United States Patent

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[54] **MINING MACHINE HAVING LIQUID SUPPLY SEALING MEANS**

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[52] **U.S. Cl.** **299/73,** 299/81

[51] **Int. Cl.** **E21c 27/24**

[58] **Field of Search** 299/12, 73, 75, 81

[56] **References Cited**

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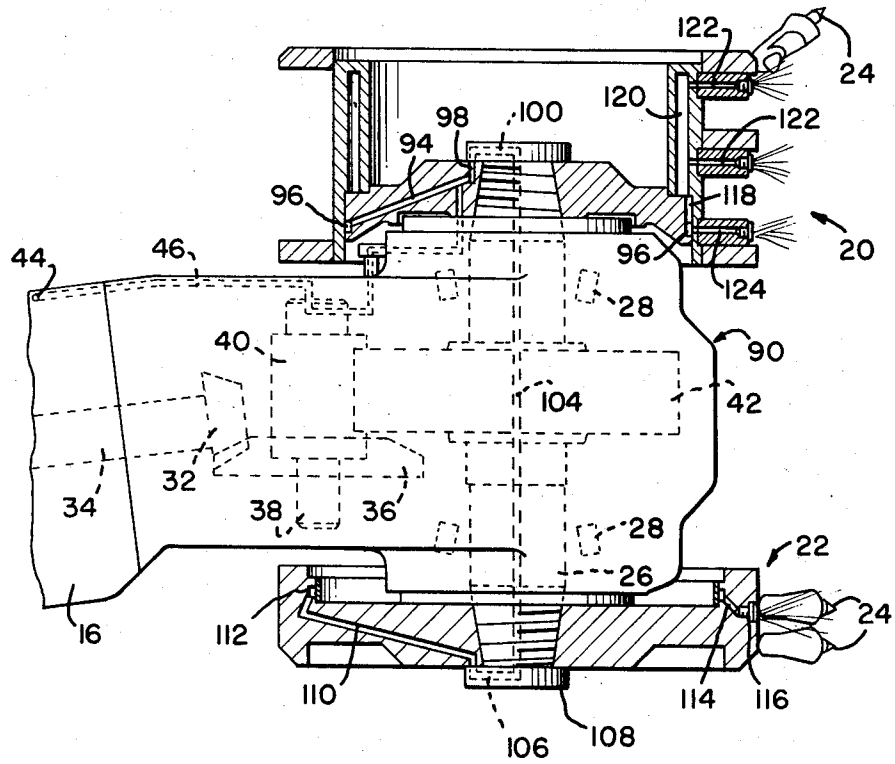
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[57] **ABSTRACT**

Mining machine having a rotary mining head including a rotatable support carrying cutter supporting drum means, wherein liquid such as water is discharged through discharge outlets peripherally of the drum means. The liquid is supplied through passage means in nonrotatable supporting means and communicating passage means in the rotary mining head, leakage at the connection of such passage means being prevented by a plurality of sealing rings which encircle the support laterally spaced apart longitudinally of the latter adjacent opposite sides of such connection. Leakage past the sealing rings flows externally of the mining head, whereby such leakage is readily and quickly detectable; and means separate from the sealing rings prevent liquid leakage past the latter from flowing to the bearings mounting the support and/or to the gears through which the mining head is rotatably driven.

