A. J. SACKETT.

PULVERIZING MILL.

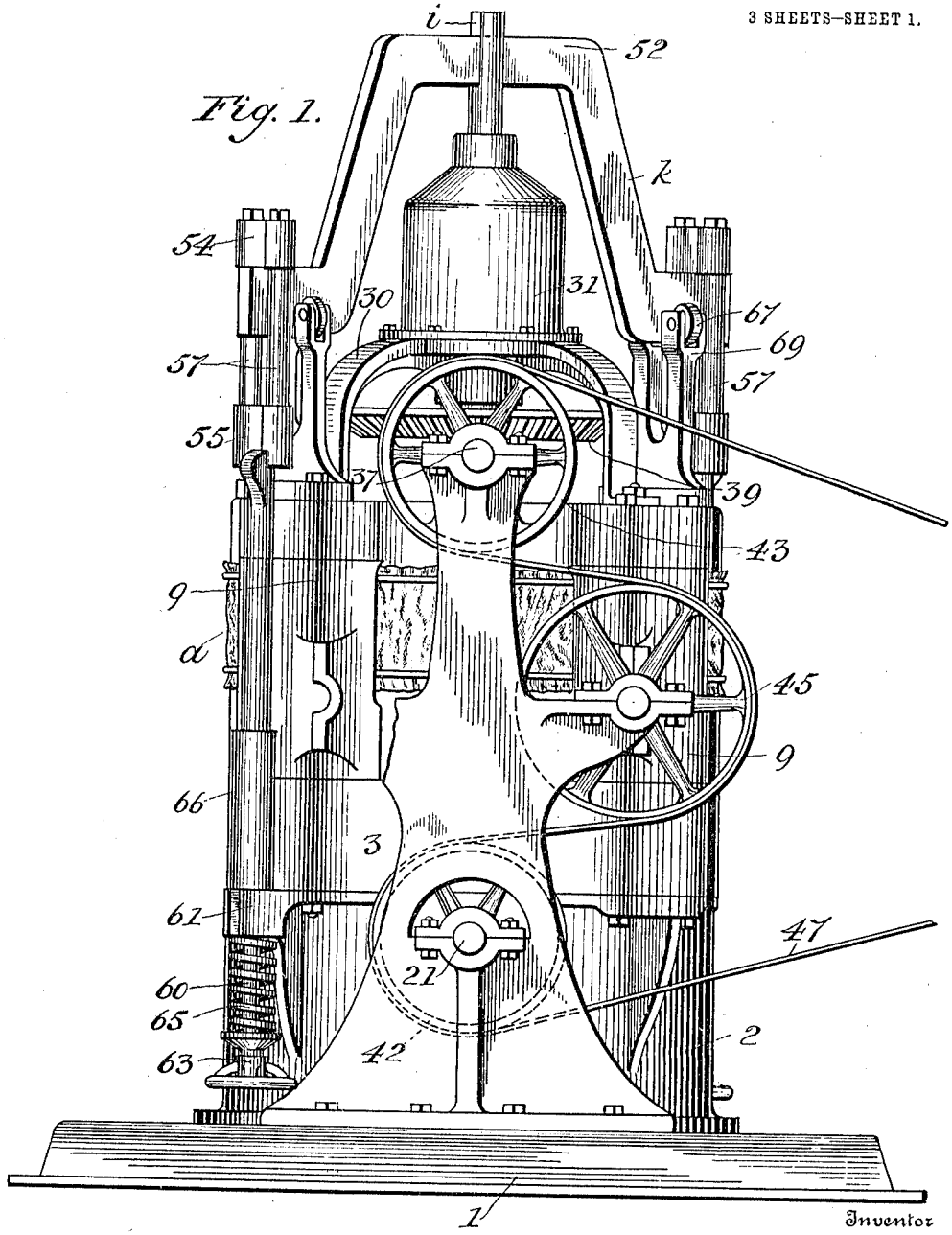
APPLICATION FILED MAR. 1, 1910.

1,040,769.

