Sept. 12, 1944. E. B. SYMONS ET AL 2,358,038

TILTING RELEASE FOR GYRATORY CRUSHERS

Filed Aug. 17, 1942 3 Sheets-Sheet 1

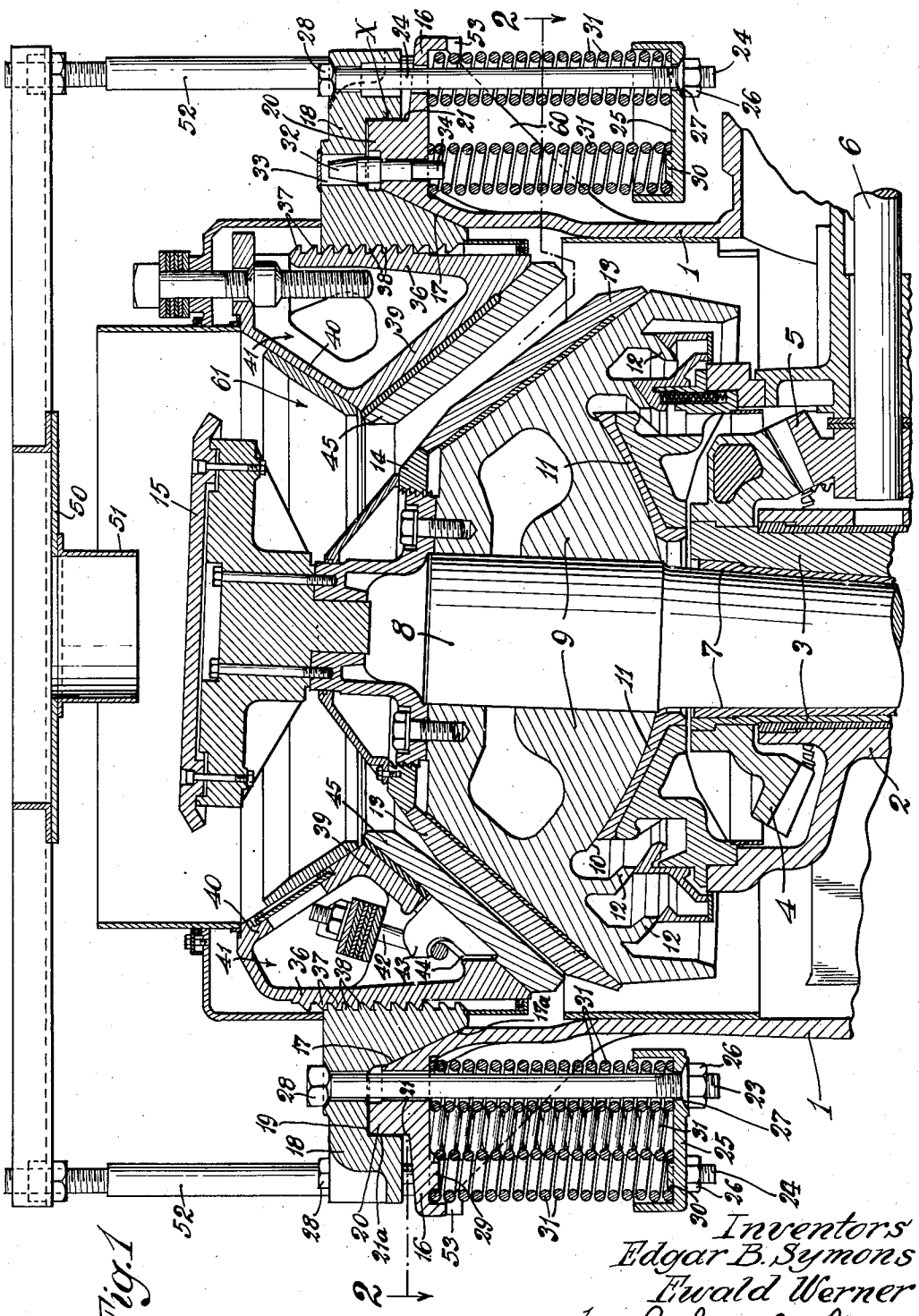


Fig. 1

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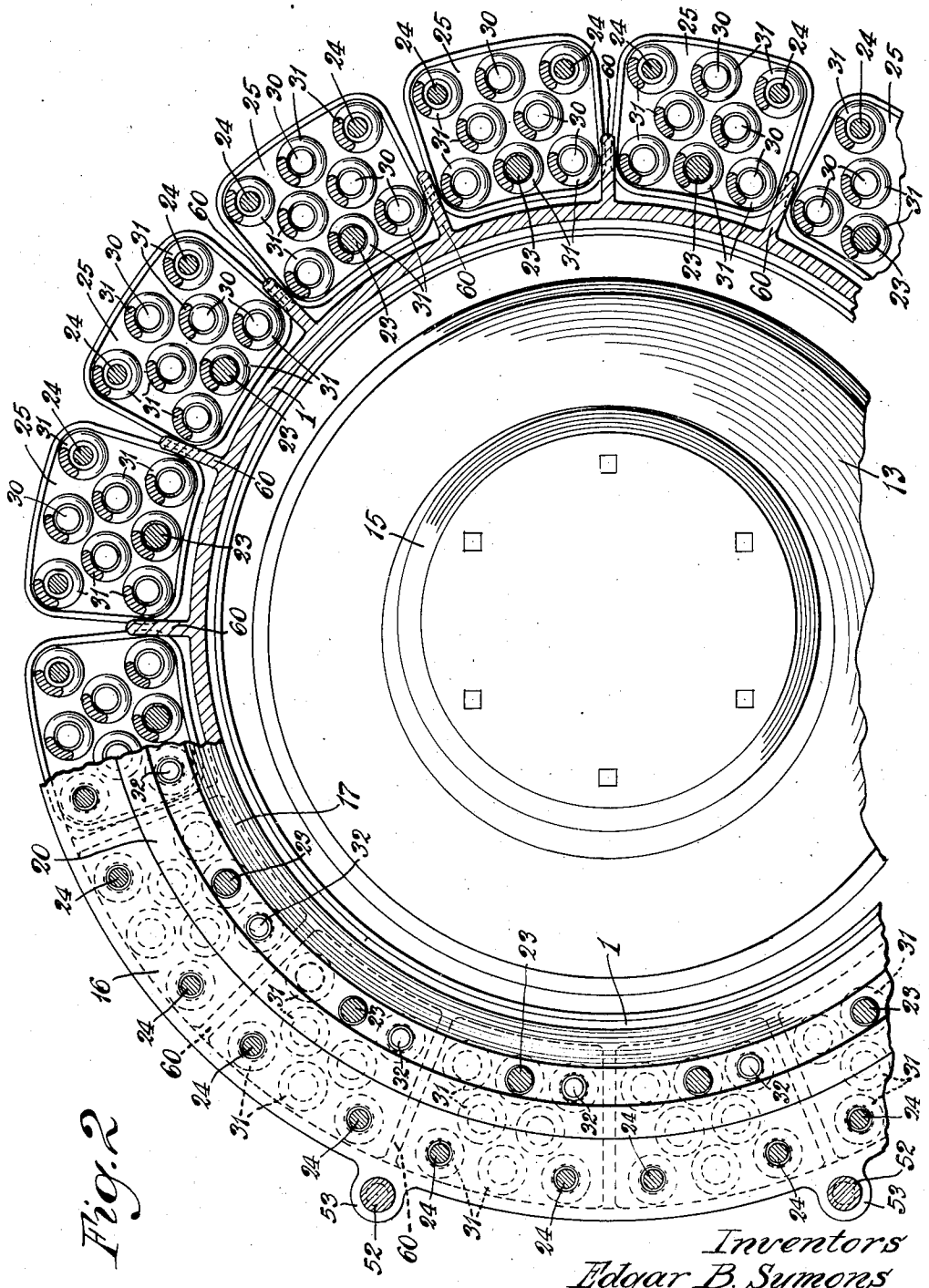


