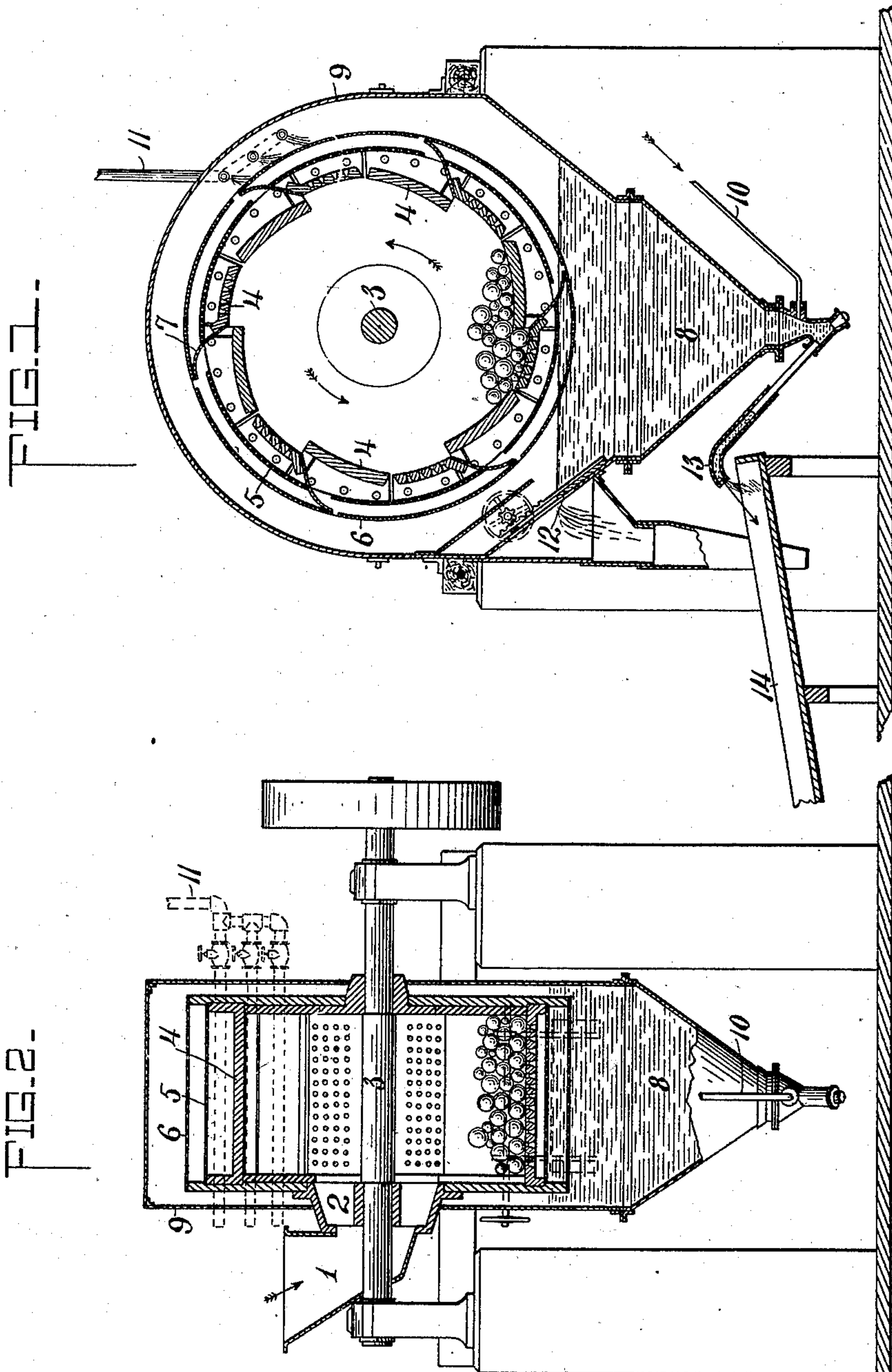


No. 647,336.

Patented Apr. 10, 1900.

H. L. SULMAN.
BALL GRINDING MILL.
(Application filed Oct. 28, 1899.)

(No Model.)



WITNESSES

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HENRY LIVINGSTONE SULMAN, OF LONDON, ENGLAND, ASSIGNOR TO
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BALL GRINDING-MILL.

SPECIFICATION forming part of Letters Patent No. 647,336, dated April 10, 1900.

Application filed October 28, 1899. Serial No. 735,112. (No model.)

To all whom it may concern:

Be it known that I, HENRY LIVINGSTONE SULMAN, analytical chemist, a subject of the Queen of Great Britain, residing at London, England, (whose postal address is 60 Gracechurch street, in the city of London, England,) have invented certain new and useful Improvements in Ball and Drum Grinding-Mills, of which the following is a specification.

This invention relates to improvements in ball and drum grinding-mills, which may be employed for reducing many substances, but which are more especially applicable to the grinding in a wet condition of ores which are obtained in a moist state and are treated by a wet process.

