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METALLURGY

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This invention relates to metallurgy and has for an object the provision of an improved metallurgical process. More particularly, the invention contemplates the provision of an improved process for dissecting and recovering metals from metal-bearing materials of secondary origin such, for example, as: light and heavy scrap brass and and bronze, dross, skimmings, ashes, refuse, irony brass, irony copper, sweated radiators, black copper, excess trimmings and cuttings from manufacturing operation and refinery slags, containing nickel, copper, zinc, lead, tin, antimony, bismuth and similar metals.

In view of economic conditions prevailing during recent years, the recovery of the metal components and costituents of metal-bearing materials of secondary origin has become a matter of considerable importance, and many metallurgical concerns which formerly dealt substantially exclusively in the treatment of metal-bearing materials of primary origin have entered the field. Therefore, this branch of the metallurgical industry has become highly competitive, with the result that the quality of the materials available for treatment is low and the margin of profit permitted in employing recovery methods or processes of the heretofore customary type is very small. Consequently the development of a more effective and more economical recovery method or process is highly desirable.

The treatment of metal-bearing materials of secondary origin of all grades and characters presents many technical problems, and before this branch of the industry became highly competitive, it was customary rather carefully to select the materials to be treated from those available in order to avoid the necessity of treating the more refractory materials and thus provide for obtaining a suitable margin of profit. With the expansion of this branch of the industry and the consequent development of severe competition for materials for treatment, the business of collecting salvaged metal-bearing materials has been so extended that large quantities of relatively low-grade materials are now being offered for treatment, and plant operators are faced with the necessity of accepting such materials for treatment or curtailing operations.

As hereinbefore indicated, it was customary, heretofore, to select for treatment materials relatively free from large quantities of undesirable or objectionable impurities and relatively simple in the aggregation of metallic alloying ingredients, and the field of application of processes of the type employed in treating such materials has not been extended satisfactorily to cover the entire range of materials now available for treatment. Furthermore, many of the processes employed heretofore have been found to be deficient in yielding a sufficiently high recovery of some of the alloying metals, even when applied to the treatment of relatively pure and relatively simple alloys, and many of such processes are complicated and comprise a multiplicity of operations which cause high operating costs and which require high capital expenditures for installation of apparatus. For example, some of the more commonly available relatively simple secondary materials are copper base alloys containing zinc, lead and tin, which also frequently contain iron. It has been proposed, heretofore, to subject such materials to oxidizing treatment while molten to fume off the zinc and a portion of the tin. When the charge contains iron, undesirable quantities of slag are produced, which slag ties up and carries off tin and lead. Consequently, in order to avoid excessive tin and lead losses, it is necessary either to select the charge materials with extreme care to avoid the inclusion of iron or to employ additional processes to recover the tied-up portions of the tin and lead. Such additional processes are expensive and frequently so expensive as to yield the additional metals at too high costs. Similar difficulties are encountered when the initial materials contain substantial quantities of silica, alumina and other slag-forming ingredients.

The present invention is directed toward the accomplishment of high percentage of recovery of the various ingredients in metal-bearing materials or secondary origin and even in complex alloys and other metal-bearing materials containing high percentages of foreign impurities by a simplified method, thus to enlarge the range of materials amenable to economic treatment for the separation and recovery of the valuable ingredients. The invention may be employed with particular advantage in the treatment of metal-bearing materials of secondary origin containing tin when the recovery of tin is important, materials such, for example, as those consisting largely of copper and containing iron in addition to copper and tin. The process of this invention is such that slag-making ingredients such as iron, silica and alumina can be received in the initial materials to be treated and a satisfactory recovery made of the valuable ingredients contained in the materials in a simple and economical man-