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Savage et al.

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(54) **CONTROLLED METAL LEACH RECOVERY CIRCUIT**

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This patent is subject to a terminal disclaimer.

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(58) **Field of Classification Search** 423/24, 423/8, 21.5, 22, 49, 54, 99, 139; 75/722
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,614,669	A	1/1927	Greenawalt
1,798,255	A	3/1931	Greenawalt
1,808,547	A	6/1931	Greenawalt
1,841,437	A	1/1932	Greenawalt
3,528,784	A	9/1970	Green
3,615,170	A	10/1971	Hazen et al.
4,013,754	A	3/1977	Stauter et al.
4,152,142	A	5/1979	Schlitt et al.
4,338,168	A	7/1982	Stanley et al.
4,526,215	A	7/1985	Harrison et al.
4,582,689	A	4/1986	Kordosky
4,666,512	A	5/1987	Hansen et al.
4,957,714	A	9/1990	Olafson et al.
5,356,457	A	10/1994	Pincheira et al.
5,431,788	A	7/1995	Jones

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1063307	12/2000
JP	2001239139	9/2001

(Continued)

OTHER PUBLICATIONS

International Search Report and Written Opinion from corresponding International Application No. PCT/US2008/075037 dated Dec. 10, 2008.

(Continued)

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(57) **ABSTRACT**

The present invention relates generally to a process for controlled leaching and sequential recovery of two or more metals from metal-bearing materials. In one exemplary embodiment, recovery of metals from a leached metal-bearing material is controlled and improved by providing a high grade pregnant leach solution ("HGPLS") and a low grade pregnant leach solution ("LGPLS") to a single solution extraction plant comprising at least two solution extractor units, at least two stripping units, and, optionally, at least one wash stage.

16 Claims, 4 Drawing Sheets