United States Patent [19]

Nesslage et al.

[11] 4,059,437

[45] Nov. 22, 1977

[54] **OXYGEN-FREE COPPER PRODUCT AND PROCESS**

[75] Inventors: **Donald John Nesslage**, Old Bridge; **Lin Sheng Yu**, Princeton, both of N.J.; **Michael Francis Shaw**, El Paso, Tex.

[73] Assignee: **Phelps Dodge Industries, Inc.**, New York, N.Y.

[21] Appl. No.: **592,622**

[22] Filed: **July 2, 1975**

[51] **Int. Cl.**[2] **C22C 9/05**; C22F 1/08

[52] **U.S. Cl.** ..... **75/76**; 75/161; 148/11.5 C; 148/32

[58] **Field of Search** ..... 148/32, 11.5 C; 75/161, 75/76

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,660,220	2/1928	de Golyer	75/76
2,003,296	6/1935	Jennison et al.	75/76
2,003,889	6/1935	Jennison et al.	75/76

FOREIGN PATENT DOCUMENTS

379,034	8/1932	United Kingdom	148/161

Primary Examiner—W. Stallard

Attorney, Agent, or Firm—Davis, Hoxie, Faithfull & Hapgood

[57] **ABSTRACT**

An improved copper product and process of making it, wherein oxygen-free copper contains small amounts of manganese above normal impurity levels, and has enhanced grain size control during annealing, high electrical conductivity, and increased ductility as cast or fabricated. By adding approximately 1 to approximately 100 parts per million of manganese, the desired oxygen-free product has a minimum electrical conductivity of 100% I.A.C.S. By adding approximately 1 to approximately 50 parts per million of manganese, the desired oxygen-free product has a minimum electrical conductivity of 101% I.A.C.S. When at least approximately 30 parts per million of manganese are added to the oxygen-free copper, ductility is maximized. The manganese may be added at any convenient stage of producing the oxygen-free copper. The copper after annealing is free of or less subject to roughened surfaces or cracking.

22 Claims, 13 Drawing Figures