Patented Oct. 8, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



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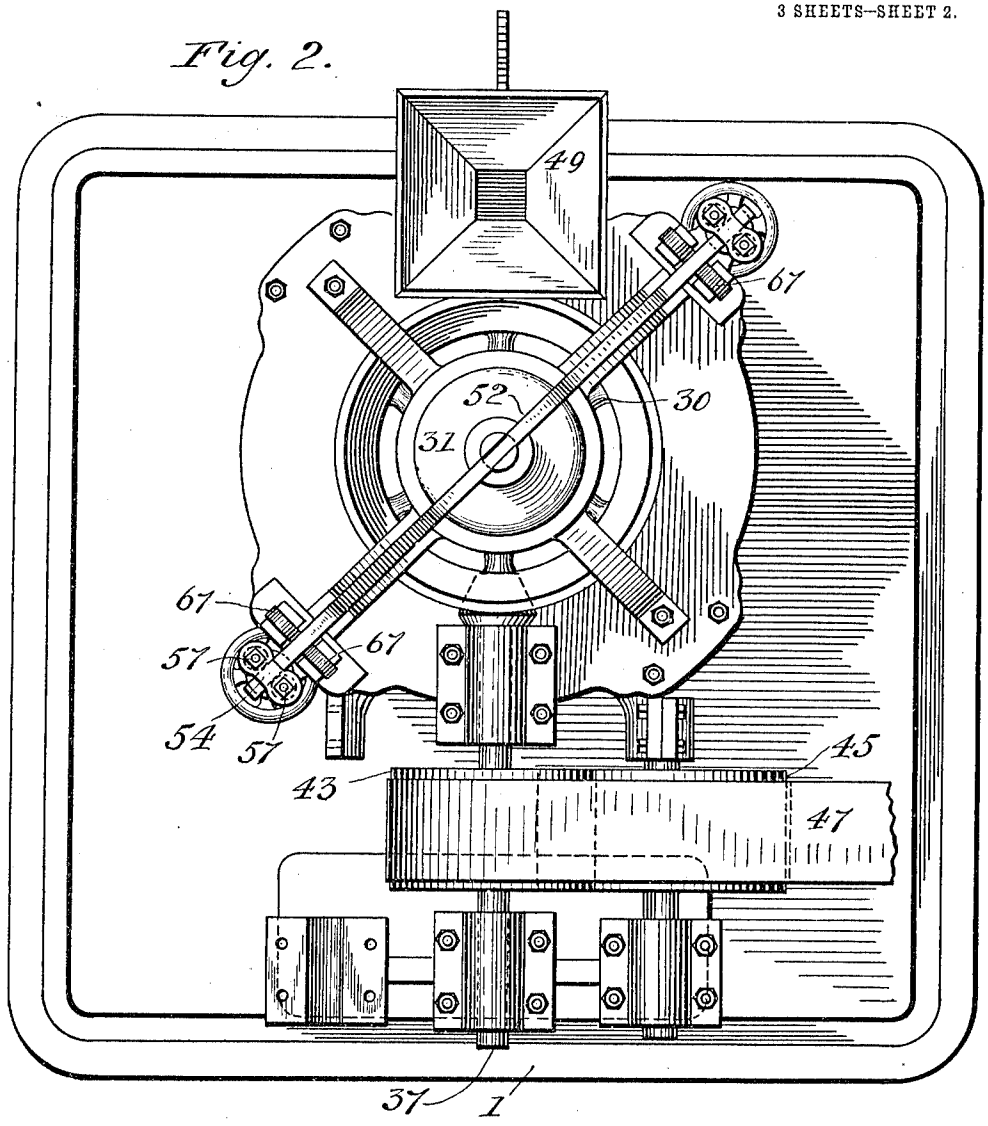
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

