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LINING FOR TUBE MILLS OR CRUSHING MILLS CONTAINING BALLS OR SIMILAR CRUSHING BODIES
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FIG 1

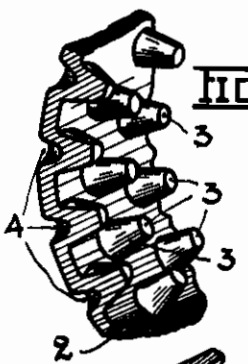


FIG 2

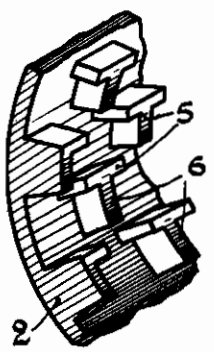


FIG 4

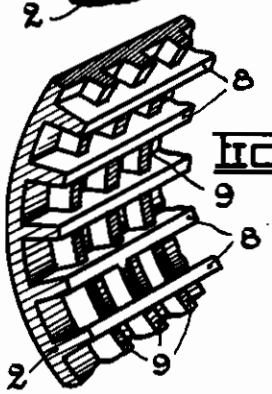


FIG 3

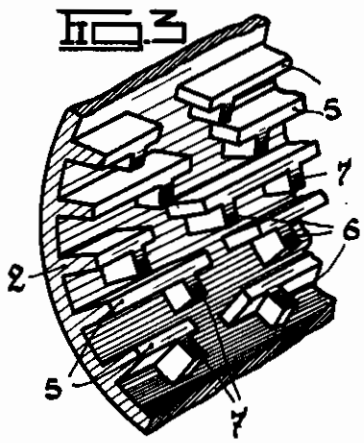
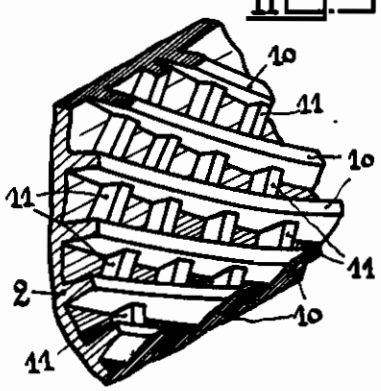


FIG 5



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LINING FOR TUBE MILLS OR CRUSHING MILLS CONTAINING BALLS OR SIMILAR CRUSHING BODIES

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This invention relates to a lining for tube mills or mills using spherical balls or similar bodies as crushing agents.

In the past, in order to protect the steel plate sheel of such crushing mills, use has been made of segmental linings providing a grooved or undulated surface. These contrivances increase the weight of lining and do not materially improve working conditions. They hardly prevent detrimental skidding of material, and they are apt to very pronounced local wear.

Finally, these segments, more commonly made of high manganese steel, are intended to acquire considerable increase in hardness, viz greater resistance to wear, under impact from the balls; this most desirable properly of high manganese steel cannot be fully made, avail of because the strength of ball impacts is deadened by crushed material skidding down to the spots where these impacts should occur.

Moreover, these undulations, as also the spaces between the shallow grooves now currently employed are pretty wide, and therefore the areas submitted to the hammering effect of impacts is very large, so that the resulting increase in hardness is not very accentuated. This, combined with pronounced skidding of material, causes wear to progress in depth more quickly than the cold-working effect of ball impacts, i. e. the pre-eminent parts of segment surface are worn away before having been sufficiently hardened by cold-working to see their wear resistance increased. Crests of undulations wear away first, so that skidding becomes more and more important.

It is the object of the present invention to avoid this by increasing the effect of cold-working and at the same time reducing skid.

According to the invention, all preeminent parts or projections on the working surface of lining segments are so shaped as to offer a reduced area, the smallest dimension of each being under the smallest dimension of balls or other crushing agents. The area submitted to the hammering effect of ball impacts being reduced, the increase in hardness is more pronounced. In a preferred form of the invention, the height of these projections is at least one-fourth part of the thickness of the bottom plate on which they are carried. These proportions, covering heights before any wear, result in a very efficient anti-skid action, the material to be crushed having very little gliding displacement, whereby wear by abrasion is greatly reduced; by way of consequence, the bottom plate thickness can also be diminished, giving a lining of lighter weight which offers the same efficiency in performance.

It is even possible to suppress completely the bottom plates of segments and fix the projections directly on inside of the mill shell.

A number of other details and particular characteristics of the invention will result from the description of the five figures of the accompanying drawings which represent, as non-limitative examples, sundry constructional forms of the invention.

Figure 1 shows a perspective view of part of a lining segment, according to the invention, portions of the plate being cut away.

Figures 2 to 5 are similar to Figure 1, illustrating various embodiments of same segment.

A segment of tube mill lining, part of which is represented on Figure 1, comprises a bottom plate 2, carrying truncated conical projections 3, whose working area is of smaller diameter than the balls.

With the object of reducing weight of segment, voids 4 are provided in bottom plate, under projection 3.

Skid of materials is greatly reduced, so that, when the mill is turning, balls and to-be-crushed material are carried upwards over a very great area before getting loose and falling from an increased height down on the bottom. Heaver blows and better production result.

In Figures 2 and 3, projections are portions of fins, such as 5, 6, 7, aligned along two perpendicular directions, several of these meeting; in Figure 3, for example, fins 5, 6 and 7 meet each other, the whole of them forming one projection.

In Figures 4 and 5, discontinuate voids exist between projections.

The segment, part of which is represented on Figure 4, shows two sets of parallel fins, one set being perpendicular to the other.

Longitudinal fins 6 are at places connected by transverse ones 9. This arrangement has a mutual bracing effect admitting of more severe hammering without undue damage.

Transverse fins 9 are less in height than longitudinal ones 8.

The segment after Figure 5 presents fins 10 askew in relation to the sides of segment, these being connected from place to place by transverse fins 11 disposed perpendicularly to 10 and slightly less in height.

The slanted disposition of fins 10 acts on the to-be-crushed material as would guide blades

and can produce a forward- or rearward-carrying effect which may combine with or against the motive action given by the slant of the axis of the tube, to accelerate or retard progress of material through the mill, as may be desired for manufacturing purposes.

According to the invention, the different projections aforesaid may be either cast together with the bottom plate, or assembled on this latter.

In the case of Figures 4 and 5, a perforated plate, consisting of fins 8 and 9 or 10 and 11, may be assembled on bottom plate 2.

The several segments herebefore described and represented are only particular constructional examples of the invention. Several constructional modifications may be used without transgressing the limits of the invention.

For instance, projections 3 may assume a cylindrical shape instead of being truncated cones.

Fins 9 and 11 must not necessarily be less in height than 8 and 10, but may be equal or even higher.

At last, fins 9 may assume a quincuncial disposition, whereas fins 11 may be in alignement. Fins or parts 5, 6, 7, 8, 9, 10 and 11 must not need be orthogonal, they may form whichever angles are found best suited for constructional or users purpose. Projections may also be attached—e. g. in form of a perforated plate—directly to mill shell, suppressing the bottom plate.

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