

(No Model.)

R. STEINBACH.  
BALL MILL.

No. 603,977.

Patented May 10, 1898.

FIG. 1.

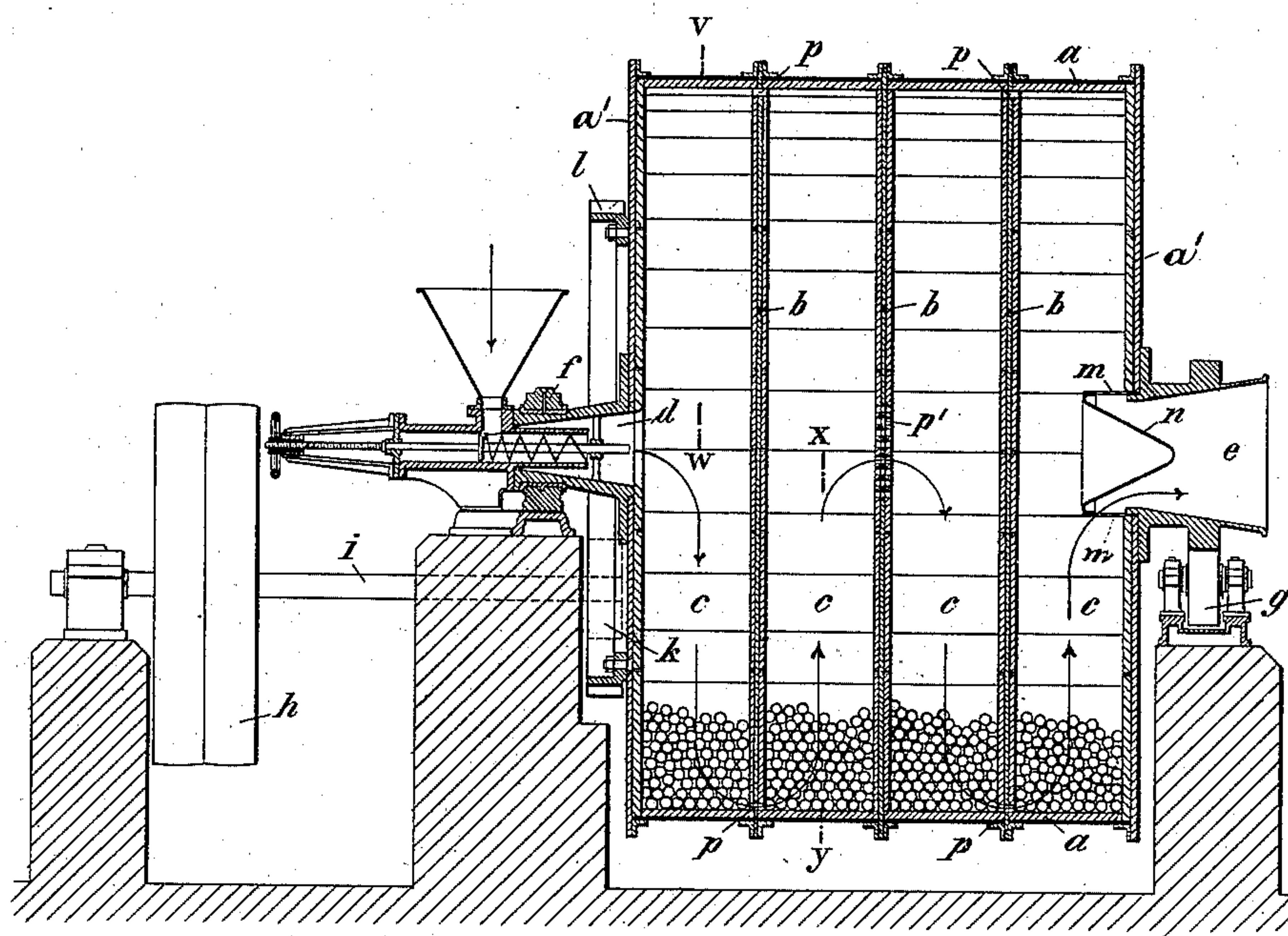
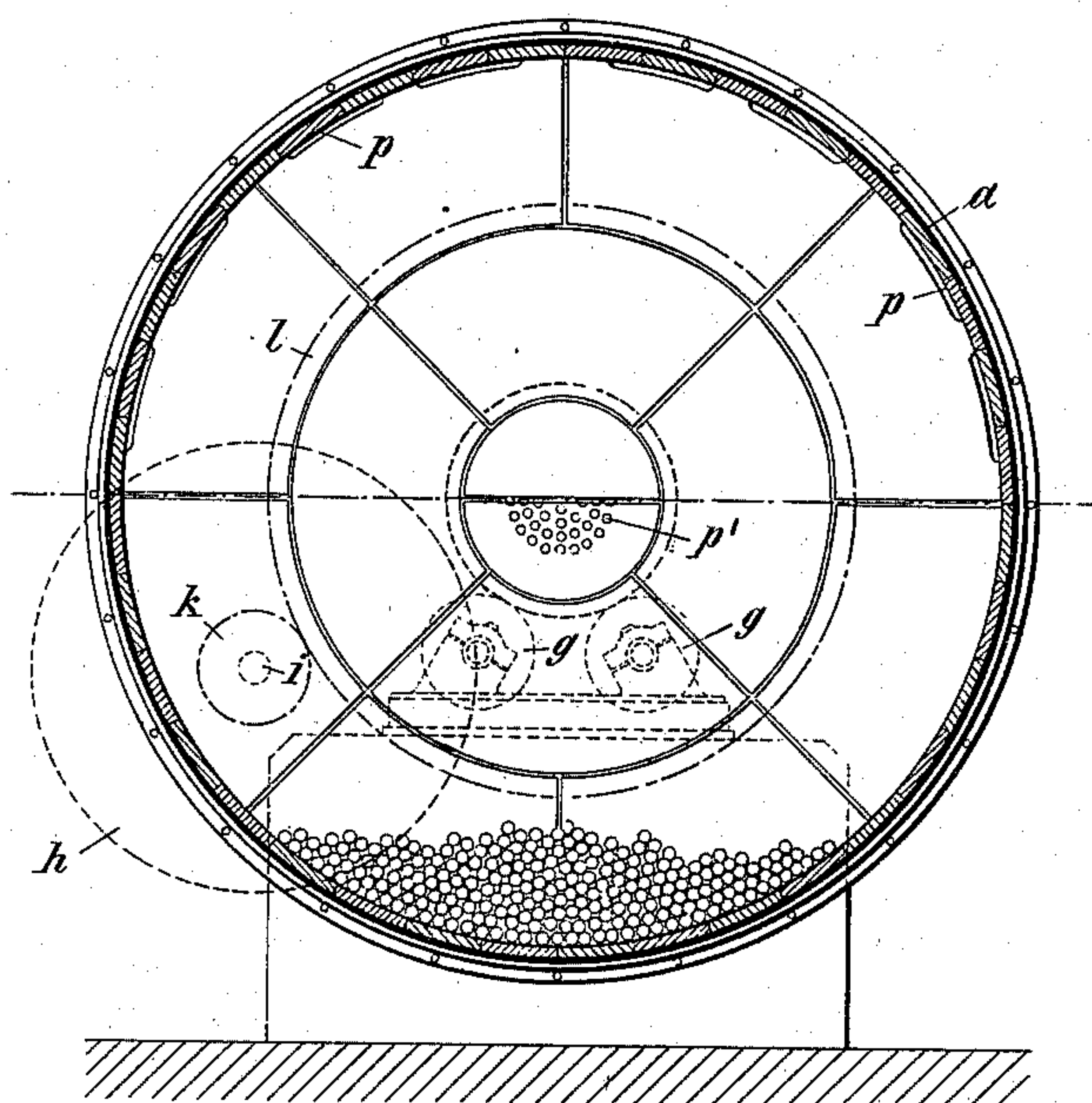


