Nov. 17, 1959 E. WERNER 2,913,189

MANTLES FOR CONE CRUSHERS

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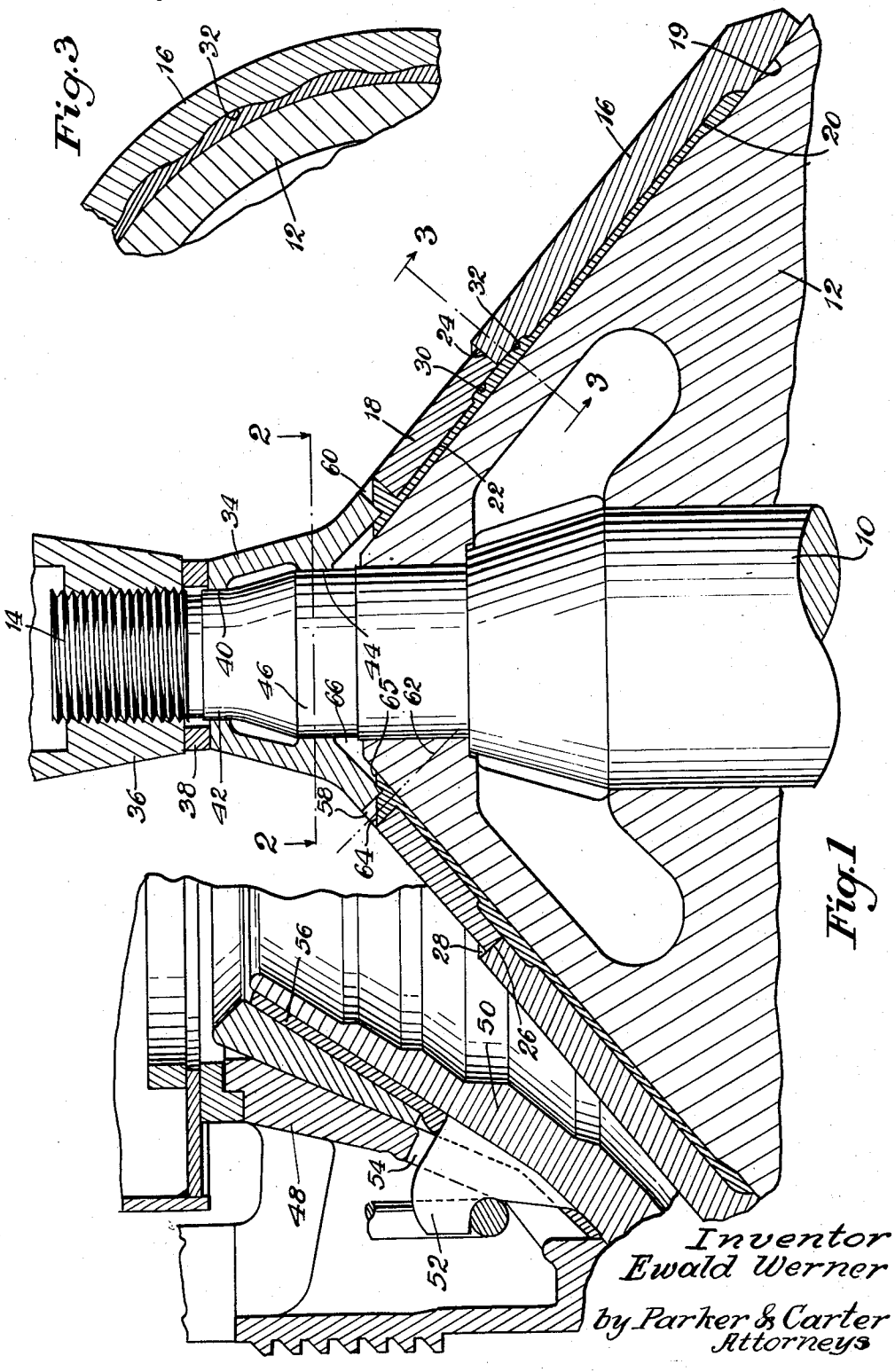


