United States Patent [19]

Chang

[11] **3,912,244**

[45] **Oct. 14, 1975**

[54] **APPARATUS FOR OXYGEN-LANCING A METALLURGICAL BATH**

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[73] Assignee: **Berry Metal Company,** Harmony, Pa.

[22] Filed: **Nov. 11, 1974**

[21] Appl. No.: **522,545**

[52] **U.S. Cl.** ..... **266/34 L;** 239/132.3

[51] **Int. Cl.²** **C21C 7/00**

[58] **Field of Search** ..... 239/132.3, 132.5; 266/34 L, 34 LM

[56] **References Cited**

UNITED STATES PATENTS

3,045,997	7/1962	Hudson	266/34 L
3,488,044	1/1970	Shepherd	266/34 L

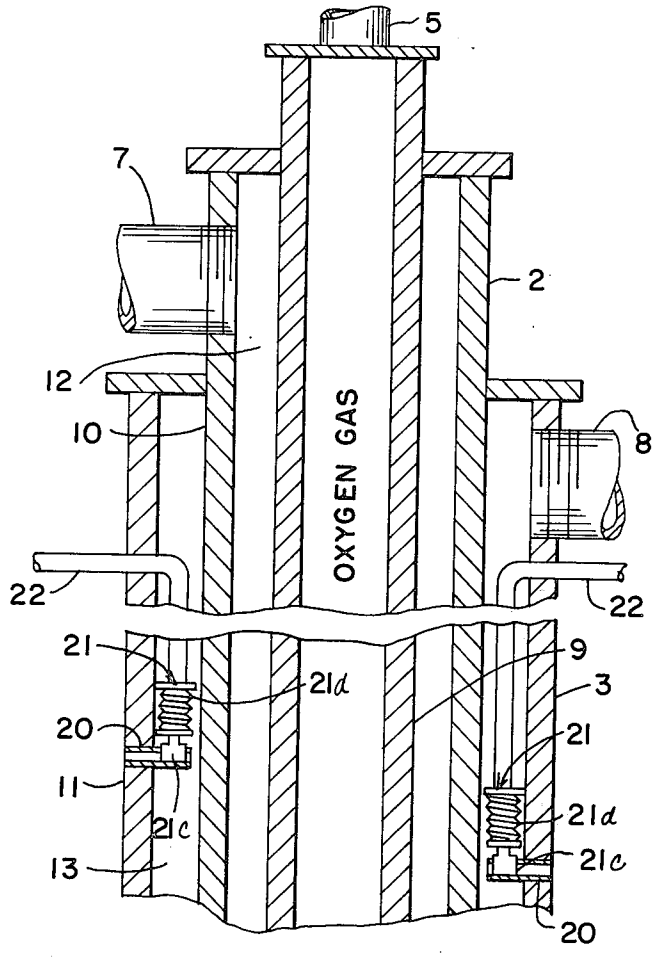
Primary Examiner—Gerald A. Dost

Attorney, Agent, or Firm—Richard J. Myers

[57] **ABSTRACT**

In a basic oxygen steel making converter, an overhead lance having a water-cooling structure in the form of a water spray system around the barrel of the lance, the spray system including exit water spray nozzles in the wall of the lance barrel for emitting water spray from the water jacket around the barrel to prevent skull formation thereat and conditioning the waste gases generated in the converter to facilitate dust removal. The water spray system may also be a separate water conduit system directed into and out of the lance barrel through spray nozzles in the lance barrel without using the existing water coolant system in the nozzle. The water spray system may exit from the water coolant passage area or from the central oxygen passage, the latter being through flexible tubing in the various water passages and to the outside of the barrel.