Fig. 2

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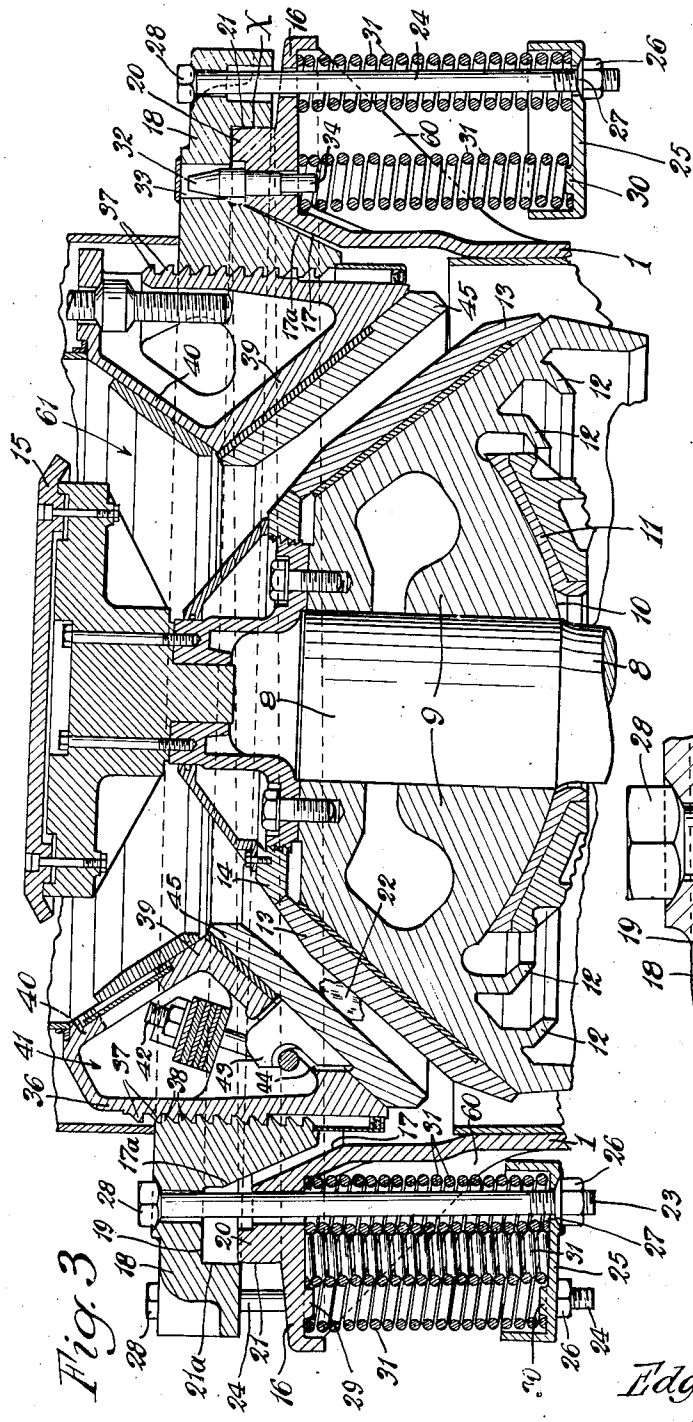


Fig. 3

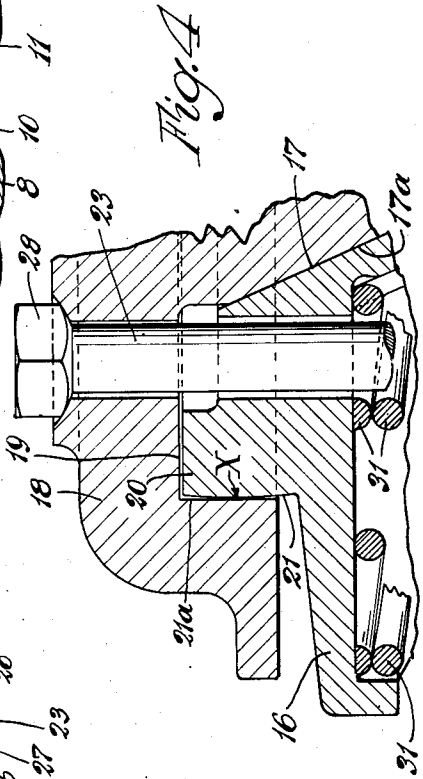


Fig. 4

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UNITED STATES PATENT OFFICE

2,358,038

TILTING RELEASE FOR GYRATORY CRUSHERS

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Application August 17, 1942, Serial No. 455,062

13 Claims. (Cl. 83—10)

The invention relates to an improvement in tilting releases for gyratory crushers, and has for one purpose the provision of a release for the bowl of a gyratory crusher.

Another purpose is the provision of means for guiding the releasing part with a minimum of wear on the opposed parts.

