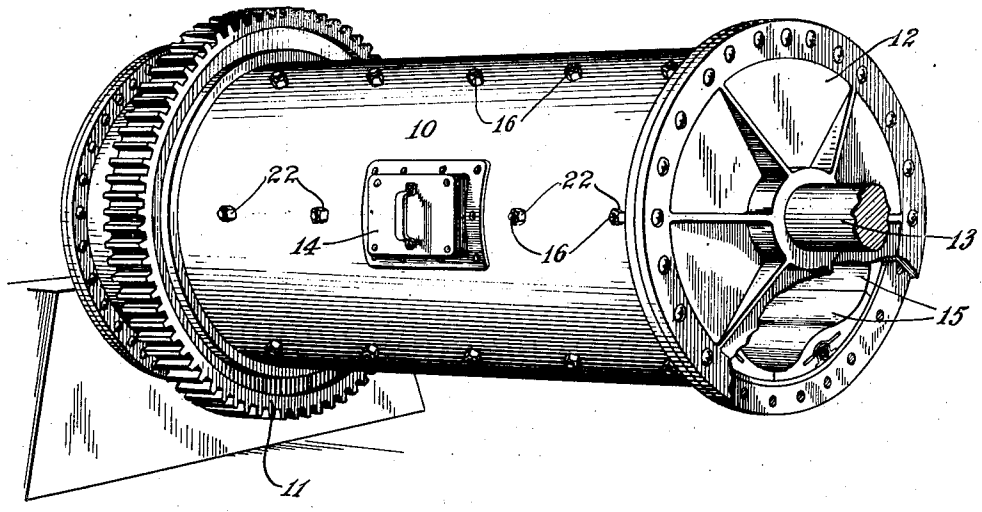
Oct. 5, 1926. 1,601,956

J. R. GAMMETER

LINING FOR ROTARY PULVERIZERS

Filed Sept. 20, 1924

FIG-1-



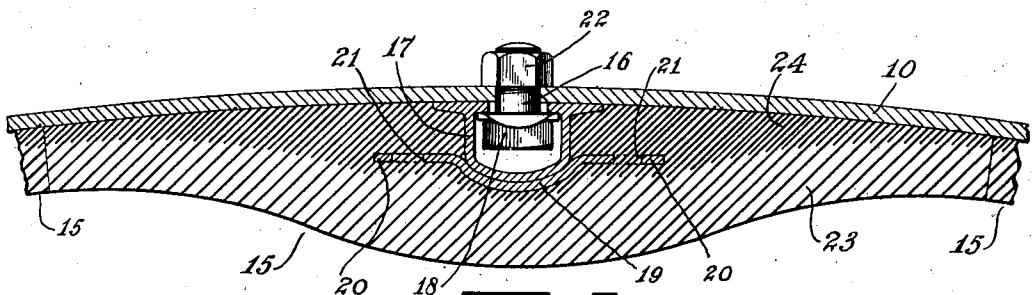


FIG-2-

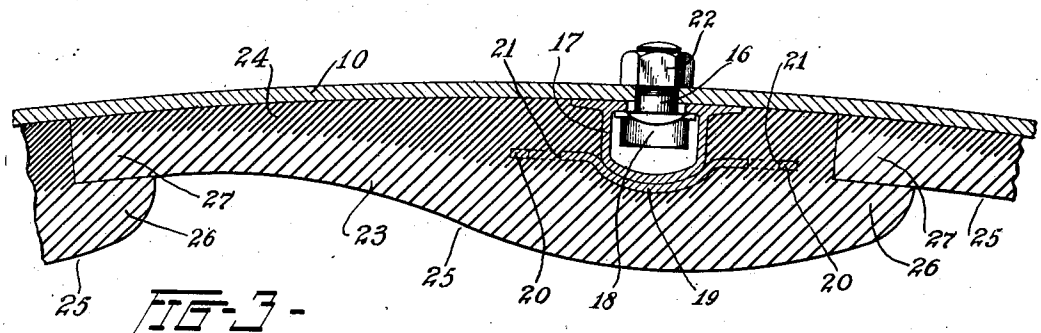


FIG-3-

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UNITED STATES PATENT OFFICE.