Fig.1

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Fig. 2

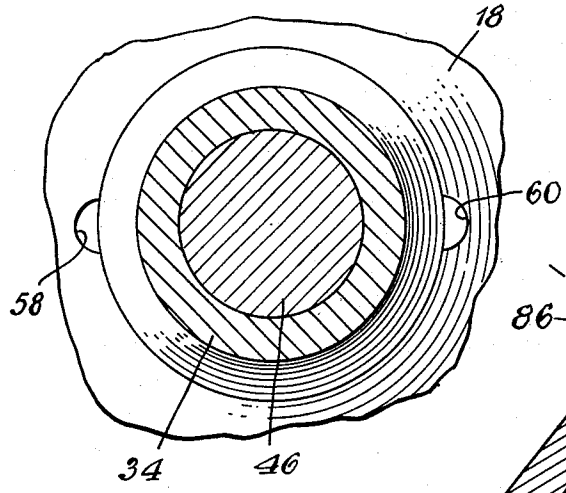


Fig. 4

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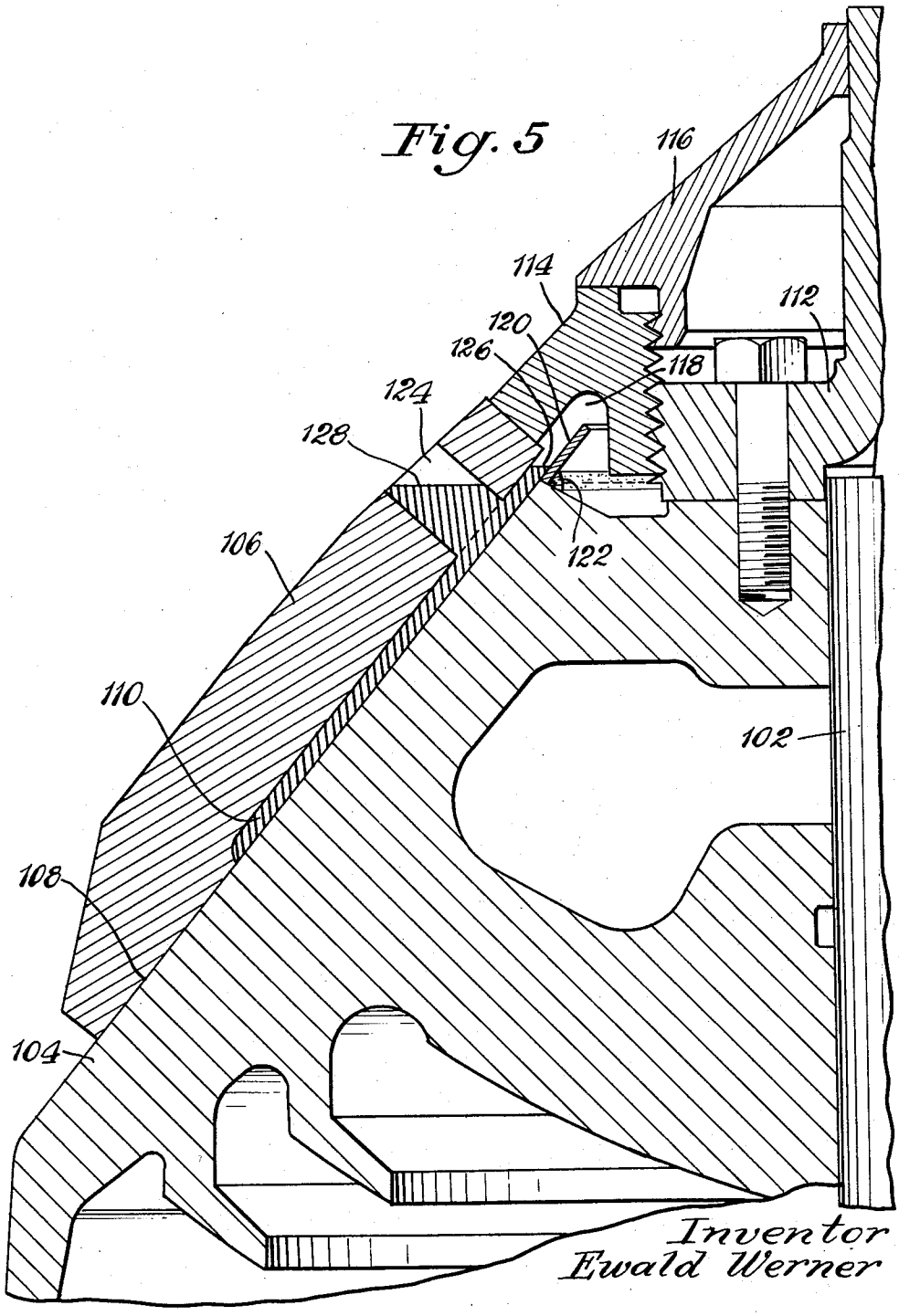
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Fig. 5



