a view partly in plan and partly in section of the same apparatus. Figs. 3 and 4 are views similar to Fig. 2, of other apparatuses. Fig. 5 is a view similar to Fig. 1 and Fig. 6 a view similar to Fig. 2 of another apparatus. Fig. 7 is a view similar to Fig. 1 and Fig. 8 is a view similar to Fig. 2 of still another apparatus, and, Fig. 9 is a view similar to Fig. 1 and Fig. 10 a view similar to Fig. 2 of still another apparatus. Figs. 11 and 12 are views in transverse and longitudinal section showing a form of the apparatus similar to that shown in Figs. 1 and 2, but with grinding bodies in the

grinding cylinder and with the outside casing in position.

Referring first to Figs. 1 and 2, the grinding chamber 1 is preferably cylindrical in form such as the grinding drum in a ball mill. This grinding drum is mounted to rotate upon a shaft 5 which preferably extends through the center thereof and is journaled in bearings 7 and 8 and provided with a driving pulley 6. There are means at one end of the grinding drum such as a hopper 3 and a feed worm 4 for introducing material to be ground into the drum, and means such as perforations 2 in the other end of the drum for discharging the ground material which is of a sufficient fineness to pass through these perforations into the delivery outlet. The sifting element, in accordance with the present invention, is revoluble about the grinding element and comprises one or more chambers mounted beside the grinding element and provided with means to receive ground material and to return to the grinding element such ground material as is too large to pass through the sieves. In Figs. 1 and 2 there are two such sifting chambers which are cylindrical in shape and which are formed by sieves 9 which form the periphery of said chambers and are mounted in suitable head pieces thus constituting what may be referred to as sifting drums. These sifting drums are shown as rigidly connected with the grinding drum and, mounted beside the grinding drum as they are, one on one side and the other on the other side so that a symmetrical and well balanced apparatus is provided, they are revolved about the grinding drum as the latter rotates upon its axis. At each end of the grinding drum are chambers and conduits 10 and 11. The chambers and conduits 11 receive and collect the ground material discharged from the perforations 2 in the rear end of the grinding drum and deliver the same into the ends of the sifting drums respectively, while the chambers and conduits 10 receive and collect the unsifted material from the sifting drums 9 and return the same into the forward end of the grinding drum. These chambers and conduits are preferably cast integral with the heads of the sifting drums and preferably constitute the means for securing the sifting drums to the grinding drums. As the apparatus

is rotated and the material is introduced into the forward end of the grinding drum, it will be obvious that the piling up of the material will advance the same to the rear end of the grinding drum where such material as can pass through the perforations 2 will be discharged into the collecting and delivering chambers and conduits 11. The flow of ground material from the chambers and conduits 11 will be first directed into one of the sifting drums 9 and then into the other drum according as the sifting drums are brought, by the rotation of the apparatus, underneath the grinding drum. The unsifted material will be advanced from one end of the sifting drums to the other end by the piling up of the material and will be continually discharged through the chambers and conduits 10 back into the forward end of the grinding drum as the rotation proceeds, the outlets of the boxes 10 being nearer the axis of the drum than are the openings 2. It will be obvious that as many sifting drums may be employed as are desired and that the grinding drums and sifting drums may be of another than cylindrical shape. In some cases, moreover, it may be preferable to provide means for advancing the material through the drums and not to depend upon the piling up of the material for such advancement.

In Fig. 3 the openings 2 are placed about midway between the ends of the grinding drum 1 instead of at the rear end and the sifting drums 9 are shortened. Otherwise the construction is similar to that shown in Figs. 1 and 2, and the operation is likewise similar to the operation already described and will readily be understood.

In Fig. 4 the arrangement is similar to Fig. 3 except that the return from the sifting drums to the grinding drum is made at the rear of the grinding drum. The operation, however, will be readily understood and need not be further specifically referred to.

In Figs. 5 and 6, the sifting drums are provided with an inner coarse sieve 9^a and an outer fine sieve 9^b. The chambers and conduits 11 deliver the ground material into one end of the coarse sieve 9^a and do not communicate at all with the fine sieve. The ground material is first sifted by the coarse sieve and such as does not pass through the coarse sieve is returned to the grinding drum through the chambers and conduits 10. Moreover, such material as does not pass through the fine sieve is also returned to the grinding drum through the chambers and conduits 10. The apparatus is in other respects similar to the apparatus illustrated in Figs. 1 and 2. With this arrangement the coarse sieve conserves the fine sieve and renders the separation of the fine material effective.

