

[54] **BOWL-LINER FOR GYRATORY ROCK CRUSHER**

[75] Inventor: **Charles M. Hendrickson,**
Vancouver, Wash.

[73] Assignee: **Columbia Steel Casting Co., Inc.,**
Portland, Oreg.

[22] Filed: **Apr. 27, 1973**

[21] Appl. No.: **355,275**

[52] U.S. Cl. **241/207, 29/526, 85/9 R,**
241/285 R

[51] Int. Cl. **B02c 2/04**

[58] Field of Search 241/207-216,
241/285 R, 299; 85/1 H, 9 R; 269/91,
93; 29/526

[56] **References Cited**

UNITED STATES PATENTS

376,951	1/1888	Hain.....	85/9 R
3,372,881	3/1968	Winter.....	241/208
3,417,932	12/1968	Patterson.....	241/216 X
3,506,204	4/1970	Kemnitz.....	241/285 R X
3,539,119	11/1970	Cook.....	241/215
3,599,883	8/1971	Pollak.....	241/213

Primary Examiner—Granville Y. Custer, Jr.

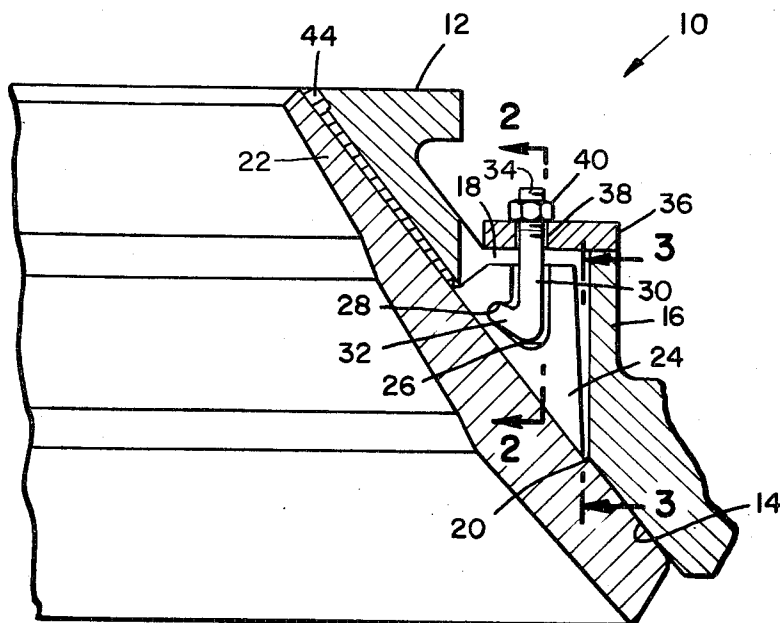
Assistant Examiner—Howard N. Goldberg

Attorney, Agent, or Firm—Owen, Wickersham & Erickson

[57] **ABSTRACT**

A bowl-liner is secured to the bowl-frame of a gyratory rock crusher by J-bolts. The bowl-frame has a number of open ended bosses circumferentially spaced about the vertical axis of the bowl-frame. The bowl-liner is positioned beneath the bowl-frame and has upwardly projecting receptacles which fit within the bosses. The receptacles are formed integrally on the upper surface of the bowl-liner, and each receptacle has a J-shaped opening in one side. Each opening has an upper bearing seat which is inclined from the horizontal. A J-shaped bolt fits within each opening, and a threaded end of the bolt extends above the top end of the bowl frame boss. A retainer plate on the top of the boss has a hole which fits over the threaded end, and a nut is turned down against the retainer plate to pull the lower end of the J-bolt against the bearing seat in the receptacle. This produces tightening forces on the bowl-liner at vector angles which are inclined outwardly from the vertical axis of the bowl frame to distribute pressures evenly over the bowl-liner.