Another purpose is the provision of improved yielding means for maintaining the parts normally fixed.

Another purpose is the provision of improved pivot means or pivotal engagement between the fixed and moving parts involved.

Another purpose is the provision of improved guiding or retaining means to prevent lateral displacement of the moving or releasing part when tilted in relation to the fixed part, for example by the passage of uncrushable material through the crushing cavity of the crusher.

Another purpose is the provision of improved means for permitting a releasing movement of the bowl of a gyratory crusher, with a minimum of wear or pounding between their opposed supporting surfaces.

Another purpose is the provision of improved means for protecting from wear and pounding the normally opposed seating faces of a crusher frame and crusher bowl support when the bowl support is raised from or tilted in relation to a fixed portion of the frame in response to the presence of uncrushable material in the crushing cavity.

Other purposes will appear from time to time in the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a vertical axial section;

Fig. 2 is a section on the line 2—2 of Fig. 1, with the moving crushing element in plan view;

Fig. 3 is a partial section similar to Fig. 1, showing the release in operation; and

Fig. 4 is a partial radial section on an enlarged scale.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates an upstanding circumferential frame portion. 2 indicates a central bearing sleeve, the parts 1 and 2 being connected together and supported in any suitable fashion not herein shown in detail. 3 is an eccentric sleeve rotatable within the fixed bearing sleeve 2. It may be rotated for example by the gear 4, the pinion 5, and drive shaft 6. The sleeve 3 is eccentrically apertured, as at 7, to receive the crushing shaft 8, on the upper end of which is mounted the crushing head or cone 9, shown as having a downwardly convex spherical bearing 10 resting on the fixed upwardly concave corresponding bearing 11, 12 is any suitable dust sealing means.

13 is a movable mantle or wear taking element held down for example by the upper thrust member or nut 14. 15 is any suitable feed distributing plate. Since the parts and details of the head, and means for gyrating it, are not of themselves important in relation to the present invention, they are not described in great detail. It will be understood that rotation of the shaft 8, through any suitable driving means, causes a gyration of the crushing head, with a movement of substantial amplitude toward and away from the normally fixed bowl below described.

The outer frame member 1 is provided at its upper edge with an outwardly extending flange 16 of substantial diameter. This flange has an inner tapered surface 17, increasing in diameter progressively from bottom to top. Normally seated against this surface 17 and overlying the top of the flange 16 is a tilting ring or bowl support 18. It will be observed that it is recessed, as at 19, to receive an annular upward projection 20 from the flange 16. When the parts are at rest, as shown in Fig. 1, there need normally be no contact between the opposed parts of the ring 18 and the flange 16, except along the tapered surface 17. The relationship of the parts is shown in somewhat greater detail in Fig. 4.

There may be a close approach and possibly a contact at the point X, as shown in Fig. 4. It will be observed that the outer face of the flange 20 is slightly arcuate, as at 21, so that in effect a rolling contact is provided when the tilting ring 18 is raised because of the presence at one side of the crushing cavity of uncrushable material, such as tramp iron, or packed fines, or the like. An uncrushable element is diagrammatically shown, as at 22, in Fig. 3, and as causing the upward tilting of the left side of the tilting ring, referring to the position of the parts as shown in Fig. 3. Extending down through suitable apertures in the tilting ring 18 are inner bolts 23 and outer bolts 24. The inner bolts 23 are of somewhat greater diameter than the outer bolts 24. It will be observed, as in Fig. 2, that the bolts are arranged in groups of three, each group of three bolts having associated therewith a nest of eight springs, arranged in three concentric arcs. These springs are compressed between the bottom of the flange 16 and the lower

abutment segments 25, through which the lower ends of the bolts 23, 24 pass. Bolts 26 may be employed to vary the compression of the springs.

It will be observed that the bolts have rounded surfaces 27 for engagement with opposed parts of the segments 25. Similarly, the heads 28 of the bolts 23, 24 are rounded or made spherical where they engage the upper portions of the surface of the tilting ring 18. The springs 31 may be centered in any suitable manner. One spring surrounds each of the bolts 23, 24. Other springs may be guided by downwardly extending bosses 29 on the bottom of the tilting ring 16 and by corresponding upwardly extending bosses 30 on the top of the segment 25.

