Feb. 14, 1967 L. H. HUTTON 3,304,009

OXYGEN LANCE CONSTRUCTION

Filed July 1, 1964 2 Sheets-Sheet 1

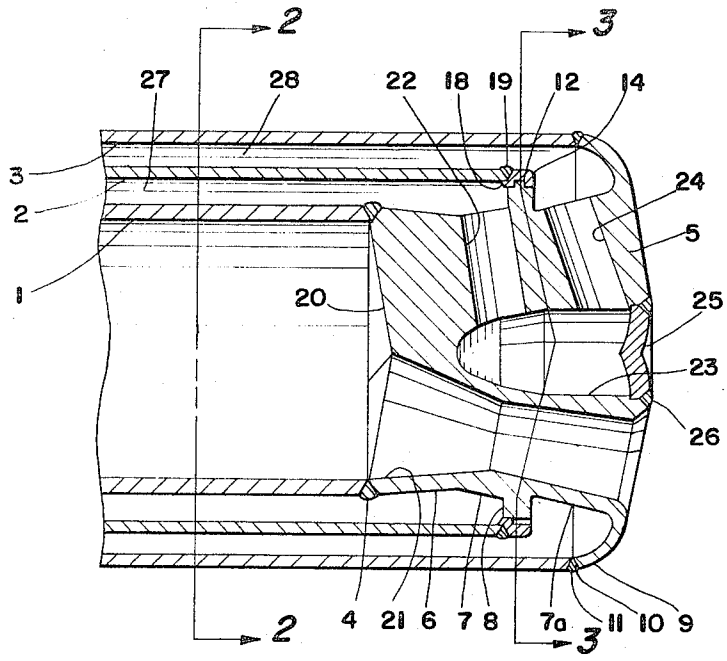

Fig. 1

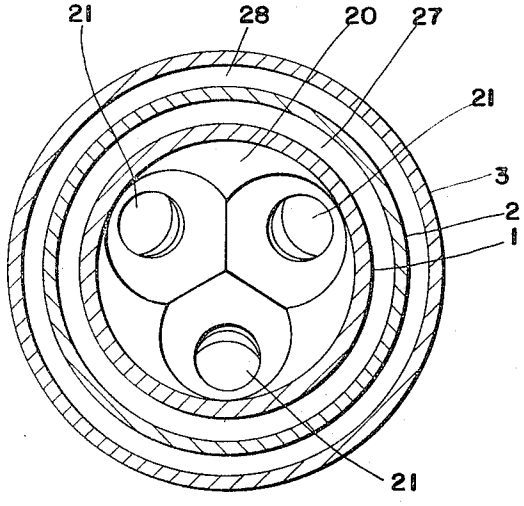

Fig. 2

INVENTOR.
LELAND H. HUTTON
BY
Isler & Armstein
ATTORNEYS

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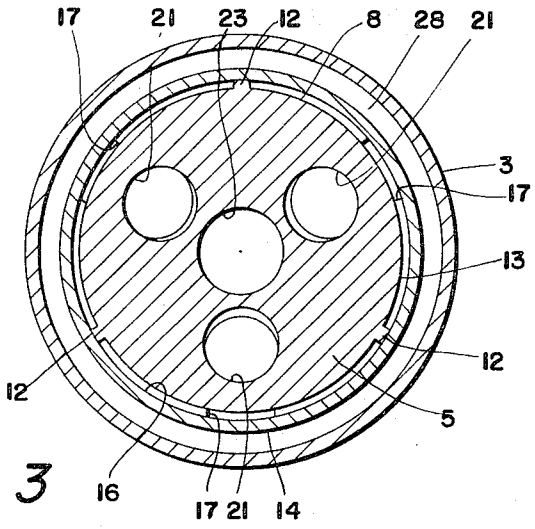