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MANTLES FOR CONE CRUSHERS

Ewald Werner, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application July 27, 1956, Serial No. 600,444

15 Claims. (Cl. 241—295)

My invention is in the field of crushers of the gyratory type and relates to a novel mantle structure for its gyrating head. The invention is also concerned with an arrangement to simplify zincing by making it more automatic and at the same time keeping the mantle tight after zincing.

A primary object of my invention is a new mantle of manganese steel or the like for use with or on a gyratory crusher constructed to simplify zincing when a mantle is installed, either the original or a replacement.

Another object is a mantle which can be easily zinced and will remain tight until it is worn down and must be replaced.

Another object is a zincing structure for a mantle constructed to prevent automatically the molten zinc from flowing up to the junction of the head and main shaft.

Another object is a dam element for the head of a gyratory crusher to prevent the zinc from locking the head and main shaft together.

Another object is an interlock between the upper and lower mantle of a two-piece mantle set.

Another object is a mantle which does not require any preliminary assembling and disassembling of the crushing head parts prior to zincing, but allows all of the permanent parts to be assembled prior to zincing.

Another object is a mantle constructed so that it cannot be overfilled with zinc.

Another object is a mantle which will automatically prevent the zinc from interfering in any way with the self-tightening characteristics of the final assembly.

Another object is a mantle with zinc openings constructed so that they do not lessen either the strength of the mantle or in any way interfere with its crushing efficiency.

Other objects will appear from time to time in the ensuing specification and drawings in which:

Figure 1 is a vertical section of a head and a portion of the bowl in a gyratory crusher;

Figure 2 is a section along line 2—2 of Figure 1;

Figure 3 is a section along line 3—3 of Figure 1;

Figure 4 is a vertical half-section of a modified form; and

Figure 5 is a section similar to Figure 4 of a further variant.

In Figure 1, the generally upright eccentrically mounted main shaft of what may be considered a conventional gyratory crusher is indicated at 10. The shaft carries a head 12 and is reduced or shouldered a number of times up to a threaded portion 14 at or near the top.

As shown, the mantle is divided into a lower mantle 16 and an upper mantle 18 which are carried on the outer surface of the head. Near its lower edge, the lower mantle has a somewhat conical surface 19 that closely matches a corresponding conical surface on the head so that the lower mantle is piloted or guided to a fixed position. But above the surface 18 the mantle is peripherally cut back as at 20 to provide a zinc space or zinc cavity. The inner surface 22 of the upper mantle in a similar

fashion is relieved or spaced from the surface of the head so that the zinc cavity extends upwardly and substantially the entire crushing area of the mantle will be backed with zinc.