9 Claims, 6 Drawing Figures



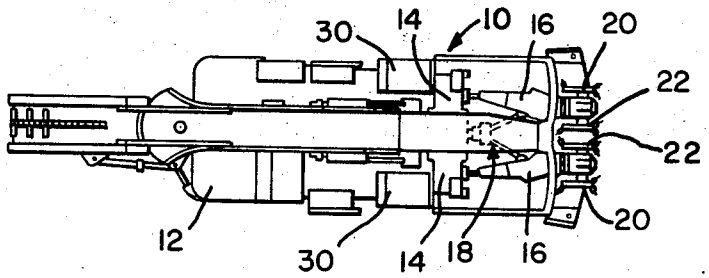


FIG. 1

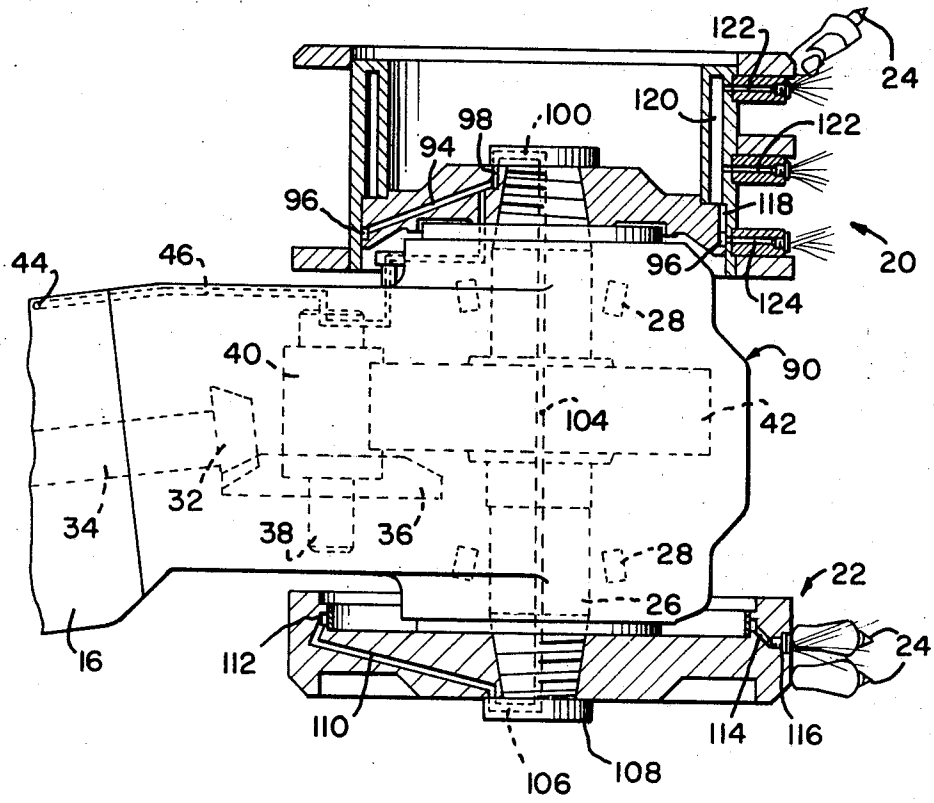


FIG. 2

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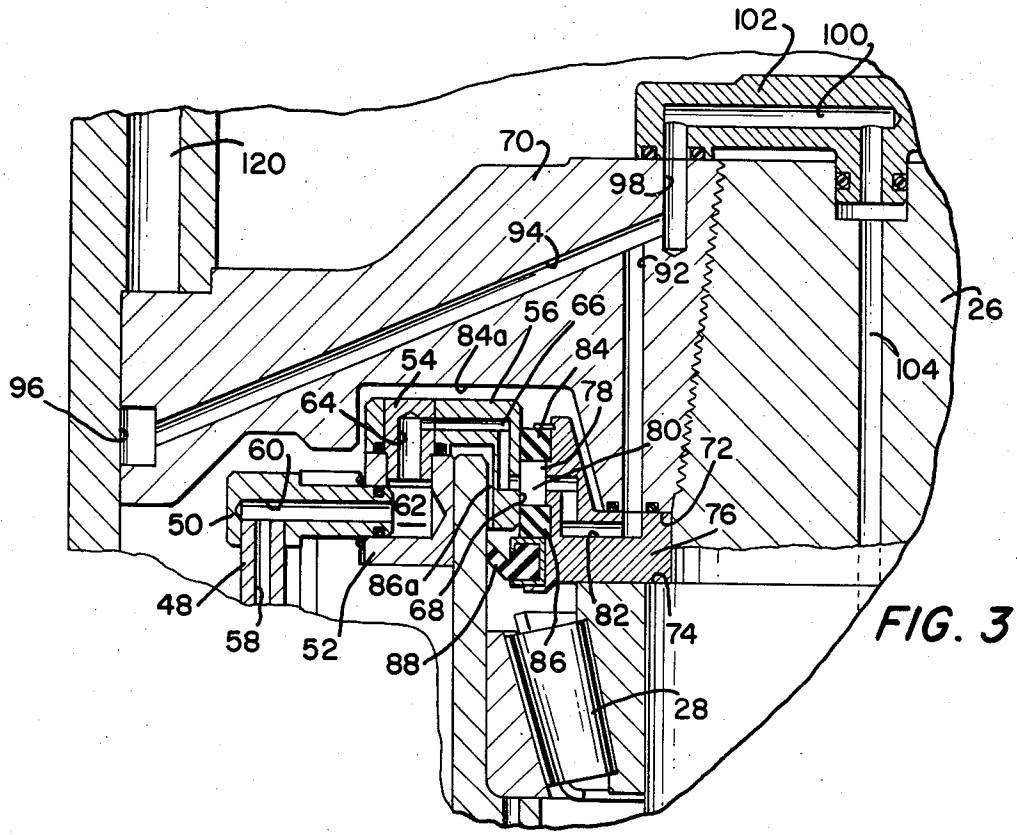