2 Claims, 5 Drawing Figures



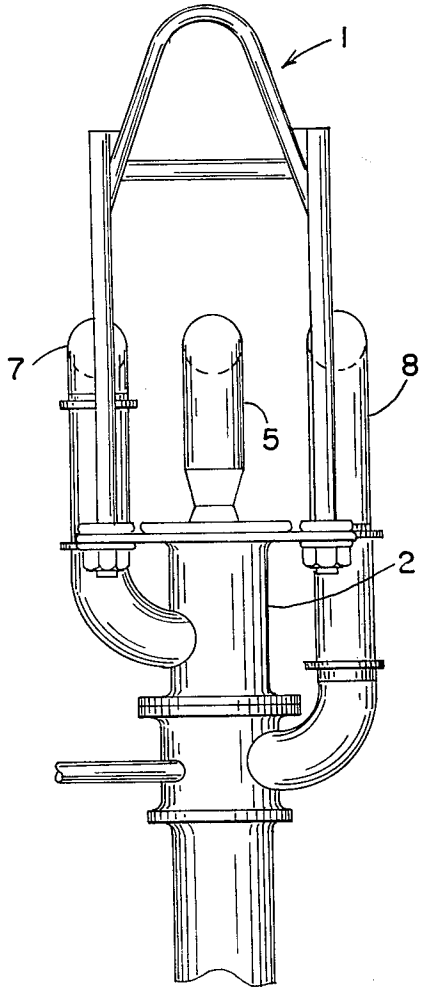
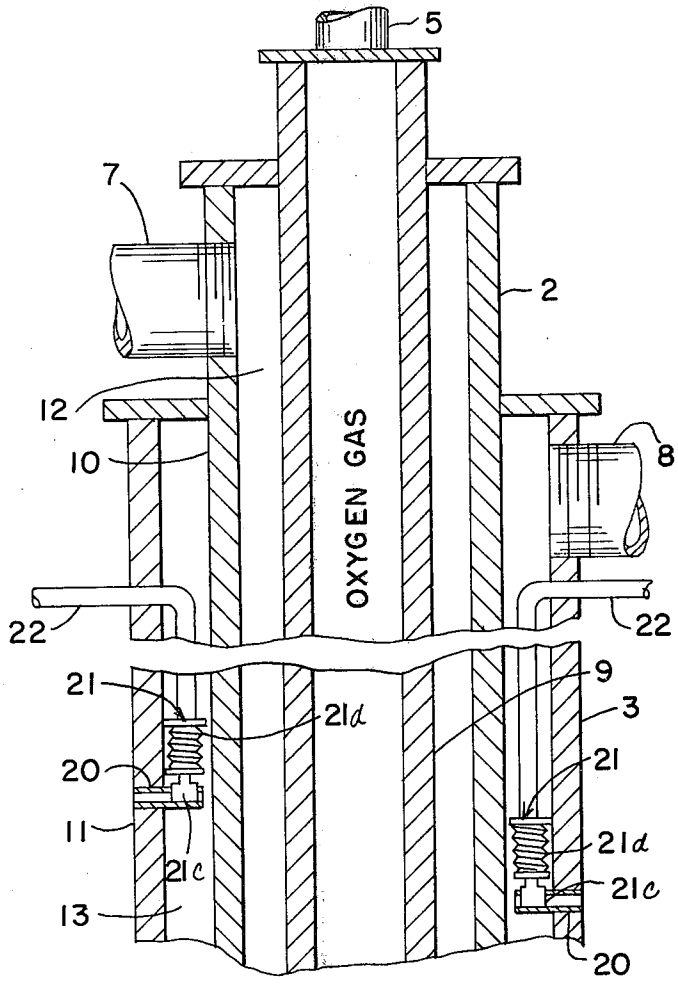