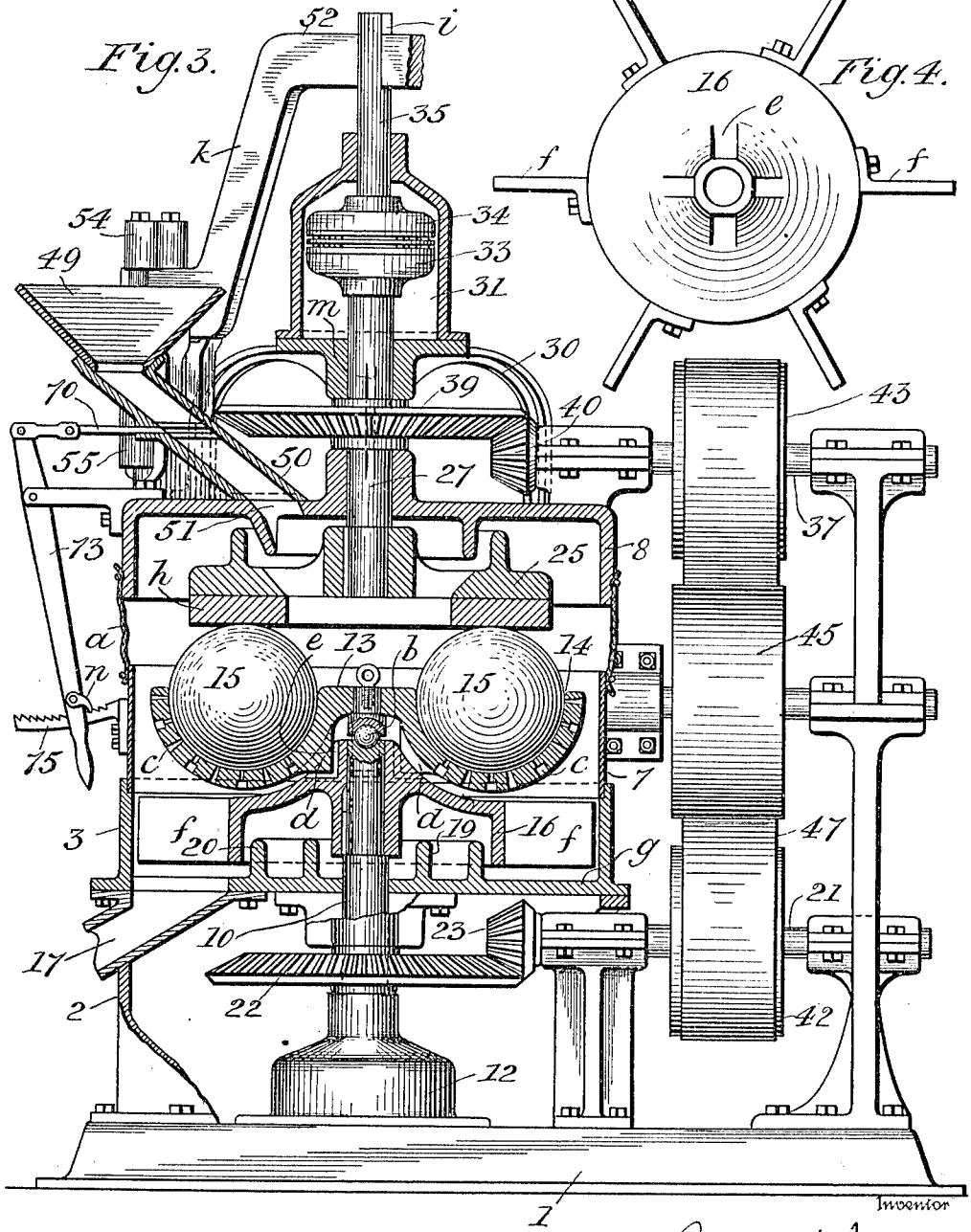

Fig. 4.

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UNITED STATES PATENT OFFICE.

AUGUST J. SACKETT, OF BALTIMORE, MARYLAND.

PULVERIZING-MILL.

1,040,769. Specification of Letters Patent. Patented Oct. 8, 1912.

Application filed March 1, 1910. Serial No. 546,635.

To all whom it may concern:

Be it known that I, AUGUST J. SACKETT, a citizen of the United States, residing in the city of Baltimore and State of Maryland, have invented certain Improvements in Pulverizing-Mills, of which the following is a specification.

