

[54] SANDCONE CRUSHER

[76] Inventor: Louis W. Johnson, 3440 Franklin Blvd., Eugene, Oreg. 97403

[22] Filed: May 13, 1971

[21] Appl. No.: 143,142

[52] U.S. Cl. 241/207
[51] Int. Cl. B02c 2/04
[58] Field of Search 241/207, 208, 209, 241/210, 211, 212, 213, 214, 215, 216

[56] References Cited

UNITED STATES PATENTS

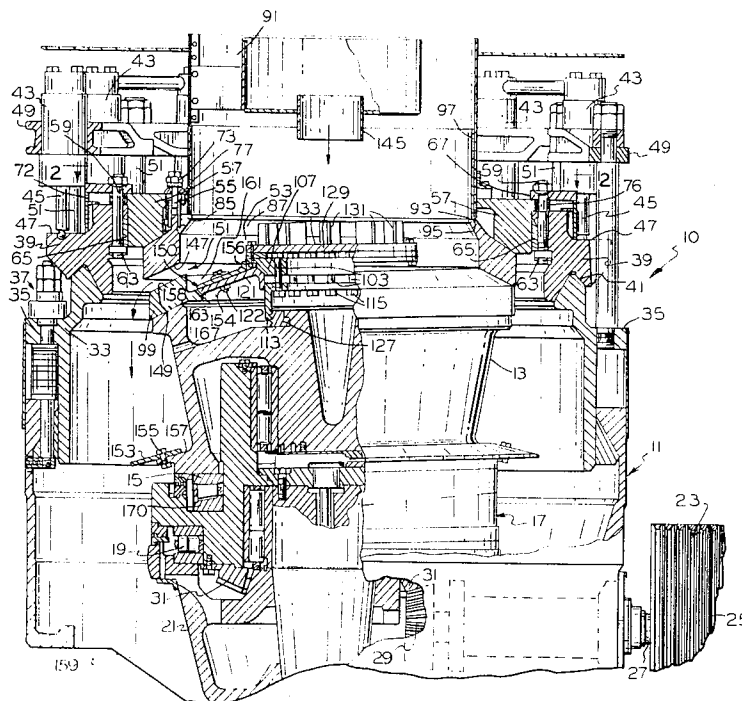
2,901,189	8/1959	Conway et al.	241/207
3,329,356	7/1967	Davis et al.	241/207 X
3,118,623	1/1964	Johnson	241/207
2,670,142	2/1954	Gruender	241/208