FIG. 2



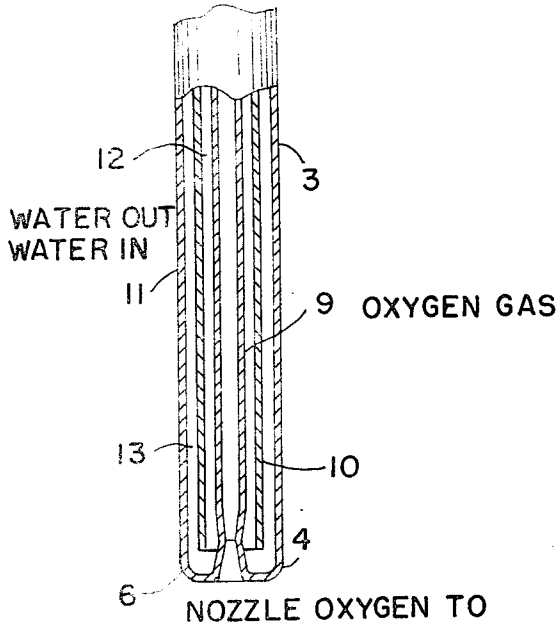
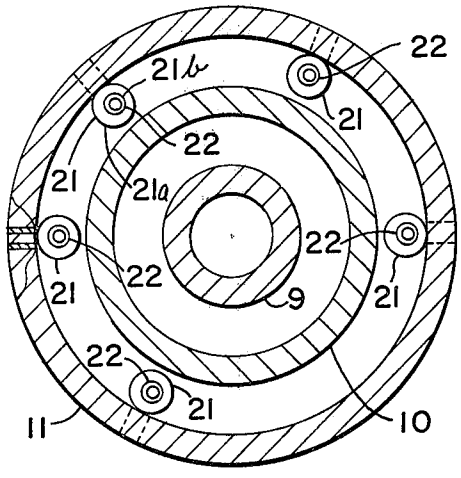


