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(54) Title: UPGRADING ORES AND CONCENTRATES THAT CONTAIN IRON AND ONE OR MORE METALS VIA SELECTIVE CARBOTHERMIC REDUCTION AND SMELTING PROCESS

(57) Abstract: A method for creating a beneficiated low-grade ore includes determining a desired finished product based on the composition of the low-grade ore, concentrate or waste-oxides. Blending this low-grade raw material source with carbonaceous material and flux (as needed) with the consideration of complete reduction and carburization of the metal intended for removal can be conducted such that the metal intended for removal is separated from a fusible slag which has affinity to the other metals in the low-grade ore. Selectively carbothermically reducing and smelting the raw material mixture produces a metallic product and a slag, and the slag can be fused to separate it from the metallic product. These steps can be repeated to selectively reduce metals sequentially, and transform them into commercially usable products.

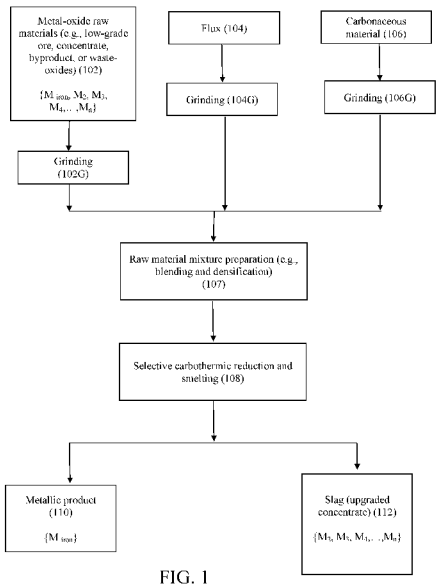


FIG. 1

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*[Continued on next page]*

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A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 75/352; 75/357; 75/10.27; 75/10.46; 75/10.62; 75/10.63 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2,653,867 A (LINDSLEY et al) 29 September 1953 (29.09.1953) entire document | 1, 6-9 |
| --- | | --- |
| Y | | 4, 5 |
| Y | US 4,036,636 A (AMMANN et al) 19 July 1977 (19.07.1977) entire document | 4, 5 |
| A | US 2015/0040728 A1 (BARSA) 12 February 2015 (12.02.2015) entire document | 1-10 |
| A | US 5,492,554 A (HANNIALA et al) 20 February 1996 (20.02.1996) entire document | 1-10 |
| A | US 3,910,787 A (VALDO et al) 07 October 1975 (07.10.1975) entire document | 1-10 |

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| Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, VA 22313-1450<br>Facsimile No. 571-273-8300 | Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

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