# United States Patent [19]

**Cockrell**

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[54] **APPARATUS AND PROCESS FOR HYDRAULIC MINING**


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[58] **Field of Search** ..... 299/17; 37/61, 62; 302/15; 166/314, 68, 105, 53, 54



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[57] **ABSTRACT**

Apparatus for and process of mining a subterranean granular ore deposit through a well bore where the ore is eroded from the ore matrix by one or more laterally directed jets of fluid, e.g. water, forming an ore-bearing slurry. The apparatus comprises:

a. a rotatable tool string having a first fluid passage through which fluid flows downwardly and a first slurry passage through which a slurry of said fluid and granular ore flows upwardly,

b. supported therefrom underground a substantially rigid housing containing an outwardly directed cutting jet nozzle for impinging said fluid against said ore to form said slurry and having

1. a second fluid passage therein connecting said first fluid passage with said jet nozzle,
2. a slurry inlet through said housing,
3. a second slurry passage connecting said inlet with said first slurry passage, and
4. a valve for controlling the amount of slurry passing through said second slurry passage and into said first slurry passage, said valve being biased to close and powered to open by hydraulic pressure in a fluid passage.

In another embodiment the apparatus includes a mining head or housing having a "downhole" level controller which controls the level of slurry in relation to the housing by regulating the valve controlling the rate of slurry being removed to the surface. Also, there can be included in the housing valve means regulated by the level controller to control the rate of fluid added to the ore body through the jet nozzle or nozzles, air lift means and auxiliary air lift means to assist the lifting of the slurry to ground level, check valve means to prevent reverse flow of fluid travelling to the jet nozzle or nozzles, one or more bottom jets to prevent restriction of movement of the mining head, one or more underreaming jet nozzles for cutting out a surge chamber in said ore body, and optionally a turbine driven by the descending fluid and a pump driven by the turbine for pumping slurry to the surface in those cases where the ore formation will not hold air pressure or in deep well applications. Ground level components are also provided for controlling the slurry level in relation to the mining head by means of controlling the back pressure in the slurry return line.


**14 Claims, 12 Drawing Figures**