Dec. 29, 1942. O. C. GRUENDER 2,306,437

MANTLE FOR GYRATORY CRUSHERS

Filed July 15, 1940 2 Sheets-Sheet 1

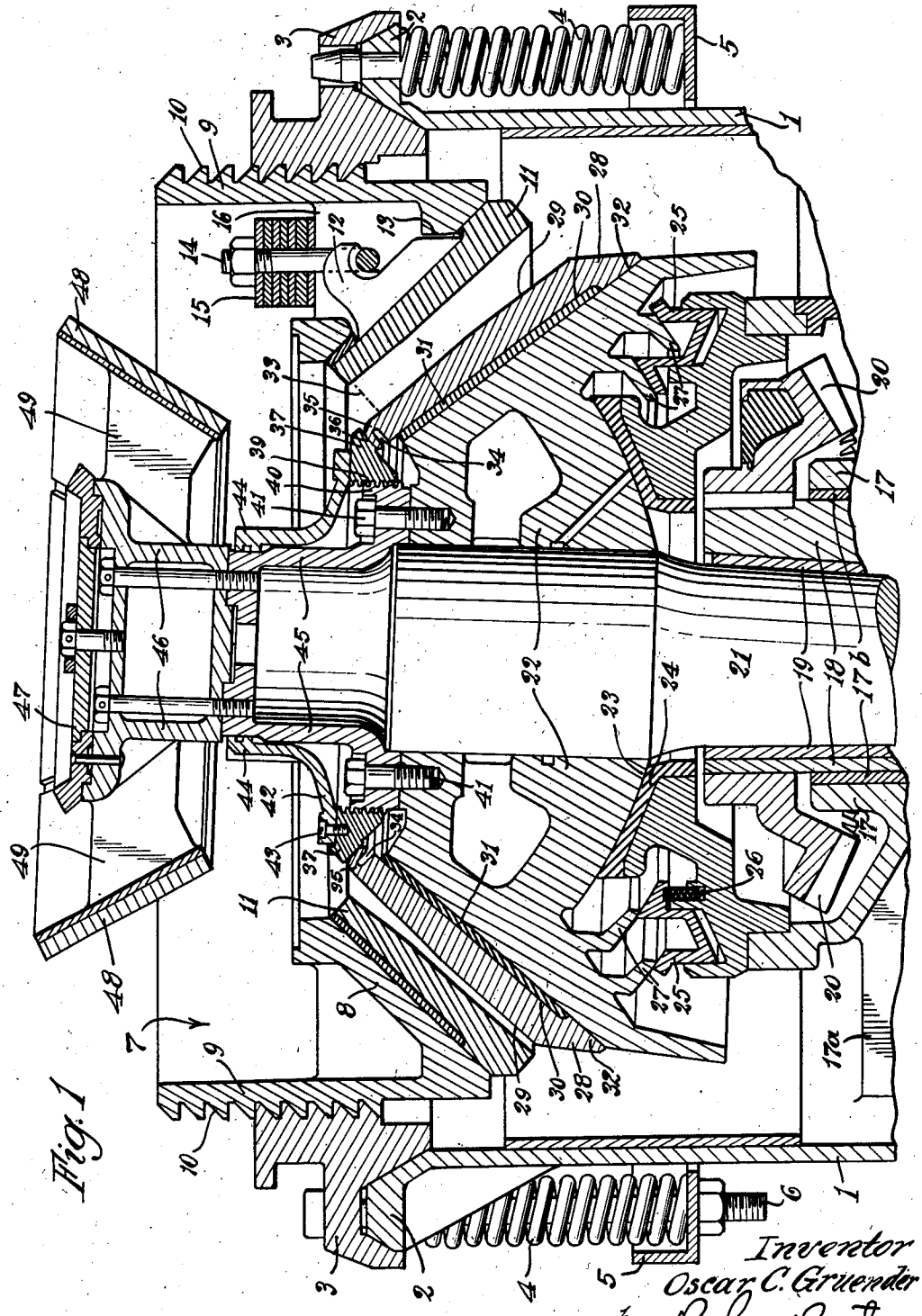


Fig. 1

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Fig. 3

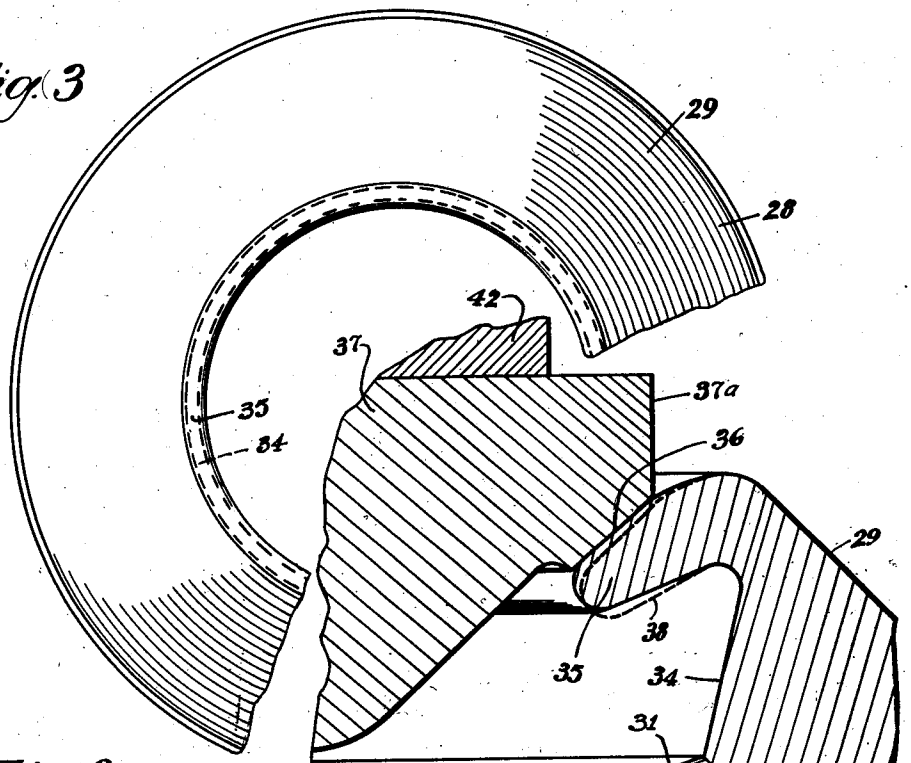


Fig. 2.

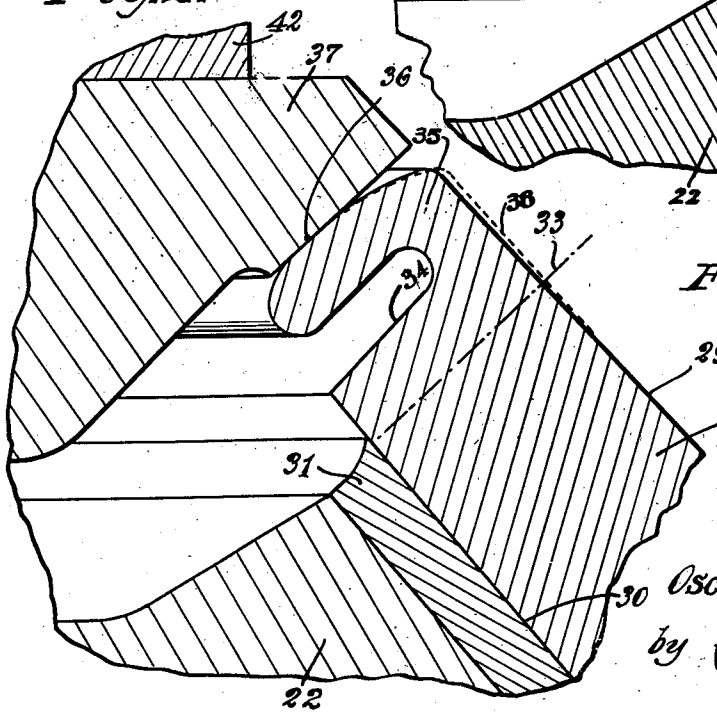


Fig. 4.

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MANTLE FOR GYRATORY CRUSHERS

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Application July 15, 1940, Serial No. 345,597

8 Claims. (Cl. 83—10)

My invention relates to an improved mantle for gyratory crushers, and has for one purpose the provision of a mantle which may more readily be removed for replacement or repair than the mantles now in use.

Another purpose is the provision of an improved mantle having means for limiting the upward thrust of the mantle against the mantle locking means, in response to peening or stretching, in the use of mantles made, for example, of manganese steel.

