

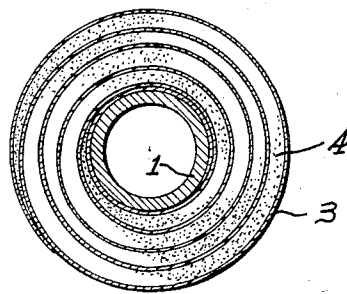
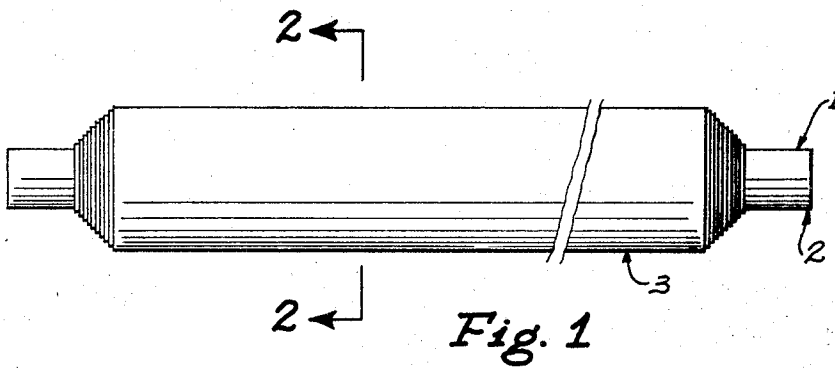
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REFRACTORY COATED COMPOSITE OXYGEN LANCE

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REFRACTORY COATED COMPOSITE OXYGEN LANCE

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4 Claims

ABSTRACT OF THE DISCLOSURE

A refractory-coated lance comprising a tubular metal base surrounded by a plurality of layers of moisture-free, chemically-bonded, refractory aggregate separate by flexible metal foil.

BACKGROUND

Steel is manufactured from iron by removing impurities such as carbon, silicon, sulfur, phosphorous, and manganese by oxidizing these impurities and removing them as gas or entrapping them in a slag floating on the surface of a molten metal. Since oxygen has become available in large tonnages, it has become common steelmaking practice to oxidize the aforesaid impurities by injecting oxygen directly into the molten metal bath. Near the end of the steelmaking process, the temperature of the molten steel bath approaches 3000° F. Since it is necessary that the oxygen be introduced immediately above the bath or even somewhat below the bath in order to obtain best results, the manner of delivering the oxygen to the bath is quite important. Generally, this is done by injecting the oxygen onto the surface of the bath through a refractory-coated lance.

Prior art oxygen lances include uncoated black iron pipe. Refractory-coated lances have been manufactured in several ways. One type disclosed in U.S. 3,292,662 is iron or steel pipe which have refractory oxide applied by dipping the pipe in a slurry of finely divided refractory material. This technique deposits a very thin coating and usually contains some low-melting binder, such as sodium silicate, to attach the coating to the iron pipe.

In that method, a phosphate-bonded paste is applied to the pipe.

Still another method is described in U.S. Patent No. 3,206,183. According to that method, a fine refractory paste is spread over a layer of paper or other combustible material and the paper and refractory wrapped around the pipe.

It is an object of this invention to provide a refractory-coated lance which has service life superior to the best prior art lances, as is demonstrated in the following detailed description.

BRIEF DESCRIPTION

According to this invention, a refractory-coated lance is provided which comprises a tubular metal base surrounded by a plurality of layers of moisture-free, chemically-bonded, refractory aggregate separated by a metal foil. The refractory layers are typically from 1/8- to 1/4-inch thick. The refractory is selected from available refractory oxides and raw materials to best resist the slag present in the particular steelmaking process in which the lances are to be used. The metal foil is suitable if it has a melting point equal to or greater than that of aluminum. Aluminum foil is preferable. The chemical binder for the refractory aggregate may be any of the well known binders, such as phosphoric acid, chromic acid, sodium silicate, and soluble phosphates and chromates.

DRAWINGS

FIG. 1 is a side view of a lance according to this invention; and FIG. 2 is a section along line 1—1 in FIG. 1.

DETAILED DESCRIPTION

Further features and other objects and advantages of this invention will become clear to those skilled in the art by a careful study of the following examples. In the specification and claims, all percentages and ratios and parts are by weight; chemical analyses were obtained by spectrographic analysis, with control by wet chemical analysis, and are reported as oxides in accordance with the present practice of the refractories industry. All sizings are measured with the Tyler Standard Screen Scale Sieve Series.

Example I

A batch was prepared by mixing 90% refractory-grade chrome ore, sized so that at least 80% passed 65 mesh and less than 1% was plus 14 mesh with 7 1/2% of sodium silicate and 2.5% clay. Sodium silicate used was manufactured under the trade name "G Powder" by Philadelphia Quartz Company. It has a soda:silica ratio of 1:3.22 and contains 18.5% of water of hydration. The particular chrome ore used was Philippine chrome ore. By "refractory grade," it is meant that the chrome ore contains less than 5% silica. The mixture was tempered with about 19% water to form a paste-like consistency. The mixture was spread to a depth of about 1/8- to 1/4-inch over the surface of 18-inch wide sheet of aluminum foil. The foil was long enough to extend within 5 inches of each end of a section of black iron pipe about 5 feet long. The aluminum foil was approximately 0.001-inch thick. The foil and the mixture were then wrapped or rolled around the 1/2-inch pipe. The lance was then dried at 250° F. for about 3 hours to remove substantially all free moisture.

