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(54) Mill liner incorporating cushioning.

(57) A liner (3) incorporating a cushioning which is used to line the inner surface of the barrel (2) of a rod mill, ball mill or the like. It is composed of the main body of the liner (3) and a cushioning material (7) of high strength and small expansion which is attached to the back surface of the main body.

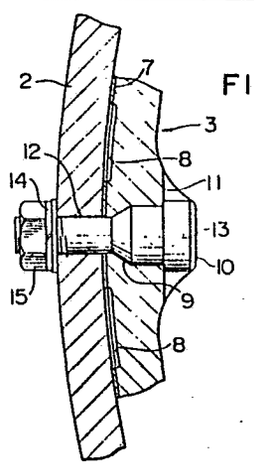

FIG. 2

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MILL LINER INCORPORATING CUSHIONING

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to improvements in a liner with which the inner surface of the barrel of a rod mill, ball mill or the like is lined, and more particularly to improvements in a cushioning material for such a liner.

DESCRIPTION OF THE RELATED ART

Conventionally, rubber is adhered to the inner surface of the barrel of a rod mill, ball mill or the like to secure the contacting surface of a liner and cushion the effect of the impact load to which the barrel is subjected.

On the other hand, when, for example in a rod mill, there is crushed and pulverized the material which subjects the rod mill to an extremely heavy load, such as slag which is produced in an ironworks, a large rod is used in order to treat large lumps of metal which are included in the slag. In such a case, since the amount of the material is very small as compared with the size of the rod mill, the rod mill is operated under very severe conditions such as a state in which an idle crushing phenomenon, namely the phenomenon of a rod directly hitting against the barrel of the rod

mill, occurs, or in which ground metal disturbs the normal motion of the rods.

Therefore, not only does the rubber become thinly stretched and broken, but also this stretching phenomenon acts in opposition to the tightening force of the liner bolts, which sometimes come loose or are broken and cannot hold the liner safely. Thus the liner bolts require retightening which is inconvenient from the viewpoint of maintenance.

SUMMARY OF THE INVENTION

Accordingly it is an object of the invention to solve the above-described problems and to provide a mill liner with a cushioning material which is free from the risk of the liner bolts coming loose or being broken even when the mill is used for the pulverization of material which subjects the mill to an extremely heavy load.

A liner with a cushioning according to the invention is characterized in that a cushioning material of high compression strength and small expansion is positioned on, more especially attached to, the back surface of the liner. By small expansion is meant small strain at the elastic limit.

A mill liner with a cushioning according to the invention, to the back surface of which a cushioning material of high compression strength and small expansion is attached, never stretches or is broken even when the cushioning is subjected to heavy impact load, and hence the liner bolts never become loose or broken.

Therefore a mill liner according to the invention is advantageous in that the liner can be retained securely, and in that maintenance is reduced because retightening of the liner bolts is unnecessary.

The above and other objects, features and advantages of the present invention will become clear from the following description of the preferred embodiments thereof, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic cross sectional view of a rod mill which is lined with a mill liner incorporating a cushion according to the invention; and

Fig. 2 is an enlarged sectional view of the main part of a mill liner incorporating a cushion according to the invention in the installed state.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of a mill liner incorporating a cushioning according to the invention will be explained with reference to the accompanying drawings. Referring first to Fig. 1 which is a schematic cross sectional view of a rod mill 1, the reference numeral 2 represents a barrel, 3 a mill liner with which the inner peripheral surface of the barrel 2 is lined, 4 an outlet port, and 5 a trunnion the inner surface of which is lined with a liner 6. To the back surface of the mill liner 3

is applied, as shown in Fig. 2, a cushioning material of high compression strength and small expansion, for example, an asbestos sheet 7. This asbestos sheet 7 is provided on the entire back surface except on upper and lower recessed portions 8 of the liner 3 and bolt holes 9. The bolt holes 9 are opened to notches 11 which are formed on both the axial ends of the lifter 10 of the mill liner 3.

A mill liner incorporating a cushioning having the above-described structure is mounted on the inner peripheral surface of the barrel 2. The bolt hole 9 of the mill liner 3 and the bolt hole 12 of the barrel are brought into alignment and a bolt 13 is inserted into these holes 12, 13 from the inside of the barrel 2 such as to penetrate through the barrel 2. The mill liner 3 is fixed by tightening a nut 15 which is placed over the threaded portion of the bolt 13 which projects on the outer side of the barrel 2 through a washer 14.

When material which places an extremely heavy load on a rod mill, such as ironwork slag, is charged into a rod mill and pulverized and ground by rolling of the rod mill, the rod mill is usually operated under very severe conditions such as a state in which idle crushing occurs, namely the phenomenon whereby a large rod employed as a pulverizing means directly strikes against the barrel of the rod mill, or in which ground metal disturbs the normal motion of the rods, because the amount of slag, which is charged

into the rod mill, is very small in comparison with the inner volume of the rod mill. However, in the rod mill 1 which has the inner surface of its barrel 2 lined with the mill liner 3 incorporating the asbestos sheet 7 according to the invention, since the asbestos sheet 7 has high compression strength and small expansion, the mill liner 3 for the barrel 2 never stretches or is broken even when subjected to a heavy impact load. Accordingly, the bolt 13 which clamps the mill liner 3 never comes loose nor is broken.

Further, a hard rubber sheet having a Shore hardness of over 60 (H_s > 60, JIS A) may be used in place of the asbestos sheet.