JOHN R. GAMMETER, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LINING FOR ROTARY PULVERIZERS.

Application filed September 20, 1924. Serial No. 738,815.

This invention relates to rotary pulverizers of the class known as "ball mills", such a pulverizer normally consisting of a rotary, cylindrical or conical receptacle or drum containing loose grinding elements in the form of steel balls, rods, hard pebbles of flint, or like material.

A primary object of my invention is to provide a continuous resilient lining for the drum of a pulverizer of the character indicated which can be readily installed and removed, and means for attaching the lining to the drum which are not exposed to the grinding wear of the loose contents. A further object is to provide a continuous, elastic, compressible, sectional lining for a pulverizer drum which shall be so constructed and attached thereto as to maintain the wearing surface portions of the lining under compression. Another object is to provide a continuous elastic lining having a gently sinuate wearing surface.

In the practice of grinding ores and other materials in rotary pulverizers it has been heretofore proposed to line the pulverizer drum with soft-vulcanized rubber, since this material is more resistant to wear than hardened steel and other metal liners commonly in use, and has a higher coefficient of friction resulting in a greater elevation and drop of the contents carried up on the interior of the rotating drum. The present invention is an improvement on such a rubber-lined mill and consists in providing a continuous elastic wearing surface composed of sections of suitable, resilient compressible material, and in providing improved means for attaching the sections to the pulverizer drum.

In the accompanying drawings, Fig. 1 is a perspective view of a cylindrical, rotary pulverizer illustrating one embodiment of my invention, parts being broken away to show the arrangement of the resilient lining sections within the cylinder; Fig. 2 is a transeverse sectional view of one of the sections of the resilient lining of Fig. 1; and Fig. 3 is a similar cross-sectional view of a modified form of lining section.

Referring more particularly to the drawings, I show a rotary pulverizer including a shell or cylinder 10, encompassed by a driving gear 11 and provided with heads or end closures 12 in which are secured the arbors 13. A door 14 is also provided for introducing into the cylinder the material to be ground and the grinding elements, and for removing the ground material.

The cylinder 10 is provided with a resilient lining which is preferably made up of sections 15 in the form of slabs of suitable elastic compressible material positioned circumferentially on the interior surface of the cylinder 10 and secured thereto by bolts 16 extending through the wall of the cylinder. Each section 15 of the lining has a longitudinally disposed, flanged metal channel 17 molded into its structure and adapted to be engaged by the heads 18 of the bolts 16. The channel 17 may have a plate 19 riveted or welded to its innermost side and extending beyond the sides of the channel to form laterally projecting wings 20. The wings 20 serve to securely anchor the channel 17 in the rubber slab and may be perforated as shown at 21 so as to be more firmly held by the material of the section.

As shown, the sections 15 are thicker over the channels 17 to provide a substantially uniform thickness of free resilient material at the inner or wearing surface thereof. These thickened portions further provide a gently sinuate inner surface for the resilient lining, a conformation which minimizes excessive abrasion of the resilient material of the sections at the portions above the channels.

It is further desirable that the sections should be molded and vulcanized with their cylinder-contacting surfaces flat, so that the portions on each side of the channel 17 shall undergo a cylindrical deformation upon being secured in place and resiliently press against the inner surface of the cylinder.

The sections may be of such length that one will extend the length of the cylinder, or they may be formed in shorter lengths. In width the sections are such that several are required to cover a circumferential zone, their total width being somewhat greater than the inner periphery of the cylinder 10, so that each section when in place will be under a considerable circumferential compression, and for this reason more highly resistant to abrasive wear.