Fig. 3

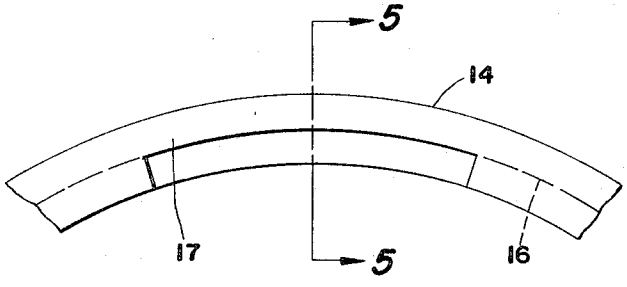

Fig. 4

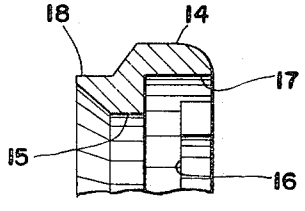

Fig. 5

INVENTOR.
LELAND H. HUTTON
BY
Isler & Ornstein
ATTORNEYS

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3,304,009

OXYGEN LANCE CONSTRUCTION

Leland H. Hutton, 2518 Claver Road, University Heights, Ohio 44106

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10 Claims. (Cl. 239—132.3)

This invention relates generally to the construction of the discharge end portions of oxygen lances, but has reference more particularly to improvements in the type of lances disclosed in my U.S. Patent No. 2,979,270.

A primary object of the invention is to provide an oxygen lance of the character described, which has a novel construction designed to produce a highly effective and efficient water-cooling of the lance nozzle or tip during use of the same.

Another object of the invention is to provide an oxygen lance of the character described, having a novel and useful arrangement of water-circulating passageways.

A further object of the invention is to provide an oxygen lance of the character described, embodying a novel removable supporting annular member or ring for one of the tubular casing or conduit members of the lance.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same.

FIG. 1 is a fragmentary cross-sectional view of an oxygen lance embodying the invention;

FIG. 2 is a cross-sectional view, taken on the line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view, taken on the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary plan view, on an enlarged scale, of a portion of the annular member for the nozzle, and

FIG. 5 is a fragmentary cross-sectional view, taken on the line 5—5 of FIG. 4.

Referring more particularly to the drawings, there is disclosed the fragmentary lower portion of an oxygen lance consisting of tubular steel members 1, 2 and 3, in concentric spaced relation to each other, with the lower end of the member 1 at a higher level than the lower end of the member 2, and the lower end of the member 3 at a lower level than the lower end of the member 2.

Secured to the lower end of the member 1, as by welding 4, is a tip or nozzle 5, preferably made in one piece from copper, which is 99.5% pure and is free from occluded oxygen.

The tip or nozzle 5 has a conical upper external wall 6, and offset conical external walls 7 and 7*a*, at the junction between which an annular flange 8 is provided, which extends horizontally outward from the nozzle.

Below the wall 7*a*, the nozzle is provided with an annular flange 9, which is of arcuate cross section, and the upper edge of which is designated by reference numeral 10. This flange coacts with the wall 7*a* to provide a trough for a purpose to be presently described.

The lower end of the tubular member 3 is welded to the edge 10 of the flange 9, as at 11.

The flange 8 is provided at three circumferentially-spaced points with lugs 12 which extend radially from the radially outer or outboard surface 13 of the flange, the lugs providing ledges or supports for a purpose to be now described.

An annular member 14 is provided having an internal surface 15 which is adapted to engage the surface 13 of the flange 8, and is also provided with an annular groove 16, which is adapted to receive the lugs 12.

For the purpose of mounting the annular member 14 on the flange 8, portions of the annular member 14 below

the annular groove 16 are removed to provide slots 17, which are spaced circumferentially of the annular member 14 to correspond with the spacing of the lugs 12.

When the annular member 14 is to be mounted on the flange 8, the slots 17 are aligned with the lugs 12, and the member 14 is dropped so that the lugs 12 enter the slots 17 and the annular groove 16, after which the annular member 14 is rotated sufficiently to lock the member 14 to the lugs 12, and thereby prevent the annular member 14 from being displaced in a vertically upward direction from the flange 8.

The annular member 14 is provided with a flange-like extension 18, which acts as a pilot for locating the tubular member 2, after which the member 2 is welded to the annular member 14, as at 19.

The welding of the member 2 to the annular member 14 is effective to prevent circumferential displacement of the member 14 from the flange 8, but when the nozzle or tip 5 is to be replaced, the welded joint 19 can be melted, to thereby provide access to the annular member 14 and permit its removal by a reversal of the steps which have been described in connection with its method of attachment to the flange 8.