In order to prevent rotation of the ring 18 in relation to the flange 16, we may also provide pins 32 penetrating apertures 33 in the tilting ring 18. Any suitable number of such pins may be employed, and the lower ends, as at 34, may also serve to guide the upper end of whichever spring 31 is associated therewith. It will be understood that the springs 31 are so compressed as normally to hold the ring 18 fixed in relation to the flange 16 at any ordinary crushing stress. However, if uncrushable material, such as the particle 22, is nipped in the crushing cavity, the tilting ring may rise against the compression of the springs 31 on the side of the crusher where the particle 22 is positioned.

The bowl structure proper includes an outer and generally cylindrical wall 36, which is screw threaded, as at 37, in opposition to threads 38 on the vertical inner surface of the ring 18.

It will be understood that a rotation of the bowl structure in relation to the ring may be obtained in any suitable manner in order to adjust the bowl upwardly or downwardly.

The bowl support also includes an upwardly and inwardly extending wall 39, and a downwardly and inwardly extending wall 40, the two walls converging and enclosing a hollow space 41, within which may be located any suitable locking means, for example the U-bolts 42, which may engage hook-shaped lugs 43, which extend through apertures 44 of the wall 39, and which are secured to and formed integrally with the bowl liner 45. However, the details of the bowl and bowl liner do not of themselves form part of the present invention and will not be further described.

Any suitable feed distributing element 50 may be employed, with its down spout 51 and adjustable supports 52, which are supported on the lugs 53 of the flange 16.

It will be observed that the outwardly extending flange 16 is supported by ribs or brackets 60, which may be formed integrally with the outer main frame element.

It will be realized that, whereas we have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of the invention. We therefore wish that the drawings and description be taken as in a broad sense illustrative or diagrammatic, rather than as a limitation to the precise showing.

The use and operation of the invention are as follows:

The head of the crushing structure shown in the present drawings has a substantial lateral excursion, as will be observed by comparing the closed side and the open side of the crushing cavity, as shown in Fig. 1. The device is normally sparsely fed by means of the cooperation of the spout 51, the feed plate 15, and the lower feeding hopper 61. The details of the feed limitation do not form part of the present invention, but it will be understood that, in the normal operation of the device, the cavity is sparsely fed, and the crushing process of Symons Patent No. 1,537,565 is practiced thereby.

It may happen that, either with packed wet material or, more frequently, with tramp iron, an uncrushable mass may be present in the crushing cavity, which is of greater radial extension than the radial width of the crushing cavity at the closest approach of head to bowl. The member 22 of Fig. 3 diagrammatically represents such a mass or piece of tramp iron. In that event, the springs 31 on the side of the machine adjacent the location of the crushing mass will give, the segments 25 being upwardly drawn by bolts 23, 24, and the side of the ring 18 tilting upwardly, as shown at the left of Fig. 3.

When this takes place, the opposite side of the ring serves as a pivot, as at the right of Fig. 3, a rolling contact being provided by the arcuate surface 21 shown in Fig. 4. The part of the ring 18 directly radially aligned with the uncrushable mass 22 may even rise entirely clear of the upper edge of the flange 20.

However, when the ring is tilted, the straight surface 19 of the ring 18 will bear on the upward projection 20 of the flange 16, in the position in which the parts are shown at the right side of Fig. 3. Simultaneously, the cylindrical surface 21*a* of the ring 18 will bear against the arcuate surface 21 of the flange 16. Even if under any circumstances the part of the ring 18 closest to the uncrushable mass 22 lifts entirely above the portion 20 of the frame, the tiltable ring is still properly centered since throughout almost all of the periphery of the machine the cylindrical face 21*a* will be in contact with the arcuate face 21.

The parts are centered, however, and lateral movement is prevented by the engagement between the surface 21, and the opposed generally cylindrical surface 21*a* of the ring 18, and the two parts are in contact all of the time, and lateral movement of the ring 18 is prevented. There is, therefore, no possibility of damaging wear between the inclined surface 17 of the flange 16 and the opposed surface 17*a* of the ring 18 when the ring 18 returns to its normal position after it has been tilted upwardly to permit the passage of steel or other uncrushable material through the crushing cavity. As will be observed in Fig. 3, when the ring 18 is tilted, all of the conic face 17*a* of the ring clears the opposed conic face 17 of the frame. Note that in Fig. 3 there is a slight clearance at the right-hand or pivot side of the ring, and a substantially wider clearance at the left-hand or tilted side of the ring. After the uncrushable mass has been removed from or passed from the crushing cavity and the ring settles down in position, the opposed conic faces 17 and 17*a* come into contact without any relative lateral movement. The direct downward impact will not do any harm, and any injurious relative lateral movement of the parts is prevented.