Thereafter, the lance was used to inject oxygen at 120 p.s.i. into an electric furnace during the manufacture of a manganese alloy steel at an approximate temperature of 2880° F. The lance was consumed at a rate of 1.9 inches per minute. Another lance manufactured according to this example was used to introduce oxygen into a chrome alloy steel bath at approximately 3050° F. The lance was consumed at a rate of 6.5 inches per minute. Lances made according to the teachings of Example I are the preferred embodiment and the best mode now known for the practice of this invention.

Example II

Lances were manufactured in the same manner as Example I, except that steel foil was used rather than aluminum foil. The steel foil was 0.002 inch thick. When used to introduce oxygen into the chrome alloy heat (3050° F.), it was consumed at a rate of 7.5 inches per minute.

Example III

Lances made according to the teachings of the prior art; that is, with combustible materials separating adjacent layers of refractory material surrounding the lance, were also tested in the same electric furnaces as the lances according to Example I. In the manganese alloy heat (at an approximate temperature of 280° F.), the prior art lances were consumed at a rate of 7.1 inches per minute, which is about four times faster than lances according to this invention. In the chrome alloy heat, the prior art lances were consumed at a rate of 25.7 inches per minute. This is about four times faster than lances made according to this invention.

Example IV

An iron pipe was coated according to the prior art with a 0.03-inch layer of refractory material by dipping in a slurry comprising 29 parts water and the remainder comprising 80 parts, by weight, minus 200 mesh potters flint (silica); 10 parts, by weight, minus 200 mesh soda feldspar; and 10 parts BW-Brand sodium silicate (manufactured by Philadelphia Quartz Company having a silica:soda ratio of 1.62:1). The lance was dried at 500° F. Lances according to this example were consumed in the manganese alloy heat at a rate of 16.5 inches per minute. In the chrome alloy heat they were consumed at a rate of 33.4 inches per minute.

Turning now to the drawing, the lance comprises a metal, elongate, tubular, open-ended base 1 which has means 2 (for example, threads) at one end for attaching to the oxygen source. The foil 3 and refractory coating 4 are wrapped about the major portion of the tubular base and crimped at each end.

While it is not entirely understood why lances according to this invention are so superior to those according to the prior art, it is believed that the foil provides a degree of tensile strength to the lance coating. Inspection of lances according to this invention, after service, shows that the foil is substantially unaltered even at what was the hottest end of the lance. It is not oxidized but, perhaps, somewhat melted. Furthermore, lances according to this invention are manufactured to be substantially free from moisture (they are dried at temperatures in excess of 212° F. until they can no longer lose weight due to moisture removal). This prevents spalling away of the lance coating as a result of rapid evolution of entrapped steam. In addition, lances according to this invention do not unravel during service as those with refractory layers separated by combustible materials.

The refractory material used in the practice of this invention may comprise any suitable refractory such as calcined bauxite, calcined fire clay, dead burned magnesite, olivine, kyanite, tabular alumina, zircon, chrome ore, or ground slag. Chemical binders that are suitable according to this invention include calcium aluminate cement, sodium silicate, sodium phosphates, soluble chromate salts, chromic acid, epsom salts, magnesium chloride, nitrecake, lignosulfonate liquor, and others well known in the art. The refractory aggregate should be sized so that at least about 50% passes 65 mesh and the remainder substantially all passes 14 mesh. The refractory

mixture is made more spreadable and workable if a small addition (less than 5%, by weight) of clay is made to the batch. The batches are usually tempered with water (generally 10 to 30%) to bring them to a paste-like consistency. However, other tempering fluids known in the art may be used.

Aluminum and steel foils are, of course, the most readily available flexible foils and, therefore, the most suitable in the practice of this invention. However, other metal foils would be satisfactory so long as they had melting points higher than or similar to that of aluminum. We have found that 18-inch wide rolls of foil are particularly suitable. The thickness of the metal foil is such that it can be easily wrapped about the pipe.

Having thus described the invention in detail and with sufficient particularity as to enable those skilled in the art to practice it, what is desired to have protected by Letters Patent is set forth in the following claims.

The claims:

1. A refractory-coated oxygen lance suitable for use in oxygen convertor vessels comprising an elongate, open-ended, tubular, metal base and surrounding said base a plurality of layers of moisture-free, chemically-bonded refractory aggregate separated by metal foil.
2. Refractory-coated lances according to claim 1 in which the metal foil is aluminum foil.
3. Refractory-coated lances according to claim 1 in which the metal foil is steel foil.
4. Refractory-coated lances according to claim 1 in which the refractory aggregate is sized so that at least 50%, by weight, passes 65 mesh, and substantially all passes 14 mesh.

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