The upper edge 24 of the lower mantle is somewhat conic and opens upwardly to receive the lower edge 26 of the upper mantle. These surfaces should be matched so that the lower mantle will seat or position the upper mantle. It should also be noted that the lower mantle is a good bit thicker than the upper mantle because it carries more of the crushing load, consequently, a step, gutter or groove is provided at 28.

A key or interlock is provided between the two mantles in the form of an irregular or fluctuating continuous notch as at 30 and 32 on the inner surfaces of both the upper and lower mantles. Figure 3 is a section of this fluctuating surface on the inside of the lower mantle at its upper edge, and the same contour can be applied to the peripheral groove or notch 30 at the lower edge of the upper mantle. I have stated that these grooves or notches are continuous, but they might be otherwise in certain applications. To prevent the formation of stress points or stress concentrations, the irregular surface should be smooth and shallow with no sharp notches or corners. Also the peaks and valleys on one mantle do not have to line up with those on the other.

These fluctuating or undulating surfaces provide an effective interlock or continuous key between the two mantles after zincing which will prevent one from working away from the other. No special interfitting parts or areas between the two mantles are required.

A sleeve 34 is provided on the main shaft to bear down on the upper mantle and a nut 36 of any suitable type forces a torch ring 38 against the sleeve which in turn bears down on the mantle. The sleeve has an upper cylindrical area 40 which bears on and is piloted by a cylindrical surface 42 on the main shaft as well as a lower somewhat larger cylindrical portion 44 which is positioned by a corresponding somewhat larger cylindrical surface 46 on the shaft.

The bowl is indicated at 48 carrying any suitable liner 50 removably mounted by hooks or lugs 52 passing through suitable openings or holes 54 in the bowl, the liner being zinc backed as at 56, if desired. A pair of zinc holes or notches 58 and 60 are provided in the upper mantle. These are shown as notches formed or cut in the upper edge of the upper mantle but they could be otherwise. These openings or channels may be directed or inclined at a substantial angle to the mantle axis as shown, for example, by the centerline 62 of one of the notches in Figure 1. I have shown the notches as perpendicular to the plane or cone of the upper mantle but they might be otherwise. They may be inclined to the mantle axis or they may be otherwise disposed. The holes are also shown as spaced 180 degrees from each other, but they might be closer if desired for any reason.

In any event, zinc is poured in one hole and the other vents. When the zinc has filled the cavity or space between the mantles and the head, it rises to the level shown at 64 in Figure 1. At this point the molten zinc will begin to flow out of either one or both of the holes and down the surface of the upper mantle. Behind the main shaft sleeve, the zinc will seek its own level or at best it will only rise slightly above the level of the zinc in either one of the notches or channels, as indicated at 65. At this point, the cavity will not accept any more zinc and the head is automatically protected from overzincing because the zinc cannot flow up to the space above the head face at 66. In prior mantles and zincing arrangements, the zinc would solidify at or around the space 66 and would interfere with the mantle's self-tightening characteristics. Zinc in the area would be in-

compressible and the sleeve **34** could not move or work down during use to tighten the mantle.

In Figure 4, I have shown a variant form with the head indicated at **68**, the mantle at **70**, the zinc cavity or space **72**, and the guiding and bearing surfaces at **74**. A locking collar **76** on the main shaft carries a locking nut **78** through a threaded connection **80** and has a suitable cover **82** to protect the nut and the thread, similar to prior U.S. Patent No. 2,635,818. The nut has a downwardly and outwardly directed flange **84** which abuts the upper edge of the mantle in the usual manner.

The mantle is provided with a zinc hole **86** which may be inclined to the mantle axis as shown by the centerline **88**, and as in the previous form two or more such holes are provided, preferably 180 degrees apart, one being a pouring hole and the other a vent. In this form, the channels are shown in the form of holes spaced from the upper edge of the mantle and are not cut or formed through the upper edge like notches.