It should be kept in mind that the employment of a rocking, shifting engagement between the ring 18 and the opposed part of the frame, very substantially reduces wear. It will be understood that where in the claims, I employ the term "rocking, shifting," I mean to describe the rocking relationship which exists between the opposed

parts of the ring and the flange **20**, in contrast to a movement of the opposed parts which would involve a slipping or sliding movement of the ring **18** across the opposed surfaces of the flange **20**. The prevention of such slipping, sliding movement is one of the objects of the present invention. The point X in Figure 4 indicates the point of rocking contact which shifts downwardly as the opposite side of the ring **18** moves upwardly. When the ring **18** is tilted upwardly away from the flange **20**, its only point of contact is the rocking contact area represented by X. When it moves into horizontal position, the sufaces **17** and **17***a* are in contact and receive the weight of the bowl. The contact X then serves as a centering contact. It will also be understood that when, as in Figure 3, an uncrushable member **22** causes one side of the bowl and ring to rise, the thrust of the head against the member **22**, and thus against the bowl, is outward as well as upward. This tends to move the lifting side of the ring **18** away from the flange **20**, thus preventing any substantial frictional wear. On the side where the contact exists, as in X in Figure 3, the relative movement is a rocking, tilting movement without slippage of the opposed parts.

It should be kept in mind that the centering effect of the contact of the surfaces **21** and **21***a* maintains the axis of the bowl substantially concentric with the axis of the machine as a whole or the axis or center of the frame flange **20**. In other words, substantially no bodily lateral movement of the tilting ring **18** and the parts associated thereby is permitted. When an uncrushable body passes into the crushing cavity and causes the ring **18** to tilt, the surface **21***a* rolls or rocks across the surface **21**, referring to the position of the parts as shown in Figure 4. The opposite side of the ring tilts upwardly. Throughout the entire circumference of the ring and frame, the surfaces **17** and **17***a* are separated. The upward tilting of the ring effects a clean separation of the two surfaces with substantially no shearing, wear or engagement. It will be observed that the bolts **23** are not relied upon to resist the lateral movement of the tilting ring and its associated parts. The opposition of the opposed surfaces **21** and **21***a* is effective to maintain the desired alignment and to prevent the undesired lateral movement. Thus, there is a minimum of wear of the opposed surfaces **17** and **17***a*. The area of the surfaces **21** and **21***a* is sufficiently great, also to prevent any substantial wear of the opposed parts in response to the limited and substantial relative vertical movement of the surface **21***a* in relation to the surface **21**.

We claim:

1. In a gyratory crusher a normally fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl surrounding said head, a tiltable support for said bowl, including a ring tiltably mounted on said frame, means for yieldably urging said ring downwardly against said frame, and means for preventing lateral movement of said ring in relation to said frame when the ring is tilted, including a circumferential flange on said frame, said ring having a surrounding face opposed thereto, said frame flange having an outer generally cylindrical generally vertical surface with a vertical extension exceeding the upward movement of the lower edge of the surrounding ring face at an angular distance of 90° from the point about which the ring tilts, whereby the ring is held against lateral movement during its tilting, one of the opposed faces on frame flange and ring being convex in vertical, axial section, and being adapted to serve as a rocking pivot during the tilting movement of the bowl.

2. In a gyratory crusher a normally fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl surrounding said head, a tiltable support for said bowl, including a ring tiltably mounted on said frame, means for yieldably urging said ring downwardly against said frame, and means for preventing lateral movement of said ring in relation to said frame when the ring is tilted, including a circumferential flange on said frame, said ring having a surrounding face opposed thereto, said frame flange having an outer generally cylindrical generally vertical surface with a vertical extension exceeding the upward movement of the lower edge of the surrounding ring face at an angular distance of 90° from the point about which the ring tilts, whereby the ring is held against lateral movement during its tilting.