7 Claims, 3 Drawing Figures



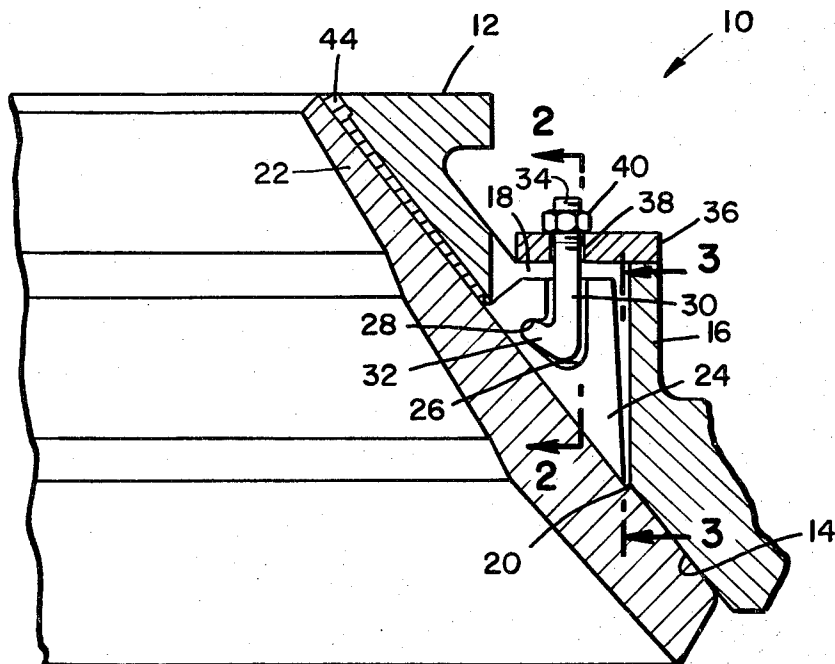


FIG_1

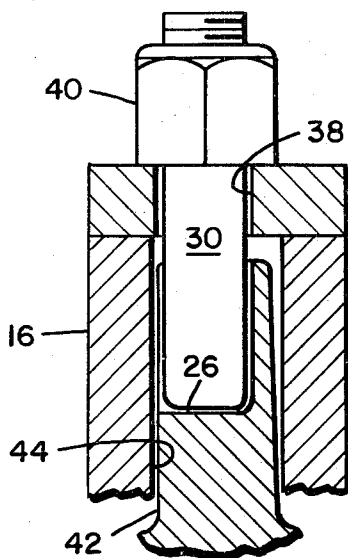


FIG_2

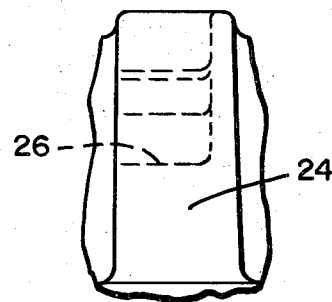


FIG_3

BOWL-LINER FOR GYRATORY ROCK CRUSHER

BACKGROUND OF THE INVENTION

This invention relates to gyratory rock crushers and in particular to a mounting arrangement for securing a bowl-liner to the bowl-frame of a gyratory rock crusher.

A gyratory rock crusher has a bowl-liner which is detachably connected to the bowl-frame so that the bowl-liner can be removed for inspection or replacement after the bowl-liner has been subjected to a certain amount of wear. Prior art methods of securing the bowl-liner to the bowl-frame have suffered from a tendency of the bowl-liner to come loose during crushing operation. The reason for this was primarily a result of supplying only vertical force in seating the bowl-liner.

It is a primary object of the present invention to overcome the problems of the prior art by applying a component of a tightening force at an angle which, when combined with the vertical tightening force, creates a vector angle and distributes pressure more evenly over the held bowl-liner.

It is a related object of the present invention to construct a J-bolt connector arrangement which incorporates a cast receptacle preloaded against the bowl-frame boss against the direction of rotation to ensure minimal slippage while the crusher is in operation.

It is a further object of the present invention to construct a J-bolt connector arrangement which retains accuracy in tightening adjustment but which can be accomplished with ordinary hand tools available at most all crushing plant sites.

SUMMARY OF THE INVENTION

The bowl-frame and J-bolt connecting arrangement of the present invention is constructed for a gyratory rock crusher of the kind in which the bowl-frame has a plurality of open-ended bosses extending upwardly from the bowl-frame and spaced circumferentially about the vertical axis of the bowl-frame. The bowl-liner is positioned beneath the bowl-frame and has upwardly projecting receptacles formed integrally on an upper surface of the bowl-liner. The receptacles fit in the bowl-frame bosses. Each receptacle has a J-shaped opening in one side with an upper bearing seat inclined from the horizontal. A J-shaped bolt fits within each J-shaped opening and has an upturned lower end which engages the bearing seat of the receptacle. The upper end of the J-bolt has a threaded shank which extends upwardly above the top of a related boss when the bowl-liner is placed up against the bowl-frame with the receptacles within the bosses. A retainer plate has a hole which fits over the threaded end of the J-bolt. The retainer plate is placed on top of a boss, and a heavy self-locking nut is threaded onto the J-bolt and tightened down against the retainer plate to pull the upturned end of the J-bolt against the related receptacle bearing seat. This produces tightening forces on the bowl-liner at vector angles inclined outwardly from the vertical axis of the bowl-frame. The angular forces on the bearing seats distribute pressures evenly over the bowl-liner. Each receptacle is preloaded against the direction of rotation of the bowl-frame boss to ensure minimal slippage while the crusher is in operation. This plus the greater seat pressure provided by the J-bolt and bearing seat effectively prevents the possibility of

the bowl-liner coming loose during the crusher's operation.