To prevent the molten zinc from getting into the threads on the locking collar and nut and destroying the self-tightening characteristics, I provide a circumferential upstanding dam ring or dike **90** which rises to a level substantially above the zinc holes. In this case, I have shown the zinc level **92** in the zincing cavity substantially above the level of the zinc in the hole **94** and under ideal pouring conditions this differential in zinc levels may exist. But the dam rises a substantial distance above the inner zinc level even under the best of pouring conditions. Additionally, the head is provided with an annular groove or trough **96** and the nut has a corresponding downwardly opening groove or crown **98** with a deflector portion **100**. Thus, any zinc thrown over the dam due to sputtering or the like during pouring will be knocked down and collected in the trough and rendered harmless.

In Figure 5, I have shown a further variant with the main shaft indicated at **102**, the head at **104**, the mantle at **106**, the guiding surfaces at **108**, the zinc space at **110**, the locking collar at **112**, the nut at **114**, and the nut cover at **116**. The head in this modification represents those in the field, and I can adapt or reconstruct such heads quite simply to accept my new mantle.

The lower surface of the nut is upwardly groved or channeled at **118** to accept an upstanding shield or ring dam **120** made of a narrow strip which is welded or otherwise suitably secured to the upper outer edge of the head at **122**. The pouring or zinc hole **124** in this form is shown as spaced from the upper edge of the mantle and the zinc level **126** in the zinc space again is shown as rising above the zinc level **128** in the holes.

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

I provide a replaceable mantle for use on or with a gyratory crusher with a vastly improved assembly and zincing arrangement. Prior to my invention, zincing the mantle on the head of a crusher has been a problem. The hot molten zinc is poured into the zinc space between the head and the mantle and no accurate or automatic method had been worked out to determine when the zinc had reached its proper upper level. Prior to my invention, nothing has prevented the zinc from rising too high and damaging the crusher. For example, when the zinc is too high, it can flow over and substantially reduce or do away with its self-tightening characteristics. In any zincing operation, there is a lot of smoke and sputtering and the people required to zinc the mantle do not care to hover around the mantle during zincing.

But with my invention, the molten zinc is automatically stopped at a predetermined upper level. One of the holes, notches or apertures is used for pouring and the other as a vent. The dam on the upper end of the head, be it a field unit as in Figure 5 or a new manufacture as in Figure 4, prevents the zinc from ruining the self-tightening characteristics of the mantle.

The channels or openings for the zinc may be disposed at an angle to the mantle axis. I have said that they are spaced 180 degrees apart but they could be otherwise. At the same time, I have shown and described two such holes or channels but more could be used depending upon the circumstances.

The hole or aperture to receive the zinc might have a special shape or configuration, for example, a star shape, rectangular, triangular or otherwise, to hold a special pouring spout or funnel. I have not shown any because many suitable arrangements may be used. Also, the holes or channels may be at different levels, the upper one for pouring, the lower one for venting and for automatically determining the zinc level.

The holes may be filled with a plug or otherwise, except that this has the disadvantage that the plug would have to be removed which might involve taking off the nut. If a plug is used, the hole can be tapered inwardly and the plug will be pinned firmly in place after the first few runs. Or it can be welded.

One important aspect of my invention is that no special pouring mandrels are needed. Once the mantle is in place, the locking mechanism, whatever form is used, can be turned down to fully tighten the mantle and thereafter left alone. Furthermore, hand tightening is sufficient whereas sledging or ramming has been necessary heretofore. The zinc is then poured and allowed to solidify, which additionally tightens the mantle. No intermediate or preliminary steps are necessary prior to pouring the zinc and no parts have to be removed after the zinc is poured and replaced by standard parts. Removing and replacing parts after zincing results in a loose initial fit which defeats self-tightening.