3. In combination, in a gyratory crusher, a fixed circumferential frame, a head mounted for gyration within said frame, a bowl opposed to said head, and a tilting connection between said bowl and said frame including a circumferential annular portion having a circumferential concavity in a lower face thereof, the frame including a portion adapted normally to extend into said concavity, yielding means adapted normally to extend into said concavity, yielding means adapted normally to prevent movement of said annular portion in relation to said frame, the opposed surfaces of the frame and the annular concavity including portions adapted to maintain continuous contact, and to prevent lateral movement of the bowl in relation to the main frame, during a substantial range of tilt of the bowl in relation to the frame in response to the presence of uncrushable material in the crushing cavity, the frame having an upstanding exterior generally cylindrical surface, the concavity having an interior generally cylindrical surface opposed to and surrounding said first mentioned cylindrical surface, the height of said surfaces being sufficient to provide a substantial overlap during tilting of the bowl, said generally cylindrical frame surface being outwardly slightly convex in vertical radial section.

4. In combination, in a gyratory crusher, a fixed circumferential frame, a head mounted for gyration within said frame, a bowl opposed to said head, and a tilting connection between said bowl and said frame including a circumferential annular portion having a circumferential concavity in a lower face thereof, the frame including a portion adapted normally to extend into said concavity, yielding means adapted normally to prevent movement of said annular portion in relation to said frame, the opposed surfaces of the frame and the annular concavity including portions adapted to maintain continuous contact, and to prevent lateral movement of the bowl in relation to the main frame, during a substantial range of tilt of the bowl in relation to the frame in response to the presence of uncrushable material in the crushing cavity, the frame having an upstanding exterior generally cylindrical surface, the concavity having an interior generally cylindrical surface opposed to and surrounding said first mentioned cylindrical surface, the height of said surfaces being sufficient to pro-

vide a substantial overlap during tilting of the bowl.

5. In combination, in a gyratory crusher, a circumferential frame, a head mounted for gyration in relation to the frame, a bowl opposed to the head, and means for holding the bowl normally fixed against movement in relation to the frame, while permitting movement of the bowl from the head in response to the passage of uncrushable material through the crushing cavity, including yielding means tending normally to urge the bowl downwardly in relation to the frame, and means for preventing lateral displacement of the bowl when the bowl is upwardly tilted by the passage of uncrushable material through the crushing cavity, including a portion on the frame having an outer generally cylindrical surface and an opposed portion of the bowl having an inner generally cylindrical surface, the surfaces being at all times closely opposed, both surfaces being generally parallel with the axis of the machine, whereby lateral displacement of the bowl during tilting is positively prevented, the surface on the bowl being slightly convex in vertical cross section.

6. In combination, in a gyratory crusher, a circumferential frame, a head mounted for gyration in relation to the frame, a bowl opposed to the head, and means for holding the bowl normally fixed against movement in relation to the frame, while permitting movement of the bowl from the head in response to the passage of uncrushable material through the crushing cavity, including yielding means tending normally to urge the bowl downwardly in relation to the frame, and means for preventing lateral displacement of the bowl when the boyl is upwardly tilted by the passage of uncrushable material through the crushing cavity, including a portion on the frame having an outer generally cylindrical surface and an opposed portion of the bowl having an inner generally cylindrical surface, the surfaces being at all times closely opposed, both surfaces being generally parallel with the axis of the machine, whereby lateral displacement of the bowl during tilting is positively prevented.

7. In combination, in a gyratory crusher, a circumferential frame, a head mounted for gyration in relation to the frame, a bowl opposed to the head, and means for normally holding the bowl normally fixed against movement in relation to the frame, including an annular flange at the top of the frame, said flange having an outer generally cylindrical face, slightly convex in vertical radial section, and an inner face inclined downwardly and inwardly toward the axis of the crusher, and an exterior ring surrounding the bowl and having a downwardly open recess, the outer face of which is generally cylindrical and is opposed to the outer face of said flange, the inner face of which is formed to conform generally to the downwardly and inwardly inclined face of the flange, and yielding means tending normally to hold said ring downwardly against said flange with said downwardly and inwardly inclined faces in contact, and with the cylindrical face of the ring surrounding and opposed to the generally cylindrical outer face of said flange, the outer portion of the ring being at all times out of contact with that part of the frame which is exterior to the flange.

