

Oct. 29, 1963

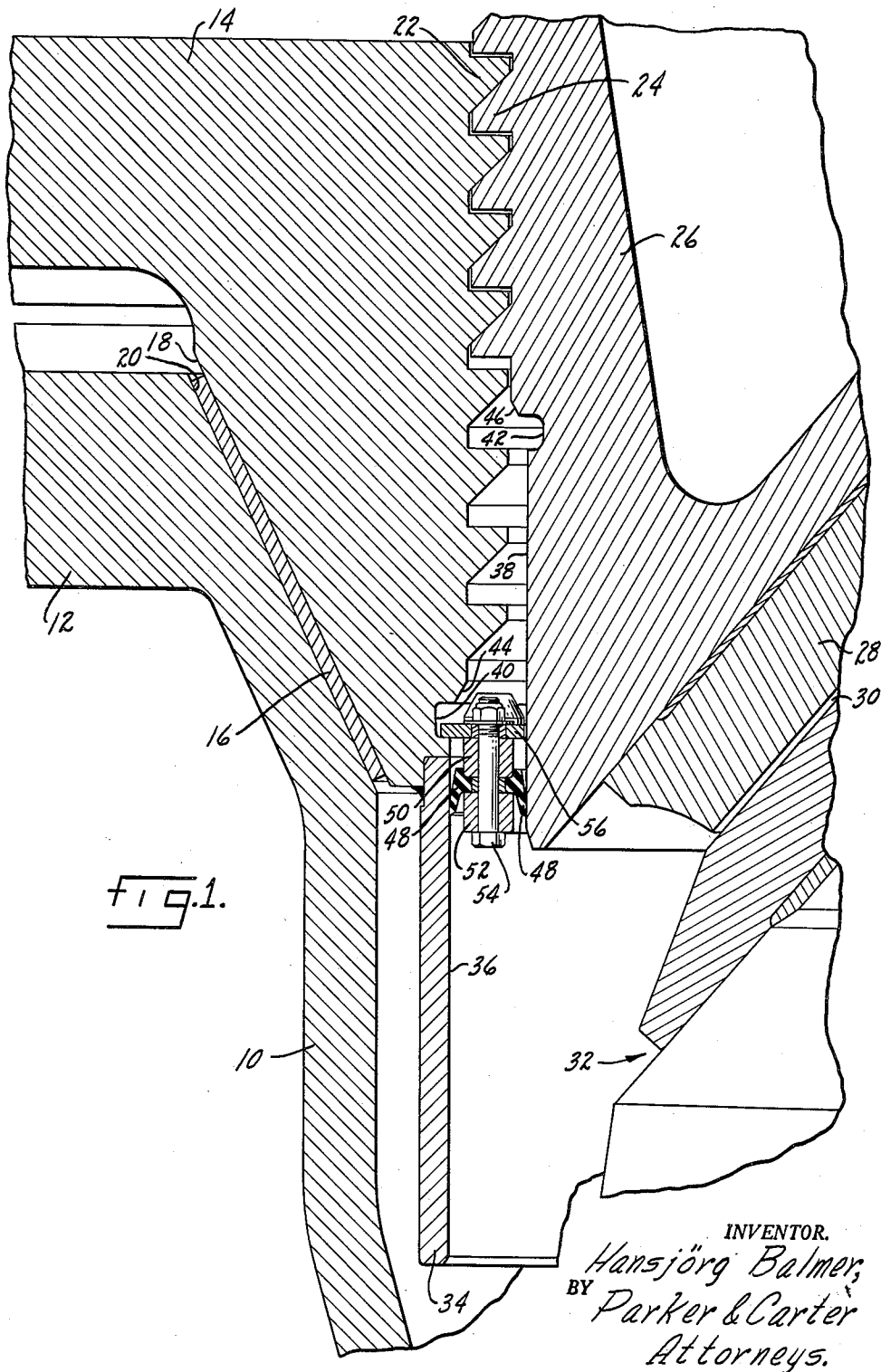
H. BALMER

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SEAL FOR GYRATORY CRUSHER OR THE LIKE