FIG. 2.



Witnesses:  
Herbert Bradley  
Fred R. Proctor

Inventor  
Reinhold Steinbach

By *Knight Bros.*  
Atty's



# UNITED STATES PATENT OFFICE.

REINHOLD STEINBACH, OF MAGDEBURG-BUCKAU, GERMANY, ASSIGNOR TO  
THE FRIED. KRUPP GRUSONWERK, OF SAME PLACE.

## BALL-MILL.

SPECIFICATION forming part of Letters Patent No. 603,977, dated May 10, 1898.

Application filed December 21, 1896. Serial No. 616,561. (No model.) Patented in England November 23, 1896, No. 26,501.

*To all whom it may concern:*

Be it known that I, REINHOLD STEINBACH, a subject of the King of Prussia, Emperor of Germany, residing at Magdeburg-Buckau, Prussia, Germany, have invented a certain new and useful Improved Ball-Mill, (for which I have obtained a patent in Great Britain, No. 26,501, dated November 23, 1896,) of which the following is a specification.

10 Ball-mills hitherto used in grinding or crushing hard bodies generally comprise drums or cylinders containing balls, the casings of which cylinders are made up of a number of separate perforated or slotted grinding-plates underneath which sieves are arranged, the size of the meshes of the sieves being determined according to the fineness to which it is desired to reduce the material to be crushed or ground. Now sieves or sifting-frames of this class are very liable to become obstructed or clogged when a high degree of fineness has to be attained. The serviceableness of the mill is thereby impaired and the difficulty of obtaining a fine product is increased.

25 The present invention relates to a ball-mill consisting of a horizontal cylinder or conical drum having a number of vertical chambers or compartments wherein the material by being continuously passed through the mill is reduced to any required degree of fineness from that of coarse grit to that of dust without the aid of sifting-frames.

35 The mill mainly consists of a cylindrical or conical drum which is divided into two or more compartments by means of vertical partitions arranged at right angles to its axis. Each compartment is partly filled with balls. The first compartment communicates with the second one by peripheral apertures or slots provided in the partition at points close to the casing of the drum, while communication is established between the second and third compartments by perforations at or near the center of the second partition. The said compartments thus centrally and circumferentially in alternate succession communicate with each other.

