

April 14, 1942.

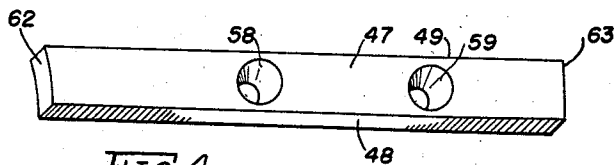
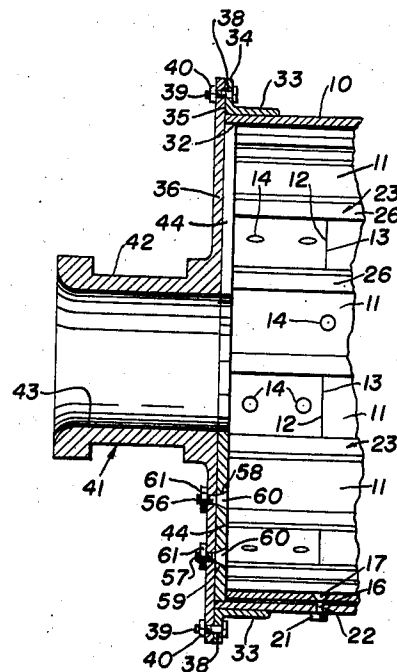
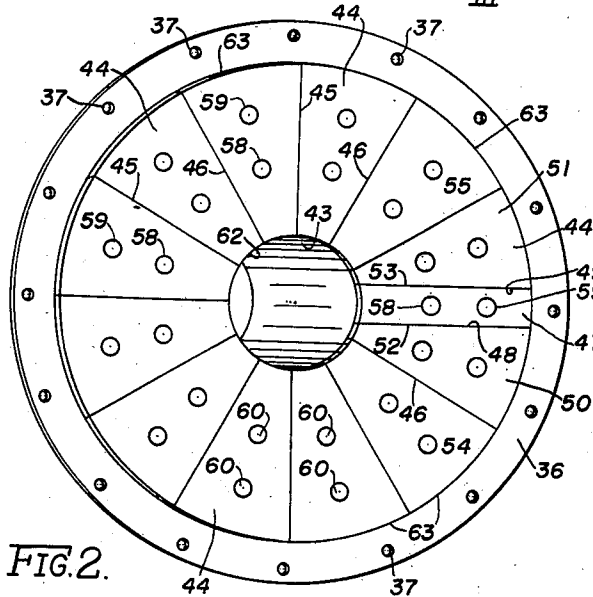
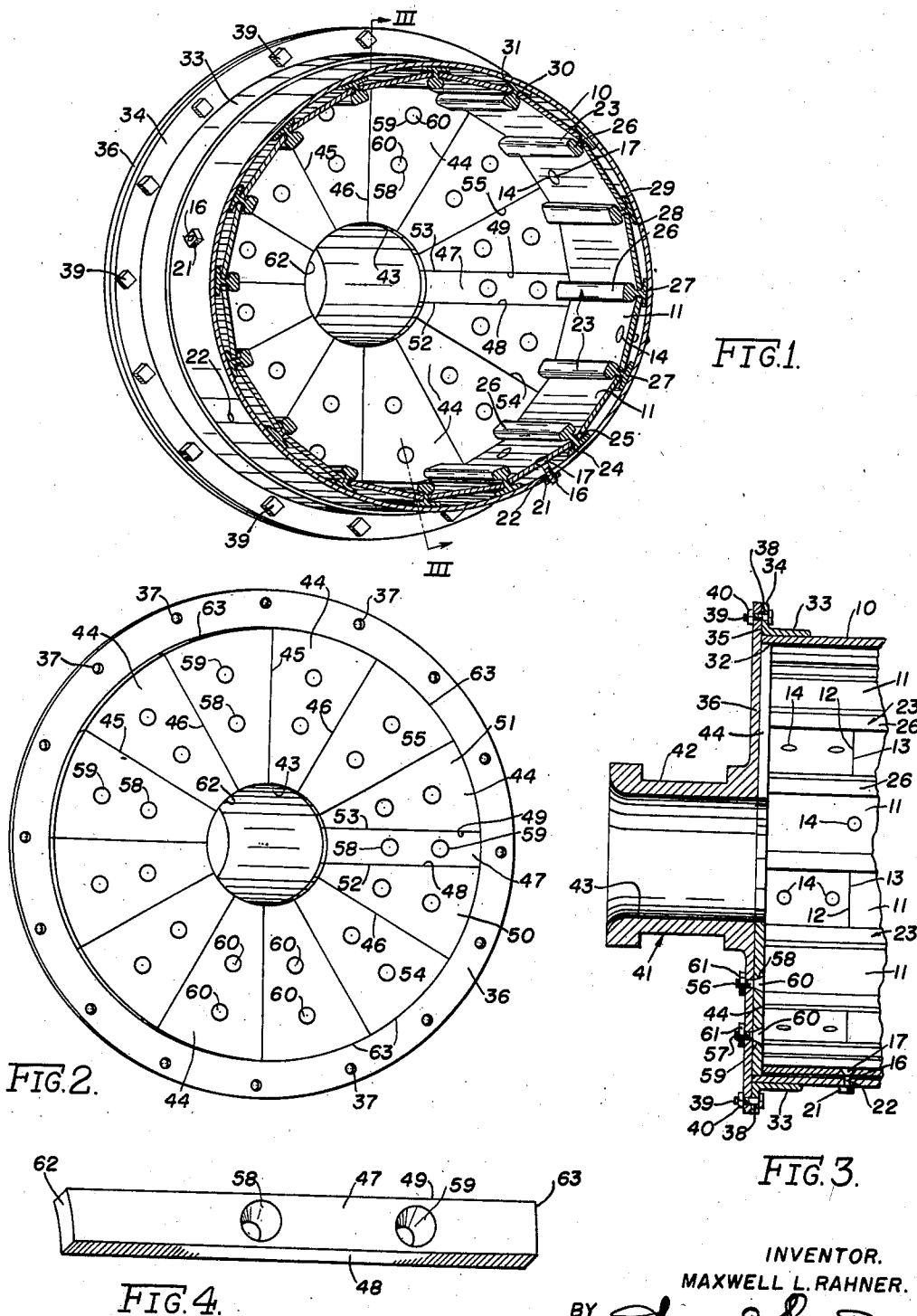
M. L. RAHNER