FIG. 3

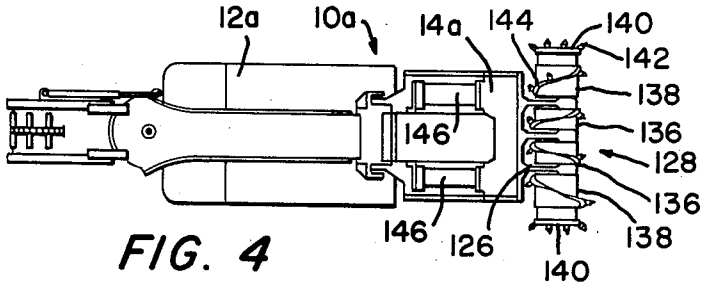


FIG. 4

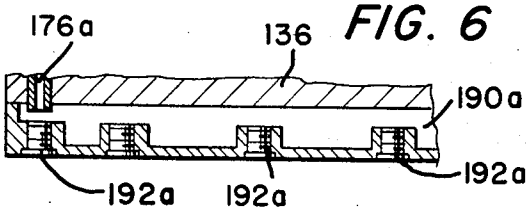


FIG. 6

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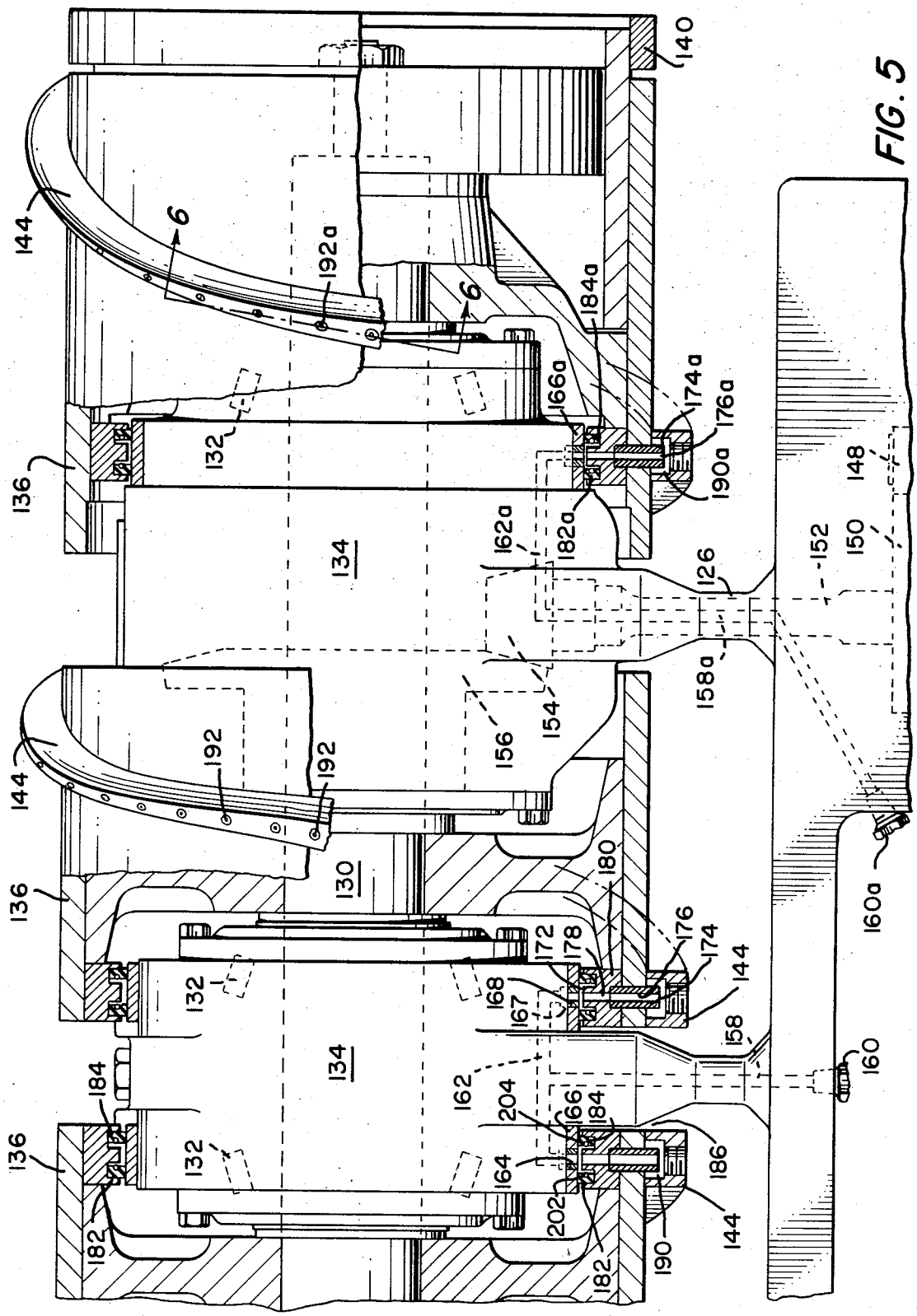