Filed April 5, 1961

2 Sheets-Sheet 1



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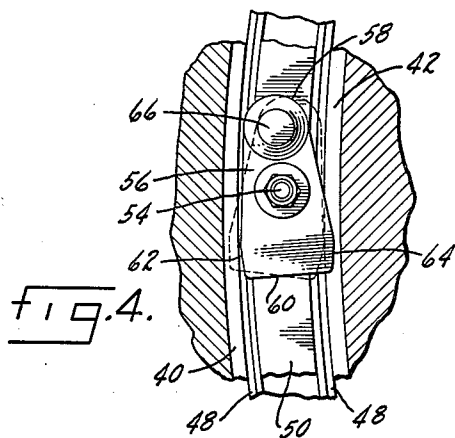
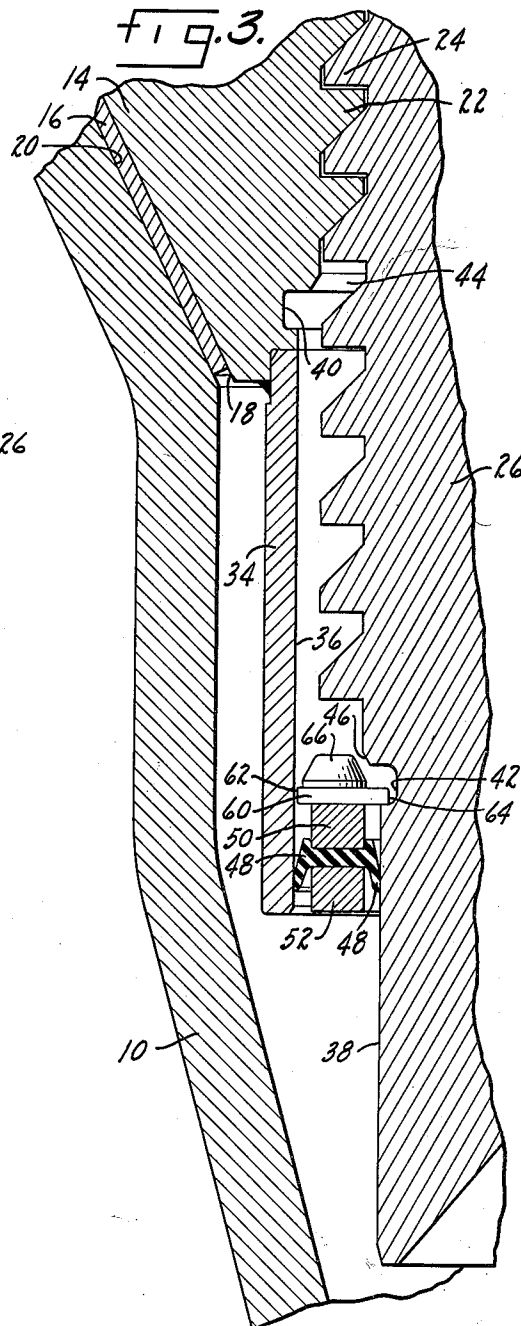
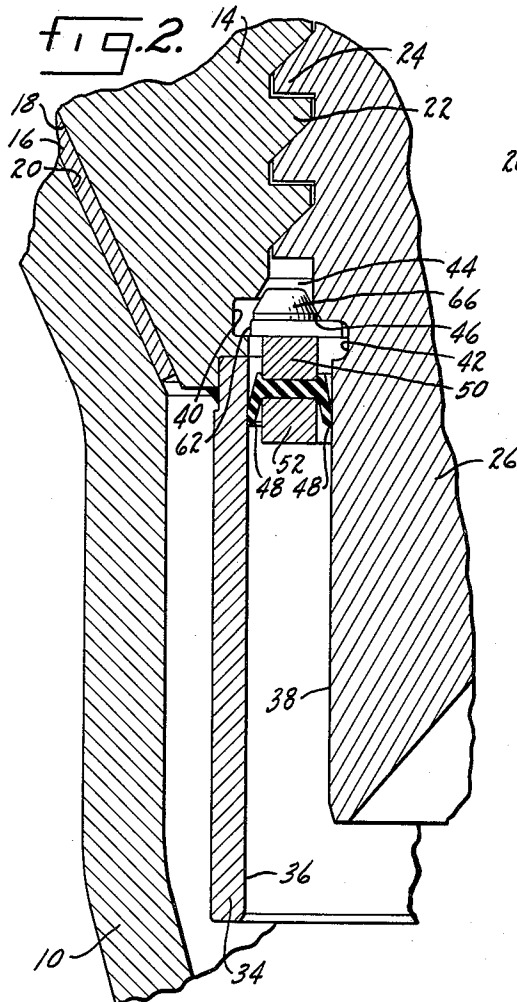
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2 Sheets-Sheet 2



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SEAL FOR GYRATORY CRUSHER OR THE LIKE
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12 Claims. (Cl. 241—216)

This invention relates to a seal for gyratory crushers or the like and in particular to a means for providing a seal to prevent dust and other particles from the crushing cavity from entering the threads between the bowl and adjustment ring.