2,279,639

END LINER FOR GRINDING MILLS

Filed April 10, 1939

2 Sheets-Sheet 1



INVENTOR.
MAXWELL L. RAHNER.
BY *Larry P. Roberts*
ATTORNEY.

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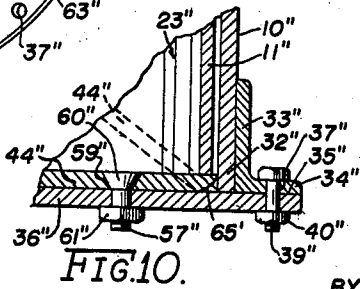
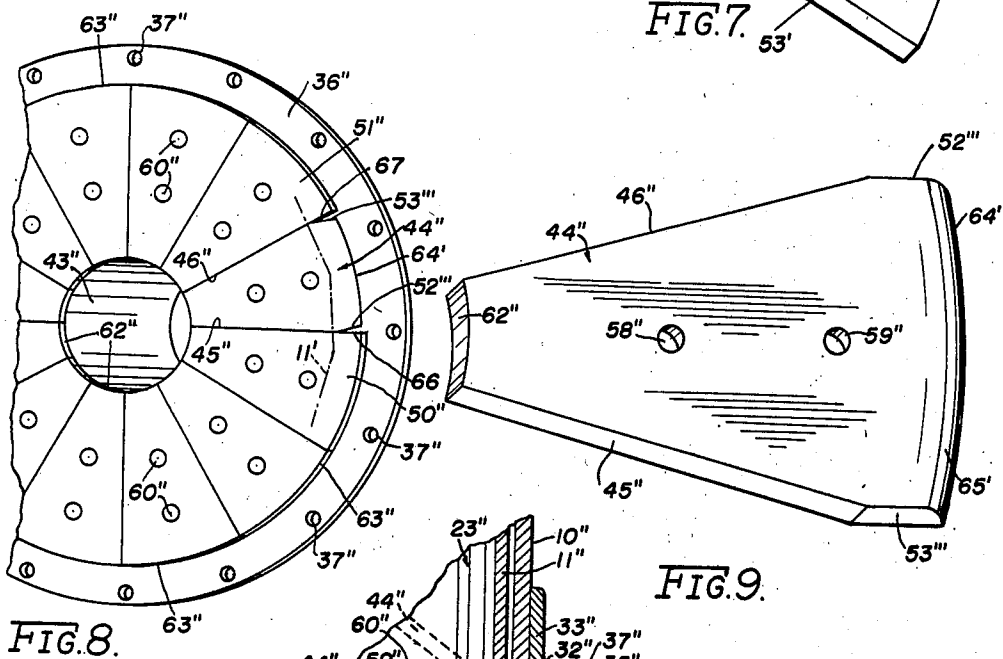
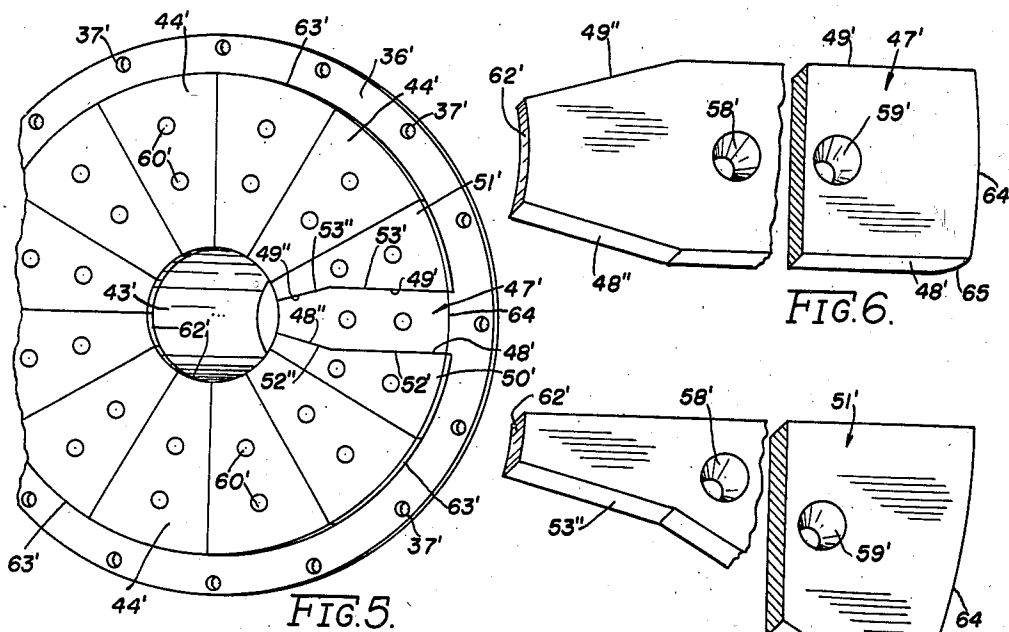
M. L. RAHNER

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END LINER FOR GRINDING MILLS

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2 Sheets-Sheet 2



INVENTOR.
MAXWELL L. RAHNER
Larry C. Huntz
ATTORNEY.

UNITED STATES PATENT OFFICE

2,279,639

END LINER FOR GRINDING MILLS

Maxwell L. Rahner, Highland Park, Ill.

Application April 10, 1939, Serial-No. 267,112

5 Claims. (Cl. 83—9)

This invention relates to grinding mills and more particularly to improved end liners therefor, although certain features thereof may be employed with equal advantage for other purposes.

It contemplates more especially the provision of improved end liners for grinding mills to enable the removal thereof with minimum expenditure of time and effort, thereby permitting speedy and unhampered access to the working mechanism and interior of the grinding mill for interior reconditioning and replacement of parts such as liners or even the end liners.

Numerous types of grinding mill liners have been proposed and for the most part these are formed from cast material or rolled plates interposed with lifting members and anchoring expedients therefor. These liners and lifting elements are subjected to severe wear and require frequent replacement. Accessibility to the interior of the grinding mill is, therefore, an important consideration and should be accomplished with minimum effort and without entailing too much time. It has been found that the provision of readily removable end liner plates solves the problem of rendering the interior of grinding mills accessible from the standpoint of simplifying housing liner replacement.