Another purpose is the provision of means for preventing the flowing of the mantle of manganese steel or the like from affecting or unduly cramping or bending the securing means which are employed to hold the mantle in place on a gyratory crusher head.

Another purpose is the provision of means for permitting ready removal of mantles and securing means for replacement.

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

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a vertical axial section through a gyratory cone crusher, illustrating one of my mantles in position;

Fig. 2 is a partial section on an enlarged scale illustrating the action of the mantle in relation to its securing means;

Fig. 3 is a plan view of the mantle; and

Fig. 4 is a view similar to Fig. 2 of a variation of the shape of the mantle slot.

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

Referring to the drawings, 1 generally indicates a fixed circumferential main frame, which may be supported upon any suitable base, not shown. It is provided with a circumferential outwardly projecting upper flange 2, upon which is tiltably mounted the ring 3, the flange and ring being formed together to interpenetrate, as shown in Fig. 1. 4 are springs tending normally to hold the ring 3 fixed in relation to the flange 2 by means of a spring abutment 5 and the bolts 6, which maintain the springs under pressure.

7 generally indicates a bowl structure including an upwardly and inwardly inclined wall 8, and a generally cylindrical wall 9, herein shown as screw threaded, as at 10, to mesh with the screw threaded ring 3. Any suitable means may be employed for constant relative rotation of the bowl 7 whereby its vertical adjustment may be obtained. Such adjustment forms no part of the present invention.

11 indicates a bowl liner for the bowl 8, which liner is provided with hook-shaped lugs 12, adapted to penetrate through apertures 13 and to be engaged by generally U-shaped bolts 14, which pass through the abutment box 15, mounted on ribs 16. 17 indicates a fixed bearing sleeve, preferably formed integrally with the frame 1 and connected thereto by any suitable ribs 17*a*, or the like. Located within the fixed bearing sleeve 17 is a bushing 17*b*; rotatable within the cylindrical bore of the bushing 17*b* is an eccentric sleeve 18 provided with a bushing 19. At the top of the eccentric sleeve 18 is mounted any suitable driving gear 20 through which the eccentric sleeve 18 may be driven.

21 indicates a crusher shaft within the bushing 19. Associated therewith is the crusher head 22, provided with a spherical bearing surface 23, adapted to conform to and rest upon the spherical bearing member 24. Any suitable means may be employed for preventing the access of dust to the opposed spherical bearing surfaces. I illustrate for example the wiping member 25, which may be upwardly thrust as by the springs 26, in opposition with the opposed wiping elements 27 on the outer lower surface of the head 22.

Mounted upon the upwardly tapered surface of the head 22 is the crushing mantle 28. Its outer surface 29 may be generally conic; its under surface 30, likewise. Most of the inner surface 30 is spaced outwardly from the conic surface of the head 22 in order to provide space for zinc or the like 31.

The bottom of the mantle may directly engage the opposed surface of the head, as at 32. It will be observed, as in Fig. 1, that the mantle extends upwardly above the top of the crushing cavity defined between it and the opposed bowl liner 11. The top of the crushing cavity may be roughly defined, for example, by a dash and dot line 33, as shown in Fig. 1.

The mantles employed in my crusher are prevailingly made of manganese steel. One characteristic of manganese steel is that of flowing by peening and deforming under crushing stress. The material is very tough, and wear-resistant, but under the pounding and impact of the crushing operation it tends to flow or spread laterally. This characteristic is an inconvenience in connection with securing means, since it may cause an abnormal pressure of the head against the securing means and a deformation or even breakage of whatever securing member or members

abut directly against the upper end of the mantle. I provide means for maintaining a locking thrust against the top of the mantle while permitting the mantle to flow or spread without undue strain upon the locking means. For example, I may carry the mantle itself upwardly above the boundary 33 of the crushing zone, and may employ this upper portion of the mantle as the means for transmitting the locking thrust against the top of the mantle, without the disadvantage of having the deformation of the mantle increase the thrust against the locking means to the bending or breaking point.

For example, I may form this upper end of the mantle with a slot or groove 34. In the drawings it is shown as located for convenience on the inner face of the mantle, where it is free from the risk of being filled with dust, broken stone, or the like. The slot 34 is so proportioned as in effect to define a flange 35, which may be hook-shaped or L-shaped in cross section. The thickness of the flange or the mass of metal involved is in practice made sufficient to support the locking thrust of the locking means below described. However, as the mantle flows or spreads in service, I find that in practice the thrust of the flange 35 at its contact area 36, as shown in Fig. 2, is insufficient to bend or break the securing nut or ring 37.