This invention relates to certain improvements in a pulverizing mill adapted for the reduction to a powdered form, of materials such for instance as phosphate rock, and it consists in peculiar features of construction of the mill as will hereinafter be claimed.

In the description of the present invention which follows, reference is made to the accompanying drawings forming a part hereof, and in which,—

Figure 1 is an exterior side elevation of the improved mill. Fig. 2 is a plan of the same. Fig. 3 is a vertical central section of the mill. Fig. 4 is a top view of a part of the mill illustrated in Fig. 3.

Referring now to the drawings, 1 is the base or bed-plate of the mill, and 2 a hollow cylindrical stand bolted to the bed-plate, and which sustains the lower section 3 of a stationary cylindrical casing which contains the grinding appliances hereinafter described.

7 is a removable vertical extension of the section 3 of the cylindrical casing, connected to the upper section 8 of the casing by a strip of textile fabric *a* which serves to prevent the escape of dust from the grinding devices hereinafter described, to the outer air. The section 8 is supported by the columns 9 shown only in Fig. 1.

10 is a central rotary shaft having its lower end supported by a step 12 which is seated on the bed-plate 1.

13 is the grinding disk, having in its upper surface an annular race or channel 14 which is semicircular in cross section as shown in Fig. 3. The said disk is centrally supported by the upper end of the shaft 10, and in such maner as to allow of its being tilted or rocked from a horizontal position in any direction for a purpose hereinafter described. This peculiarity in the construction of the mill is preferably effected by providing the end of the shaft with a spherical depression, and the under side of the disk with a plug having a similar depression, and inserting between the two opposite concave faces a ball *b*.

15, 15 are grinding balls situated in the annular race 14; and the bottom and the outer side of the race which are practically in contact with the balls, are perforated, and the holes *c* are made smaller on the inside than on the outside of the race, to prevent their becoming clogged with the ground material, in the operation of the mill.

It is intended that the grinding disk 13 shall rotate with the shaft 10, and yet be free to tilt without placing any appreciable strain on the shaft, and to this end, the under side of the disk is provided with four lugs *d*, and the shaft 10 with a driving disk 16 having pockets *e* for the reception of the lugs *d*. The pockets *e* are well shown in Fig. 4. It will be understood that the lugs *d* do not fit closely within the pockets *e*, but loosely as shown in Fig. 3, and in consequence of this loose connection the tilting of the disk is not productive of excessive friction between the two parts of the mill.

Projecting from the circumference of the driving disk 16, are six radial scrapers *f* (see Figs. 3 and 4) which extend downward to near the bottom *g* of the lower section 3 of the stationary casing, and in their rotation with the disk 16, the ground material is conducted to the delivery chute 17 which is bolted to the under side of the casing as shown in Fig. 3.

To prevent the ground material from coming into contact with the shaft 10, the bottom *g* of section 3 of the casing, is provided with two circular rings 19 and 20 which project upward to a plane which is higher than the lower edges *f* of the radial scrapers.

The rotary movement of the vertical shaft 10 is derived from the horizontal shaft 21 through the medium of the beveled gear wheel 22 and the beveled pinion 23 in mesh therewith, as shown in Fig. 3.

25 is an upper rotary disk the hub of which is secured to the driving shaft 27; and in order that the disk will not be injured by wear in the grinding operation to

such extent as to require its renewal, it is provided with a removable hardened annular plate *h* which rests directly on the balls 15. The means whereby the annular plate *h* is fastened to the ring 25 are not shown, but it is intended to use for that purpose ordinary bolts.

The driving shaft 27 passes loosely through a bearing on the head of the upper section 8 of the cylindrical casing, and also through a similar bearing formed as a part of a skeleton dome-shaped covering plate 30, and extends into a hood 31 which is seated on the covering plate. The extreme upper end of the shaft 27 is fitted with a tight disk 33, and between this disk and the corresponding one 34 on the fixed shaft 35 which passes loosely through the top of the hood, are placed ordinary anti-friction balls and rollers, in order that the fixed shaft 35 may have little tendency to rotate with the shaft 27 beneath. The shaft 27 together with its disk 25 receives its rotation from the horizontal shaft 37 through the medium of the beveled gear wheel 39, and the beveled pinion 40.