While I have shown and described the preferred form and several modifications of my invention, and suggested others, it should be understood that numerous additional modifications, changes, substitutions, alterations and additions can be used where appropriate and should be considered to fall within the scope of my invention. I, therefore, wish that the invention be unrestricted except as by the appended claims.

I claim:

1. For use in a gyratory crusher or the like, an upwardly truncated centrally open frusto-conical mantle of a material having the general characteristics of manganese steel with a normally open outer crushing surface and a symmetrically arranged inner surface constructed to define with the crusher head a space for backing material having a normal maximum upper level, the upper edge of the mantle having a peripheral surface constructed to be engaged by a locking device arranged to apply a downward axial thrust against the mantle to hold it in place on the head, and at least two backing material receiving apertures at the upper end of the mantle inclined to the mantle axis opening through the mantle's inner surface well up in the space but below and related to the maximum upper level such that, during pouring, the backing material will not rise above its maximum upper level.

2. The structure of claim 1 in which the mantle is the upper mantle of a combination upper and lower mantle set.

3. The structure of claim 1 in which the apertures include two holes in the mantle, 180 degrees apart, spaced down from the upper edge of the mantle and inclined at a substantial angle to the mantle axis.

4. In a gyratory crusher or the like, a generally upright shaft, a crushing head on the shaft, a frusto-conical removable and replaceable mantle on the head formed to define an annular zinc space with the head having an upper zincing limit, a locking member for the head arranged to engage the peripheral upper edge of the mantle to apply a downward axial thrust to the mantle and to secure it on the head, at least two apertures in the mantle inclined to the mantle axis and opening into the zinc

space below its upper limit, and means for automatically preventing molten zinc from flowing in and interlocking the shaft and head.

5. The structure of claim 4 in which the channels are holes below the upper edge of the mantle.

6. The structure of claim 4 in which the channels are notches formed in the upper edge of the mantle.

7. The structure of claim 4 in which the last mentioned means includes a dam ring on the head rising a substantial distance above the level of the apertures.

8. For use with a gyratory crusher or the like, an axially open mantle having an outer crushing surface and an inner supporting surface adapted to define a space for backing material with the head of the crusher, one end of the mantle being constructed to abut another mantle to provide a substantially leakproof joint when locked on the head, and an undulated area on the inner surface of the mantle at the said one end so that the backing material, when poured into the space, will lock the mantles together.

9. The structure of claim 8 in which the undulated area on the inner surface of the mantle is at the small end and is peripherally substantially continuous.

10. In a gyratory crusher or the like, a generally upright shaft, a crushing head on the shaft and means for gyrating it, a mantle set including upper and lower somewhat frusto-conic removable and replaceable mantles on the head formed to define an annular space for backing material with the head, the upper and lower ends of the lower and upper mantles, respectively, abutting, and an undulated area on the inner surface of both mantles at their abutting ends so that the backing material locks the mantles together.

11. The structure of claim 10 in which the undulated area on each mantle is substantially peripherally continuous.

12. In a gyratory crusher or the like, a generally upright shaft, a crushing head on the shaft, a frusto-conical removable and replaceable mantle on the head formed to define an annular space for backing material with the head and having a peripheral upper edge, a locking member for the head arranged to engage the peripheral upper edge of the mantle to apply a downward axial thrust to the mantle and to secure it to the head, at least two apertures in the mantle inclined to the mantle axis and opening into the space below its upper limit, and means for automatically preventing backing material from flowing in and interlocking the shaft and head.

13. The structure of claim 12 in which the mantle includes a mantle set having upper and lower somewhat frusto-conic removable and replaceable mantles on the head, the upper and lower edges of the upper and lower mantles, respectively, abutting one another providing a substantially leakproof joint, the apertures being at the small end of the upper mantle.

14. The structure of claim 4 in which the last-mentioned means includes a dam ring in the form of an upstanding strip welded to the crushing head.

15. The structure of claim 4 in which the last-mentioned means includes a dam ring upstanding from and integral with the crushing head.

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