the mill by means of a feeding-screw M revolving in a chamber connected with the hopper, its axle turning in a bearing carried by the hopper-support, and having fixed upon it a bevelled-toothed wheel N, gearing with a corresponding pinion O upon the spindle *l*. A shifting-clutch *p* allows the pinion O to be disengaged from the spindle *l* when desired. A sliding-door Q enables the opening from the hopper to be closed or regulated, and a movable cover R affords access when necessary to the feeding-screw M. A passage T delivers the material just inside the upper edge of the grinding-ring *b*. The pulverised material is removed from below the pan by conveyers U or other means.

By the novel methods of construction described and shown, the bearing-surfaces of the driving apparatus are completely protected from dust and dirt, and are perfectly and accurately adjustable, so as to be very durable. The material to be pulverised (after having been reduced to a certain size) is supplied regularly and uniformly, and the output is very large; and by means of the revolving fan-blades *i* a current of air is caused, which is drawn in through the conical casing *g*, and prevents any escape of dust.

In dry pulverising the fine material that passes through the screens falls downward through the openings *d* outside the ring into the receptacle *e* underneath, from which it is carried by a conveyer provided for that purpose.

The fan attached to the shaft above the roll draws air in at the top of the cone, forcing it through the screen and out into the discharge, thus effectually keeping all dust within the mill.

In wet pulverising the water is introduced with the feed, and when the mill is running the water takes the same motion as the material in the dry mill, carrying with it the ore, both coarse and fine.

The fine material, with the water, composing the pulp, passes through the screens into a surrounding trough, and is discharged on one side, whence it may be passed over plates or into an amalgamator or concentrator as desired.

In the reduction of mineral ores by the improved mill the percentage of slimes is less than from stamp-mills or from any other pulveriser, and for all processes of after-treatment the ore is left in the very best condition.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is,—

1. In pulverising-mills in which a suspended revolving crushing-roll is pressed by centrifugal force against a fixed ring, the method of suspending the roll by means of a vertical shaft having a ball at its upper end and two transverse trunnions, in combination with a driving-pulley having an internal spherical bearing upon which the ball rests, and vertical recesses, and plates in which the trunnions work, a hollow conical bearing upon the pulley, a corresponding external cone carried by the frame of the mill, adjusting-screws and friction-plates for adjusting the pressure upon the cones, a spherical friction-plate above the ball, and a spring between the said friction-plate and the top of the pulley, all substantially as and for the purposes set forth and illustrated.

2. In combination with the parts claimed in claim 1, the feeding apparatus, consisting of a hopper, a chamber containing a feed-screw driving-gear, consisting of a vertical shaft driving the feed-screw by toothed bevelled wheels, and driven by cone-pulleys upon its upper end and upon the driving-pulley described in the first claim; a passage delivering the material above the ring against which the crushing-roll works; and doors for regulating the supply and affording access to the parts of the feeding apparatus, substantially as set forth and illustrated.

3. In a dry-crushing mill, in combination with the parts described and claimed in claims 1 and 2, the fans upon the driving-shaft above the crushing-roll, the perforated screens surrounding the suspended shaft, the openings surrounding the pan, and communicating with a chamber below in which a conveyer works, all substantially as set forth and illustrated.

4. In a wet-crushing mill, in combination with the parts described and claimed in claims 1 and 2, the stirrers below the crushing-roller, the perforated screens surrounding the suspended shaft, a trough surrounding the perforated screens, and a discharge-opening from the trough, all substantially as set forth.

Dated this 2nd day of January, 1896. AMMI VINING YOUNG.

IMPROVEMENTS IN STAMPING APPARATUS FOR CRUSHING ORES AND OTHER ANALOGOUS STAMPING PURPOSES.

I, Donald Barns Morison, of Hartlepool, in the County of Durham, England, engineer, do hereby declare the nature of my invention for "Improvements in Stamping Apparatus for crushing Ores, and other Analogous Stamping Purposes," and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

According to this invention the downward or operative strokes of the stamps in a stamping, crushing, or hammering apparatus adapted for crushing minerals, ores such as gold-ores, and other substances, or for other purposes for which such stamping or hammering apparatus is suitable, are effected by the action of gravity and for speeds at which the number of strokes in a given time exceed what is practically obtained by gravity (less retardation due to friction). The movement due to gravity is supplemented by motion imparted by friction from positively-driven parts of the apparatus, and the return upward strokes of the stamps are effected by the rising movement of the said positively-driven parts communicated to the stamps through bodies of liquid, either alone or in combination with other elastic bodies, as will now be explained.

Referring to the accompanying illustrative drawings, Figure 1 shows partly in cross-section and partly in side elevation, and Figure 2 in front elevation, a stamp-head provided with one arrangement of operating mechanism according to this invention. Figure 3 is a front elevation showing a battery of ten stamps provided with such operating mechanism.