FIG. 1

FIG. 3



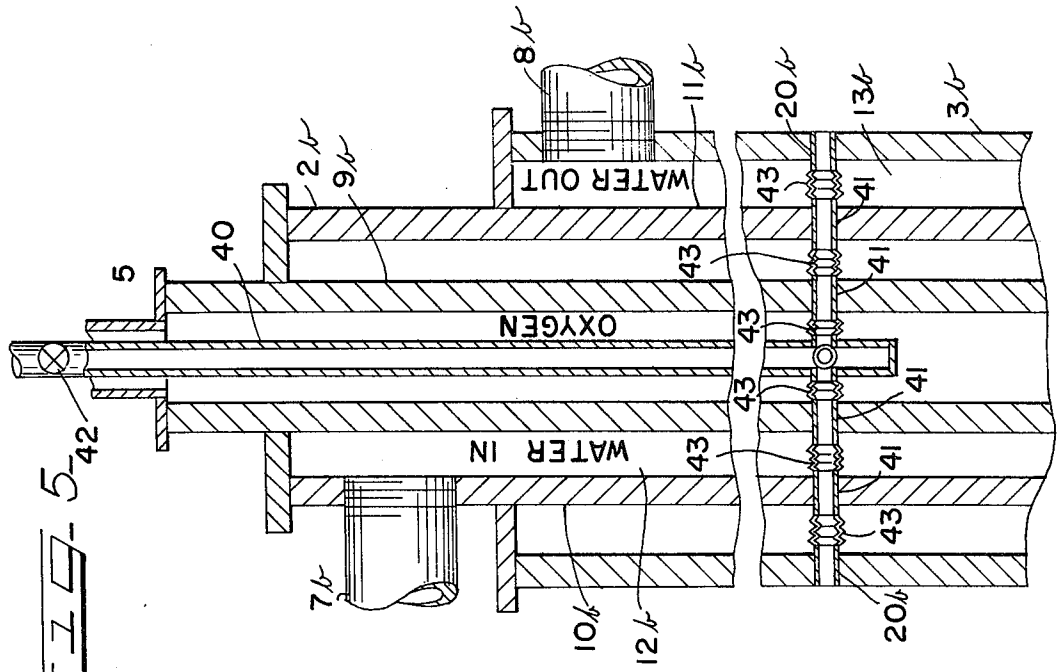

WATER OUT
OXYGEN
WATER IN
8b
11b
20b
13b
3b
2b
9b
40
5
43
41
42
7b
10b
12b

FIG. 5

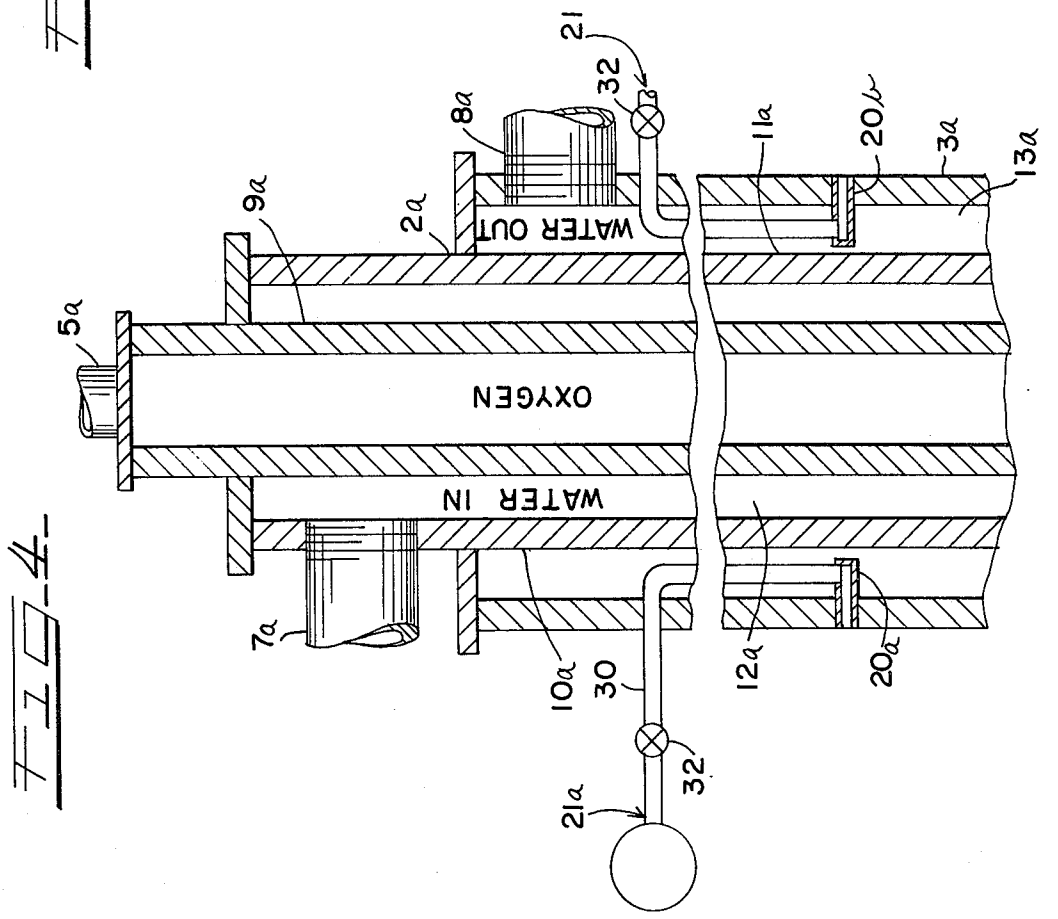

21
32
8a
11a
20a
3a
13a
9a
2a
WATER OUT
5a
OXYGEN
WATER IN
7a
10a
30
12a
20a
32
21a

FIG. 4

APPARATUS FOR OXYGEN-LANCING A METALLURGICAL BATH

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a structure for treating of an oxygen lance utilized in a metallurgical bath for directing oxygen into the bath, such as in the basic oxygen steel making process. The invention particularly relates to treatment of the lance to prevent the formation of a skull on the lance barrel.

2. Description of the Prior Art

In the conventional basic oxygen steel making process, an overhead water-cooled lance is employed in the delivery of high pressure oxygen to the steel bath. The strong oxygen jet impacts on the molten steel bath which is covered by a layer of slag, causing a considerable amount of splashing with the molten particles of steel and slag flying in the free-board of the furnace. This condition creates two difficult problems. First, some of the molten particles will land on the relatively cool outer surface of the oxygen lance and become solidified there, resulting in the formation of a solidified slag or skull on the lance barrel, which skull is troublesome to the proper operating of the lance and difficult to remove due to its high temperature. U.S. Pat. No. 3,045,997 to Hudson explains the difficulties encountered. Second, smaller particles ejected from the bath will be carried by the effluent gas stream to the waste gas cooling system where the dust particles must be removed to avoid pollution of the air. Removal of fine dust is difficult and expensive. This invention purports to overcome these two problems.

