H. A. HANSEN & J. M. SCHMUESER.

LINING FOR BALL OR PEBBLE MILLS.

APPLICATION FILED FEB. 1, 1913.

1,083,400.

Patented Jan. 6, 1914.

2 SHEETS—SHEET 1.

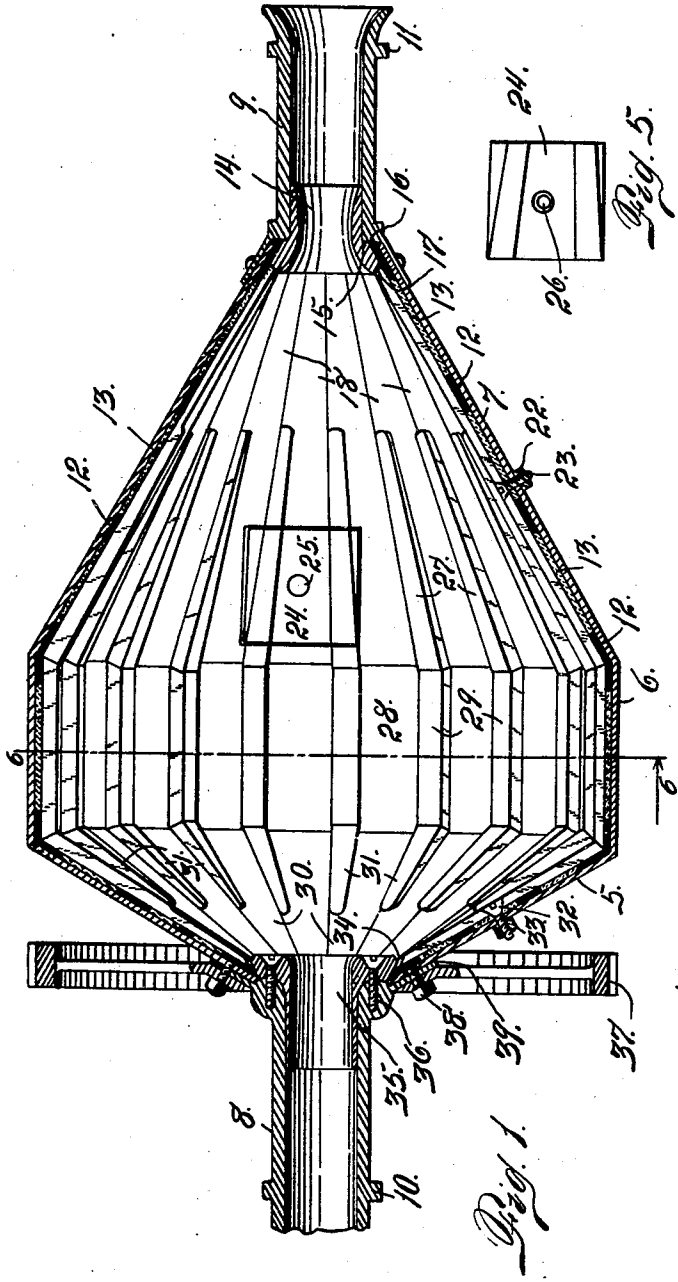


Fig. 1.

Fig. 5.

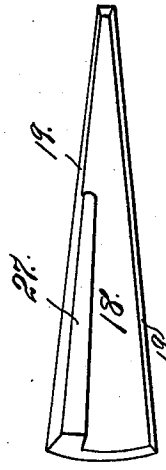


Fig. 4.

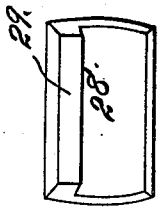


Fig. 3.

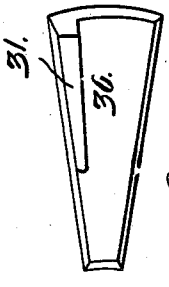


Fig. 2.

Witnesses

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2 SHEETS—SHEET 2.

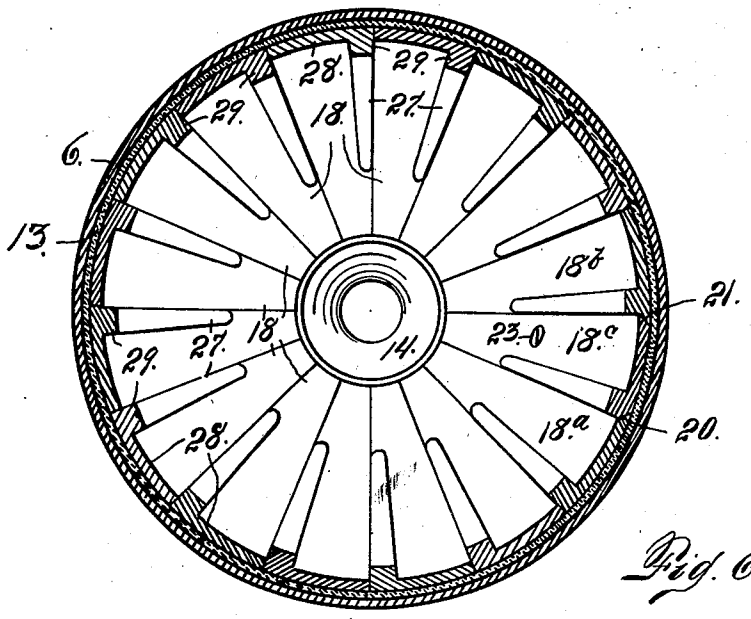


Fig. 6.