Bowl-liner and J-bolt structural features as described above and effective to function in the ways described above constitute further, specific objects of the present invention.

Other objects, advantages and features of my invention will become apparent from the following detailed description of one preferred embodiment taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial, vertical, radial section through a crusher illustrating one embodiment of the invention;

FIG. 2 is a fragmentary, enlarged view taken along the line and in the direction indicated by the arrows 2—2 in FIG. 1; and

FIG. 3 is a fragmentary, enlarged view taken along the line and in the direction indicated by the arrows 3—3 in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A bowl-liner and J-bolt connecting means constructed in accordance with one embodiment of the present invention are indicated generally by the reference numeral 10 in FIG. 1.

FIG. 1 illustrates parts of a gyratory rock crusher structure. The details of the crusher as a whole do not form a part of the present invention. The present invention is an improvement on structure like that shown in U.S. Pat. No. 3,281,083 to Johnson and issued Oct. 25, 1966, or that shown in U.S. Pat. No. 3,371,875 to Gasparac et al and issued Mar. 5, 1968.

The type of crusher with which the present invention is used includes a circumferential main frame (not illustrated), a tilting ring mounted on the upper edge of the main frame (to provide an overload release) and a bowl adjustable on the tilting ring.

The bowl includes a bowl-frame 12 as illustrated in FIG. 1. The bowl-frame 12 has a generally conically extending lower surface 14. The bowl-frame 12 also has a plurality of upwardly extending bosses 16 which are circumferentially spaced about the vertical axis of the bowl-frame. Each boss has an open upper end 18 and an open lower end 20.

A bowl-liner 22 is positioned beneath the bowl-frame 12. The bowl-liner 22 is a generally conically shaped annular member as illustrated.

The bowl-liner 22 has a plurality of receptacles 24 formed integrally on the upper outer surface of the bowl-liner. The bowl-liner is made by casting, and the receptacles 24 are cast integrally with the bowl-liner. One receptacle 24 fits within each boss 16. In a preferred form of the present invention there are a plurality of such bosses 16 and a corresponding number of receptacles 24 spaced evenly about the circumferences of the bowl-frame 12 and the bowl-liner 22.

Each receptacle 24 has a J-shaped opening 26 formed in one side of the receptacle. Each J-shaped opening 26 has an upper bearing seat 28 which is inclined at an angle from the horizontal as illustrated in FIG. 1.

A J-bolt 30 is positioned within each opening 26. The upturned end 32 of the J-bolt engages the bearing seat 28. The shank of the J-bolt extends upwardly beyond

the top of the boss 16 and has a threaded upper end 34.

A retainer plate 36 has an off-center opening 38 for the threaded end 34. The retainer plate 36 fits over the open upper end of the boss 16.

A heavy duty, self-locking nut 40 is threaded on the end 34 and engages the top of the retainer plate 36 to pull the upturned end 32 of the J-bolt tight against the bearing seat 28. This produces an angular force perpendicular to the bearing seat 28. This angular force, in combination with the vertical tightening force, creates a vector angle which distributes pressure evenly over the bowl-liner 22. The nuts 40 are selectively tightened about the periphery of the bowl-liner 22 to secure the bowl-liner evenly to the bowl frame 12.

As best illustrated in FIG. 2 the receptacle 24 has a side 42 which is positioned against the opposite surface 44 of the bowl-frame boss 16 against the direction of rotation to ensure minimal slippage while the crusher is in operation. The side 42 is pre-loaded against the surface 44 by placing a pry bar between one receptacle 24 and a related boss 16 and prying the receptacle 24 to the left as viewed in FIG. 2 to thereby force all the receptacle sides 42 against the related boss surfaces 44. This is done before the retainer plate 38 and nut 40 are installed on the receptacle being pryed. This preloading with the pry bar applies pressure in the direction of rotation of the crusher's action. The pre-loading negates the possibility of the bowl-liner slipping or rotating in the bowl and allowing the filler or backing material 44 to come loose. This pre-loading function is made possible because of the boss receptacle and J-bolt construction of the present invention. This arrangement, plus greater seat pressure which is exerted by the J-bolt and bearing seat construction described above, connects the bowl-liner 22 more securely than was possible with the prior art constructions and is effective to prevent the possibility of the bowl-liner coming loose during the crusher's operation.