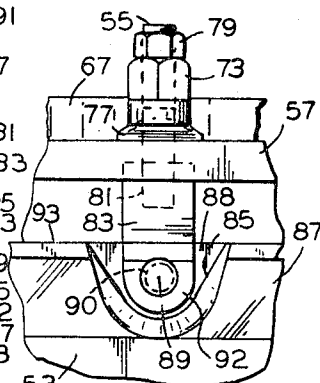
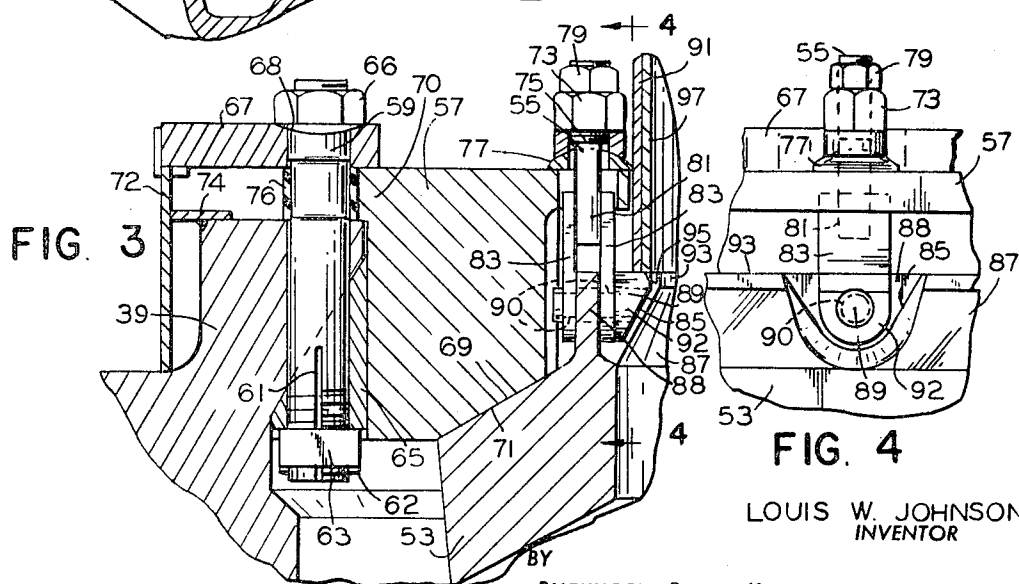
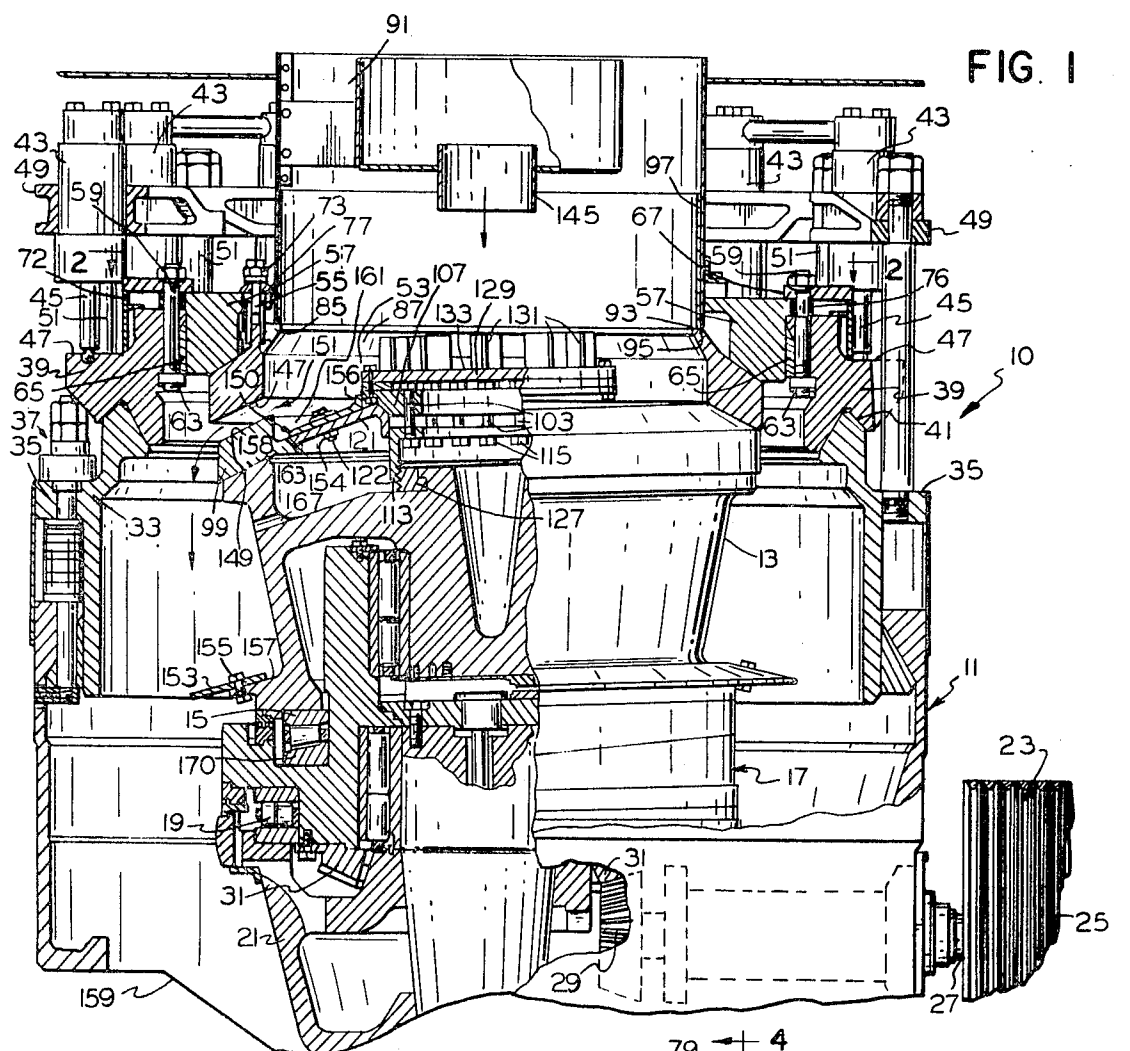
Primary Examiner—Granville Y. Custer, Jr.
Attorney—Buckhorn, Blore, Klarquist & Sparkman