Another purpose is a seal of the type described which is effective to reduce the overall height of the crusher.

Another purpose is a seal of the type described which is movable between the sealing surfaces on the bowl and adjustment ring and is fixed to the bowl during a portion of bowl movement and fixed to the adjustment ring during the remaining portion of bowl movement.

Another purpose is a seal for gyratory crushers of the type described which effects a continuous seal between the bowl and adjustment ring regardless of the position of the bowl.

Other purposes will appear in the ensuing specification, drawings and claims.

The invention is illustrated diagrammatically in the following drawings wherein:

FIGURE 1 is a diagrammatic illustration of a portion of a gyratory crusher showing the sealing means of this invention in one position;

FIGURE 2 is a view, similar to FIGURE 1, showing the bowl in a second position and the seal ring in the same position as FIGURE 1;

FIGURE 3 is a view similar to FIGURES 1 and 2 showing the bowl in a still further position and the seal ring in a second position; and

FIGURE 4 is a top plan view showing the levers used for moving the seal ring into and out of engagement with the bowl and adjustment ring.

This invention is directed to a means for effecting a seal between the bowl of a gyratory crusher and the adjustment ring to prevent dust, dirt and other particles from getting into the threads between these members. Such particles can easily score or damage these threads to such an extent that they must be refinished. A further purpose of the invention is to reduce the total height of the crusher and hence to increase the head room above the top of the crusher.

In seals of this general type, it has been the general practice to provide a skirt that extended downwardly from the adjustment ring and had a seal at its bottom. This seal had to be positioned such that it was always in contact with the bowl regardless of whether the bowl was at its lowest position or at its highest position. In this connection, normally the bowl of a crusher is gradually dropped down as the crushing surface of the bowl liner is worn away so that the size of the crushing cavity can be controlled. When the liner is almost completely worn, it is replaced. A further limitation on the extent that the bowl may be dropped is that there must always be a certain number or amount of engagement between the threads, for example two or three threads, between the bowl and adjustment ring. The present invention is designed to overcome many of the disadvantages of previous seals of this general type.

Turning to the drawings, in FIGURE 1 the crusher main frame is designated at 10 and has a flange 12 along its upper edge. The flange 12 supports an adjustment ring 14 and there may be a backing 16 of bronze or the like between a slanted surface 18 on the adjustment ring

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and a mated slanted surface 20 on the main frame 10. The adjustment ring is supported on the main frame for tilting movement to thereby provide for release of the bowl.

5 The adjustment ring has threads 22 which mate with threads 24 on a bowl 26. The bowl 26 mounts a bowl liner 28 and there is a crushing cavity 30 defined between the bowl liner and a gyrating head 32 as is conventional. In crushers of this type the head gyrates to crush material in the crushing cavity.

10 Below the threads 22 on the adjustment ring there is a cylindrical skirt 34 which may be welded or otherwise suitably connected to the adjustment ring and which defines a cylindrical sealing surface 36 which is opposed to the bowl. The bowl in turn has a cylindrical sealing surface 38 which is concentric with the surface 36 and spaced therefrom. Annular grooves 40 and 42 are positioned just above each of the sealing surfaces 36 and 38 respectively. Each of these annular grooves includes a generally slanted camming surface, 44 and 46 respectively, along the upper edge which performs a function to be described hereinafter.

15 The seal between the sealing surfaces 36 and 38 is provided by oppositely directed annular sealing lips 48 which extend circumferentially around the space between the bowl and skirt 34 and are held in sealing relationship with the sealing surfaces 36 and 38. The seal rings or sealing lips 48 may be any of the suitable rubber or rubber substitutes or any suitable material having the general characteristic of rubber as to flexibility, distortability and sealing qualities and may be held together by upper and lower annular rings 50 and 52, the entire assembly being suitably secured together by a plurality of bolts 54 or any suitable connecting element.

20 Mounted on top of the sealing structure comprising the lips 48 and the upper and lower annular rings 50 and 52 are a plurality 56, shown in detail in FIGURE 4. There may be any number of levers 56 circumferentially spaced around the seal ring, and in a 7 foot crusher I have found it convenient to use twelve such levers. The levers are mounted to the seal ring assembly by means of the bolts 54, or the like, and are pivoted about these.