The J-bolt is a forged, high alloy, high strength bolt.

The steel retainer plate 36 with the off-center hole has sufficient sectional thickness to resist deflection.

In the assembly of the construction shown in the drawings and described above, the J-bolts are inserted into the cast-in receptacles on the bowl-liner. The bowl-liner is positioned into the bowl-frame. The threaded portion of the J-bolt is exposed through the openings at the top of the bosses. The retainer plate with the off-center hole is then placed over the J-bolt and seated on the boss surrounding the opening in the bowl frame. The heavy duty, self-locking nut is then threaded onto the J-bolt and tightened accordingly. This operation is repeated about the periphery of the equipment until the bowl-liner is secured evenly.

As illustrated in FIG. 1 a filler 44 can be poured into the space between the upper portion of the bowl-liner 22 and the bowl-frame 12 to form a good bearing material between these portions of the bowl-liner and bowl-frame.

The J-bolt connecting assembly of the present invention is inexpensive. It is simple in design principle and customer use. It is more dependable than prior art constructions. The assembly is easy to install while still retaining accuracy in tightening adjustment. It can be accomplished with ordinary hand tools available at most

all crushing plant sites, and it can be installed with an adjustable end wrench, if necessary.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A gyratory rock crusher including, a bowl-frame having a vertical axis, a bowl-liner and J-bolt connecting means connecting the bowl-liner to the bowl-frame, said bowl-frame having a plurality of open-ended, upwardly extending bosses circumferentially spaced about the vertical axis of the bowl-frame, said bowl-liner being positioned beneath the bowl-frame and having a plurality of upwardly projecting receptacles formed integrally on an upper surface of the bowl-liner with each receptacle disposed within a related bowl-frame boss, each receptacle having a J-shaped opening in one side and each opening having an upper bearing seat inclined from the horizontal, a J-shaped bolt within each J-shaped opening and having an upturned end engaged with the bearing seat and a threaded shank which extends upwardly above the top of the related boss, a retainer plate having a hole for the threaded end and positioned over the top of the bowl-frame boss, a nut on each threaded end and engaged with a related retainer plate to pull the upturned end of each J-shaped bolt against the related receptacle bearing seat to produce tightening forces on the bowl-liner at vector angles inclined outwardly from said vertical axis.

2. The invention defined in claim 1 wherein the bowl-liner is annular shaped and has four equally spaced receptacles.

3. The invention defined in claim 2 wherein the angular forces on the bearing seats distribute pressures evenly over the bowl-liner.

4. The invention defined in claim 1 wherein the fit between a receptacle and a related boss provides positive anti-rotational securement of the bowl-liner to the bowl-frame.

5. A bowl-liner and J-bolt connecting means for connecting the bowl-liner to the bowl-frame of a gyratory rock crusher, said bowl-liner having a plurality of upwardly projecting receptacles formed integrally on an upper surface of the bowl-liner for insertion in open ended bowl-frame bosses, each receptacle having a J-shaped opening in one side with an upper bearing seat inclined from the horizontal, a J-shaped bolt for each opening having an upturned end engagable with the bearing seat and a threaded shank which extends upwardly above the top of the receptacle, a retainer plate having a hole for the threaded end and positionable over one end of a bowl-frame boss, and a nut for tightening the threaded end to produce tightening forces at vector angles inclined outwardly from the vertical axis of bowl-liner by pulling the upturned ends of the J-shaped bolts against the bearing seats.

6. A method of securing a bowl-liner to a bowl-frame in a gyratory rock crusher, said method comprising, forming a bowl-liner with a plurality of upwardly projecting receptacles each having an opening shaped to receive an upturned end of a J-shaped bolt, each opening including an upper bearing seat inclined from the horizontal, placing the lower part of a J-shaped bolt in

5

each receptacle with a threaded upper end of the bolt extending upwardly above the receptacle, positioning the liner against the lower surface of the bowl-frame with each receptacle aligned within a related bowl-frame boss and with the threaded ends of the bolts projecting upwardly through openings in the tops of the bosses, placing a retainer plate having a hole for the threaded end over each opening in each boss, and turning a nut down on each threaded end and against a re-

6

lated retainer plate to pull the upturned end of each J-shaped bolt against a related receptacle bearing seat to produce tightening forces on the bowl-liner at vector angles inclined outwardly from the vertical axis of the bowl-liner.

7. The invention defined in claim 1 wherein the bowl-liner is annular shaped and has a plurality of equally spaced receptacles.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65