The tip or nozzle 5 is provided in its upper end with a conical recess 20 from which a series of circumferentially spaced passageways 21 extend through the nozzle in a downwardly and outwardly inclined direction, communicating the lower end of the member 1 with the space below the nozzle or tip. Three such passageways are shown in the drawings, spaced apart circumferentially 120 degrees. The passageways 21 are inclined at an angle of approximately 10 degrees to the axis of the nozzle or tip 5.

The tip or nozzle 5 is also provided with a series of circumferentially spaced passageways 22 which are arranged alternately with the passageways 21 and extend downwardly and inwardly from the wall 7 toward the center of the tip, the inner ends of these passageways 22 communicating with a cavity 23 in the lower end of the nozzle or tip. The passageways 22 are inclined at an angle of approximately 80 degrees to the axis of the tip or nozzle 5.

The tip or nozzle 5 is further provided with a series of circumferentially spaced passageways 24, also arranged alternately with the passageways 21 and extending downwardly and inwardly from the wall 7, the inner ends of these passageways communicating with the lower portion of the cavity 23. The passageways 24, which are of substantially the same diameter as the passageways 22, are inclined at an angle of approximately 70 degrees to the axis of the tip or nozzle 5.

The cavity 23 is closed at its lower end, as by a closure cap or plug 25, which is welded to the nozzle or tip 5, as at 26.

In the use of the oxygen lance, as thus described, oxygen is supplied to the tubular member or conduit 1, and thence through the passageways 21 to the molten metal in the open hearth furnace.

As oxygen is thus supplied to the furnace, water for cooling the tip or nozzle 5 is supplied continuously to the space 27 between the members 1 and 2, the water circulating downwardly through the passageways 22, cavity 23 and passageways 24, into the trough formed by the wall 7*a* and flange 9, and then upwardly through the space 28 between the members 2 and 3.

The cooling action is enhanced by the fact that the cooling water takes a somewhat circuitous path in passing through the passageways 22, cavity 23 and passageways 24, which passageways conjointly have a large cubical volume. This circuitous path is provided by reason of the fact that the cooling fluid from the space 27 is diverted to the passageways 22 by the flange 8 and an-

nular member **14** which conjointly form a baffle to cause such diversion.

It is thus seen that I have provided a novel construction for an oxygen lance, which is advantageous from many viewpoints, including principally the ease with which it may be assembled or disassembled for repair or replacement purposes.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes may be made in the shape, size and arrangement of parts thereof, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In a device of the character described, three concentrically spaced tubular members, a nozzle or tip supported by the innermost of said members, said nozzle or tip made as a one-piece member of copper having a series of passageways consisting of circumferentially spaced inclined bores diverging downwardly and outwardly through said nozzle or tip for the passage of oxygen therethrough, said nozzle or tip having a second series of passageways consisting of cylindrical bores arranged circumferentially alternately with said first-named passageways and extending upwardly and outwardly from a region within the nozzle or tip to the outer surface of the nozzle or tip, said nozzle or tip having a third series of passageways consisting of cylindrical bores arranged circumferentially alternately with said first-named passageways and disposed above said second-named passageways and extending upwardly and outwardly from a region within said nozzle or tip to the outer surface of the nozzle or tip, but at an angle to the axis of the nozzle different from that of said second-named passageways, the inner ends of said second and third series of passageways having fluid communication with each other, whereby a cooling fluid passing through said second or third-named passageways passes through the other of said series of second or third-named passageways.

2. A device, as defined in claim **1**, wherein said nozzle or tip is provided at its lower end with an upturned annular flange, which is secured to the lower end of the outermost of said tubular members, said flange providing an annular trough for flow of said cooling fluid.

3. In a device of the character described, three concentrically arranged spaced tubular members, a nozzle or tip supported by the innermost of said members, said nozzle or tip made as a one-piece member of copper having a series of passageways consisting of circumferentially spaced inclined bores diverging downwardly and outwardly through said nozzle or tip for the passage of oxygen therethrough, said nozzle or tip having a cavity in the lower central portion thereof for passage of a cooling fluid, a second series of passageways in said nozzle or tip consisting of bores arranged circumferentially alternately with said first-named passageways and extending from the outer surface of the tip downwardly and inwardly to said cavity, and a third series of passageways in said nozzle or tip consisting of bores arranged circumferentially and alternately with said first-named passageways, and extending from said cavity upwardly and outwardly to the outer surface of the tip at points spaced below the inlet ends of the second series of passageways, said nozzle or tip provided at its lower end with an upturned annular flange, which is secured to the lower end of the outermost of said tubular members and provides an annular trough, said nozzle or tip provided with a second annular flange which extends horizontally outwardly from the nozzle at a level between the outer ends of the second and third-named passageways, said last-named flange provided at circumferentially spaced points with lugs extending radially from the radially outer or outboard surface of said last-named flange.