25 Each of the levers 56 gradually increase in size from the rear 58 toward the front 60 and there are locking portions 62 and 64 on the outer and inner edges of the front of the levers. These locking portions are adapted to fit in the grooves 40 and 42 to fix the seal ring assembly to either the adjustment ring or bowl. The rear of each of the levers 56 includes a somewhat frusto-conic cam 66 which has slanted annular surfaces which are adapted to mate with and contact the slanted annular surfaces 44 and 46 on the adjustment ring and bowl respectively. Contact between the slanted cam surfaces and the surfaces 44 and 46 is effective to rotate the levers about their pivot points and to move the locking portions on the levers either into or out of contact with the grooves in the adjustment ring and bowl.

30 The use, operation and function of the invention are as follows:

35 Shown and described herein is an improved sealing arrangement for protecting the threads of the bowl and adjustment ring on a gyratory crusher or the like. Dirt and other particles from the crushing cavity must be kept out of the threads or they will score or otherwise damage them. These threads must be kept in good shape so that the bowl finds firm support on the adjustment ring and may be accurately positioned by its movement. Besides forming a more effective seal between the bowl and adjustment ring, the present invention reduces the overall height of the crusher and hence provides additional head room above the crusher. In most seals of this general type used heretofore, it was necessary to

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provide a skirt which extended downwardly from the adjustment ring and had a seal at its bottom.

In prior machines the travel of the bowl from its highest possible position with new manganese liners to its lowest possible position just before completely worn out liners are replaced determines the length of the sealing surface necessary on the bowl. Measuring from the bottom edge of the bowl, the sealing surface, as determined by travel during adjustment, would establish the lowest point of the bowl threads. The threads on the adjustment ring would have to be above this point. In addition, a certain number of turns of engaged threads would have to be provided, for example two or three full turns, for proper connection and support when the bowl is in its highest position. This means that the adjustment ring would have to rise to a height above the lowest point of the bowl by a distance at least equal to the travel of the bowl during adjustment plus the two or three threads of necessary engagement.

The present invention reduces this height by cutting the sealing surface on the bowl approximately in half, everything else being equal. This means that the bowl threads can start at a point above the lower edge of the bowl approximately one-half of previous practice. Adding to this the two or three turns of engagement, and the adjustment ring is brought down a substantial distance. Everything else being equal, a crusher having for example about 19 inches of travel during adjustment may be reduced in height something on the order of 9 or 10 inches with this invention.

The operation of the present seal can be described in three steps. When the bowl is in its up position, as is normal when the bowl liner is new, the seal is in the position of FIGURE 1. The seal is held to the adjustment ring by locking portions 62. Both of the sealing lips 48 are in contact with the sealing surfaces 36 and 38 on the adjustment ring and bowl respectively. As the bowl moves downward to compensate for wear to the bowl liner, the seal will remain fixed to the adjustment ring as the locking portions 62 are still positioned in the groove 40. Continued downward movement of the bowl will not effect the position of the seal until the bowl has passed through generally half of its total downward travel. When the bowl has moved down to the position of FIGURE 2 which is generally midway of the bowl's travel, the slanted camming surface 46 on the bowl strikes the cam 66 on each of the levers and causes each of the levers to rotate about the bolts 54 in a counterclockwise direction, as seen in FIGURE 4. Rotation in this direction moves the locking portions 62 out of groove 40 and moves locking portions 64 into groove 42. Each of the levers has now been released from the adjustment ring and has been fixed to the bowl. The seal ring is no longer fixed to the adjustment ring but is now fixed to the bowl.

Continued downward movement of the bowl will push the seal ring down along sealing surface 36, at all times there being a seal between the surfaces 36 and 38. The seal ring will continue to move downward with the bowl until the position of FIGURE 3 is reached. Normally, the position of FIGURE 3 is the lowest downward position of the bowl and it is generally desirable to have at least two or three threads of contact between the bowl and adjustment ring. When the bowl reaches this position, the bowl liner will generally be renewed and the bowl will be moved back to the up position of FIGURE 1.