The cushioning material of high compression strength and small expansion for use in the invention preferably has a compression strength of 500 kg/cm^2 or more. The strain at elastic limit of the cushioning material is preferably 20 per cent or less.

While there has been described what is at present considered to be a preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended that the appended claims cover all such modifications as fall withing the true spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A liner (3) incorporating a cushioning which is used to line an inner surface of a barrel (2) of a rod mill, ball mill or the like comprising:

a liner body; and

a cushioning material (7) of high strength and small expansion which is attached to a back surface of said liner body.

2. A liner (3) incorporating a cushioning according to claim 1, in which said cushioning material is an asbestos sheet (7).

3. A liner (3) incorporating a cushioning according to claim 1, in which said cushioning material is a hard rubber sheet having a Shore hardness of over 60.

4. A liner incorporating a cushioning according to claim 1, in which said cushioning material has a compression strength of 500 kg/cm^2 or more.

5. A liner incorporating a cushioning according to claim 1, in which said cushioning material has a strain at the elastic limit of 20 per cent or less.

6. A lined mill having positioned between the mill wall and the liner a cushioning material of high compression strength and small expansion.

7. A liner incorporating a cushioning which is used to line an inner surface of a barrel of a rod mill, ball mill or the like comprising:

a liner body; and

a cushioning material of higher compression strength and lower expansion than the liner body, the cushioning material being attached to a back surface of said liner body.

FIG. 1

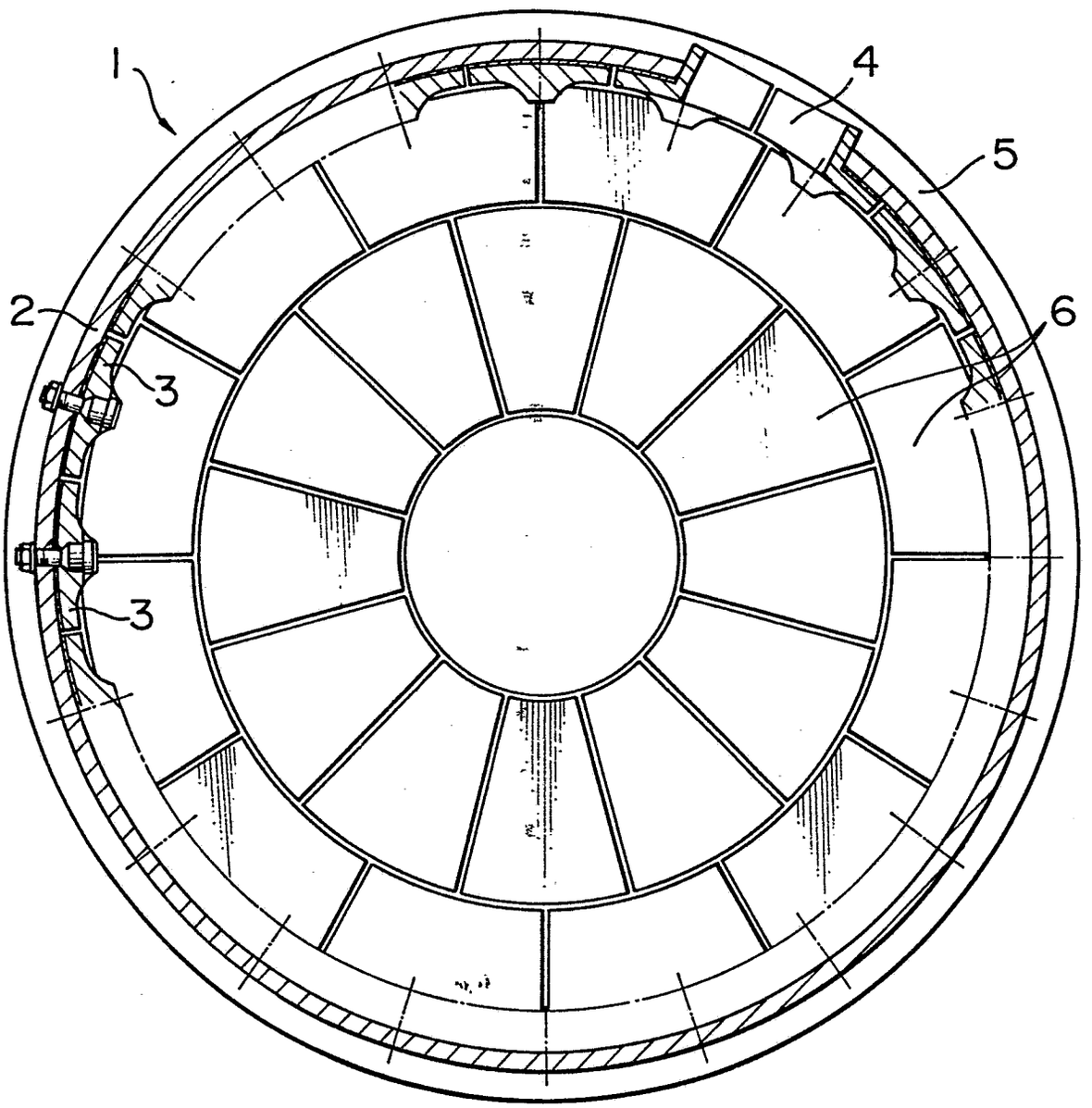

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FIG. 2