[57] ABSTRACT

A crusher has a crusher head that is gyrated relative to a crusher bowl. The crusher head supports an annular mantle held by a mantle washer and a clamping plate clamped to a self-tightening nut by a clamping plate bolted to the nut. The washer covers a drained chamber in the crusher head and has drain holes for water from an annular recess formed by the inner edge of the mantle and the washer. A distributor plate having pickets covers the clamping plate and is positioned below a center distributing hopper in a larger hopper having a lining outwardly set back from an inwardly extending protective flange of a bowl liner. Self-locking pins lock eyebolts to the bowl liner and the eyebolts secure the bowl liner to a clamp bar through self-aligning washers. The clamp bar is bolted by fluted bolts to a bonnet secured to a bonnet support by holddown cylinders. A skirt on the crusher head overhangs a cam and thrust bearing structure mounting the cam and the crusher head.

15 Claims, 6 Drawing Figures





LOUIS W. JOHNSON
INVENTOR

**BUCKHORN, BLORE, KLARQUIST & SPARKMAN
ATTORNEYS**

FIG. 2

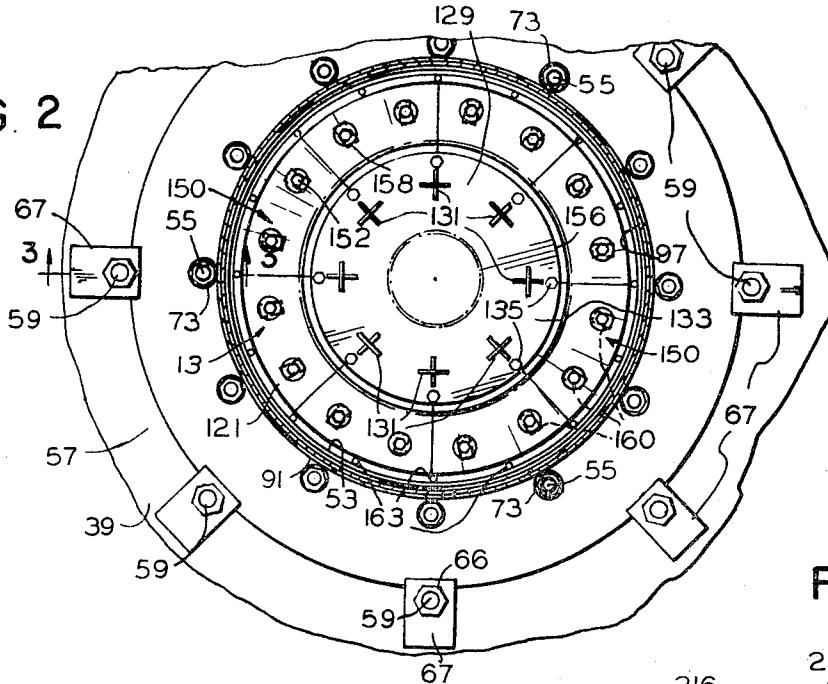


FIG. 5

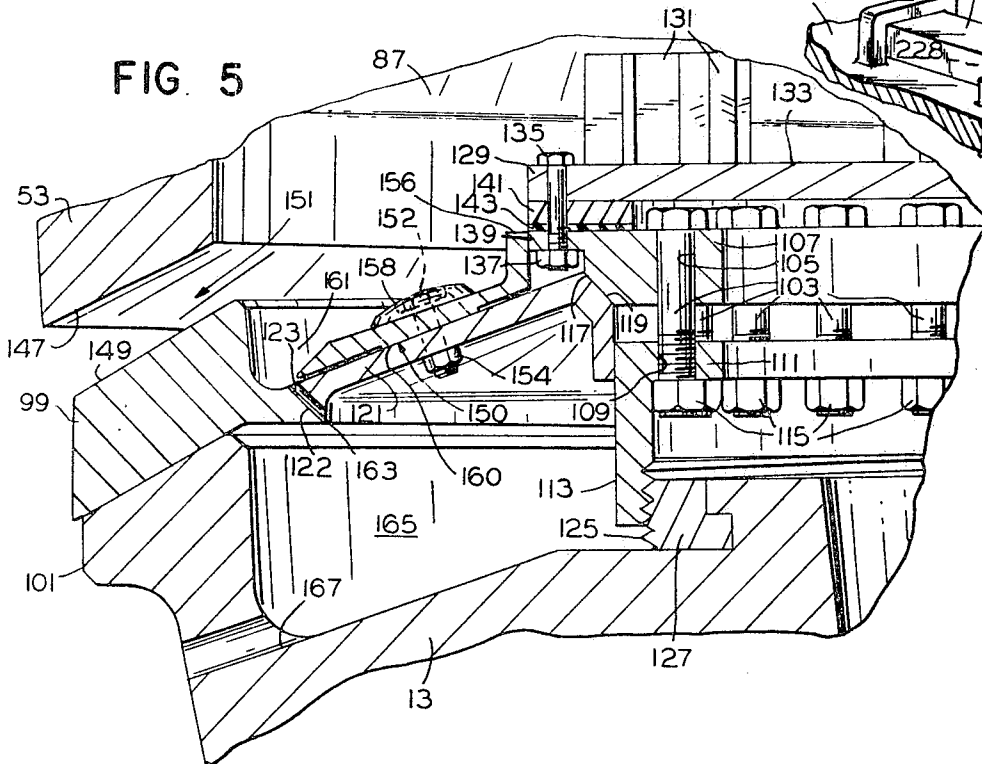
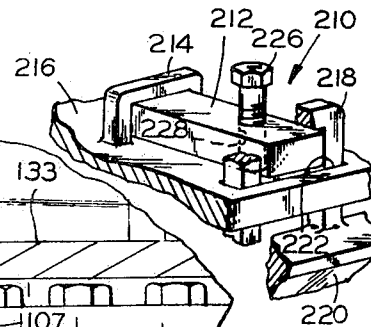


FIG. 6



LOUIS W. JOHNSON
INVENTOR

BY
BUCKHORN, BLORE, KLARQUIST & SPARKMAN
ATTORNEYS

SANDCONE CRUSHER

This invention relates to an improved rock crusher, and more particularly to an improved rock crusher of the gyratory crusher head type.

An object of the invention is to provide a new and improved rock crusher.

Another object of the invention is to provide a new and improved rock crusher of the gyratory crusher head type.

A further object of the invention is to provide a new and improved mantle securing structure.

Another object of the invention is to provide a self-locking mantle structure.

Another object of the invention is to provide a moisture draining crusher head.

Another object of the invention is to provide a crusher having an annular mantle clamped against a crusher head by a frustoconical washer secured by a clamping plate bolted to a self-tightening nut screwed onto the crusher head.