Attempts to grind ores in a wet condition, in which the water has either been admitted to the machine through the inlet for the introduction of the substance to be ground or has been sprayed by nozzles against the outer sieve, have not hitherto led to any satisfactory result, because during such process the space between the grinding-plates and the first or coarse sieves and also between the latter and the fine sieves usually becomes clogged or choked with mud. According to this invention this clogging or choking with mud is obviated by partly immersing the ball-drum to a predetermined depth in water in a trough or vessel and keeping the water and material within the mill in motion.

My invention consists in a ball and drum mill having novel features of construction, as hereinafter described and claimed.

In order that my invention may be clearly understood and readily carried into effect, I will now proceed to describe the same more fully with reference to the accompanying drawings, in which—

Figure 1 is a vertical transverse section, and Fig. 2 a vertical longitudinal section, of a ball-mill constructed according to this invention.

1 is the hopper, and 2 is the hub of the ball-drum, provided with apertures by which the material is fed to the ball-drum. The material is ground or reduced by means of the balls acting in cooperation with the grind-

ing-plates 4 as the ball-drum rotates about the central axis 3.

5 is the inner coarse sieve, and 6 is the outer fine sieve.

7 7 are tangentially-arranged return-plates for conducting the coarser particles from between the plates 4 and the coarse sieve 5 and also from the space between the sieves 5 and 6 back to the interior of the mill for further reduction.

9 is the mill-casing, the lower part 8 of which is preferably tapered and forms a water-trough, which is kept filled with water and through which the water constantly flows.

10 is a supply-pipe by which water enters at the bottom of the trough 8, and 11 are a series of nozzles which deliver water upon the upper part of the periphery of the ball-drum as it rotates.

12 is an adjustable slide by which the water-level in the trough is determined, the water being maintained at such a level in the trough 8 that the lower periphery of the ball-drum is immersed and rotates therein at a depth approximately corresponding to the point at which the coarse sieve is situated.

13 is a pipe for conducting away the coarser particles from the lower part of the trough 8 to the channel 14, whence they may be conveyed to any suitable vessel for further treatment. This pipe 13 may either be fixed or, as shown in the drawings, it may be telescopic, so that by regulating the height of the outlet the fineness of the particles conducted away may be determined.

The water may be admitted either through the nozzles 11 and the pipe 10 or through either of these, according to the nature of the material to be treated.

As the ball-drum revolves the ground material falls through the holes in the grinding-plates 4 upon the coarse sieve 5 and through this latter upon the fine sieve 6. The material that is sufficiently finely ground passes through the sieve 6 into the trough 8, and the coarser particles which cannot pass through the sieves are returned by the plates 7 to the interior of the mill to be further reduced. The vigorous circulation of water which is maintained greatly assists in the process of

reduction, as it washes the fine particles out of the substance which is being ground. The fine mud is kept in suspension at the upper portion of the water-trough 8 and flows over
 5 the slide 12 with the water. The grit and coarser particles sink to the bottom of the trough 8, and owing to the pressure of water above them are conducted through the pipe 13 into the channel 14. The principal object
 10 of the nozzles 11 is to afford special means of swilling the outer sieves when necessary. The water is admitted through the pipe 10 principally when the substance to be ground contains very fine dust which it is desired to sep-
 15 arate from the heavy grit and the like by means of the ascending current of water.

What I claim is—

1. A mill comprising a casing having a lower part providing a water-trough, the ball-drum
 20 having grinding-plates, inner and outer concentric sieves, and tangential return-plates, extending from the outer sieve through the inner sieve to the grinding-plates, and an adjustable slide whereby the level of the water
 25 in the trough and the immersion of the sieves at the bottom of the ball-drum are determined; substantially as described.

2. A mill comprising a casing having a lower part providing a water-trough, the ball-drum
 30 having grinding-plates and inner and outer concentric sieves and tangential return-plates extending from the outer sieve through the inner sieve to the grinding-plates, a series of

nozzles for spraying water on the periphery of the outer sieve in advance of the return- 35 plates and means whereby the level of the water in the trough and the immersion of the sieves at the bottom of the drum are determined; substantially as described.

3. A mill comprising a casing having a lower 40 part providing a water-trough, a water-supply pipe leading to the lower part of the trough, a discharge-pipe adjustable in length for regulating the height of the outlet and extending from the lower part of the trough beneath 45 the supply-pipe, means for determining the level of the water in the trough, and a ball-drum having grinding-plates, inner and outer concentric sieves and tangential return-plates, and mounted so as to dip its lower sieve part 50 only in the water contained in the trough; substantially as described.

4. A mill comprising a water-trough, a ball-drum having a sieve dipping into the trough, an adjustable slide regulating the level of the 55 water in said trough, a water-inlet pipe and a sand-outlet pipe communicating with the bottom of said trough, and means in the upper portion of the mill for spraying the sieve.

In testimony whereof I have hereunto set 60 my hand, in presence of two subscribing witnesses, this 18th day of October, 1899.

HENRY LIVINGSTONE SULMAN.

Witnesses:

WALTER J. SKERTEN,
 J. COLLINS.