H. W. HARDINGE.

CONICAL MILL.

APPLICATION FILED JAN. 19, 1918.

1,279,335. Patented Sept. 17, 1918.

Fig. 1.

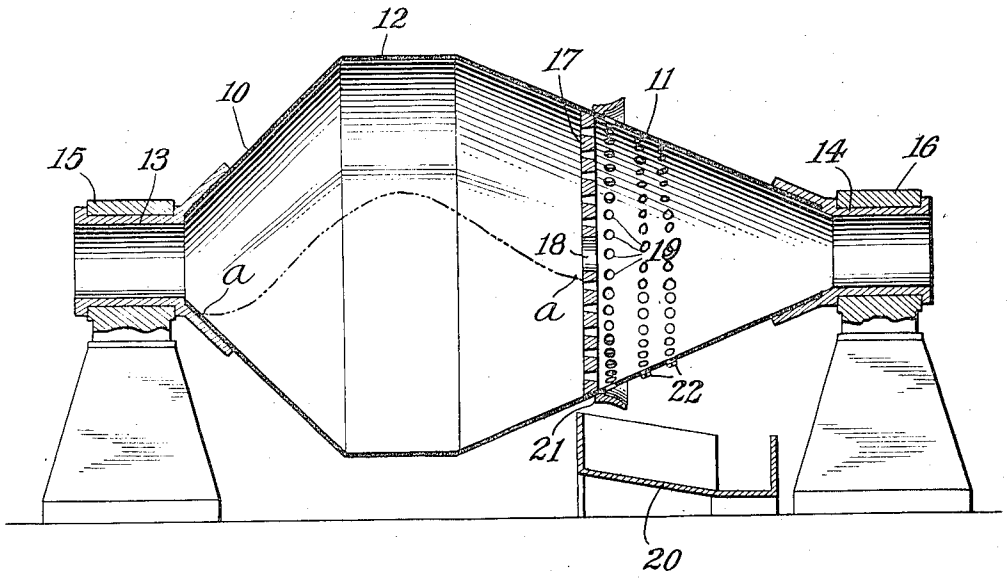
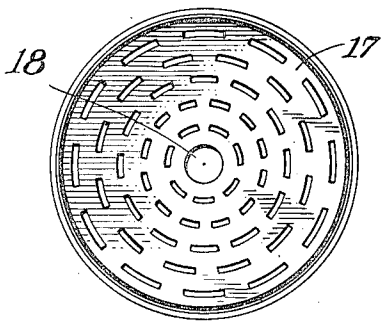


Fig. 2.



INVENTOR.
H. W. Hardinge
BY
Kerr Page Cooper & Hayward
ATTORNEYS

UNITED STATES PATENT OFFICE.

HARRY W. HARDINGE, OF NEW YORK, N. Y.

CONICAL MILL.

1,279,335. Specification of Letters Patent. Patented Sept. 17, 1918.

Application filed January 19, 1918. Serial No. 212,571.

To all whom it may concern:

Be it known that I, HARRY W. HARDINGE, a citizen of the United States, residing at New York, county and State of New York, have invented certain new and useful Improvements in Conical Mills, of which the following is a full, clear, and exact description.

The invention which constitutes the subject matter of this application relates to an improvement in conical mills the latter consisting, in its most common form, of cones arranged base to base (preferably with a cylindrical section between the two) and having an inlet opening at the apex of one cone and an outlet opening, at the apex of the other. It is with a mill of this type that my improvements are incorporated.

Figure 1 of the drawing represents a longitudinal section of a conical mill, and Fig. 2 illustrates in detail the screen employed. The distinguishing structural characteristic of all conical mills is the tapering shape of the portion (which may be conveniently referred to as the outlet portion) next to the axial outlet opening. This tapering form causes the material in the outlet portion to assume a sort of vertical stratification according to size, the largest pieces being at the plane of greatest diameter and the pieces diminishing in size toward the outlet, as fully described in my Patent No. 908,861.

In most cases the assorting of the material according to size, produced by the tapered form of the outlet portion, permits only particles of the desired degree of fineness to issue form the outlet under normal load, but in working with capacities above normal, as is often desirable to increase capacity of a single mill, it is found that some of the material discharged is composed of particles which are too large for the purpose desired. In such cases it is necessary to separate the coarse uncrushed material and return it to the same mill, or to another mill, for regrinding. The present invention relates to this problem, and its object is to provide improved means whereby the desired separation will be effected inside of the mill and the coarse particles retained in the mill for further reduction, instead of permitting them to pass out as would be the case without the screen. To this end the conical mill is provided with a screen within the walls of the conical portion of the body of the mill the meshes or perforations of which extend not only to a point below the axis of the mill but to a point below the inlet opening, and an outlet is provided for the screened material just beyond and at the peripheral edge of said screen. In the form illustrated the screen defines chambers on each side thereof, one of which is adapted to receive the screened material and is provided with perforations adjacent said screen and arranged around the conical portion of the mill to permit a discharge of the screened material through the walls of the mill thereby obviating the necessity of providing means for removing the material through a trunnion located at the point 14. This results not only in a reduction of the motor power which is required to operate the mill but provides a more complete gravity or hydrostatic head on the free side of the screen, thus enabling a free flow of the pulverized material through the screen.