Another object of the invention is to provide a crusher having a distributor plate mounted on the crusher head below a center discharge hopper.

Another object of the invention is to provide a crusher having an overhanging bowl which protects an outer hopper from abrasion.

Another object of the invention is to provide a crusher of the attrition type having narrow crushing surfaces at angles at which lines of force on a mantle thereof are inside an annular bearing supporting a crusher head carrying the mantle.

Another object of the invention is to provide a crusher wherein a bonnet liner is supported by quick-releasing eyebolts secured by self-locking pins to a web of the liner.

Another object of the invention is to provide a crusher wherein a wedging ring is held by fluted draw bolts.

Another object of the invention is to provide a crusher having an annular deflector plate overhanging on a rim of a crusher head structure to protect the rim from falling rocks.

DRAWINGS

FIG. 1 is a fragmentary, vertical, sectional view of a rock crusher forming one embodiment of the invention;

FIG. 2 is a fragmentary, plan view taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged, fragmentary, vertical, sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged, fragmentary, vertical sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is an enlarged, fragmentary, vertical, sectional view of the crusher head mounting; and

FIG. 6 is a fragmentary, vertical, sectional view of a rock crusher forming an alternate embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now in detail to the drawings, there is shown therein a rock crusher 10 forming one embodiment of the invention which is an improvement over that disclosed and claimed in my prior U.S. Pat. Nos. 3,118,623, 3,281,083 and 3,337,143. The crusher 10 includes a main frame 11, which for gyration supports a crusher head 13 on a thrust bearing 15 on a camming

member 17 which, in turn is rotatably supported on bearing 19 on the inner shell 21 of the frame 11. The camming member 17 is driven by a drive system 23 like that disclosed in above-mentioned U.S. Pat. No. 3,337,143 and having a pulley 25 driven by a motor and belt drive (not shown), a jack shaft 27 and pinion gear 29 rotating a ring gear 31 fixed to the bottom of the camming member 17. The crusher head is gyrated and rocked by the drive system and the camming member.

A bonnet support 33 is supported on the frame 11 through a flange 35 of the bonnet support and a plurality of support assemblies 37. A bonnet 39 is held down against the upper surface 41 of the support 33 by the pressure exerted by cylinder units 43 through piston rods 45 pressing against upper surface 47 of the bonnet 39. A hold-down frame 49 is supported on rods 51 on the flange 35 of bonnet support 33. This hold-down system is disclosed in more detail in my prior U.S. Pat. Nos. 3,281,083 and 3,337,143.

A bowl liner 53 is clamped by eyebolts 55 to a support ring 57 which is attached to the bonnet 39 by drawstuds 59 with longitudinal flutes 61 (FIG. 3) and rectangular nuts 63 which are loosely supported by pairs of angles 62 welded to a split wedging ring 65, the angles 62 serving to keep the nuts 63 to the ring 65 and held against rotation. The wedging ring 65 clamps the support 57 tightly between bonnet 39 and clamp bars 67. Self-aligning nuts 66 seated in spherical aligning sockets 68 in the clamp bars 67 press the clamp bars tightly against flange 70 of the support ring 57. The clamp bars 67 bear on outboard fulcrum posts 72 welded to the bonnet 39 and having braces 74 welded to the bonnet. Rubber tubes 76 are longitudinally compressed between the clamp bars and the upper face of the bonnet.

When nuts 73 are screwed onto threads 75 of the eyebolts 55, the inclined surface 69 of the bowl liner 53 is drawn up against inclined surface 71 of liner support ring 57 to lock the liner on the ring. Self-aligning washers 77 and jam nuts 79 are positioned on the eyebolts. Each eye-bolt 55 includes a center bolt section 81 integral with a clevis 83, which straddles a web 88 of the bowl liner 53 and projects into a recess 85 provided in upwardly extending flange 87 of the liner 53. Self-locking pins 89 having annular grooves 90 connect the clevises 83 to the webs, the clevises pulling up into the grooves 90 to lock the pins against endwise movement. The pins 89 have wear plug heads 92 contoured to the tapered inner face of the flange 87. The support ring 57 and the bowl liner 53 can be easily lifted out through the top of the crusher after removing the hopper and unscrewing nuts 66 and removing bars 67. The bowl liner 53 then can be easily removed from the ring 57 after loosening nuts 73 and pulling pins 89.