140
144
6
192a
184a
166a
174a
176a
190a
132
136
134
162a
182a
126
148
150
152
154
156
158a
192
130
180
176
172
178
174
168
167
158
160
160a
162
204
166
184
186
164
202
182
190

FIG. 5

MINING MACHINE HAVING LIQUID SUPPLY SEALING MEANS

The present invention relates to mining machines and more particularly to mining machines, such as for example employed for the mining of coal, adapted for discharging liquid such as water through a rotary mining head.

An object of the present invention is to provide a new and improved mining machine of the type set forth which has sealing rings preventing leakage of the liquid at the connection of a liquid supply passage in a nonrotatable support with a liquid supply passage in the rotary mining head.

Another object o the invention is to provide a new and improved mining machine of the type set forth which is particularly constructed and arranged to prevent liquid leakage past the sealing rings from flowing to either the bearings mounting the mining head or the gears through which the latter is rotatably driven.

Another object is to provide a new and improved mining machine of the type set forth which is particularly constructed and arranged whereby liquid leakage past the sealing rings flows externally of the mining head and is thereby readily and quickly detectable.

In accordance with the invention, a mining machine may comprise a chassis, a boom mounted on the chassis for vertical movement thereto, supporting means carried by the boom, a rotary mining head including a support and cutter supporting drum means carried by the support for rotation therewith, bearing means rotatably mounting the support on the supporting means, driving means including gear means for rotatably driving the support relative to the supporting means, discharge means peripherally of the drum means for discharging liquid during rotation of the drum means, the supporting means being provided with first liquid supply passage means, second liquid supply passage means in the mining head connected to the first supply means to receive liquid therefrom and communicating with the liquid discharge means for supplying liquid thereto, a plurality of sealing rings laterally spaced apart adjacent opposite sides of the connection of said passage means for preventing liquid leakage at such connection, at least one of such sealing rings preventing liquid leakage from passing externally of the mining head, and means separate form the sealing rings preventing liquid leakage by the sealing rings from flowing to said gear means and said bearing means.

Referring to the drawings:

FIG. 1 is a top or plan view of one form of mining machine embodying the invention;

FIG. 2 is an enlarged fragmentary top or plan view, partially broken away and in section, of the mining machine shown in FIG. 1;

FIG. 3 is a further enlarged fragmentary sectional view of the mining machine shown in FIG. 1;

FIG. 4 is a top or plan view of another form of mining machine embodying the invention;

FIG. 5 is an enlarged fragmentary sectional view illustrating a portion of the rotary mining machine shown in FIG. 4; and