In installing the lining, the bolts 16, are loosely placed in apertures arranged in rows along elements of the cylinder, the rows being equally spaced circumferentially and as many in number as the number of the sec-

tions. A section 15 is now slipped into the cylinder, the heads of a row of bolts riding in the channel 17. If short sections are used, a sufficient number are employed to extend the length of the cylinder. Similarly, other sections 15 are slipped in place over the bolt heads 18 until the inner surface of the cylinder is completely covered, care being taken where short lengths are used to offset the circumferential seams. The sections are then forced to place in abutting relation and the nuts 22 of the bolts 16 set, drawing the channels 17 in close contact with the cylinder 10, and holding the sections 15 firmly in place.

The sections 15 may be composed entirely of a high-grade wear-resisting compressible rubber stock, such as a pneumatic tire tread stock, or, as shown in Fig. 2, the sections 15 may be formed of a facing or wearing surface portion 23 of wear-resisting rubber stock and a backing portion 24 of semi-hard rubber stock having a considerable degree of stiffness but still somewhat elastic and sufficiently compressible to be installed in place under circumferential compression in the manner above described.

Where a section 15 of combination stock is employed, the semi-hard rubber stock of the backing portion of the section is preferably disposed to cover the plate 19 and to surround the channel 17, for the reason that stock of this character adheres more firmly to metal than does the more resilient and softer stock of the wearing surface portions 23. The stock of the backing portion preferably diminishes in thickness toward the lateral edges of the section. Facing stock of substantially uniform thickness is disposed upon the stock of the backing portion and the entire section, including the channel 17, plate 19, backing stock 24 and facing stock 23, is placed in a mold and vulcanized under heat and pressure.

Sections constructed of the two stocks just described have certain advantages. Thus, the sections are firmer and stronger and at the same time the wearing surface has all the advantages of softness, resiliency and high resistance to abrasion. The stiffer backing stock presses more firmly against the cylinder shell, insuring that the lateral edges will not leave the inner cylinder surface under severe service conditions, and also adheres more firmly to the anchoring members 17 and 19 than does softer and more resilient stock. The backing stock is a less expensive stock than the facing stock and thus a certain economy in the manufacture of such sections results.

In the modification shown in Fig. 3, the sections 25 are formed with an undercut trailing edge 26 adapted to overlie the leading edge 27 of the adjacent section. The channel 17 is preferably disposed nearer the trailing edge 26 in order to insure a tight ship-lap seam between contiguous sections. In other respects, the sections 25 are similar to the sections 15 of Figs. 1 and 2, and are applied to the cylinder in the same manner. Consequently, a further description thereof is deemed to be unnecessary for the purposes of the present application.

A lining of the character herein described is distinctly superior to linings heretofore employed in rotary pulverizers in several respects. The sections are relatively small and light and are easily detached and replaced, either for completely relining the cylinder or for replacing one or more defective or worn sections. The attaching means for the sections are strong and sturdy, as they need be for the severe service to which linings of ore mills are subjected, and are not exposed to the abrasive effects of the cylinder contents, but are spaced from the inner surface of the sections to give a substantially uniform thickness to the resilient, wearing portions thereof. The wearing surface of the lining is gently sinuate to assist in elevating the grinding elements and the material to be ground to higher levels, and at the same time presents no abrupt projections which quickly wear down. The sections are compressed into position on the cylinder not only to close effectively the seams between the sections but also to place the rubber of the sections under a circumferential compression, a condition in which its wear-resisting properties are greatly increased.

While I have shown two forms of resilient lining embodying my invention, it is obvious that other variations and modifications in the construction of the continuous resilient lining may be made without departing from the principles of this invention, and that the resilient lining herein disclosed is adapted for use in other machines than the rotary pulverizers referred to in the specification. I therefore do not purpose to limit the claims of this application otherwise than necessitated by the prior art. While a cylindrical drum is here illustrated, the invention also applies, with obvious adaptation in the shape of the liner sections, to mills of conical form.

I claim:

1. In a rotary pulverizer, in combination, a shell, a lining of resilient flexible material for said shell, and a rigid means embedded in the material of the lining and not exposed to the contents of the shell for attaching the lining to the shell.