45 The material, which has undergone a preparatory grinding process in another mill to reduce the particles thereof to a suitable size, is, by means of controllable feeding appara-

tus, introduced through the center of one of the side walls of the drum into the first compartment or chamber. The said material descends between the balls (by which it is further ground) to the casing of the revolving drum, and thence, through the peripheral apertures or slots provided for the purpose, passes into the next chamber. The reduced particles behave somewhat like a fluid and rise between the balls of the second chamber until they reach the same level as the layer of material in the first chamber, and in so doing they are further gradually reduced. Before, however, they reach that level they come up to the perforations in the center of the second partition and through them flow into the third chamber. In this and the following chambers, if any, the same process is repeated. Thus the material in traveling through the mill from the inlet to the outlet takes a serpentine or winding course and eventually leaves the last chamber through the outlet provided in the center of the end wall of the drum in the desired fine condition.

75 When it is desired to vary the degree of fineness of the ground material—for example, to change from a coarser to a finer product—instead of (as has been necessary in the ordinary ball-mills heretofore employed) changing the sifting-frames, and reducing the charge of material accordingly, all that is required in the case of this improved mill is to reduce the rate of “feed” of the material by properly adjusting or setting the feeding mechanism in such a manner that the material takes more time to travel from one compartment to the next, remains longer in contact with the grinding-surfaces of the balls, and is consequently ground to a greater degree of fineness.

85 A ball-mill constructed in accordance with this invention is shown, by way of example, in Figures 1 and 2 of the accompanying drawings, which are respectively longitudinal and transverse sections of the same.

90 The said mill consists of a horizontal drum *a*, with vertical end walls *a'* and divided by a vertical partition or two or more vertical partitions *b*, arranged at right angles to its axis. These partitions divide the drum into a corresponding number of vertical compartments



or chambers *c*, the number of which depends mainly upon the hardness of the material to be ground, and secondarily upon the desired size of the "grains" or particles of the product to be obtained. Each chamber is partly filled with balls or spherical castings of steel or other hard material. The end walls are provided with hollow pivots or trunnions, one of which, *d*, serves as an inlet and the other of which, *e*, serves as an outlet. The inlet pivot or trunnion turns in an ordinary bearing *f*, while the outlet pivot or trunnion rests upon rollers *g*. The drum receives motion through the belt-pulleys *h*, shaft *i*, and pinion *k*, which engages with an annular rack or toothed ring *l*, secured to the drum. The grits to be crushed are supplied by means of a controllable feeding device of any suitable construction. In the drawings a conveyer-screw having an increasing pitch from one end to the other is shown, by way of example, for this purpose. The entrance to the outlet is fitted internally with a cylindrical wide-meshed sieve *m*, the object of which is to keep the balls from dropping out of the drum. Within and secured at the inner end of this sifting-cylinder is a cone *n*, the apex of which projects outward into the outer trunnion. The said cone serves to deflect the fine material which is carried up by the end wall and sieve and which falls therefrom through the sieve; or, in other words, this sieve carries at its inner end a cone *n*, with its point directed outwardly, and this cone serves to deflect the finer material, which is taken up in great quantities by the side walls and the sieve and which again falls from above into the sieve. If the sieve were closed by means of a flat plate instead of the cone, then this material would fall all the way through the sieve and again enter the lower part of the drum. The cone, however, intercepts this material and conducts it toward the escape. It is obvious therefore that with this cone more material per hour will pass through the outlet than without the cone. The partitions *b* have, as

above stated, a number of apertures or slots *p* of any suitable shape at their periphery and perforations *p'* at or near the center, and through these apertures or slots and perforations the material is enabled to pass from one chamber to the other, as previously described. The size of these apertures is such that the balls will not pass through them. By the above-described means the material is compelled to travel through the mill in the direction indicated by the arrows in Fig. 1.

When hard materials are to be dealt with, both the drum-walls and the partitions may be provided with exchangeable plates of correspondingly hard material, as suggested in the drawings.

I claim—

1. A ball-mill comprising a cylinder mounted upon a horizontal axis, and having end walls provided respectively with an inlet and a hollow-trunnion outlet; said outlet having secured at its inner end a cylindrical wide-meshed sieve and a cone secured within and at the inner end of the sieve and projecting into the hollow-trunnion outlet; substantially as and for the purpose set forth.

2. A ball-mill comprising a horizontal cylinder having end walls provided respectively, with inlet and outlet hollow trunnions; the cylindrical wide-meshed sieve secured to the inner end of the outlet hollow trunnion, the cone secured within and at the inner end of the sieve and projecting into the outlet hollow trunnion, the vertical partitions having peripheral apertures or slots, a vertical partition having perforations at or near its center and located between the first-named partitions and means for rotating the cylinder; the partitions providing vertical ball-compartments; substantially as described.

The foregoing specification signed at Magdeburg this 23d day of November, 1896.

REINHOLD STEINBACH.

In presence of—

JULIUS MUTH,  
M. C. MUTH.