The flange 87 is frustoconical in shape and upper edge 93 protects the lower edge 95 of hopper liner 97 from wear from the bed of material as it pulsates up and down during the crushing operation. The liner 97 is mounted inside of hopper 91, and can be replaced if wear develops. The bowl liner 53, when worn, can be rapidly removed for replacement by removing the bolts 59, removing the hopper 91, and lifting the bowl liner 53 directly out through the top of the crusher 10.

A self-tightening mantle 99 (FIG. 5) is supported by a flange 101 of the crushing head 13 and is clamped to the flange 101 by bolts 103 passing through holes 105

in a clamping plate 107 and through holes 109 in the top flange 111 of a self-tightening nut 113. Nuts 115, one flat of each of which engages the inner periphery of the nut 113, are screwed onto the bolts. As the bolts 105 are tightened, inclined surface 117 of clamping plate 107 is pressed downwardly and outwardly on inclined surface 119 of a mantle washer 121 to wedge the periphery 122 against inside edge 123 of the mantle 99 to press the mantle against the flange and lock the mantle in place. The nut 113 is screwed onto threads 125 of a threaded ring 127 secured to the top of the crushing head 13. The ring 127 is split in two, and is secured to the head 13 by cap screws (not shown). If during the operation of the crusher the mantle 99 should become loose and turn, it will automatically turn the nut 113 in a direction that will cause it to become tighter, this being a continuous tightening action, or self-tightening. A distributor plate 129 with feeder pickets 131 welded to its top 133 is secured by bolts 135 and nuts 137 to a flange 139 of the clamping plate 107. The plate 129 is spaced upward for bolt head clearance by ring 141 and gasket 143. The plate 129 covers the bolts 103 and with the gasket keeps dust and grit away from the bolts.

When it is necessary to replace the mantle 99, the hoppers and the mantle structure are removed. Then the distributor plate 133 and the bolts 103 and nuts 115 are removed, and the clamping plate 107, the washer 121 and the mantle are lifted out of the crusher. A space is provided between the nut 113 and the clamping plate 107 to provide access for cutting the bolts 103 in the event that the nuts should become frozen to the bolts.

To protect the mantle washer 121 from wear, thick tapered wear plates 150 forming segments of a frustum are secured to the washer by bolts 152 and nuts 154. The outer edges of the wear plates are beveled and the wear plates have upstanding inner flanges 156. The heads of the bolts fit into counterbored bosses 158 and thin rectangular pad portions 160 bear on the washer and space the wear plates slightly from the upper surface of the washer.

The material to be crushed is fed into the crusher 10 by way of the center distributing hopper 145 in the outer hopper 91 to the center of the gyrating distributor plate 129. Normally a bed of material at least eight inches deep is maintained to achieve the best crushing action between lower surface 147 of the bowl liner 53 and upper surface 149 of the mantle 99. Because of the small angle between the liner 53 and the mantle 99, the material does not progress very rapidly out of the crushing chamber 151, thereby causing increased crushing by rocks being ground against each other, which produces a very cubicle product and with a fairly low wear rate on the unit. As the crushed material falls clear of the crushing chamber 151, it is deflected by a ring 153 that is mounted by bolts 155 on a flanged lower portion 157 of the crushing head 13. The ring 153 protects the camming member 17 and directs the material so that it will fall out through the opening 159 in the bottom of the crusher 10 onto a conveying means not shown.