2. In a rotary pulverizer, in combination, a shell, a lining of resilient material for said shell, a plurality of longitudinally extending channels embedded in the lining and spaced from its wearing surface, and means securing the channels to the shell.

3. In a rotary pulverizer, in combination,

a shell, a resilient lining therefor having a wearing surface sinuate in contour and an outer surface circular in contour in planes normal to the shell axis, and means embedded in the thick portions of said lining and not exposed to the contents of the shell for securing the lining to the shell.

4. In a rotary pulverizer, in combination, a cylindrical shell, and a resilient flexible lining therefor having its wearing surface gently sinuate in contour and its shell contacting surface circular in planes normal to the axis of the shell.

5. In a rotary pulverizer, the combination with a rigid shell, of a lining therefor having a continuous elastic wearing surface under circumferential compression.

6. In a rotary pulverizer, in combination, a shell, and a lining for said shell comprising sections of resilient material, said sections being of such oversize for the shell that when secured in place against the shell the resilient material of the sections is placed under compression.

7. In a rotary pulverizer, the combination, with a rigid shell, of a lining therefor having a continuous elastic wearing surface under circumferential compression, said lining comprising a plurality of longitudinal sections of elastic compressible material, the combined width of the several sections being normally greater than the inner periphery of the shell, and means for securing said sections to the shell in compressive lateral contact, whereby the wearing surface of the lining is held under circumferential compression.

8. In a rotary pulverizer, the combination, with a rigid shell, of a lining therefor having a continuous elastic wearing surface, said lining comprising a plurality of longitudinal sections of elastic, compressible vulcanized rubber, the sections being molded with the shell-contacting faces flat, and means for holding central portions of the flat-formed faces in contact with the shell, whereby the marginal portions of the sections are held tightly against the shell by reason of the cylindrical deformation of the sections.

9. In a rotary pulverizer, the combination, with a rigid shell, of a lining therefor having a continuous elastic wearing surface, said lining comprising a plurality of longitudinal sections of elastic material, each section having embedded in the shell-contacting side thereof an internally-flanged channel member and rows of bolts aligned on elements of the shell and having heads occupying the channel members for clamping said sections upon the shell, the sections being adapted to be slipped longitudinally into the shell with the heads of the bolts riding in the flanged channel members.

10. In a rotary pulverizer, the combination, with a rigid shell, of a lining therefor having a continuous, elastic, highly-resilient wearing face portion and a less-resilient, stiffer backing portion, said face and backing portions being integrally united to each other, and metallic members embedded in the backing portion for securing the lining to the shell.

11. In a rotary pulverizer, the combination, with a rigid shell, of a lining therefor having a continuous, elastic, wearing surface, said lining consisting of a plurality of sections, each section comprising a highly-resilient rubber face portion and a less-resilient, stiffer rubber backing portion, said face and backing portions being integrally united to each other by vulcanization, and an attaching member of rigid material embedded in the material of the backing portion of each section for attaching the section to the shell.

12. In a sectional, resilient lining for pulverizer shells, a removable section having an attaching means permanently embedded in the resilient material and exposed only at the outer face of the section.

13. In a sectional, resilient flexible lining for pulverizer shells, a removable section having a rigid channel member embedded in the resilient material of the section contiguous to its outer face and extending longitudinally of the section.

14. In a sectional, resilient flexible rubber lining for pulverizer shells, a removable section having a rigid channel member embedded therein at its outer surface, the inner face of the section being sinuate to provide a thickness of rubber over the channel member substantially equal to that at the edges of the section.

15. In a sectional lining for pulverizer shells, a removable section comprising a highly-resilient rubber face portion and a less-resilient stiffer rubber backing portion, said face and backing portions being integrally united to each other by vulcanization, and a channel member of rigid material embedded in the material of the backing portion for attaching the section to the shell of the pulverizer.

In witness whereof I have hereunto set my hand this 18th day of September, 1924.

JOHN R. GAMMETER.