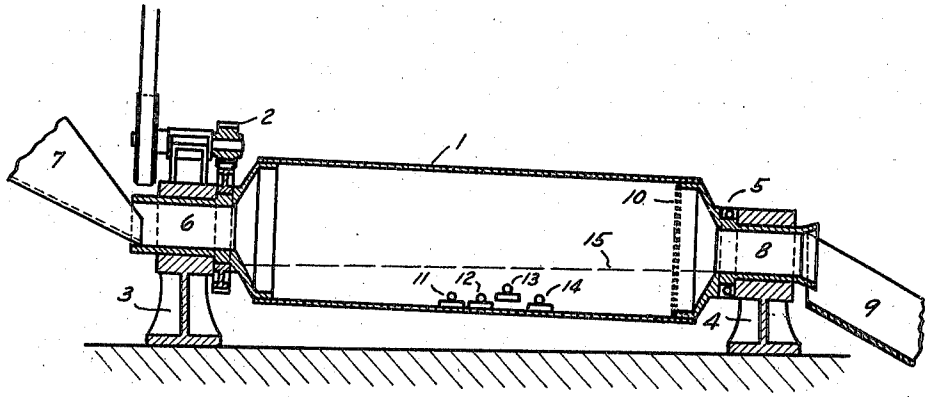
L. T. BACHMAN.

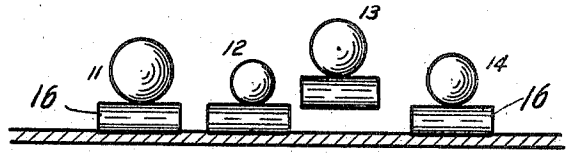
GRINDING MILL.

APPLICATION FILED FEB. 7, 1920.

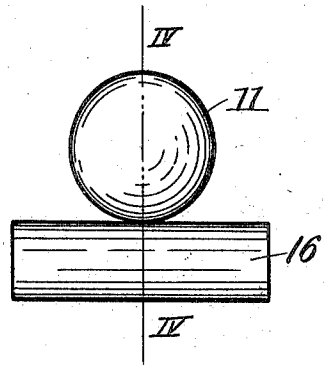
1,393,334. Patented Oct. 11, 1921.



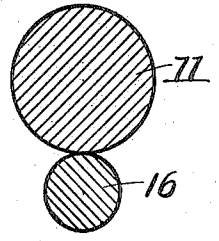
— Fig 1 —



— Fig 2 —



— Fig 3 —



— Fig 4 —

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GRINDING-MILL.

1,393,334. Specification of Letters Patent. Patented Oct. 11, 1921.

Application filed February 7, 1920. Serial No. 356,962.

To all whom it may concern:

Be it known that I, LLEWELLYN T. BACHMAN, a citizen of the United States, and a resident of Santa Cruz, county of Santa Cruz, State of California, have invented new and useful Improvements in Grinding-Mills, of which the following is a specification.

My invention has for its object the more perfect grinding and reduction to a fine powder of materials such as rock or earth formations, and is particularly adapted to the grinding of cement producing materials and cement clinker.

This object I accomplish by rolling material to be ground between a cylindrical member and a relatively spherical member, and one of these of a higher degree of hardness or toughness than the other.

I prefer to use a metallic cylinder, as of iron or steel, and a relatively harder body of approximately spherical form, such as a hardened steel ball or flint pebble. The rolling contact effected in the operation of the mill between these two grinding bodies results in a point of contact, or during the rotation, a line of contact between sphere and cylinder. Because the line of contact is relatively narrower with a corresponding increase in number of lines of contact the unit pressure upon the material to be ground is very much greater, and the relatively softer and harder grinding bodies permits a sufficient embedding of the said material to insure its being carried along and exposed to the said rolling pressure. This exposure to a higher pressure at an increased number of points of contact insures its more effective grinding.

I am aware that cylindrical bodies have heretofore been used in contact with each other whereby a rolling between them on the "elements" of the cylinders results in a wide grinding area, whereas in my invention I attain the result by reducing the width of this grinding area to a minimum while maintaining a large surface thus proportionately increasing the effective grinding pressure between bodies of different relative hardness.

By referring to the accompanying drawings my invention will be made clear.

Figure 1 is a longitudinal cross section through a grinding mill such as is suitable for practising my invention.

Fig. 2 is a view of a plurality of grinding bodies as they operate in the drum of Fig. 1.

Fig. 3 is a detail view of one of the spherical and one of the cylindrical grinding bodies in grinding action on the line IV—IV.

Fig. 4 is a section on the line IV—IV of Fig. 3.

In the drawings the tube mill is shown slightly inclined, but it is to be understood that it may be set horizontally if preferred without departing from my invention.

Throughout the figures the same numerals refer to similar parts.

The grinding drum is indicated by the numeral 1 adapted to rotate through the gear driving mechanism at 2 and carried in suitable supports as 3, 4, giving it preferably an inclination to the discharge outlet. The thrust occasioned by the said inclination is taken up on a suitable bearing as for example the rollers 5, an inlet to the drum is provided at 6 which is fed by the chute 7 through which the material and grinding bodies may be introduced and thereafter grinding action takes place within the drum; the material during this time having traveled toward the outlet 8, and is discharged through the hopper 9. Suitable baffles or screens may be introduced, as at 10, to prevent the egress of grinding bodies, or restrain the unground material.

It is to be understood that the grinding bodies comprising approximately spherical bodies 11, 12, 13, and 14 and cylindrical body 16, in large number are introduced within the drum 1 with the material to be ground, the entire mass, as 15, being subjected to rotation whereby the cylinder grinding bodies are rotated in rolling contact with the drum, thus providing rolling surfaces upon which adhering material is carried around on the surfaces of the said rolling cylinders, and the spherical bodies coming in contact therewith effect grinding action between the said surfaces and the said cylinders.

In practice I have found soft iron rollers, or cylinders, which may advantageously be cut from any scrap, but preferably of a relative small size, in combination with flint pebbles, to produce excellent results, and to effect quicker and finer grinding with a less expenditure of power than heretofore employed.

The flint pebbles are of approximately spherical form and when I use the expression "approximately spherical" in the claims I intend to cover such pebbles. I have also found that hardened steel balls may be employed in combination with the relatively softer metallic cylindrical bodies, and the benefits of the invention will be obtained, and I accordingly contemplate employing such hardened steel balls, when desired.

I claim:

1. A grinding mill comprising a drum adapted to rotate and within which the material to be ground is subjected to the action of grinding bodies, and grinding bodies consisting of a substantially equal number of approximately spherical members and short cylindrical members which are of softer material and of greater specific gravity than said spherical members.

2. A grinding mill comprising a drum adapted to rotate and within which the material to be ground is subjected to the action of grinding bodies, and grinding bodies consisting of a substantially equal number of flint pebbles and of short cylindrical metallic members which are of greater specific gravity and of softer material than said pebbles.

In testimony whereof, I have hereunto set my hand at Santa Cruz, California, this 23rd day of January, 1920.

LLEWELLYN T. BACHMAN.

In presence of—

THOMAS P. WILLIAMS,

JAMES MANN.