The deformation of the flange 35 serves as a means for compensating the deformation or lateral flow of the metal. For example, the flange 35 as the plate stretches may deflect. A range of deflection, such as shown in the contrast between the full line of Fig. 4 and the dotted line as shown at 38, indicates a possible flexure of the flange which compensates for the stretching of the mantle while still maintaining the downward thrust of the locking member 37.

In order to secure the mantle 28 in place, I provide the locking nut or ring 37, which is in screw threaded relation, as at 39, with the ring 40, bolted to the top of the head as by the bolts 41. It will be understood that, in response to the movement or crawl of the mantle 28, the nut or ring 37 tends to tighten itself upon the securing member or ring 40, and thereby maintain a downward pressure against the upper edge of the mantle at the contact area 36. Thus the firm downward pressure against the upper edge of the mantle is maintained, which automatically effects its firm seating upon the head 22.

42 indicates a cover plate secured to the ring or nut 38, as by the screws 43. It overlies also the heads of the screws 41 and is provided with a central upward extension or sleeve 44, which surrounds and engages an upward extension from the sleeve 45 of the ring 40. Secured to the top of the sleeve 45 is any suitable feed distributing means, including the central portion 46, with a feed distributing plate 47 and a surrounding feed cone or hopper 48, mounted on ribs or spider members 49. The details of such structures do not of themselves form part of the present invention, which is concerned primarily with the mantle itself.

It will be realized that, whereas I 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 my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

For example, I illustrate in Fig. 4 a form of mantle in which the space between the flange 35 and the top of the body of the mantle is generally V-shaped in cross section. In either event, it is clear that, as indicated in dotted line 38, the flange 35 serves as a compensating means for maintaining the necessary downward locking thrust against the top of the mantle, while permitting the mantle to spread. Preferably the thrust at the area 36 is directed at a point intermediate the ends of the flange 35 and well within the junction between the flange 35 and the body 28 of the mantle. In order to insure this, the locking member 37 may terminate, as at 37*a*, in Fig. 4, at a point well within the bend of the flange 35. While I have described the flange 35 for convenience as L-shaped, it will be understood that what I wish to indicate is that preferably the flange extends upwardly from the upper end of the mantle 28 and thereafter bends laterally.

It will be understood, of course, that, whereas I show a one-piece mantle, I have not limited my claims to a one-piece mantle and do not wish them to be so limited, as it is practical to employ mantles made with more than one piece. The use and operation of my invention are as follows:

No material has so far been found to equal manganese steel for the wearing parts of gyratory crushers of the type herein shown. Manganese steel possesses extreme toughness and wear-resisting characteristics. It has the peculiar characteristic of flowing or deforming under the pounding or impact normal to the crushing operation. It is, therefore, a difficult problem to provide means for adequately holding the mantles in position and to provide for their ready removal for replacement.

Where a locking means at the top of the head is provided in direct bearing contact with the body of the mantle, the deformation of the mantle in the course of time may create an excess upward thrust against the locking means sufficient to bend or distort the threads and finally break it. This is a condition which is not infrequently met in the field.

I find it desirable to interpose between the locking means and the body of the mantle an intermediate thrust member which is channeled to maintain a locking thrust against the top of the mantle, but which will not transmit to the locking means the undesired lateral thrust caused by the deformation of the mantle in the course of wear. In the present device I find it convenient to make this thrust transmitting means integral with or part of the mantle itself. It, however, is a matter of convenience rather than necessity, and takeup means of the type herein shown could be interposed between the top of the mantle 28 and the locknut 37.

However, in the form as herein described and shown I employ a one-piece mantle 28, with the space between its rear face and the opposed face of the head, as at 30, adapted to receive zinc or other suitable filler or supporting metal 31. In fact, it is preferable to provide such an intermediate layer of soft metal between the rear of the mantle and the surface of the head. I find it desirable, however, to provide a direct contact between the bottom of the mantle and the head, as at 32, the seating portion of the bottom of the mantle serving as the bottom of the space to be filled by the zinc or other metal. The upper flange 35 is substantially thinner than the body of the material, and will flex or deform slightly,

as illustrated in dotted line in Fig. 2, in response to the general expansion or crawl of the manganese steel of which the mantle as a whole is formed. The structure is sufficiently rigid to transmit the desired locking thrust through the tightening of the ring or nut **37**, but the channel provides a break or separation between the body of the mantle and that portion of the mantle which actually engages the nut **37** at **36**.