With the teachings of the present invention, the end liner plates are so arranged and constructed as to afford speedy detachment thereof without entailing the usual time, labor and effort required with the end liner sector plates of quadrant shapes. While expedients to render end liner quadrants readily removable have heretofore been proposed, such have not been adopted with any degree of success because they appreciably enhance the cost of end liners and require loosely associated end liner sections that are not entirely satisfactory.

One object of the present invention is to simplify the construction and improve end liner sections designed to render such more readily removable.

Another object is to provide end liner grinding mill segments of standard shapes with a single intermediary section of special construction to afford the ready removal thereof for gaining access to the interior of grinding mills.

Still another object is to provide grinding mill end liners of substantially standard shapes for association with a special end liner segment that is readily removable to permit remaining sections to be detached without entailing much time, labor or expense.

A further object is to provide end liner quadrants in association with an insert having parallel side portions to afford ready removal thereof and provide space to separate the remaining quadrants or radial sectors.

A still further object is to provide end liner quadrants of standard shape in conjunction with a special section shaped to afford the ready detachment thereof without appreciably increasing the expense of construction and substantially increasing the removability of the interior parts thereof.

Still a further object is to provide a plurality of end liner sections complementary to each other and an insert having the side edges or portions thereof disposed parallel to each other for permitting the ready removal thereof so that the remaining quadrants are readily detachable.

Other objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the drawings:

Figure 1 is a perspective sectional view of a grinding mill showing a portion of its interior looking toward the feeding end or open trunnion, the end liner sections being shaped to embody teachings of the present invention.

Figure 2 is a perspective view of an end plate and open mounting trunnion looking from the interior and showing end liners in operative relation therewith, certain of the end liner sections being shaped to embody features of the present invention.

Figure 3 is a fragmentary sectional view taken substantially along line III—III of Figure 1.

Figure 4 is a perspective view of an end liner insert embodying features of the present invention and shown in assembled relation in Figure 2.

Figure 5 is a fragmentary perspective view similar to Figure 2 and showing modified end liner sections embodying features of the present invention.

Figure 6 is a fragmentary perspective view of a special end liner insert shown in assembled relation in Figure 5.

Figure 7 is a fragmentary perspective view of an end liner auxiliary insert constituting a complement of the insert shown in Figure 6.

Figure 8 is a fragmentary perspective view similar to Figure 2 and showing a still further modified end liner sections embodying features of the present invention.

Figure 9 is a fragmentary perspective view of the special end liner casing shown in assembled relation in Figure 8.

Figure 10 is a fragmentary sectional view of a corner section of a grinding mill showing the internal liner in its relation with an end liner section of the type shown in Figure 9.

The structure selected for illustration comprises a substantially cylindrical shell 10 of a conventional grinding mill. The shell 10, in this instance, has its interior lined with a plurality of detachably associated flat steel rectangular plates 11. The substantially flat rectangular plates 11 extend for any desired length and width, and merely comprise a component part of the sectional liner that extends longitudinally for the length of the grinding mill shell 10. To this end, the substantially flat liner plates 11 extend longitudinally of each other so that their ends 12—13 are in adjacent contact (Figure 3) and the number depend upon the requirements of handling and the length of the particular grinding mill shell 10 together with the most efficient unit size thereof.

A plurality of frusto-conical apertures 14, in this instance two, are provided along a longitudinal median line of each plate 11 to receive anchoring fasteners such as threaded bolts 16 having correspondingly shaped and sized heads 17. The frusto-conical heads 17 of the threaded fastener bolts 16 and the apertures 14 are preferably provided with complementary inter-engaging means more particularly illustrated and described in my copending application serially numbered 256,679 and filed February 16, 1939, thereby precluding the fasteners 16 from turning as their nuts 21 are turned down tight against the shell 10 with the fastener shank 16 projecting through suitable apertures 22 therein.

The width of the plates and the number thereof that are circumferentially spaced around the internal periphery of the shell depends upon the diameter thereof and the size of the lifting elements 23 disposed therebetween. The lifting elements 23 preferably though not essentially consist of standard rails having side channels 24 and 25 that define the rail head 26 and a substantially wider base flange 27, a cross section thereof being of standard and conventional design with the channels 24—25 serving to receive the side edges 28 and 29 of the liner plates 11 disposed therebetween to define a continuous liner comprising the plates 11 and the intermediary lifting elements 23.