As the bowl is moved in an upward direction to replace the bowl liner, it is necessary that the seal ring be moved back into engagement with the adjustment ring. As the bowl and seal ring move upward, there will be contact between the slanted camming surface 44 and the cam 66 on each of the levers when the bowl reaches the position of FIGURE 2. This contact will cause rotation of the levers in a clockwise direction, as seen in FIGURE 4,

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and hence move each of the levers and the seal ring back into a locking relationship with the adjustment ring.

Briefly summarized, the invention includes a seal ring which is movable with the bowl through part of the bowl movement and is fixed to the adjustment ring through the remainder of the bowl movement. This seal ring is effective at all times to seal the space between the sealing surfaces 36 and 38. Means are provided on the seal ring for releasing it from either the adjustment ring or the bowl and for fixing it to the other of these two members. Generally, the change over point is approximately halfway through the bowl's path of movement.

Whereas the preferred form of the invention has been shown and described herein, it should be realized there are many modifications, substitutions and alterations thereto within the scope of the following claims.

I claim:

1. In a gyratory crusher, a main frame assembly, a bowl adjustably mounted on the main frame assembly for up or down movement, a gyratable head positioned in the main frame assembly and defining a crushing cavity with the bowl, and a seal between the bowl and the main frame assembly including generally concentric cylindrical surfaces on the bowl and main frame assembly spaced a uniform distance from each other, a seal ring between said surfaces and bearing on each, means for carrying said seal ring with the bowl for a portion of its adjustable up or down movement and means connecting the seal ring to the main frame assembly for the remaining portion of bowl movement.

2. The structure of claim 1 further characterized in that said seal ring is fixed on the main frame assembly during movement of the bowl from an uppermost position in the main frame assembly to a generally intermediate position in the main frame assembly, said seal being fixed to the bowl during further downward movement thereof.

3. The structure of claim 1 further characterized by means on the bowl for releasing the seal from the main frame assembly and for fixing the seal to the bowl, and means on the main frame assembly for releasing the seal from the bowl and for fixing the seal to the main frame assembly.

4. In a gyratory crusher, a main frame, an adjustment ring mounted on the main frame, a bowl adjustably mounted on said adjustment ring for up or down movement, a gyratable head positioned in the main frame and defining a crushing cavity with the bowl, and a seal between the bowl and adjustment ring, including generally concentric cylindrical surfaces on the bowl and adjustment ring, said surfaces being spaced a uniform distance from each other, a seal ring between said surfaces bearing on each, means connecting said seal ring to the adjustment ring during movement of the bowl from an uppermost position to a generally intermediate position and means for carrying said seal ring with the bowl during further downward movement thereof.

5. The structure of claim 4 further characterized in that the cylindrical surface on the adjustment ring includes a generally cylindrical depending skirt at the lower portion of the adjustment ring.

6. The structure of claim 4 further characterized in that said seal ring includes a pair of oppositely directed sealing lips, said sealing lips bearing on said concentric cylindrical surfaces.

7. The structure of claim 4 further characterized by means for releasing said seal ring from said adjustment ring and for fixing said seal ring to the bowl, said means including a plurality of pivotal levers mounted on said seal ring.

8. The structure of claim 7 further characterized in that said levers are effective to release said seal ring from said bowl and to fix said seal ring to said adjustment ring upon upward movement of the bowl.

9. The structure of claim 7 further characterized by

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an annular groove on the inner face of said adjustment ring and a similar annular groove on the outer face of said bowl, said annular grooves being formed and adapted to receive said levers and thereby to fix said seal ring to either said adjustment ring or said bowl.

10. The structure of claim 9 further characterized in that each of said levers include a cam, and camming surfaces on both said bowl and adjustment ring positioned to contact the cams on said levers and to thereby rotate said levers into or out of said annular grooves.

11. The structure of claim 4 further characterized in that said seal ring carries a plurality of movable locking members, said locking members being movable into and out of locking engagement with said bowl and said adjusting ring.

12. In a gyratory crusher, a main frame assembly, a bowl structure mounted on the main frame assembly, threads effective to provide rotary adjustment of the bowl structure relative to the main frame assembly, a gyratable

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head positioned in the main frame assembly and defining a crushing cavity with the bowl structure, and a seal between said threads and the crushing cavity to prevent dust, particles, etc., from reaching said threads including generally concentric cylindrical surfaces spaced a uniform distance from each other, a seal ring between said surfaces and bearing on each, means connecting said seal ring to one of said surfaces during a portion of bowl movement, means connecting said seal ring to the other of said surfaces during the remaining portion of bowl movement, and means for releasing said seal ring from each of said surfaces.

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