It is intended that the upper and lower disks 13 and 25 shall rotate in opposite directions, and so effect a result which tends to increase the efficiency of the mill with respect to its grinding capacity; and to produce such result in a simple and effective manner, I place between the pulleys 42 and 43 which are on the shafts 21 and 37, respectively, a third and idle pulley 45, and use a single driving belt 47 arranged with reference to the said pulleys as best shown in Fig. 1.

49 is a feed hopper terminating at its lower end in a downward-inclined chute 50 which communicates with an opening 51 in the head of the upper section 8 of the casing of the mill. By means of the hopper and chute, materials to be pulverized pass to and through the upper disk 25, and thence to the lower grinding disk 13, and finally to the race 14 where they are ground by the combined action of the balls 15 and the two disks.

In order that the upper disk may be held in contact with the balls 15 with a yielding pressure, I slot the end of the stationary shaft 35, and place in the slot which is denoted by *i*, the bent bar 52 the ends of the pendent portions *k* of which are turned outward. Upon each of the outwardly projecting ends of the bar 52, is placed a block 54 which is united to a similar block 55, situated at a proper distance below, by the twin bolts 57. Extending downward from the center of the lower block 55 is the bolt 60 which passes through a lug 61 projecting from the flange of the stand 2 of the casing, and is provided with a nut 63, the said bolt being threaded to receive it; and between the nut and the said lug and coiled about the bolt 60, is a stiff spring 65. By means of the nuts 63 the pressure on the upper rotary disk 25 can be regulated according to the work to be performed.

66 is a loose sleeve on the bolt 60, and has no important function.

The bar 52 is guided in its up-and-down motion by the rollers 67 (see Figs. 1 and 2) on the brackets 69 which are fixed and seated on the head of section 8 of the mill casing.

As the shaft 27 carrying the upper disk 25, has to have an up-and-down movement independently of the beveled gear wheel 39 which has no vertical movement, the said wheel is not keyed fast to the shaft, but instead, is driven by a spline *m* fast on the shaft, the hub of the wheel being grooved to fit the spline.

I have hereinbefore described the lower grinding disk as adapted to rock or tilt. To fully understand the object of this construction, it must be borne in mind that in many materials to be ground, are found pieces which are larger or harder to grind than the others; and in mills unprovided with a tilting grinding disk, one or more of the balls in passing over such pieces which are more than ordinarily refractory, are lifted above the others. Such unequal action of the balls on the upper disk has a tendency to reduce momentarily the grinding efficiency of the balls which are on a lower plane, and which at the time are relieved to some extent, of pressure obtained through the medium of the holding down devices. It also has a tendency to deflect the upper rotary disk from a horizontal position and thereby subject the shaft carrying the said disk to a lateral or bending strain. With the lower grinding disk made tilting, as described, the pressure of the upper rotary disk upon the balls is at all times uniform, and should a more than ordinary refractory body pass under a roll, the lower disk at that point is thrown down, thus distributing the pressure alike to every part of the upper disk with which the balls are in contact.

It is within the scope of the present invention, to make the grinding disk 13 rigid and non-tilting, and give the upper disk 25 a rocking motion, but such change is not considered to be good construction.

As the balls become worn by attrition, the upper disk is drawn down by the coiled springs and the efficiency of the mill is not impaired to any great extent.

The feed of materials to the mill is regulated by means of a sliding gate 70 in the chute 50, which gate is operated by a lever 73, and the lever when so placed as to give

the requisite feed of the materials to be ground, is held by the pawl *n* which engages the rack 75.

I claim as my invention,—

In a pulverizing mill, a tilting grinding disk having an annular race therein, means to rotate the disk in a certain direction, and a system of balls situated in the race, combined with an upper disk, mechanism to rotate the said upper disk in a direction contrary to that of the lower disk, and appliances to hold the upper disk in contact with the said balls with a yielding pressure, substantially as specified.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."