To remove the moisture from the material before the moisture can enter the crushing chamber 151, where it can cause packing of the product, which could be damaging to the machine, excessive amounts of water are collected in an annular, upwardly facing groove or recess 161 formed in the mantle 99 and by the washer

121. A plurality of narrow notches 163 in the periphery 122 of the washer 121 provide drains into a lower compartment 165 formed in the crushing head 13. Ports 167 are provided to drain the water so that it will pass out through the bottom of the crusher along with the crushed material.

The crushing surfaces 147 and 149 are narrow and cause the rock to grind on itself in what is termed "attrition grinding." This causes the rock to be crushed exceedingly fine. The inclination of the surfaces to the longitudinal axis of the crusher head and the height of the surface 147 above thrust bearings 19 and 170 supporting the crusher head are such that the resultant forces on the surface are substantially all inside the annular bearings 19 and 170. This eliminates overhung loading of the thrust bearings. The closer the lines of force are to the center of the thrust bearings, the longer their life.

EMBODIMENT OF FIG. 6

A rock crusher shown in FIG. 6 and forming an alternate embodiment of the invention is identical to the rock crusher shown in FIGS. 1-5 except for a bowl lining retaining system 210. The system 210 comprises lever bars 212 (only one of which is shown) having one end pivotal in a loop or eye 214 welded to bowl ring 216, which is like the ring 57. The other end of the bar extends through eye 218 extending upwardly from bowl liner 220 loosely through a hole 222 in a flange of the bowl ring. The bowl liner 220 is generally like the bowl liner 53. A jackscrew 226 screwed through tapped bore 228 in the bar 212 bears against the bowl ring 216 and forces the bowl liner tightly against the bowl ring.

What is claimed is:

1. In a rock crusher, crusher head means having an outer frustoconical support surface, mantle means having an outer mantle portion resting on the support surface and an inner thrust portion, the mantle means having an upwardly cupped portion having drain openings, clamping means engaging the thrust portion, and releasable fastener means securing the clamping means to the crusher head means.
2. The rock crusher of claim 1 wherein the crusher head means has a moisture collecting cavity below the cupped portion and having drain openings.
3. In a rock crusher, crusher head means having an inner threaded boss means and an outer frustoconical support surface, nut means on the threaded boss means, mantle means having an outer mantle portion resting on the support surface and an inner thrust portion slidable on the nut means, clamping means engaging the thrust portion, and releasable fastener means securing the clamping means to the nut means.
4. The rock crusher of claim 3 wherein the thrust means comprises a frustoconical washer having an inner sleeve-like portion slidable on the nut means.
5. The rock crusher of claim 3 wherein the clamping means comprises a clamping ring.
6. The rock crusher of claim 5 including a distributor plate releasably secured to the clamping ring and covering the fastener means.

5

6

7. The rock crusher of claim 3 wherein the mantle means has an upwardly cupped portion.

8. The rock crusher of claim 7 including drain openings in the cupped portion.

9. The rock crusher of claim 8 wherein the crusher head means has a moisture collecting cavity below the cupped portion and having drain openings.

10. In a rock crusher,
an annular bonnet,
a support ring,
a clamp bar,
wedge means locking the support ring to the bonnet and the clamp bar,
a bowl liner,
and a plurality of releasable fastener means securing the bowl liner to the support ring.

11. The rock crusher of claim 10 wherein the fastener means include eyebolts, pins securing the eye-

bolts to the bowl liner and nuts on the eyebolts.

12. The rock crusher of claim 11 wherein the fastener means also include self-aligning washers.

13. The rock crusher of claim 11 wherein the eyebolts include clevis portions fitting over web portions of the bowl liner.

14. The rock crusher of claim 10 wherein the wedge means include a wedge engaging the support ring and bolts on the clamp bar and pulling the wedge against a wedge surface of the bonnet.

15. The rock crusher of claim 10 wherein the bowl liner includes an annular, inwardly projecting, upper ledge portion,

and hopper means on the ledge portion and spaced outwardly from the inner periphery of the ledge portion.

* * * * *

20

25

30

35

40

45

50

55

60

65