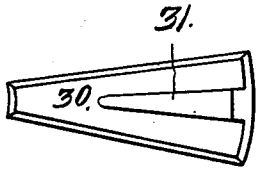


Fig. 7.

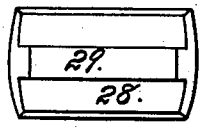


Fig. 8.

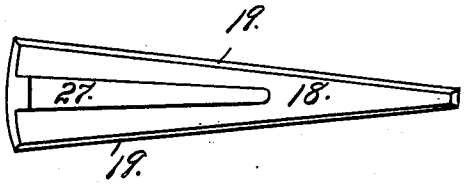


Fig. 9.

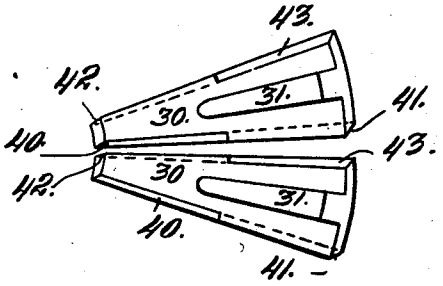


Fig. 10.

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UNITED STATES PATENT OFFICE.

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LINING FOR BALL OR PEBBLE MILLS.

1,083,400. Specification of Letters Patent. Patented Jan. 6, 1914.

Application filed February 1, 1913. Serial No. 745,561.

To all whom it may concern:

Be it known that we, HANS A. HANSEN and JOSEPH M. SCHMUESER, citizens of the United States, residing at the city of Smuggler, county of San Miguel, and State of Colorado, have invented certain new and useful Improvements in Linings for Ball or Pebble Mills; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in linings for ball or pebble mills and has for one of its objects to provide units of such a character that it will be possible to speedily assemble the lining within a mill.

Another object is to provide a construction in which the use of large numbers of bolts or screws for holding the lining in place is rendered unnecessary.

A further object of the invention is to provide means, namely longitudinal ribs integral with the units, for preventing slippage of the pebbles or balls upon the lining, thus prolonging the life of the lining, preventing flattening of the pebbles or balls and avoiding waste of power.

Other objects of the invention will appear hereinafter as we proceed with the description of that embodiment, which for the purposes of the present application, we have illustrated in the accompanying drawings, in which:

Figure 1 is a central longitudinal sectional view of a mill provided with our improved lining. Fig. 2 is a view in detail of one of the units of our lining. Fig. 3 is a similar view of another unit. Fig. 4 is a similar view of still another unit. Fig. 5 is a plan view in detail of the door lining. Fig. 6 is a cross section taken upon the line 6—6, Fig. 1, and looking in the direction of the arrow. Figs. 7, 8, and 9 are detail views of the different units of a modified form of lining. Fig. 10 is a detail view of two units of a modification in which each side edge is beveled in two different directions.

The same reference characters refer to like parts throughout the views.

In the drawings, which form a part of this specification the numbers 5, 6 and 7 refer to the two conoidal and the cylindrical parts, respectively, of the casing of a pebble or ball mill. The casing is supported upon and secured to hollow trunnions 8 and 9 which have collars 10 and 11, fixed thereupon to coöperate with the journals (not shown) for preventing longitudinal movement thereon.

The casing is first provided with a number of strips of belting 12 upon the inside, and running completely around the casing. After the belting 12 has been secured in place, cement 13 is spread over the remaining exposed parts of the casing on the inside, the thickness of the cement layer being the same as that of the belting.

A hollow end support 14 is next inserted within the trunnion 9, the shoulder 15 on said support abutting against the shoulder 16 upon the trunnion, thus preventing the support from being moved outwardly. The support 14 has a flat wall 17 which acts as an abutment for the outer extremities of the lining units 18. These units are made concavo-convex, their outer surfaces being of a curvature similar to that of the casing against which they rest. The side edges 19 of these units are inclined toward the middle in planes which if extended would include the axis of the mill.

Two of the units, namely 18^a and 18^b have their adjacent edges beveled off inwardly and away from each other as at 20 and 21 (see Fig. 6). When the other units have been set in place a unit 18^c is inserted between the units 18^a and 18^b and is caused to exert a wedging action against both of the latter, the unit 18^c being drawn outwardly in assembling the parts by means of a nut 22 upon a screw bolt 23, the head of which is mounted in the unit 18^c the nut 22 bearing upon the exterior surface of the casing whereby the unit 18^c is secured to the casing. It will be apparent that the unit 18^c acts as a key to hold all of the other units in position, the units 18 being formed and arranged like the stones in a masonry arch, their contacting radial edges preventing the movement of any unit toward the middle of the mill. Each of the units 18, 18^a, 18^b and 18^c, is provided along one edge with an integral inwardly extending rib 27, designed to catch the balls or pebbles as they are thrown against the lining, during the operation of the mill and thus overcome slippage.