In Figs. 7 and 8 the sifting drums are also provided with an inner coarse sieve 9^a and an outer fine sieve 9^b. The inner coarse sieve is preferably conical in shape and the smaller end of said sieve is in communication through a delivery chamber and conduit 12 with the grinding drum about midway between its ends at which point the discharge openings 2 are arranged. The larger end of the conical sieve 9^a is in communication with the return chamber and conduit 10 which carries back to the grinding drum such material as cannot pass through the sieve 9^a, introducing such material into the forward end of the grinding drum. The finer sieve is preferably cylindrical in shape and communicates only with the chamber and conduit 11 through which the material which does not pass through this sieve is returned to the rear end of the grinding drum. With this arrangement the material introduced into the grinding drum is more or less disintegrated before it reaches the outlet openings 2 through which it is discharged into the chamber and conduit 12 and into the smaller end of the sieve 9^a. There the material is sifted, the finer portions passing through the meshes of the sieve 9^a and on to the sieve 9^b. The residue from the sieve 9^a is discharged through the larger end thereof into the chambers and conduits 10 where it is collected and returned to the grinding drum at the forward end thereof and commingles with the material which is entering from the hopper 3. The residue left in the sieve 9^b gradually passes back into the collecting chambers and conduits 11 and through these chambers and conduits into the rear end of the grinding drum. From here it works its way back through the grinding elements to the openings 2. It will thus be obvious that a stream of coarser material works its way from the forward end of the grinding drum to the openings 2 and a stream of finer material from the rear end of the grinding drum to the openings 2.

In Figs. 9 and 10 the grinding drum itself is provided with a cylindrical sieve 13 upon which the material from the hopper 3 is fed. In this way material, the elements of which are very irregular in size, may be effectively treated, the larger particles which remain unground and do not pass through the sieve 13 being gradually worked through the drum and discharged at the rear end thereof into the chambers and conduits 11 and thence through a discharge outlet 14. The material which passes through the sieve 13 drops upon the outer shell 15 of the grinding drum, which is preferably conical, with its larger end communicating with the chambers and conduits 10 at the front end of the apparatus. From the chambers and conduits 10 the material is dis-

charged upon the fine sieves of the sifting drums 9 and such material as remains unsifted passes from these drums into the chambers and conduits 11 and is thence discharged through the outlet 14.

In Figs. 11 and 12 the position and the movement of the sifted and unsifted material are indicated clearly while grinding bodies 15 are shown in position in the grinding cylinders and the casing inclosing the drum and sifters is shown at 15.

It will be clear that many other embodiments of the invention are possible and that many departures may be made from the constructions illustrated and described herein without avoiding the spirit of the invention.

I claim as my invention:

1. In a grinding and sifting apparatus, the combination of a grinding chamber mounted to rotate about a fixed axis, a separate sifting chamber eccentrically mounted to revolve about the axis of the grinding chamber and having its own axis without the periphery of the grinding chamber, means to deliver ground material from the grinding chamber into the sifting chamber, and means to rotate the grinding chamber and revolve the sifting chamber.

2. In a grinding and sifting apparatus, the combination of a grinding chamber mounted to rotate about a fixed axis, a separate sifting chamber eccentrically mounted to revolve about the axis of the grinding chamber and having its own axis without the periphery of the grinding chamber, means to deliver ground material from the grinding chamber into the sifting chamber, means to return unsifted material from the sifting chamber to the grinding chamber, and means to rotate the grinding chamber and revolve the sifting chamber.

3. In a grinding and sifting apparatus, the combination of a rotatable grinding drum, a collecting and delivery chamber to receive material from the grinding drum, a separate sifting drum into which said collecting and delivery chamber delivers such material, the sifting drum being mounted eccentrically with respect to the axis of the grinding drum and revoluble about the grinding drum, and means to rotate the grinding drum and revolve the sifting drum.

4. In a grinding and sifting apparatus, the combination of a rotatable grinding

drum, a collecting and delivery chamber to receive material from the grinding drum, a sifting drum into which said chamber delivers such material, a collecting and return chamber to return unsifted material from the sifting drum to the grinding drum, the sifting drum being mounted eccentrically with respect to the grinding drum and revoluble about the grinding drum, and means to rotate the grinding drum and revolve the sifting drum.

5. In a grinding and sifting apparatus, the combination of a rotatable grinding drum mounted to rotate about a fixed axis and a separate sifting drum mounted eccentrically with respect to the grinding drum, said sifting drum being revoluble about the grinding drum, means to deliver ground material from one end of the grinding drum into one end of the sifting drum, means to return unsifted material from the other end of the sifting drum into the other end of the grinding drum, and means to rotate the grinding drum and revolve the sifting drum.

6. In a grinding and sifting apparatus, the combination of a rotatable grinding drum and a sifting drum side by side and secured together so that as the grinding drum rotates the sifting drum is revolved about the same, a collecting and delivery chamber at one end of the grinding drum to deliver ground material to the sifting drum, a collecting and return chamber at the other end of the grinding drum to return unsifted material from the sifting drum to the grinding drum and means to rotate the grinding drum and revolve the sifting drum.

7. In a grinding and sifting apparatus, the combination of a grinding drum mounted to rotate about a fixed axis, a supporting shaft therefor, a sifting drum rotatable about said shaft and mounted eccentrically with respect to the grinding drum, means to deliver ground material from the grinding drum to the sifting drum at one side, means to return unsifted material from the sifting drum to the grinding drum on the other side and means to rotate said shaft.

This specification signed and witnessed this 26th day of October, A. D., 1907.

JOHAN SIGISMUND FASTING.

Signed in the presence of—

P. HOFMAN BAUG,
ERNEST BOUTARD.