8. In combination, in a gyratory crusher, a circumferential frame, a head mounted for gyration in relation to the frame, a bowl opposed to the head, and means for normally holding the bowl normally fixed against movement in relation to the frame, including an annular flange at the top of the frame, said flange having an outer generally cylindrical face slightly convex in vertical radial section, and an inner face inclined downwardly and inwardly toward the axis of the crusher, and an exterior ring surrounding the bowl and having a downwardly open recess, the outer face of which is generally cylindrical and is opposed to the outer face of said flange, the inner face of which is formed to conform generally to the downwardly and inwardly inclined face of the flange, and yielding means tending normally to hold said ring downwardly against said flange with said downwardly and inwardly inclined faces in contact, and with the cylindrical face of the ring surrounding and opposed to the generally cylindrical outer face of said flange, said flange having an upper surface extending generally horizontally between its cylindrical and its inclined surfaces, said upper surface being at all times out of contact with the opposed surface of the recess in the ring.

9. In combination, in a gyratory crusher, a circumferential frame, a head mounted for gyration in relation to the frame, a bowl opposed to the head, and means for holding the bowl normally fixed against movement in relation to the frame, including an annular flange at the top of the frame, said flange having an outer generally cylindrical face slightly convex in vertical radial section, and an inner face inclined downwardly and inwardly toward the axis of the crusher, and an exterior ring surrounding the bowl and having a downwardly open annular recess, the outer face of which is generally cylindrical and is opposed to the outer face of said flange, the inner face of which is formed to conform generally to the downwardly and inwardly inclined face of the flange, and yielding means tending normally to hold said ring downwardly against said flange with said downwardly and inwardly inclined faces in contact, and with the cylindrical face of the ring surrounding and opposed to the generally cylindrical outer face of said flange.

10. In combination in a gyratory crusher, a fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl opposed to said head, means for normally holding said bowl fixed against movement in relation to said frame, and release means therefor, including opposed interpenetrating members on bowl and frame, yielding means tending normally to hold them fixed in relation to each other, said members having opposed parts adapted to prevent lateral movement of the bowl when the bowl is tilted by the presence of uncrushable material in the crushing cavity, said parts including an upward shoulder on the frame having a generally cylindrical but slightly barrel shaped surface with a free upper edge, the ring having a portion downwardly extending thereabout, the ring and the frame having opposed generally conic faces located radially inwardly from said generally cylindrical surface, the generally conic surface of the frame being adapted to receive the surface of the ring in a supporting relationship when the ring is at rest.

11. In combination, in a gyratory crusher, a fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl opposed to said head, means for normally holding said bowl fixed against movement in relation to said frame, and release means therefor, including opposed interpenetrating members on bowl and

frame, yielding means tending normally to hold them fixed in relation to each other, said members having opposed parts adapted to prevent lateral movement of the bowl when the bowl is tilted by the presence of uncrushable material in the crushing cavity, said parts including an upward shoulder on the frame having a generally cylindrical but slightly barrel shaped surface with a free upper edge, the ring having a portion downwardly extending thereabout.

12. In a gyratory crusher a normally fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl surrounding said head, a tiltable support for said bowl, including a ring tiltably mounted on said frame, means for yieldably urging said ring downwardly against said frame, and means for preventing lateral movement of said ring in relation to said frame when the ring is tilted, including a frame portion having an outer generally cylindrical, generally vertical surface, said ring having a surrounding face opposed thereto, said generally cylindrical surface having a vertical extension exceeding the upward movement of the lower edge of the surrounding ring face at an angular distance of ninety degrees from the point about which the ring tilts, whereby the ring is held against lateral movement during its tilting.

13. In a gyratory crusher a normally fixed circumferential frame, a head mounted for gyration in relation to said frame, a bowl surrounding said head, a tiltable support for said bowl, including a ring tiltably mounted on said frame, means for yieldably urging said ring downwardly against said frame, and means for preventing lateral movement of said ring in relation to said frame when the ring is tilted, including a frame portion having an outer generally cylindrical, generally vertical surface, said ring having a surrounding face opposed thereto, said generally cylindrical surface having a vertical extension exceeding the upward movement of the lower edge of the surrounding ring face at an angular distance of ninety degrees from the point about which the ring tilts, whereby the ring is held against lateral movement during its tilting, one of the opposed faces on said frame portion and ring being convex in vertical, axial section, and being adapted to serve as a rocking pivot during the tilting movement of the bowl.

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