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5 looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, FIG. 1 illustrates a

mining machine designated generally as 10 which comprises a chassis 12 having mounted thereon a vertically movable boom 14 which projects forwardly of the forward end of the chassis 12. The boom carries a pair of cutter supporting arms, 16, mounted adjacent opposite sides of the longitudinal centerline of the machine 10, which during the machine operation are laterally oscillated towards and away from one another by a hydraulic motor designated generally as 18 located between the supporting arms 16. The rotary mining head of the machine 10 comprises rotatably driven cutter supporting drums 20, 22 at the forward end of each supporting arm 16 carrying the usual cutter bits 24 which may be of any conventional construction and arrangement. The drums 20, 22 of each supporting arm 16 are threadedly mounted on opposite ends of a support or supporting shaft 26 which longitudinally extends tranversely through the arm 16 and is rotatably mounted thereon by bearings 28. The supports 26 are connected to be rotatably driven by individual drive motors 30 through separate gear trains each comprising a bevel gear 32 mounted on one end of a rotatable shaft 34 at its other end connected to be rotated by a respective motor 30, an intermeshing bevel gear 36 keyed to a rotatable shaft 38, a drive gear 40 also on the shaft 38, and a driven gear 42 keyed to the support 26 and intermeshing with the drive gear 40. If desired, further details of a conventional mining machine of this general construction can be obtained from U.S. Pat. No. 3,353,871, issued Nov. 21, 1967 and assigned to the assignee of the present invention.

Each supporting arm 16, as shown in FIG. 2, is provided with a liquid inlet 44 adapted for connection to a supply hose (not shown) communicating with a pressurized source of water or other liquid supply pipe or tube 46 which is connected at its rearward inlet end to the inlet 44 to receive the liquid therethrough. Each arm 16 rigidly carries nonrotatable connector or adaptor housing 48, 50, 52, 54, 56 containing communicating bores 58, 60, 62, 64, 66, respectively, the housing 56 encircling the respective shaft 26 and including an annular inner face 68 bounding the outer side of an annular supply chamber 80. The bore 58 in the adaptor housing 48 is connected to the forward discharge end of the supply tube 46 to receive liquid therefrom; and the bore 66 in the adaptor housing 56 extends through the annular face 68 to discharge liquid to the chamber 80 in a direction tranversely or circumferentially of the surrounded shaft 26. Hence, liquid supplied through the inlet 44 flows successfully through the supply pipe 46 and the bores 58, 60, 62, 64, 66 inwardly of the annular face 68 of the adaptor housing 56.

The hub 70 of each drum 20 is mounted on its shaft 26 with an annular shoulder 72 spaced axially of such shaft 26 from an annular shoulder 74 on the latter. An annular adaptor housing 76 is clamped to each shaft 26 for rotation therewith between the pair of spaced shoulders 72, 74. The adaptor housings 76 have annular faces 78 spaced inwardly from the respective adjacent annular faces 68 to bound the radially inner sides of the supply chambers 80, and contain passages 82 communicating with the chambers 80 to receive liquid therefrom in a direction radially or transversely of the shafts. Liquid leakage form the sides of the chambers 80 is prevented by sealing rings 84, 86 which

encircle the shafts **26** laterally spaced apart longitudinally of the shafts **26** adjacent opposite sides of the chambers **80**. The sealing rings **84, 86**, prevent liquid leakage from the chambers **80** externally of the mining head through the spaces **84***a*, **86***a*, whereby in the event of liquid leadage past the rings **84, 86**, such leakage will accumulate externally of the head and be resultantly readily and quickly detectable. Annular sealing rings **88** encircle the shafts **26** and prevent liquid leakage past the sealing rings **86** from flowing to the bearings **28** mounting the supports **26**. The gears **32, 36, 40, 42** are enclosed in housings one of which is indicated generally as **90** in FIG. **2**; and such housings **90** prevent liquid leakage past the rings **86** from flowing to the gears through which the drums **20, 22** are driven.

Each hub **70** contains a bore **92** at one end connected to the passage **82** in the respective thereadjacent adaptor housing **76** and at the other end communicating with a supply bore **94**. The bore **94** at opposite ends is connected to an annular chamber **96** and a supply bore **98** in its hub **70**. The bores **98** each communicate through passages **100** formed in cap elements **102**, mounted on the thereadjacent end of the respective shaft **26**, with end of a bore **104** formed axially through such shaft **26**. As shown in FIG. **2**, the other end of each bore **104** communicates with passages **106** formed in a cap element **108** carried at the other end of the shaft **26**, the passages **106**, in turn, being connected to one end of a passage **110** formed in the drum **22**. The passage **110** is connected to an annular chamber **112** which at intervals alongs its arcuate extent communicates through bores **114** with liquid discharge outlets **116** located to discharge the liquid from the periphery of the drum **22**.