SUMMARY OF THE INVENTION

It is a general object of this invention to provide for an improved treatment of the outer barrel of the lance used in the basic oxygen steel making process as, for instance, considered in such U.S. Pat. Nos. as 3,269,829 and 3,529,955.

Another object of this invention is to illustrate the use of a water spray around the barrel of the oxygen lance in the basic oxygen steel making process during the blowing period of said process, to prevent formation of skull on the lance barrel and to condition the dust-laden furnace gas in such a way that the cooling system is greatly facilitated.

To carry out the process according to this invention a specially constructed oxygen lance is employed and is similar to the conventional water-cooled lance except that special nozzles are provided in the wall of the lance barrel for spraying of the water around the lance barrel.

It is another object of this invention to provide for water spray nozzles in the outer wall of the lance barrel discussed above wherein the water may be from the water coolant system or may be from a separate source and may be directed from within the water cooling jacket or from the oxygen passage.

These and other objects of the invention will become apparent by reference to the following description, appended claims and attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view of an oxygen lance as, for instance, shown in U.S. Pat. No. 3,525,508 to W. W. Berry, issued Aug. 25, 1970, and employing the present novel water spray system at the barrel of the lance;

FIG. **2** is a partial longitudinal sectional view of the lance showing the water spray arrangement;

FIG. **3** is a cross sectional view of the lance and attendant water spray arrangement shown in FIG. **2.**

FIG. **4** is a partial view similar to that shown in FIG. **3** but of a modified form of the water spray arrangement used in the lance.

FIG. **5** is still another modification of a water spray arrangement used in the lance, as shown in FIGS. **3** or **4.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1** there is shown a water-cooled oxygen lance **1.** It comprises a head section **4,** a barrel section **3,** and an adapter section **2.** The barrel section is generally 40 to 60 feet long, made of three concentric pipes. The inner pipe **9,** or conduit carries the oxygen gas to the exit nozzle or nozzles, **6,** of the head section of the lance. Cooling water **12,** for the nozzle-face of the head section enters from the annular space between the inner pipe **9** and the intermediate pipe or conduit **10,** and leaves water out **13** from the annular space between the intermediate pipe **10** and the outer pipe or conduit **11.** The adapter section of the lance contains the inlet **7** and outlet **8** connections for the cooling water, the inlet for oxygen gas **5** and the supporting mechanism.

The water-spray nozzles are located at suitable heights (one or more elevations) of the barrel section of the lance. Basically, the water spray system consists of exit nozzles in the wall of the outer pipe and a source of spray water plus a control device for regulating the amount of spray.

In FIGS. **2** and **3** the lance cooling water in the annulus between the intermediate and the outer pipes is the source of the spray-water. A number of openings are arranged circumferentially in the wall of the outer pipe communicative with the said annulus. A controller **21** is provided to regulate the amount of spray. FIG. **2** shows a diagram of this arrangement located in the barrel section **3** of the lance. Water spray nozzle **20** is provided in the wall of the outer pipe **11** with an air-operated bellows valve **21** for regulating the amount of spray. Air for this bellows enters the lance at the adapter section **2** of the lance in a supply tube **22** passing through the wall of the outer pipe **11.** The bellows valve **21***c*, bellows tube **21***d* and the air tube **22** are located in the annular space between the intermediate and the outer pipes and immersed in the cooling water. By adjusting the pressure of the operating air, the amount of spray is regulated.

FIG. **3** shows a layout of the spray nozzles around the barrel of the lance. Although eight nozzles are shown here, the number is determined by need. It is also not necessary to have all the nozzles placed at the same elevation (height). The placement of nozzles need not be symmetrical and uniform.