Turning the nuts 21 down tight exteriorly of the shell 10 will serve to retain the lifting elements 23 in a predetermined assembled relation therewith for turning with the shell 10. With this arrangement, the lifting elements 23 are secured indirectly by the liner plates 11, and this affords the convenient replacement of either or both elements 11—23 comprising the internal liner of the shell 10. It should be observed that the lower longitudinal corners 30 and 31 of the liner plates 11 will engage the base 27 so as to effectively grip the base 27 therebetween to avoid the minutely ground materials confined interiorly of the liners 11—23 to find their way to the shell 10, thereby avoiding appreciable wear and injury thereto over long periods of operating use.

It will be observed that the shell 10 has its peripheral end regions 32 provided with a reinforcing collar 33 that is welded or otherwise joined thereto to present an upstanding peripheral flange 34. The finished flat surface 35 of the collar flange 34 is in alignment with the pe-

ripheral edges 32 of the shell 10 to receive substantially circular end shell heads 36. The circumferential edge region of the heads 36 are provided with a plurality of circumferentially spaced apertures 37 that are in aligned registry with corresponding apertures 38 provided in the peripheral flange 34 of the shell 10, to receive fastener bolts 39 therethrough.

The fastener bolts 39 are provided with threaded nuts 40 that serve to securely attach the end shell heads 36 to the shell 10. As shown, the intake end head 36 is provided with an axial trunnion 41, in this instance formed integral therewith, to serve as a housing mount. To this end, the trunnion 41 is provided with an annular groove 42 that cooperates with correspondingly sized and shaped bearings associated with standards on suitable bearing brackets for journalled support of the shell 10 through the medium of their end trunnions 41. The intake trunnion 41 is provided with an enlarged axial bore 43 through which the shell 10 is charged with the desired articles to be finished therein.

The tubular trunnion 41 is sized so that the attendant can have access to the interior of the shell 10 therethrough for the purpose of manipulating a plurality of end liner plates 44 attached to the interior surface of the circular shell end head plate 36. To this end, the end liner plates 44 or plurality of sectors have their inclined side edges 45 and 46 disposed along the radii of the end head or mounting plate 36 to define complementary sectors 44. The complementary sectors 44 are sized in a sufficient number to cover the entire exposed interior surface of the trunnion plate or head 36.

Because the converging sides 45 and 46 of the sectors 44 do not permit ready tilting or linear displacement of one relative to the other in the direction of the axis of the shell 10 and trunnion 41 to permit their removal for replacement purposes, it has been found desirable to interpose therebetween an insert plate 47 having parallel sides 48 and 49 preferably though not essentially extending for the entire border between the bore 43 and the trunnion 41 and the internal diameter of the shell 10 to render such readily movable by permitting the tiltable displacement thereof relative to its parallel edges 48—49.

In consequence thereof, the next adjacent sectors 50 and 51 are shaped to serve as complements of the insert end liner plate 47 to the end that their confronting edges 52 and 53 are disposed parallel to the radial median line of the insert 47 so that the end liner plates 47—50—51 are complements of each other with their outside edges 54 and 55 conforming to and disposed along the radii to correspond with the converging sides 45—46 of the next adjacent standard end liner sectors 44.

It will be apparent, therefore, that the end liner insert 47 can be tilted or displaced radially toward the center of the trunnion 41 by the application of manual force through the bore 43 therein. After the end liner insert 47 has been removed in this manner, there is sufficient space available to circumferentially displace the remaining end liner sectors 44—50—51 so that they can be removed in their entirety for replacement after being excessively worn responsive to the extended use thereof.

It is to be noted that the end liner sectors 44—47—50—51 are attached to the end head or trunnion supporting plate 36 by means of thread-

ed bolts 56 and 57, in this instance two, that project through aligned apertures 58—59 provided in each of the end liner sectors 44 including the liner insert 47 and the complementary adjacent liner sectors 50—51. The fastener bolts 56—57 preferably have tapered heads 60 seated in correspondingly shaped apertures 58—59, in this instance two, provided in the end liner sectors 44—47—50—51. The bolt shanks project through corresponding aligned apertures 59 in the end head or trunnion supporting plate 36 to receive fasteners such as threaded nuts 61 that are exteriorly accessible for securing the end liners 44—47—50—51 in position and permit their removal.