Whereas I find it convenient to position the slot or aperture defined by the flange on the inner face of the mantle, it may under come circumstances be positioned on the outer face of the mantle, with the flange **35** in that case extending outwardly instead of inwardly. The form shown, however, is in most cases preferable.

I claim:

1. As a new article of manufacture and for use with a gyratory crusher having a crushing head and a mantle securing means, a crushing mantle defined by inner and outer generally conic surfaces, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, and means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including an L-shaped annular circumferential flange extending upwardly and inwardly from the upper outer edge of the mantle, the free arm of the L being spaced from but overhanging the inner portion of the upper edge of the mantle.

2. As a new article of manufacture and for use with a gyratory crusher having a crushing head and a mantle securing means, a crushing mantle defined by inner and outer generally conic surfaces, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, and means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including an annular circumferential flange extending laterally from a face of the upper edge of the mantle, said flange overhanging the adjacent portion of the mantle and being separated therefrom by a circumferential channel extending a substantial distance through the mantle from the face thereof opposite to that from which the flange extends.

3. As a new article of manufacture and for use with a gyratory crusher having a crushing head and a mantle securing means, a crushing mantle defined by inner and outer generally conic surfaces, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, and means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including an annular circumferential flange extending inwardly from the outer face of the upper edge of the mantle, said flange overhanging the adjacent portion of the mantle and being separated therefrom by a circumferential channel extending a substantial distance through the mantle from the inner face thereof.

4. As a new article of manumacture and for use with a gyratory crusher having a crushing head and a mantle securing means, a crushing mantle defined by inner and outer generally conic surfaces, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, and means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including flange means extending substantially circumferentially about the upper edge of the mantle, said flange means extending upwardly from an area adjacent one face of the mantle and including a portion extending radially toward the opposite face of the mantle, such radially extending portion overhanging an adjacent portion of the mantle and being separated therefrom by an intervening channel.

5. As a new article of manufacture and for use with a gyratory crusher having a crushing head and a mantle securing means, a crushing mantle defined by inner and outer generally conic surfaces, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, and means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including flange means extending substantially about the upper edge of the mantle, said flange means including a portion extending upwardly from an area adjacent the outer face of the mantle, and extending radially inwardly toward the inner face of the mantle, and overhanging the adjacent portion of the mantle, and being separated therefrom by an intervening channel opening into the inner face of the mantle.

6. In combination, in a gyratory crusher, a crushing head having a generally conic outer face, a crushing mantle defined by inner and outer generally conic surfaces, said inner surface conforming generally to the outer conic surface of the crushing head, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including flange means extending upwardly from an area adjacent one face of the mantle and including a portion extending radially toward the opposite face of the mantle, such radially extending portion overhanging an adjacent portion of the mantle and being separated therefrom by an intervening channel, and means for maintaining a normally constant locking thrust downwardly against the upper face of said radially extending portion of said flange means.

7. In combination, in a gyratory crusher, a crushing head having a generally conic outer face, a crushing mantle defined by inner and outer generally conic surfaces, said inner surface conforming generally to the outer conic surface of the crushing head, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including flange means extending upwardly from an area adjacent the outer face of the mantle and including a portion extending radially toward the inner face of the mantle, such radially extending portion overhanging an adjacent por-

tion of the mantle and being separated therefrom by an intervening channel, and means for maintaining a normally constant locking thrust downwardly against the upper face of said radially extending portion of said flange means.

8. In combination, in a gyratory crusher, a crushing head having a generally conic outer face, a crushing mantle defined by inner and outer generally conic surfaces, said inner surface conforming generally to the outer conic surface of the crushing head, said mantle being formed of a metal having the general characteristic of flowing under crushing impact, means for relieving the thrust or expansion of the metal of the crushing portion of the mantle caused to flow by the crushing impacts to which the mantle is subjected in the course of the crushing operation, including flange means extending upwardly from an upper portion of the mantle, and including a portion extending radially toward a face of the mantle, such radially extending portion overhanging an adjacent portion of the mantle and being separated therefrom by an intervening channel, and means for maintaining a normally constant locking thrust downwardly against the upper face of said radially extending portion of said flange means.

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