The shape of the nozzle opening (exit opening) can be varied in shape and size. Round, oval, star-like, polygonal and irregular are all possible. The orientation

of the axis of the spray nozzle can also be varied according to need. A lance may have nozzles of more than one shape, size, and orientation.

In the second embodiment of this invention, the spray water is supplied externally and independent of the cooling-water of the lance. It is to be noted that where parts used in this embodiment are the same as the parts used in the embodiment of FIGS. **2** and **3** the reference characters shall have small letters "*a*" after them. Each spray nozzle is connected with a water supply tube which is located in the annular space between the intermediate pipe **10** and the outer pipe **11,** and passes through the wall of the outer pipe in the adapter section of the lance to connect to a water main outside the lance. FIG. **4** shows this arrangement. Spray nozzle **20** is connected to spray water supply tube **30** which penetrates through the wall of the outer pipe **11** at the adapter section **2** and connects to the spray water main **31.** A control valve **32** is provided for regulating the amount of spray. Alternatively, water main **31** can be placed in the annular space between the intermediate and outer pipes (such annular space can be enlarged by enlarging a section of the outer pipe). A single tube can penetrate the outer pipe and connects the water main to an outside water supply.

In a third embodiment of this invention (see FIG. **5**), a central spray water supply pipe **40** is located inside the oxygen pipe **9** of the lance. It is to be noted that where parts used in this embodiment are the same as the parts used in the embodiments of FIGS. **2** and **3** or FIG. **4,** the reference characters shall have small letters "*b*" after them. Branch outs or conduits **41** distribute the spray water to each nozzle **20.** Flexible connectors or conduits **43** are used between the various pipes to allow expansion and contraction of the various pipes. A control valve **42** is used to control the amount of the spray.

So far, description of this invention concerns only the case of an oxygen lance; however, it can be extended to cover the case of an oxy-fuel burner. In an entirely similar manner, water sprays can be installed in an oxy-fuel burner lance and be used during the period of preheating scrap in a basic oxygen steelmaking process furnace to condition the hot combustion gases before leaving the furnace. Reduction in temperature of the hot gases in the upper parts of the furnace by water spray minimizes the wear and erosion of the furnace lining by the hot gases. This is particularly important when larger oxy-fuel burners (larger than 5 m.m. [millimeter] BTU [British Thermal Unit] per minute) are used. Hence, the provision and usage of water spray with oxy-fuel burners is also a part of this invention. Thus, the water spray around the barrel from the nozzles **20** prevents skull formation and washes out the fine dust particles in the furnace.

Moreover, the various nozzle and piping arrangements described for spraying water from the lance can be employed to inject hydrogen gas or an organic gas or vapor containing hydrogen for the purpose of generating heat and for the suppression of the brown fumes generated by oxygen-lancing of steel bath.

The foregoing description and drawings merely explain and illustrate the invention and the invention is not limited thereto, except insofar as the appended claims are so limited, as those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention.

What is claimed is:

1. For a basic oxygen steel making converter,

an overhead lance having a water-cooling structure in the form of a water spray around the barrel of the lance,

said lance including a water cooling jacket,

the spray structure including exit water spray nozzles in the wall of the lance barrel for emitting water spray from the water cooling jacket within the lance to prevent skull formation thereat and conditioning the water gases generated in the converter to facilitate dust removal, and

said water spray structure including an air motor means having a bellows acting upon a source of air pressure and a valve operated by said bellows for selectively allowing water from said water jacket into said spray nozzle and out around the barrel of the lance.

2. For a basic oxygen steel making converter,

an overhead lance having a water-cooling structure in the form of a water spray around the barrel of the lance,

said lance including a water cooling jacket,

the spray structure including exit water spray nozzles in the wall of the lance barrel for emitting water spray from the water cooling jacket within the lance to prevent skull formation thereat and conditioning the water gases generated in the converter to facilitate dust removal, and

said water spray structure including a separate water conduit system directed into the oxygen passages of the lance and through conduit means extending from the oxygen passage through the water inlet and outlet passages and out the said spray nozzles and around the barrel of the lance, the connection in the water passages being flexible tubes.

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