It will be apparent, therefore, that the standard end liner sectors 44 are rendered readily removable without entailing any appreciable time, labor or expense by providing a parallel side therebetween together with complementary sectors 50—51 adjacent thereto. It is worthy of note that the inner and outer radial ends 63 and 3 of the end liner sectors 44—47—50—51 are of arcuate configuration to conform with the circumference of the trunnion bore 43 and the interior diameter of the shell 10, respectively, so that they will serve to cover and provide a full liner for the interior surface of the shell head or trunnion supporting plate 36.

In the modified embodiment shown in Figures 5 to 7 inclusive, the parts and shapes of the members are substantially identical with those described in the preferred embodiment. However, the end liner insert 47' has parallel sides 48' and 49' for a substantial portion of its length. The parallel sides 48'—49' merge with converging substantially radial edge portions 48'' and 49'' to constitute complements of correspondingly sized and shaped adjacent edges 52'—52'' and 53'—53'' provided on complementary end liner sectors 50' and 51'. The end liner sectors 50'—51' that are adjacent to the insert 47' have, their edges 52'—53' shaped to correspond with the adjacent edges 48'—48'' and 49'—49'' so that in the removal of the end liner insert 47', it is tilted to permit the converging side portions 48'—49' to be displaced from adjacent alignment with the complementary end liner sectors 50'—51' to permit withdrawal or displacement thereof toward the center along the parallel edge portions 52'—53'.

To afford the tilting of the end liner insert 47' along a sufficient arc to effect the total displacement of the converging edge portions 48'—49' thereof, a circumferential outer edge 64 of the end liner insert 47' is arcuately curved or bevelled as at 65 to provide the necessary clearance during the tilting displacement thereof to avoid contact or abut with the interior surface of the circular head or trunnion supporting plate 36 (Figure 10).

In a further modified embodiment shown in Figures 8 to 10, one of the standard liner sectors 44'' is cut off proximate to their circumferential outer ends 64' to provide short parallel sides 52''' and 53''' that are shorter or no greater in length than the shortest distance between the interior of the shell 10 and its confronting liner plates 11 (Figure 1). Consequently, the dust and pulverized substances removed from the articles during the grinding thereof responsive to the rotation of the shell 10, will not become packed between the shell 10 and its liner plates 11, even though comparatively small corner openings 66

and 67 are presented by cutting off the outer corners of one of the end liner sectors 44''.

The removal of the outer corners presented by the comparatively short parallel sides 52'''—53''' (Figure 9) in conjunction with the bevelled outer edge 65' will permit the pivoting of the insert liner sectors 44'' along the parallel edge portions 52'''—53''' thereof to assume a position shown in dotted outline in Figure 10. The bevelled outer circumferential surface 65' provides clearance relative to the internal surface of the shell head or trunnion supporting plate 36''. It will be appreciated, therefore, that after the end liner sectors 44'' with its parallel outer edges 52'''—53''' have been pivoted to a position affording clearance for the comparatively longer converging radial edge portions 45'' and 46'' thereof, the insert segments 44'' can be displaced inwardly in the direction of the axis of the shell 10 to effect its complete removal.

The remaining liner sectors 44'' are of standard design conforming to the end liner segments or sectors 44 (Figure 1) and 44' (Figure 5). This construction avoids necessity of having special complementary liner sectors adjacent to the specially constructed insert 47'' (Figure 9) and still provides the desired tiltable freedom for ready removal comparing favorably with the shapes of the inserts 47 (Figures 1 to 4) and 47' (Figures 5 and 6).

With the teachings of the invention described herein, it will be apparent that a very simple end liner expedient has been provided to permit the ready removal thereof for replacement and to provide space adjacent the heads 36 so that the shell liners 11 can also be replaced with ease and without entailing extended time and labor heretofore required to perform these operations. Various changes may be made in the embodiment of the invention herein specifically described without departing from the invention or sacrificing any of the advantages or features thereof, and nothing herein shall be construed as limitations upon the invention, its concept or structural embodiment as to the whole or any part thereof except as defined in the appended claims.