In operating conical mills for a number of years I have observed that the difference in diameters and consequent difference in peripheral speeds at different portions of the cones has the distinctive feature of drawing or massing the contents (when in operation) toward the greatest diameter. This result ensues to an extent that when the mill is filled to its center with grinders and material being ground, the inlet and outlet trunnions are practically closed to the admission of more material, yet when the mill is rotated the above mentioned material tends to draw away from the cones to the center of the mill, piling up at its greatest diameter, leaving more or less free spaces below the axis, as shown at "*a*". This free space due to the segregating of material does not occur in a cylindrical mill in which the peripheral speed is the same throughout its whole length, except perhaps when the mill is fed below the desired maximum capacity, at which time, of course, the necessity for any screen does not exist.

I also take advantage of the fact that there is thus in a screened cone a much larger free screen area, as illustrated above the coarse mass of grinding mediums and material being ground, and a smaller area of screen is thus subjected to wear than in a mill where the screen is the full diameter of the mill. In the latter case there is an excessive and unnecessary wear of the screen and consequent consumption of power in action upon a partially closed and practically inoperative section.

The screen in a cone is not required to

retain as great a quantity of large unground material or grinding mediums against its surface owing to the classifying action of the cone, hence the screen area for equal volumes of material passing through the mill is less than its average diameter and more nearly adjusted to exact requirements.

Referring to the drawing, reference numeral 10 designates the inlet portion of a conical mill, 11 the outlet portion, and 12 the cylindrical portion between the conical portions. The specific form of mill illustrated herein is also provided, among other things, with the trunnions 13 at the apex of the cone 10, and 14 at the apex of the cone 11. Any suitable bearings 15 and 16 may be provided so as to enable it to rotate about its longitudinal axis, and any suitable mechanism may be employed to effect said rotation. A convenient and effective means for preventing large pieces or bits of material from escaping along with material of the desired degree of fineness is illustrated at 17 and comprises a screen inside the conical outlet portion of the mill. A screen located in the cone of a grinding mill has the advantage of a comparatively unobstructed area of the screen and obviates the excessive grinding area on the screen by the balls and grinding mediums. The object of this screen is to retain within the mill the material being ground until it is of a size which will pass through the meshes or orifices of the screen. This screen or barrier may be provided with a central orifice or opening 18 of sufficient size to pass material substantially or approximately as large as that originally fed to the mill, this opening acting as a safety or overflow opening to prevent choking of the mill with the material undergoing disintegration. The exact location of the screen within the conical portion 11 for best results is dependent upon the size and character of the material being ground. If the material being ground is coarse then the screen should be placed more or less adjacent to the base of the conical portion. If, however, the material being ground is not so coarse the screen should be arranged nearer the apex of the cone. For ordinary requirements the screen is preferably located midway between the apex and base of the cone. The material after passing the screen escapes through openings or perforations 19 in the conical portion, on the outlet side of but adjacent to the screen, and is conveyed by the trough or launder 20 to any suitable point. An annular member 21, surrounding the conical portion 11, is employed to prevent any portion of the material from running down to the base of said conical portion 11. To enable the substitution of another screen of larger or smaller diameter so as to vary the relative sizes of the chambers formed thereby I preferably provide a series of annular perforations and those not employed to discharge the screened material are plugged as indicated at 22. Each series of perforations are constructed to be capable of discharging all of the material passing through the screen. Therefore, when the conditions of the material require it, the screen may be located (adjusted) forwardly or backwardly to meet the exigencies of these particular conditions.

That part of the conical portion 11 which is located between the bearing 14 and the perforation 19 merely serve as a support for the outlet end of the mill. It is to be understood, however, that I do not limit myself to this method of supporting this end of the mill and that other supporting means may be employed without deviating from the true spirit and scope of my invention.

What I claim is:

1. The combination with a grinding mill of the class described having a conical outlet portion, of a screen within the walls of said conical portion of the body of said mill back of the outlet thereby forming a chamber on each side of the screen one of which is adapted to receive the screened material and is provided with perforations in the wall thereof adjacent to said screen, whereby the screened material is discharged from its chamber by gravity and a free flow of the material through the screen is provided.

2. The combination with a grinding mill of the class described having a conical outlet portion, of a screen within the walls of said conical portion of the body of said mill back of the outlet thereby forming a chamber on each side of the screen one of which is adapted to receive the screened material and is provided with a plurality of discharge openings or perforations located in various vertical planes to permit the substitution of screens of different diameters and thereby vary the relative sizes of the chambers formed by the screen.

3. The combination with a grinding mill of the class described having an inlet opening and a conical outlet portion, of a screen within the walls of said conical portion of the body of said mill the meshes or perforations of which extend not only to a point below the axis of the mill but also to a point below the inlet opening, said screen being located adjacent to or substantially at the point where the material is discharged from the mill, whereby an unrestricted free flow of the material through said screen is provided.

In testimony whereof I hereunto affix my signature.

HARRY W. HARDINGE.