In the preferred form of our invention each of the ribs 27 is located upon one edge of its unit and its outer side lies in the plane of that edge whereby the ribs serve not only to prevent slippage, but to thicken the available surface of the lining units at their edges, thus greatly assisting in the retention of the units in place by the wedging action.

Three of the units 18, are cut away to correspond with the door opening in the casing and a lining piece 24 with ribs upon its inner face constituting continuations of the ribs upon the units which are cut away as aforesaid is fastened to the door by means of a screw bolt 25 passed through an opening 26 in the door lining piece.

The lining for the cylindrical portion 6 of the casing is next put in place, this lining element consisting of units 28 having ribs 29 of the same cross sectional proportions as the ribs 26 and forming continuations of the latter when the lining is assembled. Locking units similar to the units 18^a, 18^b, and 18^c, are employed but they have not been illustrated in detail as their construction is precisely analogous to that of the similar units of the 18 group. With the wedging unit, we may use a bolt fastening 22, 23, but in the preferred form we omit this as unnecessary.

The lining for the portion 5 of the casing is now assembled. It consists of units 30 having ribs 31, the units being locked in place by means similar to those for the units 18 and 28, a screw bolt 32 and a nut 33 being employed for drawing the wedge unit into place. When the latter is set, the beveled end edges together with the beveled end edges of the units 18, overhang the end edges of the units 28 holding each of the latter including the wedging unit, in place. These end edges are forced into close union and are held there by small wooden or steel wedges 34, which are driven in between the outer extremities of the units 30 and the adjoining wall of an end supporting collar 35 which is held in position by screws 36 or other suitable fastenings, but if desired, all fastenings for the collar 35 may be omitted, the wedging action being sufficient to hold it in place.

The mill may be revolved in any suitable manner as by means of a gear wheel 37, fastened by means of bolts 38 to a coneshaped collar 39 secured upon the trunnion 8 and to the casing 5.

Although we prefer that the ribs upon the lining units shall be located at one edge thereof as shown in Figs. 1, 2, 3, 4 and 6, we do not desire to be limited to this construction, as numerous other arrangements may be used as for instance, the ribs may be located in the middle of the units as illustrated in Figs. 7, 8 and 9. Furthermore, numerous forms of interlocking edges may be employed if desired. In Fig. 10, we have illustrated one such arrangement one edge of each unit being divided into two oppositely inclined portions 40 and 41 while the corresponding portions of the opposite edge are inclined oppositely as at 42 and 43, the inclined surfaces 40 and 42 being parallel and the inclined surfaces 41 and 43 being parallel. It will be evident that when such units are assembled no one of them can move in a direction perpendicular to its surface by reason of the fact that it will be overlapped, on a portion of each side edge by the units adjacent thereto.

The materials of which our lining units may be constructed are more or less numerous, but we suggest that chilled cast iron, chrome steel, manganese steel, white or gray or hematite iron will be found satisfactory.

In view of the foregoing disclosure, it is believed that the method of assembling and putting into operation our improved lining will be obvious without further explanation.

We claim as our invention:

1. In a ball or pebble mill, a casing symmetrically arranged with respect to all planes passing through its axis and a lining of hard material composed of units held in place by wedging action, each of the said units having integral therewith an inwardly extending rib arranged longitudinally of the mill, said rib being located upon one edge of the unit the side edges of said units being formed to lie in planes through the axis of the mill when the units are assembled, means inserted between two of said units for retaining the units in close engagement with each other, said last named means being secured to the casing.

2. In a ball or pebble mill, a casing formed of two coneshaped portions arranged with their bases toward each other and a cylindrical portion interposed therebetween, a lining of hard material composed of concavo-convex units substantially triangular in shape and adapted to be held in position in the coneshaped portions of the casing by one wedge in each cone, concavo-convex lining units, substantially rectangular in shape and adapted to be held in place in the cylindrical portion of the casing by one wedge and overhanging extremities upon certain of the triangular shaped units for retaining in place the last named wedge.

3. In a ball or pebble mill, a casing formed of two coneshaped portions arranged with their bases toward each other and a cylindrical portion interposed therebetween, a lining of hard material composed of concavo-convex units substantially triangular in shape and adapted to be held in position in the coneshaped portions of the casing by one wedge in each cone, concavo-

convex lining units, substantially rectangular in shape and adapted to be held in place in the cylindrical portion of the casing by one wedge the adjacent extremities of the triangular and rectangular units being beveled to fit each other and the resulting plane of juncture overhanging the rectangular units whereby they are locked in place.

In testimony whereof we affix our signatures in presence of two witnesses.

HANS A. HANSEN.
JOSEPH M. SCHMUESER.

Witnesses:
AU LIGNBERG,
E. B. ADAMS.