Each annular chamber **96** communicates through passage means **118** with an elongated second annular chamber **120**, the second annular chamber **120** being at intervals along its arcuate extent provided with discharge outlets or nozzles **122** and the chambers **96** being directly connected to similar discharge outlets or nozzles **124**.

During the operation of the aforedescribed mining machine, the supporting arms **16** are continuously laterally oscillated towards and sway from one another while simultaneously the drums **20, 22** are rotatably driven through the aforedescribed gearing. Water or other suitable liquid is continuously supplied to the inlets **44**, and therefrom flows through the described passage means of the supporting arms **16** which comprises the tubes **46** and communicating bores **58, 60, 62, 64, 66**, to the annular chambers **80** between the nonrotatable connector housings **56** and the rotatable adaptor housing **76**. From the chambers **80**, the liquid flows through the aforedescribed passage means of the rotary mining head and is discharged through the discharge outlets or nozzles **116, 122, 124**. Leakage from the chambers **80** is prevented by the sealing rings **88** from flowing to the bearings **28** and the gears **42**. However, leakage for the chambers **80** past the sealing rings **84, 86** flows externally of the mining head to the ground where it may be readily and quickly detectable.

FIGS. **4** through **6** illustrate a mining machine designated generally as **10***a* which comprises a chassis **12***a* having a vertically movable boom **14***a* mounted thereon. The boom **14***a* carries a plurality of laterally spaced mounting arms **126** which mount the rotary mining head **128** on the boom **14***a* for vertical movement therewith. As shown in FIG. **4**, the rotary mining head **128** includes an axial support or shaft **130** rotatably mounted by bearings **132** contained in mounting housings **135** which are rigidly carried by the supporting arms **126** encircling the shaft **130**. The mining head **128** comprises pairs of laterally spaced, coaxial, inner and outer cutter supporting drums **136, 138** mounted on the shaft **130** for rotation therewith, and end cutter supporting drums **140**, also carried by the shaft **130**, which are selectively laterally movable for extending and retracting the length of the mining head **128**. The drums **136, 138, 140** carry conventional cutters shown as **142** in FIG. **4**. The cutters **142** on the drums **136, 138** may, if desired, as shown in FIG. **4**, be mounted on spiral plates **144** circumferentially carried by such drums or alternatively may be otherwise suitably mounted on the drums.

The mining head **128** is rotatably driven by a pair of drive motors **146** each independently connected to the shaft **130** through gearing including a gear **148**, an intermeshing gear **150** mounted on a rotatable shaft **152** projecting through one of the outer mounting arms **126**, a gear **154** mounted on the shaft **152** within a mounting housing **134** and an intermeshing gear **156** circumferentially carried by the shaft **130**. The bearings **130** and intermeshing gears **154, 156** are enclosed within the mounting housings **134**. The central supporting arm **126** has a liquid supply bore **158** formed therethrough, the supply bore **158** having an inlet end communicating with a supply hose fragmentarily shown as **160** which is, in turn, connected to a pressurized source of water or other liquid. The mounting housing **134** on such arm **126** contains a liquid supply passage **162** intermediate its ends connected to the bore **158** and at each end communicating with a bore **164** formed axially through an element **168** which is threadedly connected in a radial opening **167** in the mounting housing **134**. The threaded elements **168** project through the outer face of the mounting housing **134** whereby the bores **164** discharge liquid outward through such outer face in a direction transversely or radially of the shaft **130**; and the housing **134** rigidly carries nonrotatable circumferential ring elements **166** on opposite sides of the outer end of each threaded element **168**.

The sides of the drums **136** most adjacent to such housing **134** carry elements **174** having bores **176** communicating through bores **178**, formed in nuts **180** carried by the elements **174**, with the bores **164** through therebetween spaces or chambers **172**. Liquid leakage from the sides of the chambers **172** is prevented by sealing rings **182, 184**, laterally spaced apart adjacent opposite sides of each chamber **172** and encircling the shaft **130** laterally spaced apart longitudinally of the latter, biased one from the other by annular coil springs **202, 204**. Liquid leakage by the one of each pair of the rings **182, 184** most adjacent to the supporting arm **126**, as will be noted from FIG. **5**, flows externally of the mining head **128** through a clearance or space **186** and is therefore readily and quickly detectable. The spiral element **144** carried by each drum **136** contains an elongated longitudinal passage **190** communicating with the bore **176** in the respective element **174**, such

passage extending substantially the length of the spiral element **144**. Discharge outlets **192** are provided at locations spaced along the length of each spiral element **144** in communication with the therein contained passage **190** for discharging liquid form the latter externally of the elements **144**.