4. A device, as defined in claim **3**, in which an annular member is provided having an internal surface adapted to engage the outboard surface of said last-named flange and having an annular groove adapted to receive said lugs, portions of said annular member below said groove being removed to provide slots spaced circumferentially of the annular member to correspond with the spacing of said lugs, whereby the annular member may be locked to said flange by aligning said slots with said lugs, causing the lugs to enter the slots and groove and then rotating the annular member sufficiently to take the slots out of alignment with the lugs.

5. A device, as defined in claim **4**, in which said annular member is welded to the lower end of that tubular member which is intermediate the innermost and outermost tubular members.

6. In a device of the character described, three concentric spaced tubular members, a nozzle supported by the innermost of said tubular members, said nozzle comprising a one-piece member having a series of oxygen conducting passageways and a series of passageways for conducting a cooling fluid, and means for removably securing said nozzle to the tubular member intermediate the innermost and outermost tubular members, said means comprising an annular member secured to the lower end of said intermediate member, and lugs extending from said nozzle and adapted to be locked to said annular member by a rotative movement of the nozzle relatively to said annular member.

7. A device, as defined in claim **6**, wherein said annular member has an annular groove adapted to receive said lugs, portions of said annular member being removed to provide slots through which access is had to said annular groove, said nozzle being locked to said annular member by entry of said lugs through said slots and rotation of the nozzle relatively to said annular member to a position wherein said lugs are out of alignment with said slots.

8. A device, as defined in claim **7**, wherein said annular member is provided with a flange-like extension having a slide fit in the lower end of said intermediate member, whereby assembly of said annular member with said intermediate member is facilitated.

9. In a device of the character described, three concentrically spaced tubular members, a nozzle supported by the innermost of said members, said nozzle comprising a one-piece member having a series of passageways consisting of circumferentially spaced inclined bores diverging downwardly and outwardly through said nozzle for the passage of oxygen therethrough, said nozzle having a second series of passageways consisting of cylindrical bores arranged circumferentially alternately with said first-named passageways and extending upwardly and outwardly from a region within the nozzle to the outer surface of the nozzle, said nozzle having a third series of passageways consisting of cylindrical bores arranged circumferentially alternately with said first-named passageways and disposed above said second-named passageways and extending upwardly and outwardly from a region within said nozzle to the outer surface of the nozzle but at an angle to the axis of the nozzle different from that of said second-named passageways, the inner ends of said second and third series of passageways having fluid communication with each other whereby a cooling fluid passing through said third-named passageways passes through said second-named passageways, and means for diverting said cooling fluid into the outer ends of said third-named passageways, said means comprising a flange extending from the outer surface of said nozzle at a level between the outer ends of the second and third-named passageways.

10. In a device of the character described, three concentrically spaced tubular members, a nozzle or tip supported by the innermost of said members, said nozzle or tip made as a one piece member of metal having a series of passageways consisting of circumferentially spaced inclined bores diverging downwardly and outward-

ly through said nozzle or tip for the passage of oxygen therethrough, said nozzle or tip having a second series of passageways consisting of bores arranged circumferentially alternately with said first-named passageways and extending upwardly and outwardly from a region within the nozzle or tip to the outer surface of the nozzle or tip, said nozzle or tip having a third series of passageways consisting of bores arranged circumferentially alternately with said first-named passageways and extending upwardly and outwardly from a region within the nozzle or tip to the outer surface of the tip, but at an angle to the axis of the nozzle different from that of said second-named passageways, the inner ends of said

second and third series of passageways having fluid communication with each other, whereby a cooling fluid passing through said second or third-named passageways passes through the other of said series of second or third-named passageways.

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EVERETT W. KIRBY, *Primary Examiner.*