I claim:

1. In a grinding mill, the combination with a cylindrical housing, of end head members detachably connected to said housing, means projecting from said end head members to rotatively support said housing, non-tiltable complementary edge contacting end liner sectors detachably associated with the interior surface of said end head members to define a continuous liner surface, a tiltable liner insert between two end liner sectors and having parallel edges extending for the entire length thereof, and non-tiltable liner sectors adjacent said tiltable liner insert and non-tiltable end liner sectors, said adjacent non-tiltable liner sectors having edges complementary to the edges of said non-tiltable liner sectors and said tiltable liner insert for facilitating liner removal.

2. In a grinding mill, the combination with a cylindrical housing; of a head closing an end thereof; means projecting from said end head to rotatively support said housing; a plurality of complementary shaped end liner sectors extending radially between said housing and said supporting means and disposed in intimate edge contact with each other; a tiltable liner insert member interposed between adjacent sectors and

in edge contact therewith, the side edges of said tiltable insert member and the proximate edges of said adjacent sectors having parallel portions, whereby said insert member is adapted to be tilted upon an end edge as a fulcrum, said sectors and said insert member being of corresponding full length commensurate with the effective radii of said end enclosing head to define a continuous imperforate and unbroken end liner surface enclosure for said head to preclude the entrance of substances therebetween, said sectors and said insert member being incapable of radial movement prior to tilting said liner insert for removal thereof and adjacent sectors; and means detachably anchoring said plurality of sectors and said insert member in the positions named.

3. In a grinding mill, the combination with a cylindrical housing; of a head closing an end thereof; means projecting from said end head to rotatively support said housing; a plurality of complementary shaped end liner sectors extending radially between said housing and said supporting means and disposed in intimate edge contact with each other; a tiltable liner insert member having substantial width interposed between adjacent spaced sectors and in edge contact therewith throughout their lengths, the side edges of said tiltable insert member and the proximate edges of said adjacent sectors having parallel portions extending inward from their respective outer ends, whereby said insert member is adapted to be tilted upon an end edge as a fulcrum, said sectors and said insert member being of corresponding full length commensurate with the effective radii of said end enclosing head to define a continuous imperforate and unbroken end liner surface enclosure for said head to preclude the entrance of substances therebetween, said sectors and said insert member being incapable of radial movement prior to tilting said liner insert for removal thereof and adjacent sectors; and means detachably anchoring said plurality of sectors and said insert member in the positions named.

4. In a grinding mill, the combination with a cylindrical housing; of a head closing an end thereof; means projecting from said end head to rotatively support said housing; a plurality of complementary shaped end liner sectors extending radially between said housing and said supporting means and disposed in intimate edge contact with each other; a pair of said sectors

spaced from each other a substantial distance throughout their lengths; a tiltable liner insert member interposed between said spaced sectors in edge contact therewith, the side edges of said tiltable insert member and the proximate edges of said spaced sectors having parallel portions, whereby said insert member is adapted to be tilted upon an end edge as a fulcrum, said sectors and said insert member being of corresponding full length commensurate with the effective radii of said end enclosing head to define a continuous imperforate and unbroken end liner surface enclosure for said head to preclude the entrance of substances therebetween, said sectors and said insert member being incapable of radial movement prior to tilting said liner insert for removal thereof and adjacent sectors; and means detachably anchoring said plurality of sectors and said insert member in the positions named.

5. In a grinding mill, the combination with a cylindrical housing; of a head closing an end thereof; means projecting from said end head to rotatively support said housing; a plurality of complementary shaped end liner sectors extending radially between said housing and said supporting means and disposed in intimate edge contact with each other; a pair of said sectors spaced from each other a substantial distance throughout their lengths; a tiltable liner insert member having substantial width interposed between said spaced sectors in edge contact therewith throughout their lengths, the side edges of said tiltable insert member and the proximate edges of said spaced sectors having parallel portions extending inward from their respective outer ends, the outer edge of said insert member provided with a bevel whereby said insert member is adapted to be tilted upon its outer edge as a fulcrum, said sectors and said insert member being of corresponding full length commensurate with the effective radii of said end enclosing head to define a continuous imperforate and unbroken end liner surface enclosure for said head to preclude the entrance of substance therebetween, said sectors and said insert member being incapable of radial movement prior to tilting said liner insert for removal thereof and adjacent sectors; and means detachably anchoring said plurality of sectors and said insert member in the positions named.

MAXWELL L. RAHNER.