Similarly, each of the two outer supporting arms **126** contains a passage **158***a* communicating wit a liquid supply hose **160***a*, in turn, connected to receive liquid such as water from a pressurized source thereof. The passages **158***a* communicate with a liquid supply passage **190***a*, formed longitudinally in the spiral element **144** on the respective adjacent drum **138** to extend substantially throughout the length of the element **144** and at intervals along its length provided with discharge outlets **192***a*, through passages **162***a*. The connections of the passages **162***a* to the bores **190***a* are each identical to the aforedescribed connection passage **162** to one of the passages **190**. Hence, in FIG. **5** reference numerals corresponding to those applied to the aforedescribed portion of the liquid supply means associated with the central supporting arm **26** followed by the suffix "*a*" have been applied to corresponding parts associated with the latter connection. Leakage of liquid from the chamber **172***a* past the sealing ring **182***a*, of course, passes externally of the mining head **128** through the space **194**; and leakage of the liquid to the bearings **132** and the intermeshing gears **154**, **156** is prevented due to the enclosure of the latter in a mounting housing **134**.

The operation of the mining machine illustrated in FIGS. **4** through **6** is believed to be apparent from the aforegoing description.

The preceding description it will be seen that the invention provides new and improved means for accomplishing all of the aforestated objects and advantages. It will be understood, however, that, although only two embodiments of the invention have been illustrated and specifically hereinbefore described, the invention is not limited merely to these two embodiments but rather contemplates other embodiments and variations within the scope of the following claims.

Having thus described my invention, I claim:

1. In a mining machine, a chassis, a boom mounted on said chassis for vertical movement thereto, supporting means carried by said boom, a rotary mining head including a support and cutter supporting drum means carried by said support for rotation therewith, bearing means rotatably mounting said support on said supporting means, driving means including gear means for rotatably driving said support relative to said support means, discharge means peripherally of said drum means for discharging liquid during rotation of said drum means, said supporting means being provided with first liquid supply passage means, second liquid supply passage means in said mining head connected to said first supply passage means to receive liquid therefrom and communicating with said liquid discharge means for supplying liquid thereto, a plurality of sealing rings laterally spaced apart adjacent opposite sides of the connection of said passage means for preventing liquid leakage at such connection, at least one of said sealing rings preventing liquid leakage from passing externally of the mining head, and means separate from said sealing rings preventing liquid leakage by said sealing rings from flowing to said gear means and said bearing means.

2. A mining machine according to claim **1**, wherein said second supply passage means is connected to said first supply passage means to receive liquid therefrom in a direction transversely of said support, and said sealing rings encircle said support and are laterally spaced apart longitudinally of said support.

3. A mining machine according to claim **2**, wherein said second supply passage means comprises an elongated passage, and said discharge means comprises a plurality of discharge outlets serially connected to said elongated passage.

4. A mining machine according to claim **3**, wherein said elongated passage is of spiral configuration.

5. A mining machine according to claim **3**, wherein said elongated passage is annular.

6. A mining machine according to claim **2**, wherein said second supply passage means comprises an annular fluid passage, and said discharge means comprises a plurality of discharge outlets connected to said annular passage at locations spaced along the length thereof.

7. A mining machine according to claim **2**, wherein said drum means comprises a plurality of cutter support drums laterally spaced apart longitudinally along said support, said supporting means includes support housings between laterally adjacent ones of said spaced apart support drums, each said support housing is provided with liquid supply passages and each said support drum includes liquid supply passages connected to such passages of one of said support housings to receive liquid therefrom in a direction transversely of said support, each connection of said passages being provided with said sealing rings and such sealing rings extending peripherally around said support housings.

8. A mining machine according to claim **7**, wherein said support drums peripherally carry spiral plates having longitudinally extending liquid supply passages communicating with the liquid supply passages of said drums and at locations spaced along their lengths provided with discharge outlets for discharging liquid from the passages of said spiral plates.

9. A mining machine according to claim **2**, wherein said drums means carries peripheral spiral plate means having longitudinal passages forming a portion of said second supply passage means, said discharge means including discharge outlets communicating with the passages of said spiral plates at spaced locations therealong.

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